SUCCESSFUL DELIVERY OF FLASH TRACK PROJECTS

A Dissertation
Presented to
The Academic Faculty

VOLUME I

By

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In Partial Fulfillment
Of the Requirements for the Degree
Doctor of Philosophy in Building Construction

Georgia Institute of Technology

May 2016

SUCCESSFUL DELIVERY OF FLASH TRACK PROJECTS

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ACKNOWLEDGEMENTS

This research was funded by the Construction Industry Institute. The opinions, findings, and conclusions are those of the author and do not necessarily represent the views of CII. CII funding is greatly appreciated. The author would like to acknowledge the wealth of knowledge received by the following individuals from CII member companies who collaborated with the author over two years: Bob Kohlburn, MC Industrial; Cleve Whitener, Lauren Engineers and Constructors; Dale Sullivan, S&B Engineers and Constructors; Don Cahill, TVA; Marty Gamble, Alstom; Jesse Gyöngyös, ExxonMobil; John Strickland, CH2M Hill; Keith Critzer, ExxonMobil; Larry Garrett, Phillips 66; Mike Giambra, Matrix Service Company; Rob Rainbolt, Burns and McDonnell; Ron Reynolds, Yates Construction; Travis Oates, ATC; and Victor Galotti, Georgia Pacific.

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SUMMARY

This research explores a higher order of fast tracking, called Flash Tracking, in response to increasing calls for faster, more reliable project deliveries. Flash Tracking is defined *as a time-driven project, which by necessity requires a heightened degree of concurrency between engineering, procurement, and construction.* In contrast to fast tracking, which entails a level of concurrency between engineering, procurement, and construction that has become a staple of the construction industry, Flash Tracking extends the envelope by requiring a series of innovative practices across the project delivery spectrum. The specific research questions pursued include:

1. Which innovative improvements in project delivery methodology could be made to compress project durations, while maintaining safety, quality, and risk tolerance?
2. How can project teams overcome barriers to delivering shorter project durations?

A multi-method research project was undertaken to address these questions, which entailed an extensive review of the literature, structured case study interviews, and multiple group decision-making exercises. The literature review focused on the construction industry, as well as manufacturing, shipbuilding, and software development, to identify practices and techniques potentially relevant to Flash Tracking that could be extended to the construction industry. Group decision-making exercises included a modified Delphi method study, an Analytic Hierarchy Process, and a series of research charrettes or focus groups.

These studies produced a prioritized, two-tiered listing of 47 essential Flash Track practices, providing practitioners with both a measure to assess their readiness for undertaking a Flash Track project and strategies for increasing their readiness. A subsequent study--a semantic network analysis--refined and buttressed the research team's earlier findings.

This two-year study, conducted in concert with industry experts, led to a re-engineered engineering, procurement, and construction (EPC) model which embraces relational contract strategies, improved communications, and the early engagement of key stakeholders.

CHAPTER 1

INTRODUCTION

Construction users today demand increasingly faster project delivery, higher quality, and more complex facilities. These demands only add to the challenges faced by an industry already perceived to be suffering from excessive cost overruns, late project completions, and deteriorating quality. Reasons for this perception of poor performance range from high industry fragmentation, excessive litigation, a diminished skilled workforce, limited collaboration, and a simple lack of trust.

Since the 1960s, the industry has responded to demands for quicker project delivery by developing fast tracking, an approach first introduced during a multi-campus building expansion at the State University of New York. The project leaders within this program identified opportunities to compress project delivery cycles by overlapping activities that had typically been performed in rigid sequence (Caudill Rowlett Scott 1969). Since then, the fast track concept has evolved and matured in the manufacturing industry as a means to meet demands for shorter time-to-market for new products (Eldin 1997). CII Research Summary (RS) 222-1, Best Practices for Design in Fast Track Projects (CII 2008), reported in 2008 that fast tracking's inherent overlapping of the design, procurement, and construction phases had become standard operating practice for the construction of industrial projects.

This research explores earlier calls for a new paradigm, as presented in CII RR 271-11, Starting from Scratch: A New Project Delivery Paradigm, Research Report (RR) 124-11, Re-engineering the EPC Process, and RR 130-11, PEpC: A Breakthrough Project

Delivery System That Improves Performance by Reforming Owner, Contractor, and Supplier Relationships. Both Research Team (RT) 124 and RT 130 reported reduced schedules and costs of their subject projects. Using these previous research efforts as a point of departure, our research team, RT 311, drew on RT member experience with highly successful efforts and documented practices employed from within and outside the construction industry to catalog and assess current, emerging, and innovative measures. The research team particularly looked for any new and unanticipated practices with high-impact potential for successful Flash Track execution.

Flash Track projects are characterized by a heightened degree of concurrency between scope definition, engineering, procurement, and construction. In such an environment, variability in the pace of decision-making will naturally be high. When these conditions are present in the manufacturing sector, companies find it necessary to have a large capacity buffer, keeping utilization rates low to be able to adequately support rush orders (Factory Physics 2006). In a construction setting with a business-as-usual approach, it would be very unlikely to overcome the heightened uncertainty, volatility, and risks of Flash Track. However, aggressively exploring business improvement strategies is a key to successful Flash Tracking. For instance, on Flash Track projects, it can be strategic to accept increased costs for imperatives such as increased capacity or availability of essential personnel and resources to be able to resolve matters immediately as they arise. Therefore, rather than optimizing individual resource (component efficiency), Flash Track project leaders must recognize that imperative importance of dedicating key personnel and other essential resources, with an eye on the desired schedule objective (efficacy).

RT 311 identified a number of Flash Track approaches for business improvement in the construction industry as well as practices from other industries applicable to construction. The team made two general observations on the successful delivery of Flash Track projects: 1) project teams need to embrace a different and more innovative approach to project delivery, and 2) project teams should understand the need for exceptional execution of normal project activities (Figure 1.1).

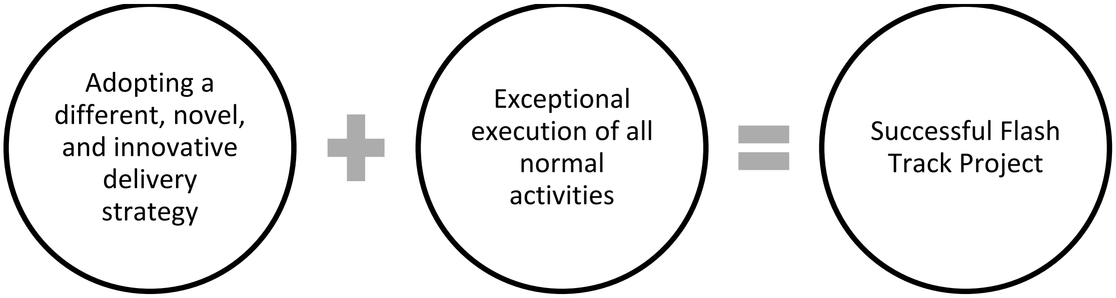


Figure 1.1 – Keys to Successful Flash Tracking

The team's search for innovative strategies focused on those used in best-in-class domestic and international construction projects. The search also involved looking for project acceleration practices in other industries, such as shipbuilding, the computer industry/microelectronic factory construction, software development, and manufacturing sectors. Via the combination of a literature review, a series of interviews, research team workshops, Delphi surveys, and an Analytic Hierarchy Process (AHP), the team developed a set of 47 practices essential to the successful delivery of Flash Track projects. By studying the 47 practices and implementation concepts, the team re-engineered the workflow processes for Flash Track projects, proposing an innovative delivery approach that extends the work of CII Research Team 130, Reforming Owner, Contractor, Supplier Relationships (see Appendix A for a summary of PEpC).

1.1 Purpose and Objectives

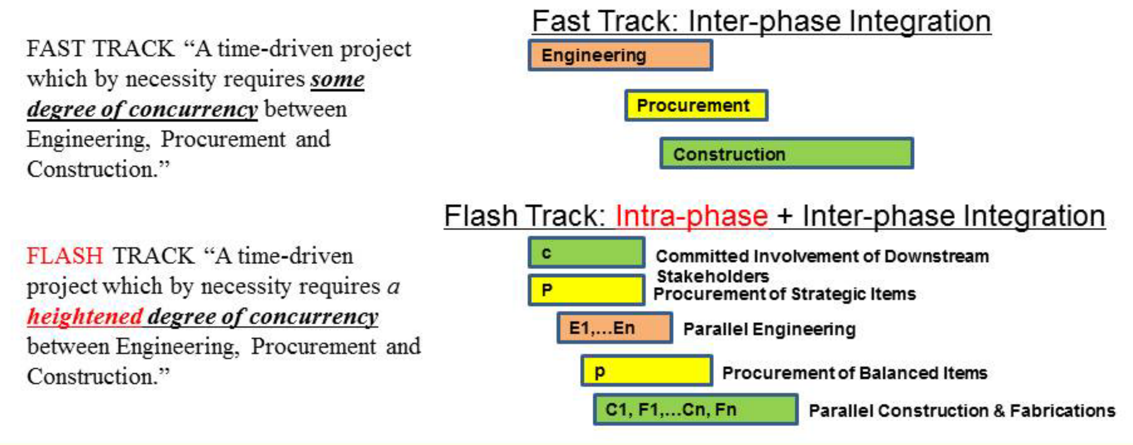
The primary purpose of RT 311 was to develop a process enabling CII member companies to assess their readiness to take on Flash Tracking and offer guidelines on implementation and execution of Flash Track projects that provide answers to the following:

1. Which innovative improvements in project delivery methodology could be made to compress project durations, while maintaining safety, quality, and risk tolerance?
2. How can project teams overcome barriers to delivering shorter project durations?

With these questions in mind, the research team established the following objectives: 1) develop useful, user-friendly tools for successful execution of Flash Track projects, and 2) re-engineer the project delivery process specifically for Flash Track projects. The focus then shifted to building on past studies of fast track practices and principles and assessing their applicability and adaptability to Flash Tracking. Using a process that identified, prioritized, and explored the inter-relationships among various practices and concepts, the team developed a re-engineered project life cycle model for successful Flash Tracking. The model incorporates relational contracting methods, advanced technologies, and collaborative work processes. The team then converted the conceptual model into a usable tool. The RT 311 Flash Track Tool, with its Flash Track readiness metric and implementation guidelines, enables project teams first to determine which projects to Flash Track and then how to incorporate the model into project practices and procedures.

1.2 Scope Limitations

The author assumes that users of the Flash Track Tool and the implementation guidelines have some prior experience with fast track projects and with the PEpC delivery model. Figure 1.2 defines and contrasts fast track and Flash Track, showing how the team’s cPEpC approach consolidates and permits a higher level of concurrency of work packaging tasks and combines early FEP gates. (See Figure 6.6 for more comparative illustrations of the fast track and Flash Track models.)



FAST TRACK “A time-driven project which by necessity requires ***some degree of concurrency*** between Engineering, Procurement and Construction.”

FLASH TRACK “A time-driven project which by necessity requires *a* ***heightened degree of concurrency*** between Engineering, Procurement and Construction.”

Figure 1.2 − Fast Track vis-à-vis Flash Track

Furthermore, the team takes as given the users’ fundamental ability to execute normal project activities effectively. Users should also understand that, while the readiness metric and implementation guidelines will help make projects successful, they do not replace proper due diligence in a company’s project preparations.

CHAPTER 2

METHODOLOGY

The primary purpose of this research was to investigate and report on a re-engineered EPC process to facilitate successful execution of “faster” Fast Track projects.

The following specific objectives were developed to achieve the primary purpose of this research:

1. identify the practices organizations use to deliver Flash Track projects successfully;
2. create a metric, based on a prioritization of the essential Flash Track practices, to assess an organization’s readiness to undertake a Flash Track project; and
3. develop an implementation resource tool, expanding on the prioritized Flash Track practices, to guide an owner in the execution of a Flash Track project.

The research methodology involved three phases. Phase 1 focused on data collection through a continuous literature review, EPC interviews, and industry expert panel discussions. Phase 2 entailed a three-round Delphi study and an Analytic Hierarchy Process (AHP). Phase 3 entailed the development of a Flash Track readiness metric, implementation guidelines for industry practitioners, and a re-engineered work flow process. The three phase research methodology is illustrated in Figure 2.1

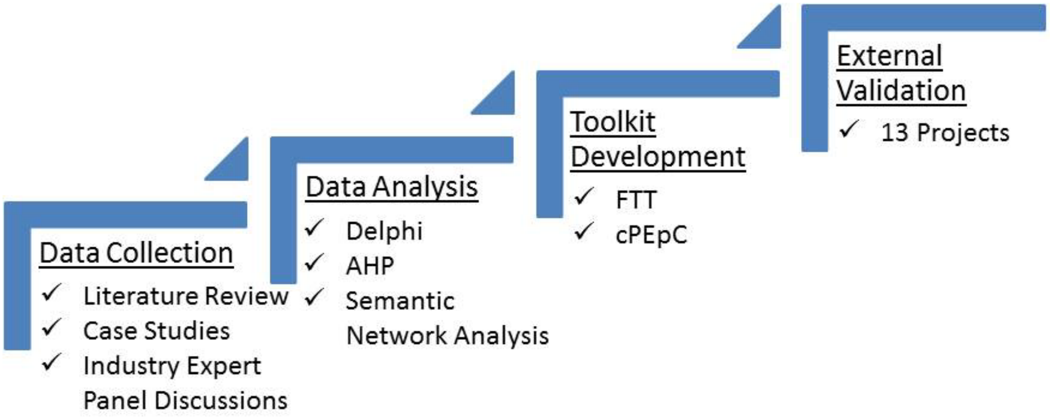


Figure 2.1 − Three Phase Research Methodology

The next three subsections give an overview of the methodology employed. The following two chapters, a literature review (Chapter 3) and case studies (Chapter 4), provide further details.

2.1 Phase One – Data Collection

The goals of Phase 1 were to identify industry practices that are uniquely important to the fast track process and then determine whether these practices are also distinguishing characteristics of Flash Track. The data collection process had three subcomponents: 1) a comprehensive literature review, 2) EPC project interviews and case studies, and 3) information gathering through a series of meetings with a Research Team, comprised of skilled practitioners. The research team meetings served as an internal validation process and as a series of focus groups for brainstorming.

2.1.1 Literature Review

The literature review process began with a comprehensive review and analysis of more than 150 papers, including several CII publications, to find applicable fast track practices. This initial review principally drew from industry publications, journals, and existing CII publications in search of potential Flash Track practices. The literature review was then extended to other industries, such as manufacturing, shipbuilding, and software/semiconductor development, to explore potential alternatives which could be incorporated into a new EPC model. In addition to industry publications and journals, the literature review also extended to academic works.

2.1.2 EPC Project Interviews and Case Studies

Structured interviews were conducted on three successful Flash Track efforts, including an emergency rebuild, a contractual Integrated Project Delivery (IPD), and project which embraced Lean Construction principles. The questions used and the responses offered in these structured interviews are included in Appendices C and D, respectively. Seven unstructured case studies, offered by industry practitioners during the periodic working meetings, and three published case studies, were also considered. Finally, information was gathered from a selection of historical Flash Track efforts. Overall, fifteen case studies were considered.

2.1.3 Industry Research Team (RT311) Discussions

A Research Team 311 (RT 311) was comprised of 15 representatives of CII member companies, including owners, contractors, and engineers served a central role in the research. Beginning in May 2013, RT 311 met fourteen times for a series of 1 ½ to 2-day sessions. On average, attendance for each meeting was eleven.

A principal early duty of the research team was to consolidate initial findings of the literature review, team discussions and the EPC project interviews into a list of topics to be explored with the modified Delphi method, as discussed in the next section. The research team critically assessed a beta version of the Delphi method survey for completeness, relevance, clarity, and ease of use. The research team later served as an experienced resource in research charrettes for developing practical implementation measures and a re-engineered project delivery process (Moustakas, 1990).

This streamlining of idea generation, provided a necessary focus and ensured that the Delphi surveys met the needs of the research (Keeney et al. 2011). This research employed three approaches in developing the initial set of Delphi questions: 1) statements from the existing literature, 2) feedback in the form of EPC interviews, and 3) engaging the research team as a focus group and as a means to consolidate and test survey.

The development of the initial questions began with a content analysis of the initial literature review, focusing on keys to successful fast tracking. This content analysis was also extended to the EPC structured interviews, which included questions about factors related to success in fast track projects. This early process strove to identify as many considerations as possible, without concern for their distinctiveness. Content analysis is a well-established and recognized research method that involves a systematic approach to analyzing information from sources (Neuendorf 2002).

Content analysis has many techniques and levels of sophistication (Krippendorff 2004). A primary use of content analysis is to summarize the formal content of textual information. It can also be used to describe the attitudes and perceptions of the author of the source material (GAO 1996). Two approaches used in this research entailed relevance sampling and categorical distinctions. Keeney et al. (2011) recommend these simple forms of content analysis to examine practices which are the same or similar and that can be collapsed into one statement.

2.1.4 Phase 1, Research Flow Chart

Collectively, the literature review, EPC interviews, and selected case studies contributed to a list of 151 fast track practices considered to be potential Flash Track practices. This list was then consolidated, resulting in 66 relevant practices for consideration in the next phase of the research (see Figure 2.2).

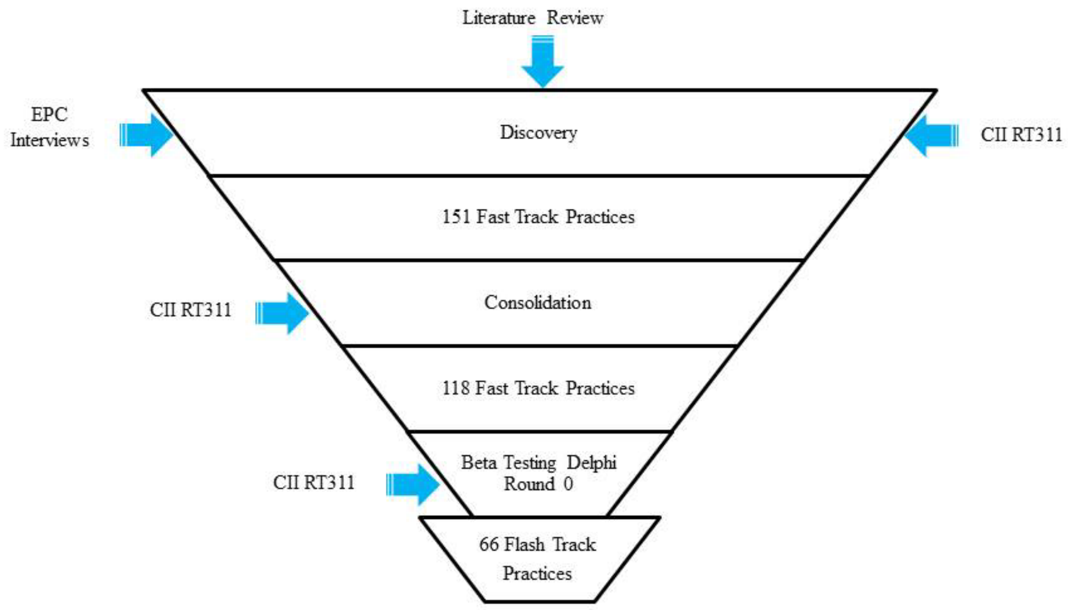


Figure 2.2 – Phase One - Data Collection

2.2 Phase Two – Data Analysis

Phase two entailed three rounds of the Delphi method and an Analytic Hierarchy Process (AHP) to select and then prioritize essential Flash Track practices.

2.2.1 Delphi Method

The Delphi method was used to narrow further the set of Flash Track practices to identify those most essential. The Delphi method is a widely employed research tool, and is characterized by an iterative process of feedback that normally leads to a group consensus reached within two to three rounds (Hallowell and Gambatese 2010). The main assumption of the Delphi method is on that group opinion is more valid than individual opinion. (Keeney et al. 2011).

2.2.1.1 Background

The Delphi method is a research technique that uses anonymous opinions and feedback from a group of experts to form a consensus on a topic. It was first developed by the Rand Corporation in 1951 as a means to obtain the most reliable consensus of a group of experts through a series of questionnaires and interviews (Dalkey and Helmer 1962). It has also been used to prioritize issues for the effective use of resources (Keeney et al. 2011).

The four key aspects of the Delphi method are as follows: 1) anonymous responses; 2) iteration of interviews, which allows participants to change their opinions; 3) controlled and statistical feedback to participants; and 4) a summary group response. Anonymity is an important aspect of the process, which permits participants to respond freely, without direct pressure to conform (Keeney et al. 2011).

For this research, a modified Delphi method (Keeney et al. 2011) was employed. In the modified Delphi method, a predetermined list of considerations is developed through literature reviews, focus groups, or interviews. In contrast, the classical Delphi method begins with a qualitative first round of open-ended questions intended to generate ideas relevant to a research question.

2.2.1.2 Expert Selection

A distinguishing characteristic of the Delphi method in contrast to traditional survey methods is that respondents are certified as being experts according to predefined criteria (Hallowell and Gambatese 2010). Expert selection is an important consideration, directly linked to the validity of the study (Keeney et al. 2011). Predefined criteria were objectively set to facilitate the selection of a diverse group of industry professionals with broad experience in multiple project phases. Qualifications for participation as an oracle, or Delphi method respondent, were as follows:

- fifteen years of experience in the Engineering, Procurement, and Construction (EPC) or Architecture, Engineering and Construction (AEC) industry,
- five years in a project leadership role,
- five years of experience in fast track or two fast track projects, and
- prior experience in at least two phases of a project's life-cycle (i.e., development, design, construction, start-up/commissioning, and operations).

There are no fixed recommendations on the number of Delphi oracles to include, as the size of a Delphi panel is dependent upon the research question, perspectives required, resources available, and range of expertise sought. Most published Delphi sample sizes consist of 10-100 experts (Keeney et al. 2011), however the majority of Delphi studies have used 15-20 respondents (Ziglio 1996).

Seventy-four potential oracles were identified by the research team for consideration. Electronic recruitment messages were sent to oracle candidates explaining the research's objectives, anticipated number of rounds, expected time commitment, and informed consent. Of the 74 candidates, 64 experts who met the inclusion criteria agreed to participate in the Delphi study. Surveys were conducted in accordance with an approved Institutional Review Board (IRB) protocol. Appendix E shows the university IRB approval, and Appendix F includes the recruitment message and consent form.

2.2.1.3 Iterative Feedback

The Delphi method involved oracles giving systematic feedback on whether each of the fast track practices was absolutely essential for Flash Track. Oracles were asked to rate each of the 66 fast track practices, identified in Phase 1, in terms of how much they agreed the practice was absolutely essential for Flash Track. Oracles gave their responses on a six-point Likert scale: 1 - strongly disagree, 2 - disagree, 3 - moderately disagree, 4 - moderately agree, 5 – agree, and 6 - strongly agree. The six-point scale was used instead of a five-point scale to preclude a neutral score. Oracles were also encouraged to offer comments and add any practices that had not been included but which they thought merited further consideration. Oracles were specifically encouraged to offer comments on any extreme responses (e.g., strongly agree or strongly disagree).

Consensus that a practice was absolutely essential for Flash Tracking was defined by the following criteria:

1. a modal response of "agree" or "strongly agree," and
2. a standard deviation of less than one if the mode was "agree" and less than two if the mode was "strongly agree".

Consequently, the lower statistical limit (1σ) of the aggregate responses would at least be "moderately agree" for consensus Flash Track practices.

In round 1 of the Delphi study, 55 of the 64 oracles participated. The oracles reached consensus that 46 of the 66 practices were absolutely essential for a Flash Track projects. They also identified four additional practices that merited consideration in the subsequent round. In round 2, 47 of the 64 oracles participated. In this round, oracles were asked to reconsider the twenty practices on which they had not reached consensus in round 1, as well as consider the four new additional practices and the corresponding anonymous comments. In round 2, the oracles reached consensus on only one more practice, which was one of the four newly added practices suggested in round 1. After two Delphi rounds, the total number of practices deemed essential for Flash Track projects was 47 (46 +1).

In round 3 of the Delphi study, the oracles were asked to select the top ten practices they considered as being most essential for a successful flash-track project from this list of 47 practices. Fifty-two of the 64 oracles responded. The ten practices most frequently nominated by oracles in this exercise were defined as the collective top ten practices.

A Relative Index was also computed as another way of identifying the top ten practices. The oracles' responses in rounds 1 and 2 were used to calculate the Relative Index of each practice. The Relative Index equation assigned a weighting for each response, ranging from one for "strongly disagree" to six for "strongly agree", as shown below:

Relative Index score = {(% responses that strongly disagree*1) + (Eq. 2.1)
(% responses that disagree*2) +
(% responses that moderately disagree*3) +
(% responses that moderately agree*4) +
(% responses that agree*5) +
(% responses that strongly agree*6)}/6

In the three rounds of the Delphi study, oracles offered more than 1,000 comments. The three rounds were completed over two months. At each round, oracles were asked to respond within approximately two weeks, and reminder messages were sent to maximize the response rate.

The Delphi process was conducted with the web survey software SurveySelect.NET, Version 4.102.011 provided by ClassApps of Kansas City, which also served as the electronic repository for trial rounds of the survey and three rounds of the Delphi process. The Delphi survey questions for rounds 1, 2, and 3 are included in Appendices M, N, and P, respectively.

2.2.2 Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP), a multi-criteria decision-making process, was used as another means to rank or prioritize the 47 essential practices. Similar to the Delphi method, AHP transforms subjective judgments to into objective measures. AHP breaks down a complex decision into its component parts, arranges them in a rational hierarchical order, and then presents a series of pairwise comparisons to simplify the decision-making process (Saaty 2006).

2.2.2.1 Background

AHP was developed by Thomas Saaty, in the 1970's, to provide decision makers with a way to make complex decisions involving many attributes with varying degrees of subjectivity (Saaty 1990, Chung 2002). . The strengths of the method are that it reduces the number of decision variables that must be considered simultaneously from many to two, and it deals with tangible as well as intangible criteria (Lee 2014). AHP is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. A fundamental aspect of the AHP is the decomposition of a complicated issue into its component parts. AHP is well suited to the group decision-making process and as a means to identify which of the practices have the greatest impact on successful outcomes (Saaty 2006).

AHP has been employed across a broad range of fields due to its mathematical simplicity and flexibility. Within the construction industry, AHP has been used for technical assessments, construction safety, project evaluation, facility siting, project risk analysis, and intelligent building design evaluations (Gilleard and Yat-lung 2004). It has also been employed for project evaluation and selection (Sipahi and Timor 2010,).

Saaty (2006) has characterized AHP as multi-criteria logic which combines deductive and inductive logic that can offer different and often better results than ordinary reductionist logic. The three principles employed in AHP are problem modeling, comparative judgments, and compilation of the results. AHP can be used for individual or group decisions (Saaty 2004, 2006 & 2012). Saaty (2012) reported that when AHP is used for group decisions, group members are engaged structuring the problem, provide the judgements and debate the results until a consensus is reached (Saaty 2012).

A group AHP effort was undertaken by the research team in a series of working sessions, that began with a training sessions that shared the purpose of AHP, explaining its process and principles, and offering examples on of how it works.

2.2.2.2 Problem Modeling

The first step in AHP is building a rational hierarchical order and structuring the decision into three parts: the ultimate goal, the judging criteria, and alternatives. The hierarchy should be balanced with a comparable number of alternatives falling under each evaluation criterion. Saaty (2012) embraced the recommendation of George Miller, a founding father of cognitive psychology (Miller 1956), that comparison elements should be clustered into homogenous groups of 5 to 9 items to provide parity and facilitate participants' responses. When levels are unbalanced (fewer than five or more than nine elements), the chance of inconsistencies increases and the comparison process becomes more taxing for participants. In these cases, the evaluation criteria merit reconsideration.

The ultimate goal of the AHP is the identification of the most essential Flash Track practices. The selection of the judging criteria entails assigning the practices into homogenous sub-groups. This requires careful consideration and an iterative approach to reach an optimum hierarchical structure. Saaty (2012) advised that the assignments of practices within a particular category are not "cast in bronze", meaning that assignments can be altered or redefined, or that new criteria can be introduced. The hierarchy can be tested by reconstructing it into another plausible structure. If the new structures yield similar results, then an optimal grouping has been achieved. Ultimately and consistent with Saaty's (2012) recommendations, the 47 essential practices were grouped into six categories of contractual, delivery, cultural, organizational, planning, and execution considerations. Each category had 7 to 9 practices. As a final measure, the 47 essential practices were re-numbered to reflect their final groupings. The hierarchal model developed for the AHP and its component practices are shown in Figure 2.3 and Table 2.1.

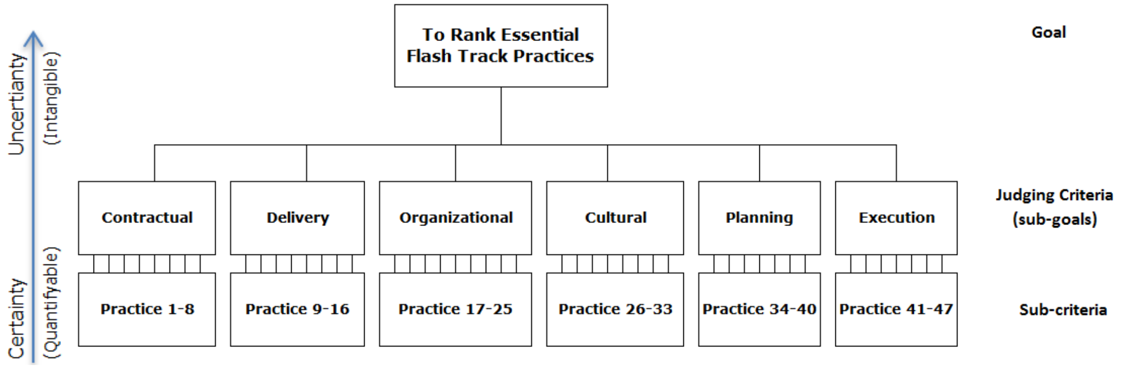


Figure 2.3 – Flash Track AHP Model

Table 2.1 − Essential Flash Track Practices

Contractual Considerations
1. Setting clear, specific scoping requirements
2. Establishing performance-based specifications
3. Aligning project participants' interests through contract
4. Establishing contract strategies specifically tailored to project conditions
5. Establishing clear change management procedures
6. Establishing an effective claims resolution process
7. Funding early critical efforts
8. Reducing risks through the collective efforts of all stakeholders.
Delivery Considerations
9. Selecting team members and staff on the basis of their fast track experience or qualifications
10. Focusing procurement decisions on construction priorities
11. Selecting and awarding contracts to subcontractors in a timely manner
12. Staffing with personnel with strong leadership capabilities
13. Employing innovative procurement practices
14. Using highly integrated 3-D modeling, with all major users updating a common database
15. Involving contractors, trades, and vendors in the design phase
16. Seeking out suppliers and specialty contractors as sources of time-saving innovations
Organizational Considerations
17. Engaging operations and maintenance personnel in the development and design process
18. Establishing a fully integrated project team, including design, construction, specialty contractors, commissioning, and operations personnel
19. Using team building and partnering practices
20. Delegating authority to the project level (i.e., max. decision-making authority at the project level)
21. Empowering the project team (ensuring that each organization is led by an empowered leader)
22. Having an owner with sufficient depth of resources and organizational strength
23. Selecting personnel with a can-do attitude and willingness to tackle challenging tasks
24. Having an engaged and empowered owner's engineer (owner's representative)
25. Staffing with multi-skilled personnel

Table 2.1 − Essential Flash Track Practices (continued)

Cultural Considerations
26. Accepting a non-traditional paradigm or mindset
27. Having an active, involved, and fully committed owner
28. Establishing flexible project teams that avoid rigid hierarchy
29. Maintaining a no-blame culture and a mutually supportive environment
30. Having open communication and transparency
31. Staffing with cooperative and collaborative personnel
32. Having an open-minded team
33. Creating executive alignment among the contracted parties
Planning Considerations
34. Emphasizing coordination planning during the design process
35. Performing exhaustive front end planning
36. Identifying and procuring long lead items
37. Monitoring and driving corrective actions through the project controls process
38. Providing enough resources for critical path items
39. Considering speed of fabrication and construction during the selection of design alternatives
40. Recognizing and managing the additional Flash Track risks
Execution Considerations
41. Co-locating the project team (i.e., owner, designer, builder, and/or key vendors)
42. Simplifying approval procedures
43. Dedicating full-time personnel to the project
44. Selecting appropriate construction methods
45. Minimizing handoffs
46. Employing innovative construction methods
47. Conducting frequent and effective project review meetings

2.2.2.3 Comparison Judgements

The AHP was completed by making a series of pairwise comparisons in which the relative importance of a practice was ranked on a scale from one to nine. A ranking of one meant that the practices were equally important, and a ranking of nine meant that one practice was significantly more important than the other. Scoring guidelines are defined in Table 2.2.

Table 2.2 − Nine-point AHP Scoring Criteria (Saaty 1994)

Intensity of importance	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective.
3	Somewhat more important	Experience and judgment slightly favor one over the other.
5	Much more important	Experience and judgment strongly favor one over the other.
7	Very much more important	Experience and judgment very strongly favor one over the other. Its importance is demonstrated in practice.
9	Absolutely more important	The evidence favoring one over the other is of the highest possible validity.
2, 4, 6, 8	Intermediate values	When compromise is needed.

In making a series of paired comparisons, AHP participants' judgments are not always logically consistent. For example, if A is 3 times greater than B and B is 3 times greater than C, then A must be 9 times greater than C. Any score other than 9 for the A – C comparison reflects a degree of inconsistency. A participant's consistency can be measured by computing a ratio of the participant's consistency score to a consistency score that would be obtained if the responses were purely random. This consistency ratio (CR) is included in the AHP process, where if a participant's consistency ratio is than 10%, the participant was compelled to reassess his or her scoring until an acceptable level of consistency was achieved. A discussion of the analytical methods employed in determining the CR is included in Appendix M.

There are a number of commercial software packages available that can build the AHP questionnaire and the supporting calculations. Alternatively, a questionnaire and supporting calculations can be created in a spreadsheet application. For this research, a series of Microsoft Excel workbook templates developed at Virgina Tech (de la Garza

2014, Horsey 2014) were used to develop a Flash Track AHP questionnaire. The questionnaire was shared with the industry members of the research team for their individual input. A copy of the instructions and AHP pairwise comparison questionnaire are included in Appendix M.

2.2.2.4 Compilation of the Results

The theoretical background and mathematical concept of the AHP methodology have been detailed in several books and articles (Cheng et al. 2002, Saaty 2004). To calculate the resulting weighting, the comparisons between the pairs of issues (practices) need to be organized into a matrix that accounts for each participant's comparative weights. Appendix M describes the compilations required for computing the consistency ratio, the weightings based on individual participant's responses, and procedures for consolidating those responses into an aggregate summary.

In addition to the two ways for determining the relative importance of practices in the Delphi study, the AHP process offered a third approach, based on the final step in the AHP:

$$\text{AHP score} = \{\text{weight of practice} * \text{weight of category}\} \qquad \text{(Eq. 2.2)}$$

2.2.3 Prioritization or Ranking Methods

Altogether, three ranking methods were employed to distinguish the top-tier practices. Any practice that was ranked within the top ten by any method was deemed a Tier I practice, thus meriting emphasis in the decision process, as defined in Eq. 2.3,.

$$\text{Tier I: } (\text{Relative Index} \cup \text{Delphi Round 3} \cup \text{AHP}) \qquad \text{(Eq. 2.3)}$$

Practices not identified as top ten by any of the three rankings were designated as Tier II practices.

2.2.4 Phase 2, Research Flow Chart

The second phase of the research used three approaches to identify and rank 47 essential concepts or practices for successful Flash Track projects. The consolidated results produced a two-tiered structure of 18 Tier I practices and 29 Tier 2 practices. Figure 2.4 illustrates the components of the Phase Two research methodology.

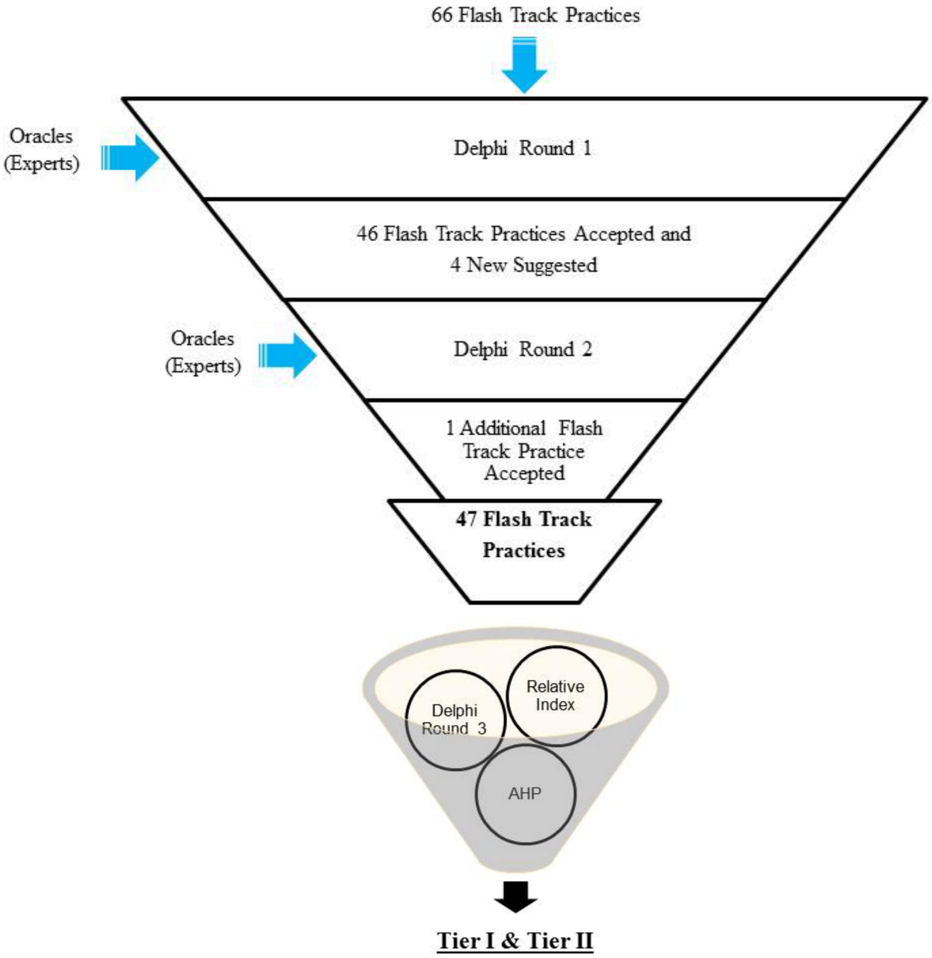


Figure 2.4 − Phase Two – Data Analysis

2.3 Phase Three – Tool Development and Re-Engineered EPC Process

The third and final phase of the research entailed the development of an Excel-based Flash Track Tool that included a readiness metric and an implementation guide. The final phase also served to build upon the information collected to propose a model for a re-engineered EPC process for Flash Track projects.

2.3.1 Flash Track Readiness Metric

A readiness metric was constructed based on information collected in Phase 2. The readiness metric portion of the Flash Track Tool was based on both the practice and category weightings from the AHP, and it indicates an organization's ability to undertake a Flash Track project.

2.3.2 Flash Track Implementation Guidelines

The implementation guidelines were derived from a series of structured workshops or research charrettes with the research team. In these research charretes, each of the 47 essential Flash Track practices were examined in greater depth to find innovative implementation measures, barriers, risks, and risk mitigation measures. A research charrette is a derivative of the planning charrette, which is common in architecture. A research charrette is a data collection method to elicit ideas and leverage industry experience in an intense and targeted workshop. Gibson and Wittington (2009) reported that this approach is useful to discover innovative practices in the construction industry. A notable example of research that employed research charrettes is CII’s Project Definition Rating Index (Gibson and Gebken 2003).

Industry experts who participated in this research offered input for innovative implementation strategies, barriers, risks, and risk mitigations which were later used in developing the implementation guidelines. That input was offered in a structured manner on predefined worksheets, included as Appendix J. Working groups of four to five industry experts were asked to examine up to six of the 47 practices and complete the worksheet. They were also asked to make note of interrelationships between any of the 47 practices.

2.3.3 Re-engineered EPC Process

A model of a re-engineered EPC process was developed as an offshoot of other activities in this research. The proposed EPC process draws on multiple sources, expanding on research concepts advocated in other construction management research and identifying elements in other industries that can be adapted to the construction industry. The concepts of the re-engineered EPC model, which are similar to the implementation guidelines, were developed in a series of structured workshops with industry practitioners.

2.3.4 Validation

The research and development of the Flash Track Tool required a series of internal and external validations to confirm the applicability of the selected practices, and ensure stability and accuracy of the results. Qualitative validity means that the researcher checks for accuracy of the findings by employing certain procedures, while qualitative reliability indicates the researcher’s approach is consistent across different researchers and different projects (Creswell, 2002). Multiple internal validation approaches were used, including forms of triangulation, field observations, and member checking. An external validation was achieved through a retrospective independent evaluation by senior-level managers on 13 projects that were characterized as having been Flash Tracked.

2.3.4.1 Internal Validation

Internal validity is a confirmation of the correctness of the study design, including verifications of inferences made in the selection of the potential Flash Track concepts and practices. Internal validity can be verified in both qualitative and quantitative studies in a variety of ways. Triangulation is a convergence of common themes or concepts in multiple data sources, such as information observed in differing literature, case studies, or practice. It can also be viewed as a comparison of data relating to the same phenomena but derived from different places. Member checking or experience-based observation is a means of verifying qualitative findings through critical consideration of whether the selected concepts ring true based on industry experience. The beta testing of the Delphi questionnaire was one of the elements of the internal validation process.

2.3.4.2 External Validation

External validity is the extent to which the results of the study can reflect similar outcomes elsewhere, and can be generalized to other populations or situations. The external validation effort involved the retrospective completion of the Flash Track Tool for 13 Flash Track projects. This effort served as an independent holistic evaluation exploring the completed tool, which explicitly sought input on several aspects of the Flash Track Tool:

- usefulness in overcoming Flash Track challenges,
- relevance of essential Flash Track practices,
- practicality and importance of the essential Flash Track practices,
- importance of the essential Flash Track practices,
- comprehensiveness of the essential Flash Track practices,
- the tool’s ease-of-use, and
- suggestions for improvements.

Suggestions for improvement noted in the validation process were incorporated into the final version of the Flash Track Tool.

2.3.5 Phase 3, Research Flow Chart

Figure 2.5 illustrates the components of the final, third phase of the research methodology.

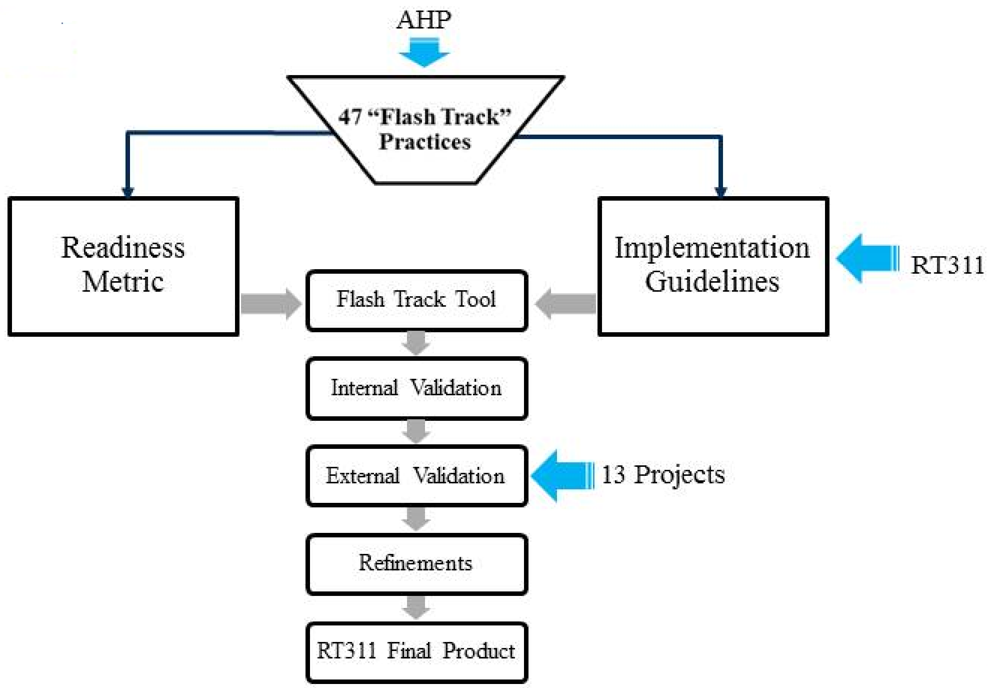


Figure 2.5 - Phase Three – Tool Development

2.4 Network Analysis

The final facet of this investigation involved a network analysis to understand the relationships and interdependencies between the essential practices and to identify the most central and critical practices. Building on the 47 essential Flash Track practices identified in the modified Delphi study, a Flash Track network was constructed with the participation of the RT 311 Research Team. The analysis permits a practice-to-practice comparison without *a priori* categorization, as was used in the AHP effort.

2.4.1 Background

Network analysis has been described as a nonlinear and iterative approach that can ably serve the increasingly complex process of contemporary construction (Pryke 2004). In this final segment the investigation is deepened, employing a type of semantic network analysis (Doerfel 1998) to evaluate the structure connecting the Flash Track practices. The results of the Flash Track semantic network analysis are then compared to prior results on Tier I practices, which were identified through the Delphi and AHP methodologies.

Network analysis focuses on overall network structure and the positions of nodes (also called vertices or points)within a network. A node's position reflects the constraints and opportunities it has to influence other nodes in the network. The overall structure of a network reveals global patterns of these constraints and opportunities (Borgatti 2013).

A few tools commonly used in Social Network Analysis (SNA), an approach for investigating social structures, are used to provide another perspective on the most important Flash Track practices. In social networks, nodes typically represent people or groups and the ties (also called links, edges, arcs, or lines) represent the relationships or interactions between them.   In the present analysis, a kind of semantic network analysis, the 47 practices are the nodes and their interdependencies are the ties.

This network is directed: a line with an arrow connects one practice to another practice that it enables. When two nodes are directly connected by a tie they are *adjacent*. The number of other nodes to which a given node is adjacent or tied is called the *degree* of that point. In Figure 2.6, node A has a degree of 3, nodes B, C, and D each have a degree of 4, and the remaining peripheral nodes each have a degree of 1.

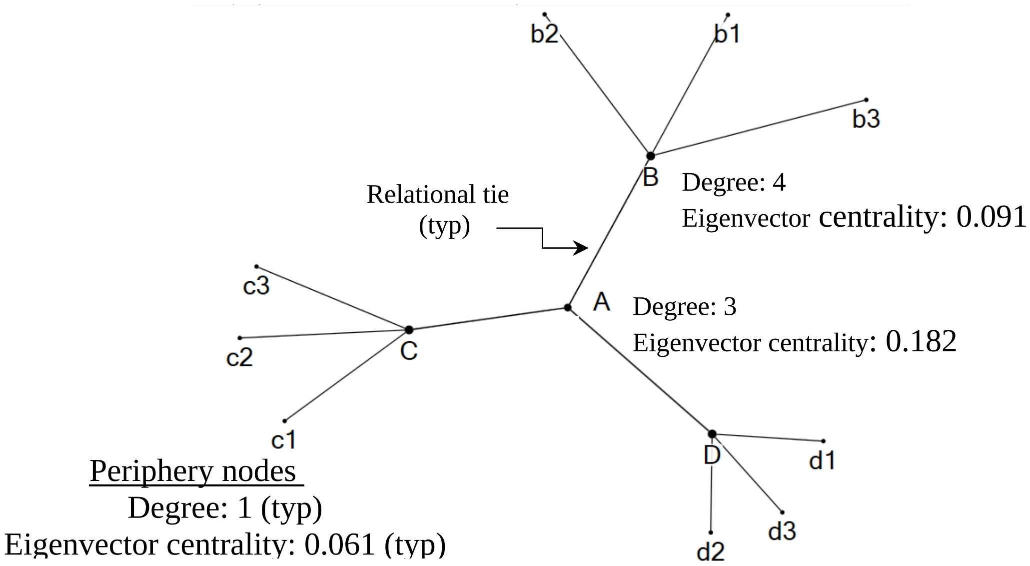


Figure 2.6 Example of a graph with 13 nodes and 12 ties

Centrality refers to a family of concepts that describe a node's position in a network and reflects how well connected a node is in the network (Freeman 1979, Borgatti et al. 2013). This pilot study focuses on degree centrality and eigenvector centrality. In a directed network, two types of *degree centrality* can be measured. In-degree centrality indicates the extent to which a node is a sink of activity through incoming ties; it is also a measure of status, prominence or prestige (Wasserman and Faust 1994, Pryke 2004). Out-degree centrality indicates the extent to which a node is a source of activity through outgoing ties. In this pilot study, out-degree centrality shows how much a practice enables other practices, and in-degree centrality shows how dependent a practice is on other enabling practices. Loosemore (1998) reported that out-degree centrality provides an indication of a node's control over a network and of the dependence of a network upon it. *Eigenvector centrality* is a more complex measure of centrality. Eigenvector centrality reflects the extent to which a node is connected to other central nodes – taking into account not only the number of ties a node has but also the degree of the nodes to which it is connected (Bonacich 1987). This is illustrated in Figure 2.6 where node B has a greater degree centrality than node A (4 v. 3), however, node A has a greater eigenvector centrality (0.18 v. 0.09). As eigenvector centrality measures the importance of a node based on the importance of the nodes to which it is tied, it can be useful for identifying "core" nodes. In this paper, eigenvector centrality shows how active and essential a practice is—in terms of enabling and/or being enabled—in relation to other practices. Eigenvector centrality can be computed for non-directed data (Newman 2010), and thus it is a secondary measure in this pilot study. Numerical equations for degree- and eigenvector- centralities are defined in Eq. 2.3 and 2.4 (Borgatti et al. 2013). Eq. 2.3 applies to overall degree centrality as well as in- and out-degree centrality measures.

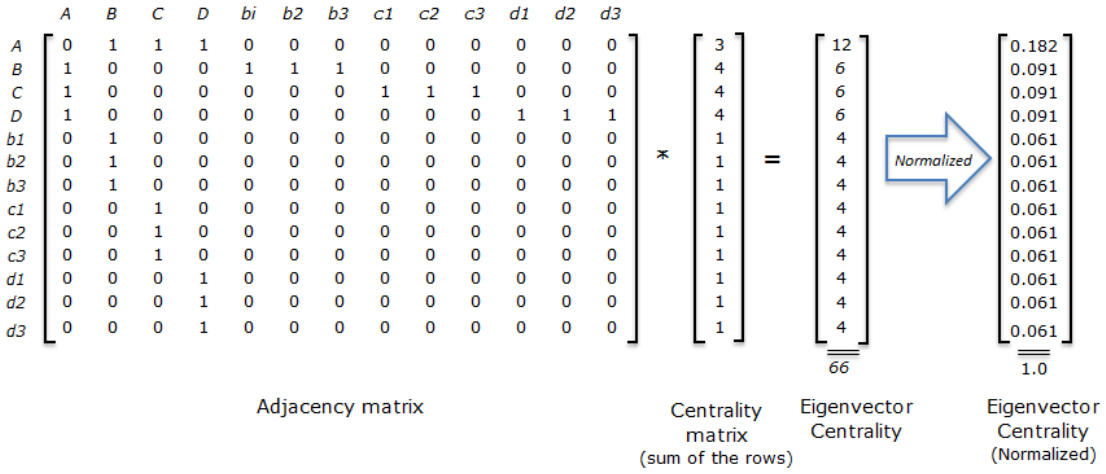
$$\textit{Degree centrality}\ (d_i) = \sum_j (x_{ij}) \qquad \text{Eq. 2.3}$$

d_i: degree centrality of node i
x_{ij}: the (i,j) entry in the adjacency

$$\textit{Eigenvector centrality}\ (e_i) = \lambda \sum_j (x_{ij} e_j) \qquad \text{Eq. 2.4}$$

λ: proportionally constant (eigenvalue)
e: eigenvector centrality of node i

Computation of the eigenvector centrality (Eq. 2.4) entails a series of matrix algebra operations of a network's adjacency matrix and its degree centrality matrix, leading to a normalized eigenvector centrality matrix. This concept is further illustrated in Figure 2.7.



$$\begin{array}{c|ccccccccccccc} & A & B & C & D & bi & b2 & b3 & c1 & c2 & c3 & d1 & d2 & d3 \\ \hline A & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ B & 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ C & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ D & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ b1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b2 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b3 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ c1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ c2 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ c3 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ d1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ d2 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ d3 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{array} * \begin{bmatrix} 3 \\ 4 \\ 4 \\ 4 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \underset{\overline{\overline{66}}}{\begin{bmatrix} 12 \\ 6 \\ 6 \\ 6 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \end{bmatrix}} \xrightarrow{\text{Normalized}} \underset{\overline{\overline{1.0}}}{\begin{bmatrix} 0.182 \\ 0.091 \\ 0.091 \\ 0.091 \\ 0.061 \\ 0.061 \\ 0.061 \\ 0.061 \\ 0.061 \\ 0.061 \\ 0.061 \\ 0.061 \\ 0.061 \end{bmatrix}}$$

Figure 2.7 Computation of eigenvector centralities of graph with 13 nodes and 12 ties (Figure 2.6)

The pattern of the interactions between the nodes can be assessed in visualizations of the large-scale network structure, where reoccurring patterns can offer a perspective on how the network works (Newman 2010).

Network analysis has applications in many different fields, including mathematics, physics, computer and information science, social science, biology, and elsewhere (Newman 2010). An underlying premise of network analysis is that the structure of a network— the particular pattern of interactions— can have a major effect on the behavior of the system. As network theories developed in various disciplines in their abstract form, the resulting analytic tools can be applied to almost any system represented by a network (Newman 2010). Network analysis is often characterized by visualizations and an extensive array of measures and metrics to describe complex networks (Hansen et al. 2011, Newman 2010). Liebowitz (2005) explored the benefits of linking visualization and metrics of social network analysis as a means to assess AHP decisions critically. His approach is consistent with Doerfel's (1998) observation that a primary benefit of network analysis, contrary to some research methods such as AHP, is that it does not employ *a priori* categories.

The foundation of SNA is graph theory, which traces back at least as far as Euler in 1736 (Prell 2012, Hansen et al. 2011, Wasserman and Faust 1997). Graph theory is the study of graphs, which are mathematical structures that model pairwise relations between objects. SNA as an academic discipline has matured over the last two decades, coinciding with the growth in information technology (Pryke 2004, Hansen 2011).

The few papers construction industry papers on semantic network analysis included an integration framework for building information modeling (BIM) and geographic information systems (GIS) (Karan and Irizarry 2015) in the facility management supply chain. Relevant social network analysis research in construction management showed that quantitative network measures helped describe the non-linear, complex, iterative, and interactive systems that construction projects comprise (Pryke 2004). Loosemore (1998) challenged traditional construction management research methodologies as being static, reductionist, and socially insensitive arguing that SNA can serve a valuable role in investigating the complexity of construction organizations. In a case study of an emergency redesign and construction effort, Loosemore employed SNA metrics. He found that a failure to engage key personnel at the onset led to their isolation, increasing poor communication and adverse efficiencies as the work progressed. Pryke (2004) critiqued traditional construction management research methods in assessing partnering, supply chain management, and performance incentives.

Pryke found that SNA revealed changes in roles and relationships arising out of the implementation of “new procurement” approaches. Amongst his findings, Pryke reported that the client must have a prominent position and that partnering and early engagement obviate the need for separate performance incentives. Chinowsky et al. (2008) emphasized a need to focus on the interactions of a project network in building trust and shared values to achieve performance breakthroughs possible through the creation of high-performance teams. They also noted that a high-performance team’s success hinged on the ability of team members to exchange knowledge and insights continuously to enhance the collective group output. In a related study, Chinowsky et al. (2010) investigated four organizations using SNA by identifying enablers (e.g., leadership, trust, client-specific communication) and barriers (e.g., geographic or discipline boundaries) to high-performance communications essential to provide a focus on the success of a team over individual objectives.

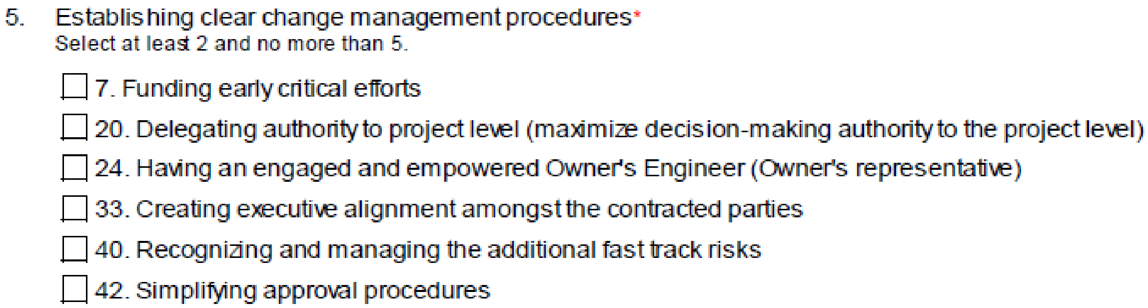
2.4.2 Network Analysis Methodology

A Flash Track network survey was developed with the assistance and participation of the RT 311 research team. The survey data were then analyzed with tools borrowed from social network analysis.

2.4.2.1 Developing the Flash Track Network Survey

Over a two-year period, RT 311 met in structured workshops for interactive exchanges to identify the essential Flash Track practices, and to develop implementation worksheets for each of these practices, discussing innovative implementation measures, barriers, risks and risk mitigation measures. A Flash Track network survey was developed primarily from information obtained from implementation worksheets, as they included implementation and risk mitigation strategies enabling each Flash Track practice. RT 311 members were also asked to identify interdependencies between the practices. In developing the survey, comments offered by the oracles engaged in a modified three-round Delphi process involving 64 external Flash Track experts, structured case studies and literature review process were also considered. Nine out of fifteen members of the RT 311 participated in the network analysis survey and identified practices that enabled other practices.

For each of the 47 Flash Track practices, enabling practices identified in the prior research phases were compiled into a 47 question, fixed-choice web survey with SurveySelect.NET (Version 4.102.011, ClassApps, Kansas City). Nine RT 311 members, who were representative of the full 15 member RT 311 panel, completed the 47-question survey in their final working session. The Flash Track network survey asked respondents to select 2 to 5 practices from a pre-defined list of 5 to 8 practices that enabled a specified Flash Track practice. An example of a typical question is shown in Figure 2.8. Respondents were also asked to rank their top 3 choices for each question, but those responses are not included in this analysis.



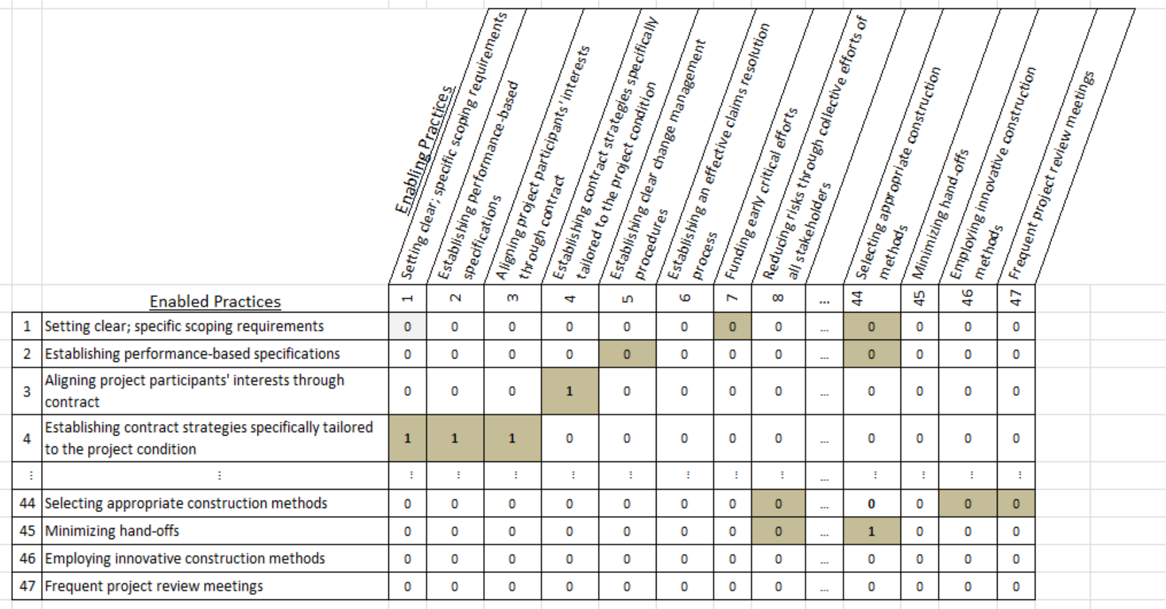
5. Establishing clear change management procedures*
Select at least 2 and no more than 5.

☐ 7. Funding early critical efforts
☐ 20. Delegating authority to project level (maximize decision-making authority to the project level)
☐ 24. Having an engaged and empowered Owner's Engineer (Owner's representative)
☐ 33. Creating executive alignment amongst the contracted parties
☐ 40. Recognizing and managing the additional fast track risks
☐ 42. Simplifying approval procedures

Figure 2.8 – Typical fixed-choice survey question to identify enablers for practice #5

2.4.2.2 Network Data Analysis

The responses of each of the nine respondents were compiled on a summary worksheet that totaled the number of respondents who reported one practice as enabling another. A threshold of 5 responses was set for defining whether a practice enabled another practice. The threshold value of 5 indicates that the majority of the nine respondents concurred that an enabling tie existed between a pair of practices. The resulting binary, non-symmetric practice-practice square matrix represented which practices enabled particular other practices. NodeXL version 1.0.1.334 (http://www.smrfoundation.org/) was used to create a network graph and compute key SNA metrics of degree and eigenvector degree centrality, as well as out-degree and in-degree centrality for each of the 47 practices. Figure 2.9 shows a subset of the practice-practice square matrix. The matrix's top horizontal axis lists the enabling practice and its right vertical axis lists the enabled practice if a respondent cited that a tie existed, a "1" is entered otherwise a "0" is entered. The shaded cells depict the fixed choices that were available for selection on the Flash Track survey. Survey choices were included based on the RT 311's prior input on the implementation worksheets and other sources described earlier.



	Enabling Practices	Setting clear; specific scoping requirements	Establishing performance-based specifications	Aligning project participants' interests through contract	Establishing contract strategies specifically tailored to the project condition	Establishing clear change management procedures	Establishing an effective claims resolution process	Funding early critical efforts	Reducing risks through collective efforts of all stakeholders		Selecting appropriate construction methods	Minimizing hand-offs	Employing innovative construction methods	Frequent project review meetings
	Enabled Practices	1	2	3	4	5	6	7	8	...	44	45	46	47
1	Setting clear; specific scoping requirements	0	0	0	0	0	0	0	0	...	0	0	0	0
2	Establishing performance-based specifications	0	0	0	0	0	0	0	0	...	0	0	0	0
3	Aligning project participants' interests through contract	0	0	0	1	0	0	0	0	...	0	0	0	0
4	Establishing contract strategies specifically tailored to the project condition	1	1	1	0	0	0	0	0	...	0	0	0	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	...	⋮	⋮	⋮	⋮
44	Selecting appropriate construction methods	0	0	0	0	0	0	0	0	...	0	0	0	0
45	Minimizing hand-offs	0	0	0	0	0	0	0	0	...	1	0	0	0
46	Employing innovative construction methods	0	0	0	0	0	0	0	0	...	0	0	0	0
47	Frequent project review meetings	0	0	0	0	0	0	0	0	...	0	0	0	0

Figure 2.9 – Sample subset of the Flash Track adjacency matrix

The results of the Flash Track network analysis were then compared to the results of three other methods of ranking the practices in terms of how essential they were for Flash Tracking. Those ranking methods were based on a modified Delphi and an Analytic Hierarchy Process (AHP) approach. The Delphi task produced two rankings based on a relative index or a mean response score of the first two rounds of a Delphi survey and a top-ten selection of the consensus practices in the third and final round. The AHP provided the third ranking based on weightings derived from pair-wise comparisons of practices and their categories that the RT 311 made collectively. Figure 2.10 shows the components of the described methodology.

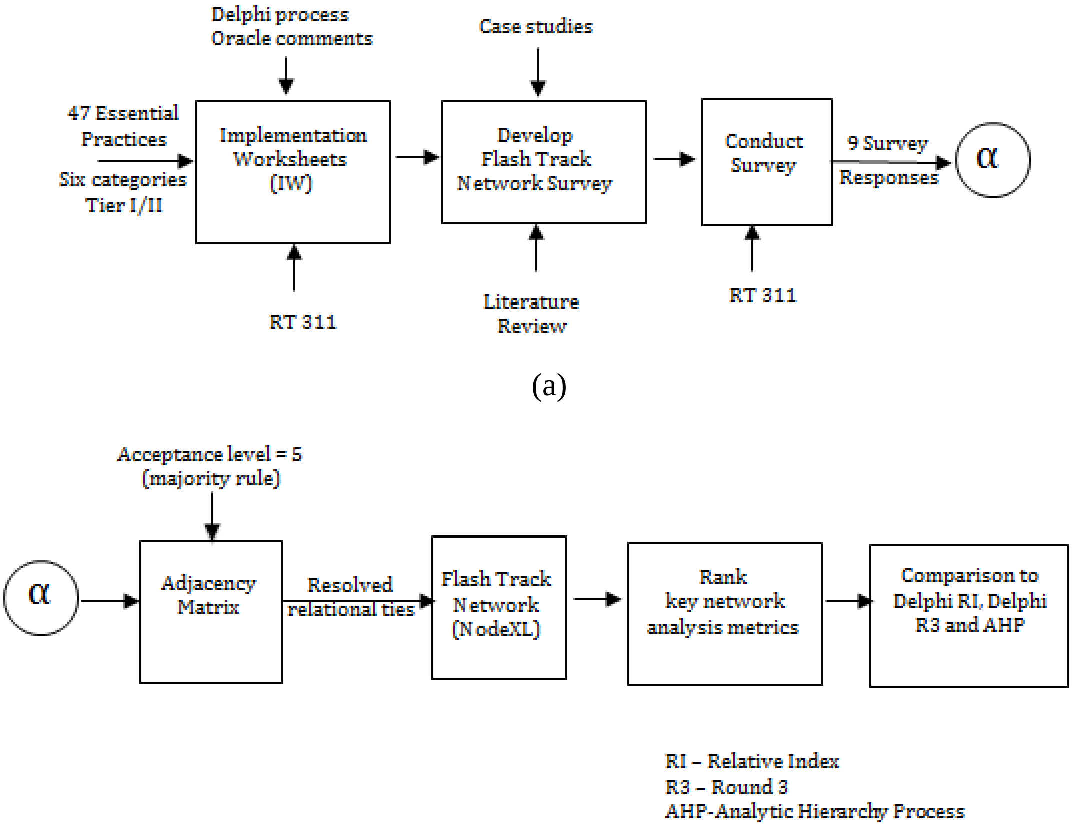


Figure 2.10 – Network Analysis Research Methodology

(a) Data collection; (b) Analysis

2.5 Compliance with the Institutions' Ethics Requirements

This research was conducted in full compliance with requirements for safeguarding the rights and welfare of human participants in research as set forth by Georgia Institute of Technology and Virginia Polytechnic Institute and State University's Institutional Review Boards.

CHAPTER 3

LITERATURE REVIEW

A comprehensive literature review and analysis was conducted to identify fast track practices pertinent to successful Flash Track efforts. The literature review was later expanded to other areas of interest identified during the industry workshop research process. This intial literature review examined domestic and international construction projects as well as accelerated efforts in other industries such as shipbuilding, microelectronics, software development, and manufacturing sectors in search of key fast and Flash Track success factors.

The first stage of the literature review served as a point of departure and as the basis for the modified version of the Delphi process (Keeney et al. 2011), which requires an initial evaluation list of fast track practices. The process identified a selection of writings of interest that included general discussions on fast tracking and focused discussions on practices within six topical research categories.

3.1 General Discussions

Fast Track and Other Procedures, A General Study of Design and Construction Management (Caudill Rowlett and Scott 1969) was offered to the New York State University Construction Fund as a means to confront rising construction costs and space needs due to increased enrollment during the Vietnam war era (1966-1972) . This document begins with the simple premise that change is inevitable and it is more important to design a facility that is adaptable to many uses than one designed with only a first use in mind. Given this premise, the author suggests that a project can begin with a general knowledge of the facility's purpose, and its specific needs can be determined at a later date. Presented as a theoretical discussion, the report urges the early introduction of a construction manager, selected to continually manage a highly compressed phased schedule. The authors predicted the proposed new delivery method would reduce construction times up to 25-45 percent. The proposed new method of project delivery consists of three steps: 1) fast track scheduling, 2) preselected systems and 3) continual delivery. Fast track scheduling incorporates three key considerations: overlapping activities, concurrent agreements and a need for irreversible decisions. Preselected systems are described as preapproved geometries, standard details, and design criteria, along with prepackaged building components and manufactured subsystems. Continual delivery urges a more long-sighted view be taken when engaging engineering and contractor resources during campus expansion programs. The three steps are reported as representing varying degrees of change from traditional practices, with fast track scheduling entailing the least amount of change. In contrast, preselected systems and continual delivery are reported as requiring more change and commitment. Achieving continual delivery is cited as the most elusive measure, requiring the greatest effort to implement.

Fast Track Construction (Kwakye 1991) discusses the need to adopt alternative and competitive procurement methods involving the application of innovations in the management of construction procurement and the industrialization of the construction process. Kwakye (1991) calls for the integration of design and construction phases, involvement of the contractor in both design and construction phases and overlapping work packaging. The early engagement of a contractor capable of managing the design and construction work is also recommended. He further reports that successful fast tracking is highly dependent on management skills; it is important for the client to have an active role and be cognizant of fast track's risks and benefits. He also reports that under fast tracking, the architect's role is less pronounced, and the early appointment of a managing contractor is seen as a central role. In a summary of the costs and benefits of fast tracking, the paper suggests that the capital costs of fast tracking will exceed those of traditional construction by more than 7.5%.

Tighe (1991) and Fazio et al. (1988) urge caution regarding the fallacies and shortcomings of fast track practices, suggesting that the benefits of fast tracking are more imaginary than real. Among critics, common complaints regarding inherent shortcomings of fast tracking include excessive conservatism, oversizing and the high likelihood of construction rework due to ill-conceived concurrent engineering. Tighe (1991) reports that rather than clamoring for more fast-tracked projects, a stronger emphasis on planning is required. Carroll et al. (2004) constructed a simulation model incorporating three important practical limitations of fast tracking: 1) changing sequential tasks into parallel tasks, 2) utilizing additional resources and 3) changing the decision-making structure to include greater delegation or decentralization. In parallelizing tasks, a higher level of face-to-face coordination or "mutual adjustment" between workers is required; the authors suggest that these hidden coordination costs are often underestimated. In providing additional resources, an additional level of variability is introduced, which necessitates increased supervision. Delegating or decentralizing authority to a lower level without a holistic perspective on the work has the potential for resulting in costly and incorrect decisions. In contrast, Williams (1995) offers that fast track projects are becoming a viable option because many organizations are abandoning their old management paradigms. He suggests that specific techniques do not make a fast track project successful; rather, the project's success is based on an aggressive objective placed before a well-managed team. The paper calls for a new paradigm that involves the development of greater engagement from suppliers and vendors in the design process. Williams (1995) concludes that "when you put together a well-trained, qualified team, set them up with good leaders, challenge them with an aggressive objective, and get out of the way, it is amazing how easy they will make the job look."

The *ECI Fast Track Manual* (Eastham 2002) offers a "reservoir of practical ideas and suggestions" across all project stages from conception through operations. The manual was developed through a series of industry workshops and from the existing literature. Industry workshop participants were drawn from contractors and owners of industrial, process and power projects. The *Fast Track Manual* calls for a new mindset offering that "simply doing all the normal things involved in the creation of a new facility more quickly than normal would not constitute a fast track project." Rather, fast track requires a combination of questioning traditional approaches and doing all of the normal things well. In identifying three fundamentals for successful fast track efforts, Eastham cites the following: 1) the caliber of the individual, 2) working relations and 3) adequacy of definition. Eastham also cautions that a fast track strategy should be avoided unless the owner's business benefits from early completion significantly outweigh any financial concerns or other risks involved.

Techniques for Radical Reduction in Project Cycle Times (CII 2004) was charged with investigating the reality, requirements and barriers of radical reductions of project cycle times to identify common elements of successful projects. The study defined ‘radical reduction’ as schedule reductions of more than 25% and found several common themes, which were divided into drivers and techniques. Drivers were defined as elements that must be present for the techniques to be effective. The report found that an owner’s commitment was the single most consistent and determining factor in successful cycle time reduction. Once that commitment was in place, the report found that other key drivers included employing high-performance teams with detailed planning. Management techniques, scheduling techniques and CII best practices were explored, resulting in a list of the most frequently used techniques. Employee involvement, use of electronic media, participative management, pre-project planning, a construction-driven schedule and alignment appeared most often across projects and in all stages from conceptualization to commissioning. The report found no simple formula or “silver bullet” for radical reduction. The most significant barriers to achieving radical reduction were scope changes, lack of clear decision-making authority and lack of clear objectives. The report reports a number of collateral benefits, including improved safety, quality and cost performance. The study concludes that radical reduction is not possible on every project; radical reduction requires a huge commitment, a strong team, and outstanding execution.

CII’s *Best Practices for Design of Fast Track Projects* (Salem and Miller 2008) reports that constructability, clearly defining design freeze points, early scope locks and establishing design criteria and standards at an early stage are the most influential measures of a successful fast track design process.

Partnering Process Model for Public Sector Fast-Track Design-Build Projects in Korea (Cho 2010) explored the interrelationship of fast track and design-build projects and found that there were five main influencing factors that acted as barriers to successful fast track projects: 1) delay in an owner's decision-making, 2) design defects and omissions, 3) lack of communication among the involved parties, 4) delay in procurement, and 5) unsuitability of the construction method. In *Key Competencies of Design Build Clients in China*, Xia and Chan (2010) developed a ranking of the top six key owner skills in China's evolving design-build market. The report found that the ability to develop a clear project scope and objective was the single most important skill; it was followed by an owner's financial capacity, contract management ability, sufficiency of staff, ability to effectively coordinate a design-build project and prior design-build experience.

3.2 Topical Discussions

The research approach involved categorization of Flash Track practices in both the content analysis and, later, as part of an Analytic Hierarchy Process. Ultimately, six topical headings were defined; they serve to organize an assortment of other documents reviewed and highlight pertinent other considerations of prospective Flash Track practices.

3.2.1 Contractual considerations

Setting clear, specific scope requirements, allocating risk appropriately and having sufficient funding are considered fundamental contractual considerations and are of heightened concern in a fast track project (Eastham 2002, Bynum 1983, Foster 1983, Alhomadi et al. 2011). The failure to provide clear requirements is a leading cause of project failures. In response to this, the development of performance specifications offers an alternative whereby contractors are in a better position to be aware of market solutions that can satisfy an owner’s needs (Thomson 2014, Frazer 2013).

Standard construction contracts, which tend to be cost-focused and risk averse, have been identified as being inconsistent with the uncertainty and need for collaboration inherent to fast tracking (Ashcraft 2012, Cleves and Meyer 2011, Sakal 2005, Rahman and Kumaraswamy 2008, Bernstein 2014). Opinions regarding contract type vary; some reports point to highly incentivized, mainly reimbursable contracts as the ideal, while others find that most types of construction contracts, including fixed price contracts, have been used successfully (Eastham 2002, Moazzami et al. 2011 Alhomadi et al. 2011, Gehrig et al. 1990, Williams 1995, Salem and Miller 2008, Love et al. 2011). Cho and Hastak (2013) report that irrespective of the contract type, high-profit projects, such as emergency re-builds and critical time-to-market endeavors, are ideal candidates for fast track.

Ashcraft (2012) offers that risk avoidance rarely reduces overall risk or cost; instead, it transfers risk to another party that will price it as a contingency to be included in the project cost. Assigning risks to the parties best able to control them is often cited as a guiding measure (Williams 1995, Moazzami et al. 2011). Advocates for relational contracting report that contracts with more equitable or shared risks help align parties to the project’s objectives and increase their commitment to the project (Love et al. 2011, Ashcraft 2012, Ballobin 2008, Mathews and Howell 2005). Relational contracts are also seen as a means of allowing project participants to focus on high-performance targets and try innovative ideas, which complements a high-performance culture (Ballobin 2008, Ashcraft 2012, Rahman and Kumaraswamy 2008). Pishdad-Bozorgi and Haymaker (2014) found that establishing contracts that complement the decision-making process promotes trust; for example, a fair contract in which the decision-making team shares risks and rewards associated with the outcome of their collaborative decisions builds trust.

Effective change and claims resolution processes should be established early to facilitate payments for extra and changed work, thereby minimizing commercial restraints and letting the project team concentrate on the work (Eastham 2002, Salem and Miller 2008).

3.2.2 Delivery considerations

Delivery considerations entail procurement practices and the interface of contracting parties during the fast track process. The introduction of innovative relationship-based procurement practices is seen as a necessary improvement on traditional procurement practices, which are considered to be inconsistent with the complexities of fast tracking (Walker and Hampson 2003, Patty and Denton 2010, Cho et al. 2010, Asmar et al. 2013). Doloi (2013) and Asmar et al. (2013) report that relational contracts provide significant improvements in quality, schedule, communications among stakeholders, and financial performance over traditional, non-relational contracting methods.

Alliance relational agreements are similar to agreements used in the design-build delivery system but have more flexibility in dealing with project risks and their ability to make adjustments or changes in the course of the work. Alliance arrangements are characterized by the collective sharing of project risks, a “no blame” culture and integrated project teams selected on the basis of identifying the best person for each position. Alliance contracts rely on environments of mutual trust, compatible organizational culture and good communication (Davies 2008). Emblematic of the central role of trust and open communications, Alliance contracts have high incidences of failure in the event of breakdowns in trust, cultural mismatches and poor communication (Davies 2008). Integrated Project Delivery (IPD), an emerging relational project delivery system, collaboratively involves key participants, particularly early on in the project timeline. Alliance and IPD contracts have many similarities. IPD relies on Lean project delivery practices to support cooperative project deliveries, whereas Alliance contracts focus on the client’s values and input from the team incorporated during the selection workshop (Gehbauer 2011).

Seeking out strategic suppliers has been shown to be a source of time-saving innovations and offer considerable benefits (Vorster et al. 1998). Using collaborative modeling tools, such as building information modeling (BIM) or Smart Plant, as a central design platform during the concurrent interactive design phase has been shown to be an effective tool in streamlined project communications and improve project performance (Love and Gunasekaranb 1997, Salem and Miller 2008, Homayouni et al. 2010, Barlish and Sullivan 2012, Bryde et al. 2013, Luth et al. 2014, Choi et al. 2014). Cheung et al. (2013) report that technical advances in information flow can mitigate project risks and improve project performance.

Timely awards of contracts, recruitment and training of the right people are essential elements of the fast track success formula (Eastham 2002). Successful fast track projects are staffed with self-motivated, technically competent team players who are expected to proactively seek solutions to problems (Gehrig et al. 1990, Miles 1996, Carroll et al. 2004, Jeffery 2009). A CII study of high-performance teams found that effective leader behavior greatly enhances the prospects of breakthrough results in performance (CII 1999b). In discussions on consensus decision making, team leaders who are both task- and relationship-oriented are preferred (Eberlin and Tatum 2008, Cosgrave 1996, Jeffery et al. 2005).

3.2.3 Organizational considerations

In a CII study, *PEpC, A Breakthrough Project Delivery System that Improves Performance by Reforming Owner, Contractor Supplier Relations*, the early involvement of contractors and suppliers in the planning stages produced up to a 19.6% schedule savings and a 17.8% cost savings compared with traditional approaches (Vorster et al. 1998), supporting other advocates of early engagement of downstream stakeholders in the design process (Tatum 1989, Egan 1998, Griffith and Gibson 1997, Eastham 2002, de la Garza et al. 1994).

Owners must have a sufficient depth of resources and strength of organization for the successful execution of a fast track process (Eastham 2002, Miles 1996, Kumaraswamy et al. 2005, Cho et al. 2010). When owners have been willing to manage construction project risks themselves, they have done well. In studying Korean fast track projects, the owner’s capacity and strength of organization was found to be the single most important success factor (Cho et al. 2010).

Key success factors in integrated teams include continuity, empowerment of the team and project personnel’s willingness to tackle challenges with a “can do” attitude

(Miles 1996, Songer and Deikmann 2000, Eastham 2002). In a study of partnering in fast track projects, a very strong correlation was found between fast tracking and partnering, leading to the conclusion that fast track projects may be more successful when combined with partnering (Cho et al. 2010). A principal benefit of a strongly aligned project team with decision-making authority is that personnel closest to the work have the needed perspective to make timely and high-quality decisions at the project level (Carroll et al. 2004, Jeffery 2009) and are vested in the project's success (Cosgrave 1996).

3.2.4 Cultural considerations

Successful fast track projects require a new mindset to enable the early establishment of flexible teams because design, procurement, construction, operations and supplier organizations work together in a cohesive project-focused unit (Williams 1995, Chan et al. 2003, Elvin 2003, Yitmen 2007, Zhang et al. 2013).

Positive, highly collaborative team relationships have been demonstrated to improve project performance (Rahman et al. 2004, Chan et al. 2003, Love et al. 2010, Laan et al. 2012, Cheung et al. 2013). Relational aspects with the highest success include the following: open and honest communication, competence, integrity and the willingness to tackle challenges for the betterment of the project (Salazar et al. 1994, Eastham 2002, Yitmen 2007). Trust and communication have been found to be important factors with strong correlations with project performance; however, owners and contractors often have different perceptions of actions that promote trust (Salazar el al. 1994, Laan et al. 2012, Hughes et al. 2012, Zhang et al. 2013). The importance of collaboration and cooperation was highlighted in an industry study of 104 construction client organizations. The study identified barriers to partnering, and two-thirds of the construction clients surveyed regarded increased cooperation as more important than competition for achieving project success (Eriksson and Nilsson 2008). CII studies of projects carried out under emergency conditions found that these projects displayed both exceptional schedule and cost performance and were executed in a collaborative environment (Vorster et al. 1998, CII 1999a, Songer and Diekmann 2000).

A commitment to organizational alignment requires the early establishment of flexible, non-hierarchical integrated project teams. The team members include designers, contractors, specialty contractors and owner representatives working toward a common shared goal (Eastham 2002). Creating executive alignment of shared goals among key fast track participants is central in setting the tone for successful projects (Bowers et al. 2003, Barki and Pinsonneault 2005, Salem and Miller 2008, Jeffery 2009, Solis et al. 2013). Key alignment issues transcend contract language and are best achieved by having 1) appropriate stakeholder involvement, 2) effective and accountable project leadership, 3) clear priorities regarding cost, schedule and project features, 4) open and effective communications, 5) timely and productive meetings, 6) a team culture that fosters trust, honesty and shared values, 7) pre-project planning that includes sufficient funding, schedule and scope to meet objectives, 8) an effective reward and recognition system, 9) effective teamwork and team-building programs, and 10) effective planning tools (Griffith and Gibson 1997, CII 2009).

Successful fast track projects start with an actively involved owner. Concern for constructability must begin at the project planning stage and must be an integral part of the design, engineering, and project contracting approach (Smock 1992, Eastham 2002).

3.2.5 Planning considerations

In fast track projects, reduced durations and increased numbers of concurrent activities increase the importance of careful, thorough and new ways of thinking about planning (Williams 1995, Miles 1996, Eldin 1996). In a CII study exploring the design of fast track projects, Salem and Miller (2008) reported that constructability was one of the most influential measures for fast tracking. Other keys to fast track design include clear definitions of design freeze points, early scope locks and establishment of design criteria and standards at an early stage (CII 2009). In contrast, Williams (1995) and Miles (1996) report that fast track schedules cannot be “frozen,” and the planning process never stops as the project evolves.

Fazio et al. (1988) caution that mistakes made early on in the fast track design process can have far-reaching consequences (Tighe 1991, Ford 2000). Implementing a dynamic planning and control methodology helps address the risks of concurrent designs by tracking decisions that will limit future flexibility (Pena-Mora and Li 2001). Bogus et al. (2002 and 2011) advise that developing and understanding the concepts of “evolution” (i.e., rate) and “sensitivity” (i.e., impact) in the context of information flow is key in developing overlapping strategies and improved planning tools. Cho et al. (2010) developed a decision model that explores the trade-offs between time and cost. This model demonstrates that scheduling, a focus on construction-driven milestones, identification of long-lead items, standardization, and detailed critical path planning are strongly correlated with successful fast track outcomes.

A collaborative, adaptive and iterative planning process focused on matching manpower to available work is preferred given the uncertainty of fast track projects. Fast track plans must be adaptable to change. At root, the notion is similar to that expressed by Dwight Eisenhower: “Plans are useless, but planning is indispensable.” Consequently, master schedules limited to key interface dates and short cycle “sprints” agreed upon by the personnel closest to the work (i.e., the Lean Construction Institute’s Last Planner System) are essential. Similar concepts are central to the computer industry’s Agile Project Management method, which has its roots in software development (Ballard 1994, Tommelein 1998, Ballard 2000, Johansson 2012, Seppanen et al. 2010, Goodpasture 2010).

Effective risk management is an integral element of the fast track project control process. Risk registers should be introduced early and used throughout the project (Eastham 2002, Williams 1995, Tighe 1991, Bogus et al. 2005, Moazzami et al. 2011, Alhomandi et al. 2011, Khoramshahi 2010, Ballobin 2008, Darrington 2011). In exploring fast track strategies, Moazzami et al. (2011) report that the most significant fast track risks include the following: 1) cost overruns and inaccurate cost estimates, 2) design errors and omissions, 3) delay damages, 4) numerous change orders, 5) construction rework and modifications, and 6) overlooked work assigned to no party. They report the main source of legal problems is inequitable risk apportionment among contracting parties.

3.2.6 Execution considerations

Effective execution entails process improvements, such as co-located teams and dedication of full-time personnel, which are necessary aspects of schedule-critical projects (Williams 1995, Miles 1996, Elvin 2003). In a study of team integration in New

Zealand, 77% of experts surveyed cited co-location as a leading performance indicator (Ibrahim et al. 2013).

A CII study of schedule-critical projects found that non-resource (i.e., no-cost) changes (e.g., focusing design and procurement decisions on construction priorities) improved communication, reduced turnaround times for reviews and produced rapid responses to inquiries. The study also found that the use of pre-existing designs and the early engagement of suppliers and contractors have a greater impact on schedule reduction than resource changes, like craft over-time, multiple shifts, increased craft levels and relieving project participants from other responsibilities (CII 1999a, Songer and Diekmann 2000, Eldin 1996). Non-resource changes, or “free changes,” like eliminating waste as prescribed by Lean Construction, can offer significant insights on better ways to work (Howell 1999, Ballard 2000, Ballard and Howell 2004, CII 2007b).

Lichtig (2006) offers “five big ideas” for a successful project: 1) Collaborate -- really collaborate -- throughout design, planning, and execution. 2) Increase relatedness among all project participants (i.e., build relationships based on trust). 3) The work of leaders is to bring coherence to the network of commitments within the project. 4) Optimize the project, not the pieces. 5) Tightly couple action with learning (i.e., foster continuous improvement).

Successful fast track projects are successful not only because they challenge conventional approaches and manage the additional risks introduced, but also because they do the normal things well. These include timely payments, being proactive in seeking regulatory approvals, having decision-focused meetings and making timely and well-informed decisions (Eastham 2002, Khoramshahi 2010, Cho et al. 2010).

Successful fast track projects strive to use the latest proven methods and technical improvements and employ time-saving modularization and off-site fabrications as well as other means to speed construction (Williams 1995, Eastham 2002). Modularization and off-site fabrication yield the greatest benefits when these methods are chosen early (Smock 1992, Tighe 1991). An Electrical Power Research Institute study on construction practices found that the greatest opportunity for cost and schedule savings is through the use of modular construction techniques (Smock 1992). In the shipbuilding industry, massive components, such as engine rooms, and whole sections of a ship have been “modularized” to speed the design process resulting in schedule reductions of 60-80%. Shipbuilding’s transformational evolution through modularization has also led to significantly lower costs, higher quality, safer construction and the opportunities for further innovations (CII 2011).

CHAPTER 4

EPC PROJECT INTERVIEWS AND CASE STUDIES

Fifteen case studies were examined, including three structured interviews, seven expert testimonials from RT 311’s panel of industry, and three published studies on Flash Tracking. Two historically notable projects were also considered to highlight prevailing and distinguishing practices that have been shown to be beneficial.

4.1 EPC Project Interviews

Structured interviews were conducted on three successful Flash Track efforts, including the emergency rebuild of the Saint Anthony Falls I-35W Bridge in Minneapolis (DeHaven 2009), a contractual Integrated Project Delivery (IPD) for the new 192-bed Maine General Medical Facility in Augusta, Maine (Farwell and Richardson 2013), and a Hot Dip Galvanizing Line within Thyssen Krupp’s new state-of-the-art steel processing facility in Alabama (MacNeel 2012) that embraced Lean Construction practices. The interview questions and responses are included in Appendices C and D.

4.1.1 Saint Anthony Falls I-35W Bridge

Figure 4.1 - Saint Anthony Falls, I-35 (Lestrud 2112, R.J Watson 2015)

The unexpected and sudden collapse in 2007 of the 40-year old Saint Anthony Falls I-35W Bridge (Figure 4.1), a principal artery into downtown Minneapolis, required a record time replacement. This emergency rebuild project was completed in little more than a year, a dramatically shorter completion time than the 24 months taken for building comparable structures.

The procurement process on this project went remarkably quickly. Within days of the August 1st collapse, statements of qualifications were sought, and short-listed design-build teams were selected on August 8th. The best-value design-build selection process was evaluated based on proposed pricing and schedule. As part of the selection process, the Minnesota Department of Transportation (MnDOT) conducted “private and confidential pre-proposal meetings” with the competing candidate firms where design alternatives were openly discussed. The best-value design-build contract, with a “no-excuse” bonus of $7M for on-time completion if the contractor waived all future claims was awarded 68 days from the date of the collapse.

A number of early project decisions and activities were key to the project’s success. These included the owner’s decision to assign its best people, or “A-team”, to the project, the securement of early access to needed property with provisions for a guaranteed timeline for financial closing, and a decision to “build the largest project possible with the smallest environmental [impact],” in the words of a project participant. To expedite the process, the owner assumed the risk of obtaining all but two of the permits, which MnDOT was able to obtain within two weeks of the collapse.

Construction began well before the final design was completed, with teams of contractors working three work shifts seven days a week, often in brutal subzero temperatures. To speed construction, a casting yard and heated, prefabricated metal buildings were set up just south of the bridge so pre-casting could continue throughout the cold Minnesota winter. Other construction measures included increased expenditures for duplicate forms and equipment to insure work progressed uninterrupted; high-performance, self-consolidating concrete mixes were employed, closely monitored and adjusted for cold weather conditions.

Co-location of all key parties helped foster a positive, highly collaborative and productive work place, which was equated to a continual “partnering” process. Several informal meetings and discussions helped speed the resolution of the project’s challenges. BIM was a great tool for constructability reviews. In lieu of braving the extreme conditions, 4D modeling of the erection sequence and other methods were employed.

The project had strong leadership provided by the central client project manager, who was the team leader. Single point contacts or hot-lines were developed for key elements of the project, including permitting, IT and a variety of other services. An “over the shoulder” review process provided stream-lined quality assurance.

Due to the accelerated schedule, there were a number of surprises on the critical path. For example, ordering light poles was a critical item with a lead time of ten months, which the designer found to be amazing given that the team could build an entire bridge in eleven months.

The project was completed more than three months ahead of schedule. The record time completion of the Saint Anthony Falls I-35W Bridge was a source of great pride to the project team. A principal member of the team suggested that the project’s key success factors – shared common goals, synergy between the engineer and contractor, and the benefits of motivated and engaged personnel – are adaptable to other projects.

4.1.2 Maine General Medical Facility

Figure 4.2 - Maine General Medical Facility (High Profile 2014)

The new state-of-the-art, 192-bed Maine General Medical Center New Regional Hospital in North Augusta (Figure 4.2) serves to consolidate two older local hospitals, resulting in savings of $7.1 million annually in operating costs. In search of a better contracting method, the owner pursued a contractual Integrated Project Delivery (IPD) approach. The original project duration was 40 months with the project's design overlapping the construction process by 18 months. The collaborative project approach, in which each stakeholder has "skin in the game," was tied to a target cost with a capped risk exposure. The architect found that shared risks were the single greatest benefit of the IPD process. As part of a standard Hanson-Bridgett IPD single entity agreement, each participant waived claims against each other, and all risks were effectively shared. The reduced level of liability encouraged the communication and creativity necessary to drive the project in innovative directions. Co-located owners and contractor teams worked closely in a flexible organization free of conventional hierarchies. In the course of regular meetings, the approval process was dramatically stream-lined, and the project was driven by a shared common goal of what was best for the project, as opposed to the traditional silo mentality. The project was executed under a fully shared Building Information Modeling (BIM), which was seen as a key element in an extensive front-end planning process. It was noted that efforts were made to staff the project with "natural collaborators" and in some cases, individuals who were too rigid in their opinions and positions were "voted off the island." When challenges arose on the project, rather than assigning blame, the participants' mindset was "how do we fix this?" The project's collaborative efforts encouraged extensive use of multi-trade pre-fabrication efforts; this was a distinguishing aspect of the project and took prefabrication to a whole new level. Both the design professional and contractor found the experience enormously satisfying, citing the following to be the most valuable lessons learned:

- Importance of careful selection of IPD partners.
- Great value of collaboration, trust and mutual respect.
- Amazing the amount of work that can be done in the absence of silo-mentalities and risk aversion.
- Benefits of early engagement of subcontractors.

4.1.3 ThyssenKrupp Steel Processing Facility

Figure 4.3 - ThyssenKrupp Hot Dip Galvanizing Line, near Mobile Alabama
(Mitchell 2012, Finch 2014)

In 2007, ThyssenKrupp invested in a world class, state-of-the-art steel processing facility in Alabama (Figure 4.3) to meet the demand for advanced flat carbon steel products. The new $3.7B steel processing facility supplies economically crucial industries such as the automotive, construction, utility, and engineered products industries.

This case study focuses on one part of this massive project, a $32 million Hot Dip Galvanizing Line (HDGL #2). At the time of bidding on the design-bid-build project, the contractor was three months into a nearby sister project, HDGL #1. Both HDGL #1 and #2 had nine month construction schedules. The original schedules were staggered so the projects would start and end three months apart from each other. The contractor elected to execute HDGL #2 under a Lean Construction program for commercial reasons (i.e., to lower costs), taking advantage of lessons learned in HDGL #1 and anticipated Lean benefits. The project had no incentives for early completion but considerable damages for failure to complete within the defined contract duration of nine months.

The Lean work process, consisting of the five S's (sort, straighten, shine, standardize and sustain), was used throughout. Based on experiences during HDGL #1, a simple color coding process (i.e., marking or pre-marking supplies with a color designation tied to its project areas) eliminated challenges in locating material on the massive and busy site. The project employed the Lean practices of a collaborative building effort and disciplined teams. It also used Lean Construction's Last Planner System (LPS) scheduling methods, including pull planning, which emphasizes work flow for the short term scheduling of work and resulted in significantly higher production rates.

HDGL #2 was completed at a lower cost ($32M v. $38M) and in an almost three month shorter duration (i.e., 6.5 months v. 9 months) than the identical HDGL #1; the differences were principally attributed to the employment of Lean Construction practices. HDGL #2 required considerably fewer man-hours, lower equipment rental costs, and significantly less end-of-job overtime, resulting in higher productivity rates. The project manager reported that Lean Construction practices can apply to any project; he emphasized the benefits of practical planning and strong execution practices.

4.2 RT 311, Industry Expert Case Studies

RT 311's industry expert panel working sessions often included discussions of select case studies of interest. Discussions were largely focused on industrial projects but also included a project in the food and consumer products and technology industry. The following is a short summary of those discussions.

4.2.1 Skelly-Belvieu Pipeline project

Figure 4.4 - Skelly-Belvieu Pipeline (Garrett 2014)

The Skelly-Belvieu Pipeline project (Figure 4.4) was an expansion of an existing 570-mile pipeline that transports natural gas liquids from Skellytown, TX to a processing facility at Mont Belvieu, TX. The project entailed the installation of additional pumps and related equipment, which upon completion increased capacity from 27,000 barrels per day (bpd) to approximately 44,000 bpd. Plant personnel solicited the central office's involvement to right-side a poor start on an aggressive six-month fast-track construction plan. As a first measure, the project's condition and scope of work were re-assessed; critical obstacles were identified, including the following:

- Development budgets had been exceeded, and the capital cost estimate of $18.5M was insufficient for the scope of work.

- Multiple design contractors were employed (i.e., Jacobs, Burns & McDonnell, Mustang), and no one agent had overall accountability.
- Design contractors had limited involvement in the procurement process.
- Refinery-based project team members were all assigned multiple projects.
- Critical long-lead equipment (i.e., SIS valves) had not been ordered.
- Numerous underground obstructions and interferences were found at project sites.
- Coordination of other dependent projects was not in place.

Corrective measures were effected and included the following:

- Funding levels were increased to $52M.
- A single design contractor, Jacob, was assigned the responsibility of coordinating engineering, overseeing vendors, and securing additional engineering support, as required.
- A dedicated contract management team was formed, which included Jacobs Field Services group assisted by the Phillips 66 organization.
- Laser technologies and other state-of-the-art methodologies were employed to identify underground and other interferences.
- A dedicated prepare-to-operate (turnover) team was established, including plant operations personnel.

In addition to the corrections discussed above, lessons learned include recommendations to secure tie-in approval from operators prior to the initiation of the design process and development of project design standards. Although confronted with early challenges, the project successfully met its tight construction schedule with no reportable injuries; it fully met its performance requirements and was within the amended budget.

4.2.2 British Petroleum's Whiting Final Filter Project

Figure 4.5 - British Petroleum Whiting Final Filter Project
(Crain's Chicago Business 2015)

Operating under a consent decree as part of their $4.2B modernization process, British Petroleum was required to install $400M worth of state-of-the-art pollution control equipment at their 1,400-acre Indiana refinery on the shoreline of Lake Michigan (Figure 4.5). The refinery was designed to process extra heavy crudes from Canada and started operations in 1889. It processes up to 413,000 barrels of raw crude oil each day and up to 15 million gallons of refined products, making it the 6th largest refinery currently operating in the US. It is also one of the first refineries to refine low sulfur gas and ultra-low sulfur diesel. As part of the modernization project, the refinery is removing older, less efficient equipment, and installing emission controls on upgraded and other units, which will help it reduce regulated emissions even further.

A $31M Final Filter project, a small part of the consent decree, was a significant element of the facility's state-of-the-art wastewater treatment plant; it entailed the installation of new tertiary filters at its waste water treatment plant, which would increase the refinery's filtering capacity by 150%. The work also entailed rerouting underground ductbanks, process sewers and other utilities, shoring existing structures and foundations, dewatering, and removing unsuitable soils within eight months (i.e., between October 2011 and June 2012) while not interfering with ongoing plant operations. Solutions employed to ensure the project's timely delivery included the following: 1) careful development of cold weather work plans and contingencies, 2) early conversion of the contract from lump sum to cost plus in response to uncertainties of underground work discovered in the early work and planning process (e.g., 30 previously unknown pipelines), 3) a strong focus on time saving construction methods, and 4) employing state-of-the art subsurface utility engineering technologies to identify existing underground utilities. Time saving construction methods included positioning a large crane within the tertiary filter cell, leaving a blackout for its disassembly and later removal, employing sealing concrete admixtures that improved finishing time, freeze-thaw performance and resistance to chemicals, and encasing existing large diameter sewer lines in concrete to facilitate a timely tie-in with new branch lines. Craft supervision was increased with a greater reliance on apprentices to ensure that work progressed smoothly.

The Final Filter project was completed on time without a lost time accident. Regarding the lessons learned, the contractor offered the following as key success factors: 1) careful task level and contingency planning, including a thorough review of plant procedures, 2) collaborative "white board" planning sessions with design, operations and quality personnel, 3) strong project leadership, 4) striving to surpass interim schedule milestones, and 5) having a very clear and shared understanding of the project's objectives.

4.2.3 Consumer Product Industry, Unilever-Sikeston, Missouri

Figure 4.6 - Consumer Product Industry, Unilever-Sikeston
(Rainbolt 2014)

Within the food and consumer products industry, first-to-market reigns supreme. First-to-market products command a dominant market share (i.e., 40-70%) and market profit (i.e., 60-80%) for a multi-year period, and the advantages can be re-staged to allow the company to maintain its leadership position. Because of the notable financial benefits, fast-track project management and design-build construction is the norm for most new and capital improvement projects. The typical project life cycle, from feasibility to completion, for a food and consumer products project is 10-18 months, and the timeline from EPC award to completion is typically 4-6 months. An integral part of the design process is that plants must be able to be modified and expanded quickly and cost effectively to produce new products and take advantage of future new technologies and materials.

Two case studies, both involving a Unilever facility, were examined (Figure 4.6). The 2010 case study involved a year-long $11.5M project introducing top-selling novelty ice cream products to the American market. The project entailed modifications to an operating facility and involved adding a special chocolate room, piping, and controls to support a proprietary process for creation of the final product. Front-end planning efforts took ten weeks, and the EPC process had a ten-month schedule. The construction phase of the 2010 project was completed in 16 weeks. The second case study, a 2012 restage, involved a nine-month, $6M project; it was characterized by product line growth of a single line process and included tunnels, work tables, process skids, stick inserters, wrappers and inspection systems. Front-end planning efforts took eight weeks, and the EPC process had an eight-month schedule. The construction phase of the 2012 project was 13 weeks.

Both projects entailed detailed planning in the development and design process, as the plant shutdowns were limited to only a few days. The projects' challenges included maintaining stakeholder alignment, establishing a firm lock on the scope of work, the availability of key stakeholders, and the complexity of the schedule due to multiple mobilizations. Both projects were successful. The 2010 project was completed two weeks ahead of schedule and had a low change order rate (2%). Productivity improvements of 60% were realized during the 2012 project compared with the 2010 project. Nevertheless, the 2012 project was one week late when compared with its original schedule, which was attributed to a scope change. Both projects met their performance targets.

4.2.4 West Sak, North Slope project

Planning Success into a Schedule-Compressed Project

Figure 4.7 - West Sak, Pump Drive Module Setting (Garrett 2014)

Conoco Phillips' West Sak DS1E oil well project in the North Slope Artic near Prudhoe Bay (Figure 4.7) produces oil that is considerably thicker and more difficult to develop than conventional oil. Oil from the West Sak fields suffers from "a triple whammy effect" of "…low rates, low recovery factors and low price" (Nelson 2007). The West Sak project was particularly challenging because it employed recent technologies under a highly accelerated schedule driven by an exceptionally short arctic construction window. The timeline to take the project from conception to operation was approximately 20 months. The approach to fast-tracking the project included the following:

- Early identification and prioritization of critical first oil systems and subsystems
- Systems designed to accommodate partial system turnover
- Operational reviews and comments that were integrated into project workflow to minimize rework
- Temporary systems that were identified and installed early to support first oil

Risk management was also at the forefront of the project. Key measures included 1) clearly defining and managing anticipated risks, 2) employing only proven and/or extensively tested technologies, 3) engaging operations and maintenance personnel early and throughout the design process, and 4) selecting contractors based on their skill levels, familiarity with Conoco Phillips specifications and standards, equipment, operational preferences, and project organization.

The $45M West Sak DS1E project, a critical element in Conoco Phillips' plans to significantly expand their artic heavy oil developments program, was successfully constructed in just ten weeks through meticulous planning and risk management targeted to the speed of construction required for the extraordinarily short artic construction window. Lessons learned and recommendations for other Flash Track efforts included 1) setting realistic project expectations and risk profiles, 2) establishing measures to ensure that work can progress without funding delays, 3) developing project execution plans with meaningful work breakdown structures, 4) employing proven, field-tested designs and standardized equipment, and 5) recognizing the importance of highly-skilled, experienced, and integrated teams.

4.2.5 Intel's Construction Revolution:

Journey into Lean and Integrated Project Delivery

Intel Corporation has pursued external and internal paths in seeking step-wise breakthroughs or radical improvements in their capital project development program, which continuously involves increasingly complex projects on increasingly short time lines at lower costs. Intel's capital investment in semiconductor facility construction typically represents 50% of their capital expenditures. Capital investments are increasing as the complexity of the work increases. The fast moving semiconductor industry faces enormous challenges to the construction process; according to Moore's Law, on average, every 18 months the power of the semiconductor will double and its price will halve. In addition to the increasing complexity and aggressive schedule, the industry experiences continually evolving equipment requirements for their support network of process chemicals, ultra-pure water, exhaust and waste scrubbing/purification; owners want to select their equipment as late as possible to capture the latest available technologies. Externally, they have considered practices of industry leaders, and internally, they have looked at their core business of information technology and manufacturing in search of a better way to work.

In examining current practices, they have found that projects are managed under a command and control approach, with each party trying to optimize its own piece. Additionally, according to an Intel employee, an approach of "managing the contract, instead of the contractor" has led to a commoditization of companies, adverse relationships and reduced communications, which leads to massive wastes of time and effort and consistent challenges during the construction process.

To meet their objective of a breakthrough with regard to improvement in capital project deliveries, Intel has moved from earlier improvement initiatives to Lean and Integrated Project Delivery and multi-party agreements. Comparable to the 2006 adoption of Lean to IT, Intel is pursuing Lean Construction as an approach that will change the way they think, change past poor practices and lead to the continual improvement and value they seek.

4.2.6 Flash Track Gas Plant

Figure 4.8 – Fire Rebuild Gas Plant - Oklahoma (Rainbolt 2014)

An established confidential client in Oklahoma lost a highly profitable gas facility and aimed for its restoration to be completed as quickly as possible. In addition to the speed of construction, the client insisted that safety be at the forefront of the work. Burns and McDonnell's industrial group quickly mobilized in assessing the damage (including heat damaged foundations), demolition, development of a design that integrated a new plant into the remaining existing facility, procurement, construction and the commissioning of services on an as-soon-as-possible basis.

Project challenges included the following: the site's remote location; the availability of labor; challenges of an aggressive schedule; timely identification of equipment and material that needed to be replaced, repaired or serviced; capturing the client’s long-term master plan requirements into the emergency reconstruction effort; and high temperatures during the peak construction period of May-September. Once construction began, forces worked six days a week, ten hours/day, totaling approximately 100,000 man-hours with a safety record of zero recordables. Subcontractors were selected based on past favorable dealings. The project’s success elements included the following: 1) the client’s senior management support in defining an early scope lock, 2) excellent communications, 3) ability to design and purchase standard “off the shelf” and modular components, 4) strong, decisive leadership and timely decisions.

The $20M emergency rebuild of the facility was completed, and the facility was returned to service 20 days ahead of schedule just nine months after the fire, with a reported payback period of four months.

4.2.7 ExxonMobil Chemical Plant – Beaumont, Hurricane Ike Aftermath

Figure 4.9 - ExxonMobil Chemical Plant, Hurricane Ike Recovery Effort (Critzer 2015)

In the aftermath of the September 13, 2008 direct hit by Hurricane Ike’s 110-mph winds and 12-foot storm surge, ExxonMobil found its 1960’s vintage multi-unit chemical plant under six to ten feet of saltwater for three or four days. The water destroyed or damaged much of the facility’s infrastructure, which normally manufactures olefins, aromatics, paraxylene and specialty synthetics and catalysts, including some of the critical components for Mobil One motor oil. The storm surge overwhelmed the facility and floated railroad tanker cars off their tracks, and its outflow gouged out a 30- to 40-foot deep crater in the levy barrier at the facility's entry road.

ExxonMobil assembled a 35-person recovery team by September 17th and began working on approximately ten buildings. The plants electronics were a total loss and nothing was operational. Staffed by personnel from many locations, the recovery team split into two parts, one to secure supplies and resources, and the other to pump out the plant. Other focus areas included control system recovery (CSR), power distribution, analyzers, mechanical execution, and loop checking. Staffing on the project was characterized by recruiting the best-of-the-best personnel; all personnel requested were provided to support the speedy restoration of the facility. The project had unprecedented support and access to executive level decision makers.

After the CSR team was assembled, the group developed a set of guiding principles, which were documented to help get all the team leaders and members on the same page. These principles became a key reference document in developing an execution strategy and schedule and identifying critical path work. The project manager for the work reported that the key to the recovery’s success was establishing a clear chain of command, having clear criteria for decision-making and having unambiguous roles and responsibilities. The members of the integrated CSR team exchanged everyone's contact information, and did a lot of file sharing with flash drives. Boundaries for the work were defined to meet the minimum requirement of being crucial for restoring production. Non-critical tasks were postponed. Once the crucial operational activities were identified, execution strategies and schedules, which identified critical path work, cut the original six-to-nine month recovery time line to approximately eight weeks.

Managing senior management expectations played an important role in facilitating the work. The project manager reported that his first call from senior management occurred within four hours of visiting the site; he was asked, “When will you be done?” Crediting the early planning documents, senior managers moved to a mindset of “How can I help?” Within a few weeks of work, the CSR was able to stay ahead of the critical path. Procurement activities were handled under existing global service agreements, and procurement efforts began immediately with the first purchase order issued on Friday, September 19, 2008. Reflective of the ExxonMobil culture, safety was emphasized at the onset through solid planning, collective approaches and stand down discussions.

With an unparalleled level of support, the CSR project realized remarkable success. The first successful distributed control system reading through the temporary specialty chemicals control room occurred by October 13, 2008, 30 days after the hurricane, and production of the first on-spec product by December 7, 2008, 85 days after the hurricane. The project manager overseeing the repair effort summarized the recovery project’s key success factors as the following:

- Clear chain of command (single points of contact)
- Unambiguous roles (decision authorities well defined)
- Inter- and intra-team communications
- Specified boundaries on scope of work

- Strong management of change process
- Twice a day meetings and daily calls with all vendors
- Equipment shipped as soon major components were available, including short shipping of essential components with non-essential components assembled on site
- Direct contact with top-level management, direct escalation path (breaking down barriers)
- A shared understanding of the gravity of the situation (expectation setting)
- A 24/7 work schedule, with 16 hours/day of management
- Some off-site set up (i.e., modularization) efforts and system staging; acceptance testing and applications engineered onsite; all acceptance testing on-site
- Fine-tuning of the supply chain/delivery practices; replace in kind (unless completely obsolete); every conceivable measure taken to create a factory to site "conveyor belt."

4.3 Published Case Studies

4.3.1 British Petroleum's North Sea, Offshore Oil Platform Andrew

In *No Business as Usual*, Knott (1996) tells of the extraordinary success British Petroleum realized in an early Alliance contract. The Andrew Alliance was a strategic alliance with seven contractors for the construction of a North Sea oil platform. The contracting team was comprised of Brown & Root, Santa Fe, Saipem, Highlands Fabricators, Allseas, Emtunga, and Trafalgar House, where the alliance contract included a gain-sharing mechanism. The partners agreed on an aggressive target cost of £373M; if the project costs exceeded the target, Alliance members were liable for a share of the overrun up to an overall limit of £50M and received a percentage of the savings if completed below the target cost.

Brown & Root was responsible for the top-side deck, support frame (i.e., jacket) and subsea piping design, as well as procurement and project management support. Brown & Root's proposal for project savings included reducing client personnel by combining resources from BP, contractors and suppliers; avoiding fabrication growth due to late design changes and equipment deliveries; adequate project duration for design innovation; improved supplier relations; use of fit-for-purpose standard products and functional specifications; and minimization of field inspections and expediting. An early target for improvement was reducing the weight of the rig's topside, which accounted for over half of the project cost. The teaming of the topside designer, Brown & Root, and fabricator, Trafalgar House, produced outstanding results in what the project coined its *110% onshore completion* goal; a shore-based commissioning process was established as part of the project's critical path. A high level of cooperation and co-location of the Alliance members resulted in increased design costs; however, great savings were experienced through innovations and construction. The project realized a more than 10-fold decrease in construction requests for information and a 31% construction manpower savings compared to comparable projects.

Within the Andrew Alliance, considerable emphasis was placed on creating a single team without duplication of functions or accountability in a non-hierarchical, flat organizational structure. There was a high level of face-to-face communication, as Alliance members shared one office building equipped with video links, a state-of-the art shared 3D modeling platform, and various manufacturing and assembly sites. Direct communications between project members were actively encouraged as a means to promote collaboration, build trust and speed the decision-making process. Considerable efforts were made at teambuilding through the engagement of JMW Consultants to assist the team in maintaining its focus, exploring its potential and maintaining its stamina for continuously setting new and ambitious goals and targets. The importance of the Alliance Agreement's gain sharing mechanism was seen as pivotal in removing restrictions common to standard contractual procedures; it helped to break down adversarial behavior and language.

All the contractors were able to generate novel approaches to the design and installation of the platform. The early involvement of the jacket fabricator, Highland Fabricators, led to a reduction of the piles from 16 to 12, resulting in a savings of £1.8M. The subsea piping subcontractor, Allseas, reconsidered subsea protective piles, excavation methods, pipe type, and connection details and was able to reduce the subsea pipeline diameters, resulting in a £2.35M savings and notable scheduling benefits. The early involvement of the EPC drilling contractor, Santa Fe, in selecting equipment and reviewing the design ensured that functional specifications were tailored to the needs of Andrew; this greatly reduced rework. Emtunga, the design and fabrication contractor for the platform's accommodation unit, was able to demonstrate to regulatory authorities that rapid detection and evacuation of the cabins were more effective than universal sprinklers, resulting in a £100,000 project savings.

In addition to cost and schedule savings, innovative rigging methods enabled Saipem to set a heavy lift record by employing dynamically positioned twin S7000 cranes to lower the fully assembled topside platform atop the jacket within three hours. Because of the aggressive 110% onshore construction of the platform, the Andrew Alliance was able to bypass the traditional practice of engaging a flotel to house offshore workers for the hookup of the topside. The hookup process, which often entails months of work, was completed in a scant seven days, eclipsing the previous best-in-class performance by an order of magnitude and resulting in a 75% reduction in hook-up and commissioning costs.

Andrew’s completion cost was more than 21% under the target cost of £373 million and was commissioned a full six months ahead of its aggressive target schedule. Compared with contemporary industry bench marks, Andrew was completed at £160 (i.e., 35%) below the industry bench mark, non-alliance estimate for the project.

Other benefits realized included the involvement of BP's key operations and maintenance personnel in facilities design, resulting in a maintenance strategy focused on reliability. There were no disputes, and accident rates were half of those for comparable offshore construction projects. The Andrew Alliance has been heralded within the offshore and construction industries as a major breakthrough in construction and engineering procurement (Barlow 2000).

4.3.2 Chinese High Speed Rail Industry

Chinese engagement in high speed rail (HSR) construction has been explored in a select number of published case studies. The studies are motivated by the Chinese construction industry’s ability to construct HSR at impressive rates and at a premium cost of only 30-40%. In contrast in the rest of the industrialized world, the cost of HSR is approximately three times as high as conventional rail line construction. China’s HSR construction began in 2003 with a 404-km stretch of rail. China now has more than

10,000 km (6,200 miles) in service and expects to have 16,000 km (9,950 miles) in the near future (Chuang and Johnson 2011, Ollivier et al 2014).

HSR construction has been booming in China since 2003. Consequently, global players in the industry such as Alstom (France), Siemens (Germany), Bombardier (Canada) and Kawasaki Heavy Industry (KHI, Japan) have joined the projects by creating partnerships or joint ventures with local Chinese firms and contracting out their technologies. In 2007, China unveiled locally produced high-speed trains based on Japanese KHI models. Under this “digestion and re-innovation” program, the Beijing-Shanghai line can travel up to 380 km/hr. According to KHI, it has not provided China with core technology; however, the 380 km/hr HSR is a tuned-up version of a year-old KHI technology with a cheaper price tag. Because it can now use its own technology, China has imposed restrictions that require the government to purchase HSR from Chinese firms. Once a learner in the HSR technology industry, China has now become a competitor of HSR powerhouses that challenge China’s ownership of the technology; some express that they did not expect Chinese companies to become a threat for many years.

There are multiple reasons for this achievement, and many are rooted in the speed of construction. The Chinese employ a much higher level of standardization; they embrace significantly higher material costs for building elevated viaducts and casting and laying bridge beams on them. The viaducts speed construction and avoid costly land acquisition that would be necessary if using earthen embankments. Viaduct beams have been standardized at 24 to 32 m (78 to 104 ft, weighing about 750-800t) and are cast in temporary facilities established along the railway alignment. Each beam is transported over a distance of 8 km by a special beam carrier vehicle with up to 18 axles. It is launched over the viaduct columns by specially designed equipment, as shown in Figure 4.10 (Ollivier et al 2014).

Figure 4.10 – Chinese High Speed Rail, Beam Carrier and Launching Equipment (Olliver 2014)

Exposure to the world’s best technology aided China’s ascension in the market; however, it was not the sole reason for China’s success. China has embraced the need for innovations in their educational system. They focus on targeted, fact-based HSR education in their university system, and they encourage internationally recruited faculty members to participate in domestic and international HSR projects and visit foreign academic institutions to acquire advanced HSR know-how and knowledge. The National Science Foundation of China sponsored 55 HSR-related research and development projects (Sun 2015). Researchers were also encouraged to publish their research bilingually, in both Chinese and Arab languages, for the purpose of internationalization (Chuang and Johnson 2011). Chinese innovations in their educational systems, which have focused on learning from leading innovators, have also been characterized as “strategic learning” (Sun 2015).

A World Bank discussion of the HSR rail industry in China recognizes the lower cost of Chinese labor as one of the reasons for the speedy, lower cost construction. Other factors that significantly contributed to China's success are as follows:

- A credible medium term plan for construction over a 6-7 year period that energizes the construction and supply community
- An innovative and competitive capacity for manufacturing and construction
- Localization of design and manufacturing
- Standardization of designs for embankments, viaducts, electrification, signaling and communications

4.3.3 NYPA Power Now! Deployment of Eleven GE LM 6000 Power Plants

Figure 4.11 – New York Power Authority's – In-City Power Generation
(Thimsen 2004)

During the summer of 2000, the chairman of the New York State Public Service Commission warned that New York City (NYC) faced a serious threat of power supply shortages by the following summer. These warnings advised of "an urgent and compelling need for at least 315MW of additional capacity in NYC before the summer 2001" (Thimsen 2004). While several new power plants had been proposed for the city, it was clear that none would be available in the required time frame. In response to this emergency condition, New York Power Authority accepted the charge of undertaking what many considered an impossible task – providing more than 450 MW of power and transmission capacity in less than 10 months, a task which under favorable conditions would have taken at least two years (Thimsen 2004).

The project entailed the procurement of seven one- to two-acre sites in Queens, Brooklyn, the Bronx, Staten Island and Long Island. Site selection began with a review of 60 sites that had been included in a 1998 feasability study. Site selection was based on three criteria: 1) a minimum of one-acre parcels, 2) dispersed sites within one mile of a Con Edison 138kV substation, 3) ready access to a gas and cooling water supplies, and 4) limited environmental impact. The requirement of ties to Con Edison’s 138kV substation as opposed to a larger one was made to enhance operational reliability. The seven sites were selected by November 2000. Concurrent with site selection, licensing, design, procurement of major equipment, construction and commissioning of eleven efficient and environmentally friendly gas turbine generators began with an extraordinary sense of urgency.

NYPA Vice President of Project Management, Woodrow Crouch, described the PowerNow! effort as the most ambitious fast track project he had seen in his career, noting that NYPA was compelled to “violate some textbook project management rules” (Thimsen 2004). Mr. Crouch tells of an extraordinary level of parallel activities for site selection, detailed design work and general contracting. Within one week of the NYPA trustees’ August 2000 decision to purchase the turbines, the Authority selected its outside engineering, environmental, and legal firms based on existing service agreements. Sargent & Lundy was selected to design the plant’s foundations, piping, electrical, instrumentation and fire protection. The major equipment supplier, General Electric, was selected for the balance of plant work as well as for commissioning. After an expedited competitive process, AECOM was selected as the construction/engineering manager within one month and a local general contractor, Slattery Skanska, was awarded a lump sum contract by the end of the year. Both AECOM and Slattery Skanska's past successful experience in major NYC construction efforts was central to their selection.

General Electric LM 6000 gas turbines were selected based on their operational flexibility and their ability to be installed quickly for fast-track projects. The selected units are rated among the most fuel-efficient simple-cycle gas turbines in the world. The units employed on the In-City project featured a standardized, modular design equipped with a water injection system that, combined with selective catalytic reduction systems, provides enhanced environmental performance. The two-piece skid assembly, sectioned between the gas turbine and the generator compartments, was designed for convenient transport. NYPA was fortunate to secure four units held in storage by another utility and was able to purchase seven others that were in production for other GE customers, permitting NYPA to avoid a 12-month wait time.

In addition to extraordinary executive-level support, collaboration, and team integration, the project took aggressive measures to pre-fabricate components at nearby staging areas. Wherever possible, the decision-making and work processes were simplified through standardization and a single focus on the speed of construction as the project's imperative charge. To reduce congestion on the small urban sites, expeditors were assigned to warehousing facilities to ensure timely deliveries. At one assembly facility, large diameter exhaust stack rings were assembled at a Brooklyn port facility and barged to the sites, thereby avoiding costly assembly at the congested sites and the size limitations of transportation over congested city streets. To compensate for long lead times on major equipment, such as transformers, special transports were employed.

Most of the plants went into service in June 2001, with the first units coming online just nine months after the project began. The last plant came online on August 7, 2001. In doing so, summer power outages were avoided, with the addition 450 MW of power that has since been demonstrated to be the cleanest power sources in NYC. Mr. Crouch offered that the leading factors contributing the project's success were the early engagement and buy-in of local governments and other stakeholders and the selection of quality engineers and contractors, who were both familiar with the local construction market and had the ability to execute the work as an integrated team that was fully dedicated to the common goal of completing the project on schedule.

In addition to being sufficient for the peak summer loads of 2001 and 2002, NYPA reports that these plants have justified their investment in several other critical situations. The plants served a crititical role in stabilizing the NYC grid during the 2001 World Trade Tower tragedy, and were among the first plants to recover from the largest blackout in US history in 2003.

4.4 Historical Perspectives

Much can be learned from past endeavors such as the building of the Panama Canal and the Empire State Building.

4.4.1 Panama Canal

The Path Between the Seas (McCullough 1997) offers several anecdotes of dramatically improved production on the Panama Canal. After taking over failed French efforts to build the canal and a slow start by American forces, a new chief engineer, John Stevens, produced remarkable results in a short tenure on the project. At the conclusion of his predecessor's tenure, work crews' confidence and morale were desperately low, and many anticipated the closing of the project. However, Steven's reputation as America's premier construction engineer was supported by dramatic results. To begin with, his approach was different; he focused on the logistics of efficiently transporting as much dirt as possible away by rail car and the selection of new larger equipment, which at its peak, allowed 600 rail cars of excavation to be removed daily. Stevens was a hands-on manager; he was on-site daily and approachable by all for suggestions on how to better manage the work. Upon his appointment, he moved the Chief Engineer's residence and offices from Panama City to the Culebra Cut, a center of construction activity. He also moved to eliminate the abysmal working conditions that had been plagued by malaria and yellow fever. Additionally, he quickly abandoned his predecessor's adherence to a sea-level canal vying for a series of locks and a central water bridge at Lake Gatun. The existing Panama Railroad, seen as an oversized toy, was refitted with double rails to permit substantially larger loads. Within a year, it was able to transport many times the quantities of earth that the French and early American efforts achieved. Together with upsized excavation equipment, the new rail line was able to run efficiently around the clock. Stevens sought out the most talented, decisive personnel he could find, saying that they would not be fired for making a mistake, but they would be fired for not making a wrong decision. Stevens' position was that mistakes could be fixed; doing nothing could not. The project had a central focus: move dirt. Much to the displeasure of the workforce, Stevens resigned after a 20-month tenure, in part due to concerns regarding political forces that undermined his efforts.

His successor, George Washington Goethals, a US Army officer with considerably more authority, continued in the “Stevens system” with a single-minded focus on the work. He attacked the project as if he were at war: "I now consider that I am commanding the Army of Panama, and the enemy we are going to combat is the Culebra Cut and the locks and dams at both ends of the canal," Goethals announced to visiting Congressmen in 1907 (McCullough 1997). In 1908, laborers removed 37 million cubic yards of spoil from the Culebra Cut, half of what it took two French teams nearly 17 years to accomplish. Goethals also offered continuity in moving resources to Panama; design work was moved from Washington to Panama in an effort to eliminate waste and have an open door policy.

4.4.2 Empire State Building

The Empire State Building is often heralded for its speed of construction; the demolition of the existing Waldorf Astoria Hotel and design and construction of the world’s tallest building was completed in 20 months. Like Flash Track projects, the project was undertaken with a single dominating consideration: speed of construction. This focus began early in the design process, where the developers recognized the importance of having a trusted general contractor to consult with as soon as possible and were cognizant of the perils of a low-cost bidder. In selecting Starrett Bros & Ekins in a best-value selection, they contracted with the recognized industry leader with a commendable performance history of speed of delivery, honesty and a demonstrated ability to get the job done as promised. The contractor, Paul Starrett, reported that “never before in the history of building had there been… an architectural design so magnificently adapted to speed of construction” (Tauranac 1995). During the selection process, Starrett stunned the developers in his response to a question regarding the equipment they had. He said they had none, advising that “this building of yours is going to present unusual problems. Ordinary building equipment won’t be worth a damn on it. We’ll buy new stuff, fitted for the job, and at the end sell it and credit you with the difference … It costs less than renting second hand stuff, and it’s more efficient” (Tauranac 1995).

The speed required for the construction determined the characteristics of the design. The building management was fully engaged in efforts to develop a structure of utility, wherein the designer strove for clarity and standardized design elements and took to heart the maxim to keep things simple. Several measures were taken to dramatically increase the speed of construction, including prefabrication of structural steel and cladding. The building’s limestone façade was erected in a then-astonishing period of time due to the installation of metal channels which concealed irregularities in the panel edges that had traditionally been hand-fitted by stone masons. In addition to a high speed of construction, the design resulted in improved durability and improved energy performance, all at a significant lower cost than then-prevailing practices.

Starrett Bros & Ekins construction approach focused on methods similar to those used in the manufacturing process, with the installation of a small-gauge track able to carry the equivalent of eight wheel barrows directly to work areas and monorails that greatly sped the installation of the building’s exterior. Prefabricated structural steel from two suppliers was staged in New Jersey and delivered to the site in shipments sufficient for two floors to limit congestion at the worksite and speed installation. Aside from clean-up activities carried out by a night shift, most work was done during a five-day work week. Embracing specialty contractors, who could perform the work in a more timely and less costly manner, Starrett promoted friendly relationships among those engaged in the work and had open forums to encourage open dialogue among the subcontractors to explore the coordination of the various tasks and thresh out any problems that arose, insisting upon “relations of confidence within the group” (Tauranac 1995). Despite reports to the contrary, the project had a strong safety focus and few accidents when compared with comparable projects of the time. It bested the exemplary safety records of the recently completed Chrysler and Irving Trust buildings. Then-innovative safety practices included marshalling all material deliveries to the inner core of the building site (vs. road side delivery), steel (vs. wood) protective canopies over sidewalks, debris chutes, tubular and fire resistant planking on scaffolds and multiple daily fire safety inspections. The project also had a full time trained nurse on-site and a doctor on-call at all times (Willis 2007, Tauranac 1995, Ghosh 2014).

4.5 Case Studies Contribution

Collectively, the case studies served as a valuable resource in this research. Early in the process, the EPC structured interviews served as one of three primary sources for generating ideas during the creation of the Delphi survey. Later, the interviews with industry experts and published and historical case studies served as evidence of effective industry practices and provided examples of lessons that contributed to the development of the Flash Track implementation recommendations.

CHAPTER 5

INDUSTRY RESEARCH TEAM (RT311) DISCUSSIONS AND WORKSHOPS

The RT 311 team met 14 times in structured workshops for interactive exchanges of feedback on findings to date and for identifying the critical elements and innovative approaches of Flash Tracking. The purpose of this chapter is to present notable discussion points that contributed to the creation of a re-engineered EPC model detailed in chapter 6.

In search of new ideas, the research team was mindful of prior CII studies with calls for a new paradigm (Ballard 2012) and the “black swan” concept. A black swan (Taleb 2010) is a metaphor for an event that comes as a surprise, yet has a major effect. NFL Hall of Fame Sam Baugh’s introduction of the forward pass to modern day football in 1937 was a “black swan”. It was a rare event beyond the realm of normal expectations that led to revolutionary results. The impact of the forward pass was so notable that Sammy Baugh’s rookie record of 335 passing yards in a 1937 playoff game stood until 2012. The following offers highlights of discussions on an assortment of subjects.

5.1 What Constitutes a Successful Fast Track Project?

Early team discussions focused on defining and identifying characteristics of successful fast tracking. Fast track projects were defined as successful if participants’ anticipated costs and schedule requirements were met and project team members would welcome the opportunity to work together again. The following leading methods of achieving this goal were discussed:

- owner involvement in early project planning, project definition, and procurement practices;

- early involvement of key participants, effective communications, and team alignments;
- co-location;
- elimination of traditional stage gates;
- equitable risk distribution where high-risk items should be borne by an owner;
- target Value Design delivery approach;
- careful team selection, including personnel and organizations that can contribute in highly collaborative environments;
- execution planning with firm scope locks and optimal work packaging; and
- unique fast track safety concerns, such as congestion of personnel and equipment.

At the close of the discussion, fast track success was summarized as projects completed as envisioned as scheduled, on cost, and at the quality level to the satisfaction of the owner. The quality of the relationship between the stakeholders, especially whether a contractor could anticipate further business opportunities, was also seen as central to the success of a fast track project.

5.2 Planning

Optimal workflow planning was a common theme in RT311 workshop discussions. Howell and Ballard (1996) noted that traditional or classic project control mechanisms are ill-suited for today’s quick, uncertain complex projects. They advocated a more dynamic control system that facilitates selecting the best possible choices to manage the work. Speed of construction was considered to be an imperative during the conceptual, design, and procurement stages. The team recognized that improvements are required in traditional procurement as many organizations lack the flexibility needed to support a Flash Track effort.

Flash Tracking's need for optimal workflows and performances was compared to the passing of a baton in a 4 x 100 relay race, where early, consistent, and dedicated engagement of each organization's best personnel would ensure more efficient and less risky transitions than if the receiving party picked up the baton from a cold stop. Additionally, the on-call availability of these resources would lead to dramatically better completion times. Recognizing the limitations of traditional critical path planning, alternative planning methods were explored.

5.2.1 Critical Chain Planning

Critical Chain planning is a direct application of the theory of constraints to project management (Zhoa et al 2010). A key element of critical chain planning is undertaking tasks only when they can be fully executed without undue delay or interruption. The critical chain process strives to achieve resource leveling, flexible start times, and buffers as ways of eliminating the inefficiencies of ill-planned, multi-tasked efforts. The process has also been described as a "relay race": when one task is close to completion, the next task's resources are on the track and ready to go (Scitor Corp. 2000).

As straightforward this appears, it is contrary to how engineering and construction teams are typically managed, as they tend to focus on optimizing utilization rates. The inappropriateness of focusing on high utilization rates is illustrated in Figure 5.1. The figure shows that as utilization rates approach capacity, response times decrease.

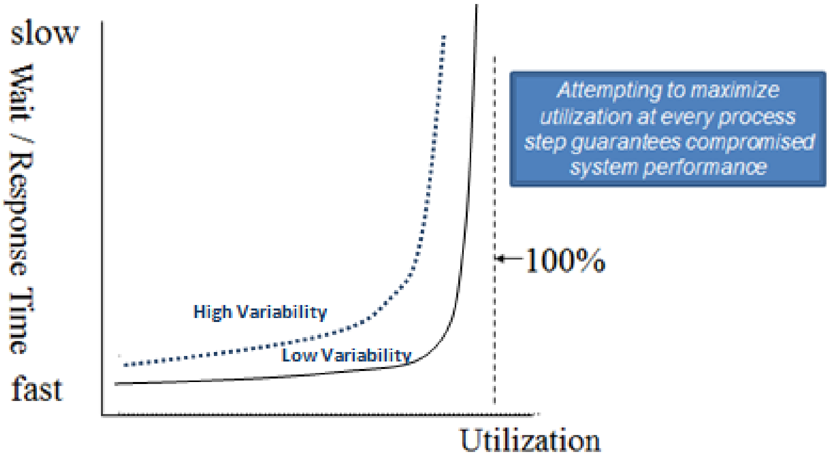


Figure 5.1 - Impact of utilization rate on response time
(Adapted from Factory Physics 2006)

To illustrate this concept further, a comparison of highways with heavy and light traffic is shown in Figure 5.2. Under full utilization, traffic or workflow slows, whereas at reduced utilization level, traffic or workflow proceeds uninhibited. Hence, in a Flash Track environment, there is a need for reserve capacity. Critical Chain planning focuses on identifying and eliminating restraints or bottlenecks that have the potential to restrict workflow.

Figure 5.2 - Highway traffic flow (Strickland 2015)

5.2.2 Last Planner System

The Last Planner system similarly recognizes improved dynamic planning as a principal means of improving construction productivity. The Last Planner is craft supervision. Those closest to the work are central to the development of short-term schedules for producing predictable workflows and identifying restraints. A central concept of Last Planner is to adapt plans continually to meet the project objectives (Ballard 1994). A comparison of the workflow focused planning to traditional critical path planning is shown in Table 5.1.

Table 5.1 - Last Planner "pull" and traditional critical path scheduling

Last Planner "Pull" Approach	Critical Path Approach
Work starts when work is ready for workers	Work starts per schedule
Work starts when workers are ready for work	
Interfaces between tasks are defined & negotiated by performers	Tasks & interfaces defined by schedulers
Plan is defined & well understood by performers	Performers rarely understand – or care about – CPM Details
Interface points constantly adjusted, including relaxing dates that do not matter	"Plan the work, work the plan."
Buffers consciously created	Buffers eliminated via "early start" mentality
Crew leveling is nearly automatic	Crew leveling is elusive

5.2.3 Pre-Project Planning

The importance of pre-project planning was often a cited as an important consideration in Flash Tracking. Projects that have a high pre-project planning effort have been shown to offer 20% cost and 39% schedule savings when compared to projects that do not have a high-level of pre-project planning effort (Gibson and Dumont 1995).

5.3 Innovation

Innovations involving unproven technologies were not embraced. However, time-saving innovations based on proven technologies were considered as a fundamental need. Strategic suppliers were seen as a resource for “outside the box” time-savings innovations (Yahya 2011, Vorster et al. 1998).

It was noted that successful fast track projects use the latest proven methods and technical improvements, and employ time-saving modularization, off-site fabrications, and any other means to speed construction (Tighe 1991, Williams 1996, Eastham 2002). Studies have shown that the greatest opportunity for cost and time savings was through the use of modular construction techniques (Smock 1992). However, these same studies noted that the benefits of early decisions to modularize are often misunderstood (Smock 1992). Another example of early adoption of innovative practices is transforming 3D collaborative design tools into 4D (3D model + 1D schedule) planning tools to coordinate design and construction activities better and thereby limit work zone congestion.

Enablers and barriers to innovation and Flash Track practices were noted as both being largely rooted in the workplace environment (Damanpour and Gopalakrishnan 1998). Similar to Flash Track enablers, flexible, non-hierarchical integrated project teams, open communication, open-mindedness, empowerment, no-blame cultures, and multi-skilled personnel have also been cited as enablers of innovation in organizations (Hartie 2005, Manley 2008, Tatum 1987, Tatum 1989). A study of the Australian construction industry reported a strong correlation between technological innovation and advanced management practices and organizational innovations (Hardie et. al 2005). Barriers to implementation of innovations in construction are primarily attributable to inexperience, reluctance, and entrenched practices (Hartie 2005, Tatum 1987). Effective integration of design, construction, and owners' teams provides a major source of innovation by increasing a designer's and contractor's understanding of the owner's technical requirements.

5.4 Trust

Trust was a continual theme in RT 311 progress meetings, either explicitly stated or discussed in terms of contract relationships, project risks, and other topics. In one meeting, the focus of the literature review session was trust.

Trust has long been cited as a major factor leading to the success or failure of construction projects (Egan 1998). CII (1994) investigated the relationship between cost and trust in a series of surveys of contracting parties and found that high trust projects had significantly lower costs than low trust projects. An adaptation of that research's cost-trust curve is shown in Figure 5.3, which also shows an implied relationship between trust and delivery time (Covey 2006).

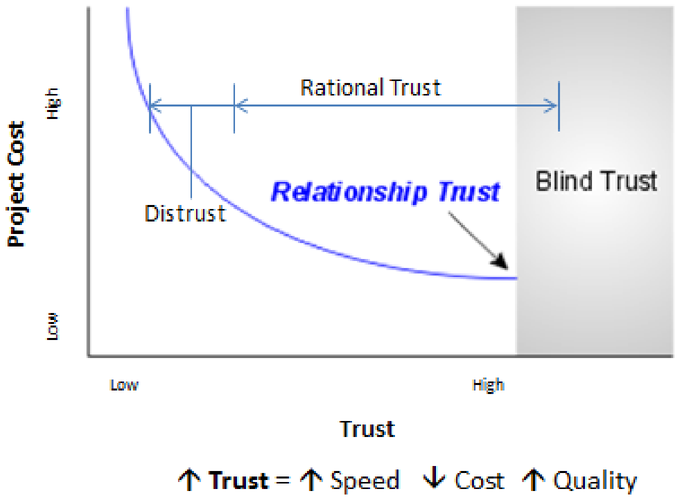


Figure 5.3 - Trust-Cost Ratio
(Adapted from CII Source Document 100 (1994) and Speed of Trust (Covey, 2006))

This research demonstrated that a number of cost related factors are closely tied to trust, including: team efficiency, timing of decisions, schedules, project performance/quality, timing of approval, and the amount of rework. Chueng (2013) showed that trust and communication significantly contributed to project performance. Covey (2006) offered these same observations.

Although the intuitive relationship between mutual trust and project costs has been supported (CII 1994), trust is a complex issue (Khalftan et al 2006). There are often differing opinions between owners and contractors on what builds trust (Laan 2012). The need to build systems-based trust through contracts is often understated in the construction industry. Systems-based trust develops from confidence built through formalized arrangements such as organizational policies, communication systems, and contracts. In one study, most participating contractors and owners viewed trust as a by-product of favorable dealings on one or more projects and that recourse to the contract was an indicator of a lack of trust (Khalftan et al. 2006).

5.5 Decision-Making

In the development of the Implementation, Barrier, Risk and Mitigation worksheets, a concept of a distinguishing Flash Track decision-making process was introduced. This led to the investigation of comparable decision-making environments. Cosgrave (1996) identified three distinguishing characteristics of decision-making in emergencies that are often applicable in Flash Track projects: 1) an urgency of timely decisions, 2) limited information, and 3) increased decision points. He also suggested a simplified decision-making model, comprising three dimensions: 1) decision quality, 2) need for acceptance, and 3) urgency. If a wrong decision has a negligible impact on the project’s outcome, it is considered to be a low-quality decision. If the consequences are high, the decision is deemed high-quality. The foremost benefit of consensus decision-making processes is that they afford the opportunity to make better decisions (Winch 1995, Kessler 1995). This benefit is particularly true in the case of diverse teams that can pool their collective knowledge to reach a more optimal solution (Waddell et al. 2013). Consensus decisions also increase the likelihood that team members will accept responsibility for and commit to the outcome of a decision (Kessler 1995). Other studies have shown that consensus decision making frequently leads to increased productivity (Brightman and Moran 2001, Green et al. 2005, O'Neill 2013). A potential drawback of the consensus decision-making process is that it can be time consuming (Kessler 1995).

5.6 Techniques Employed in Other Industries

Practices in five other industries were considered and reported upon within the research team workshops.

5.6.1 Shipbuilding Industry

Two earlier CII studies of the shipbuilding industry (CII 2007a, 2011) were discussed with considerable interest by the research team. A transformation of shipbuilding once employed practices similar to today's construction industry, but has since been transformed into an industry characterized by extraordinary standardization, modularization, automation, and product-oriented design. This shift led to dramatic cost and schedule improvements, such that major vessels can now be delivered four to five times faster at 20-30% of the cost than in the past. The keystone of this process is the Interim Product Database (IPD), which is a distinct set of standardized, configurable modules, grouped by production process similarity and built in a manufacturing environment. The IPD approach has three underlying themes: 1) design reuse, 2) supply chain integration, and 3) design for production. Shipbuilding's IPD process is reported to reduce the engineering and design time by 80%, due largely to the adaptive reuse of standard and scalable designs and the need for few new designs. The research team found that shipbuilding practices could be employed in building offshore platforms, power and chemical plants, and conventional building. The authors assessed the degree of difficulty in adopting features of the shipbuilding industry to construction found that practices of constructability reviews during design, adoption of generic design rules, supply chain integration, dedicated subcontractors, and a move to standardization would be moderately easy or easy to adopt. Other practices, such as design rules based on similar/stretchable components, were considered to be more difficult.

In the second study (CII 2011), RT 255 researchers focused on whether the practices that enabled the transformation of shipbuilding could be employed in the construction industry. The research team investigated modern shipbuilding practices in more detail and conducted five case studies representing a cross section of the construction industry. The projects in the case studies adopted high degrees of modularization as in modern shipbuilding. The case study findings included the following:

- Schedule improvement was a consistent key driver for modular construction.
- Modularization was estimated as having generated 15-50% schedule improvements.
- Schedule savings were largely dictated by when the decision was made to modularize.
- Cost savings from modularization were reported to be marginal or non-existent.

The report concluded that modern shipbuilding practices can potentially offer shorter schedules, lower material costs, higher quality innovation improvements, reduced design time, and safer construction.

5.6.2 Lean Manufacturing

Lean manufacturing involves never-ending efforts to eliminate or reduce waste or any activity that consumes resources without adding value. Measures employed include optimizing workflow, continuous improvement, and respect for people. Several Lean practices, such as integrated project teams, collaboration, relational contracting, and others are discussed elsewhere and not repeated here. CII's *Lean Implementation at the*

Project Level (2007b) found many Lean tools and techniques that, if applied correctly in the construction industry, could result in immediate improvements in project delivery costs, scheduling, quality, and safety. The study concluded that Lean implementation begins with a leadership commitment and is sustained with a culture of continuous improvement.

5.6.3 Lean Product Development

Lean product development systems or set-based concurrent engineering has been called a "Toyota paradox" (Sobek et al 1999). In this methodology, organizations consider a broader range of possible designs during product development and delays decisions using a convergence-based, rather than an iterative, decision-making process. Advocates claim that set-based concurrent engineering and related Lean Development practices are four times more productive that traditional practices (Raudberget 2012).

Set-based concurrent engineering entails the development and consideration of multiple design solution alternatives in parallel. In a consensus process, design sets are systematically reduced based on project needs, input from other stakeholders (e.g., other design disciplines, procurement, and construction), tests, and other sources, ultimately leading to an optimal solution. In contrast, under a traditional or point-based approach, project participants select a best design early on, and then the design is then refined, reworked, and modified until an acceptable solution is found (Raudberget 2012).

Traditional or point-based design practices, whether concurrent or not, tend to converge quickly on a solution (i.e., a point) and then modify that solution until it meets the design objectives. With a clear understanding of a project's scope, this can be a useful approach. However, in an uncertain environment, this approach can lead project participants to begin at the wrong starting point and experience a protracted iterative process to refine the solution, which can be time-consuming and lead to a suboptimal design (Sobek, et al. 1999). Figure 5.4 illustrates the iterative cycles characteristic of the traditional product development process (Kennedy et al. 2008).

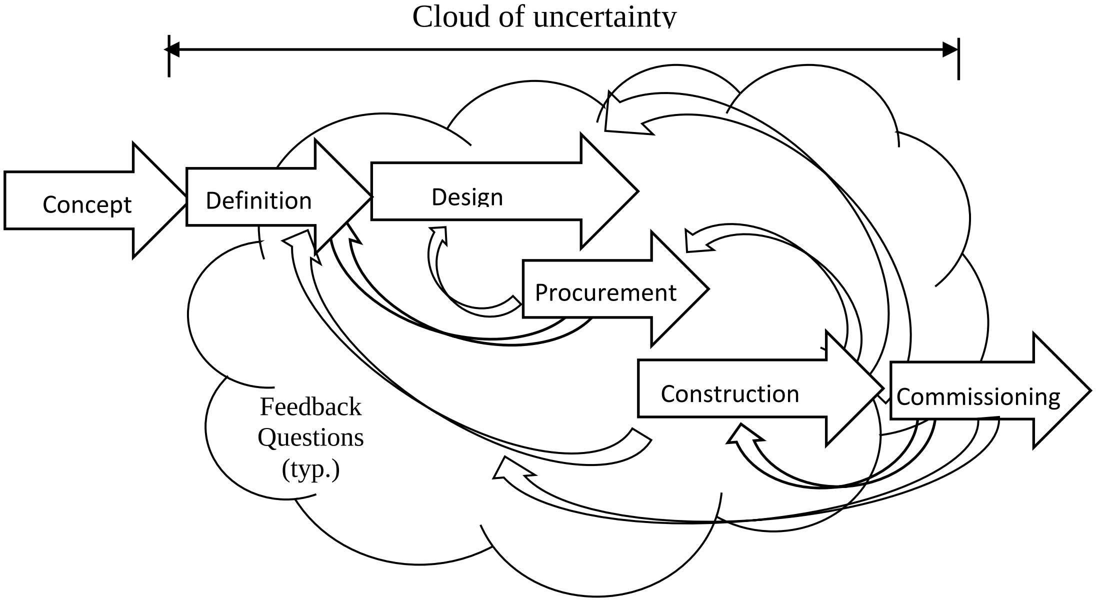


Figure 5.4 - Point-based design – a single concept is identified and then reworked and improved in iterative cycles

In contrast, set-based concurrent engineering begins by broadly considering sets of possible solutions and gradually narrowing the set of possibilities to converge on a final solution. In casting a wide net and gradual elimination of weaker solutions, makes finding better solutions more likely. Although this may take more time early in the process, ultimately set-based design is considered by advocates to be a substantially faster design process (Raudberget 2012). Under a set-based approach, personnel from multiple disciplines and other stakeholders communicate about sets of design alternatives in a series of rapid learning cycles (Mascitelli 2011). In doing so, they gradually narrow these sets by eliminating inferior alternatives until they come to a final solution. An interim goal of the process is the development of robust solutions. In contrast to dynamic modeling (Pena-Mora and Li 2001), which delays decisions during the design process, set-based design seeks alternatives earlier in the project's life-cycle. Figure 5.5 illustrates the rapid learning cycles and evolution of the set-based concurrent engineering.

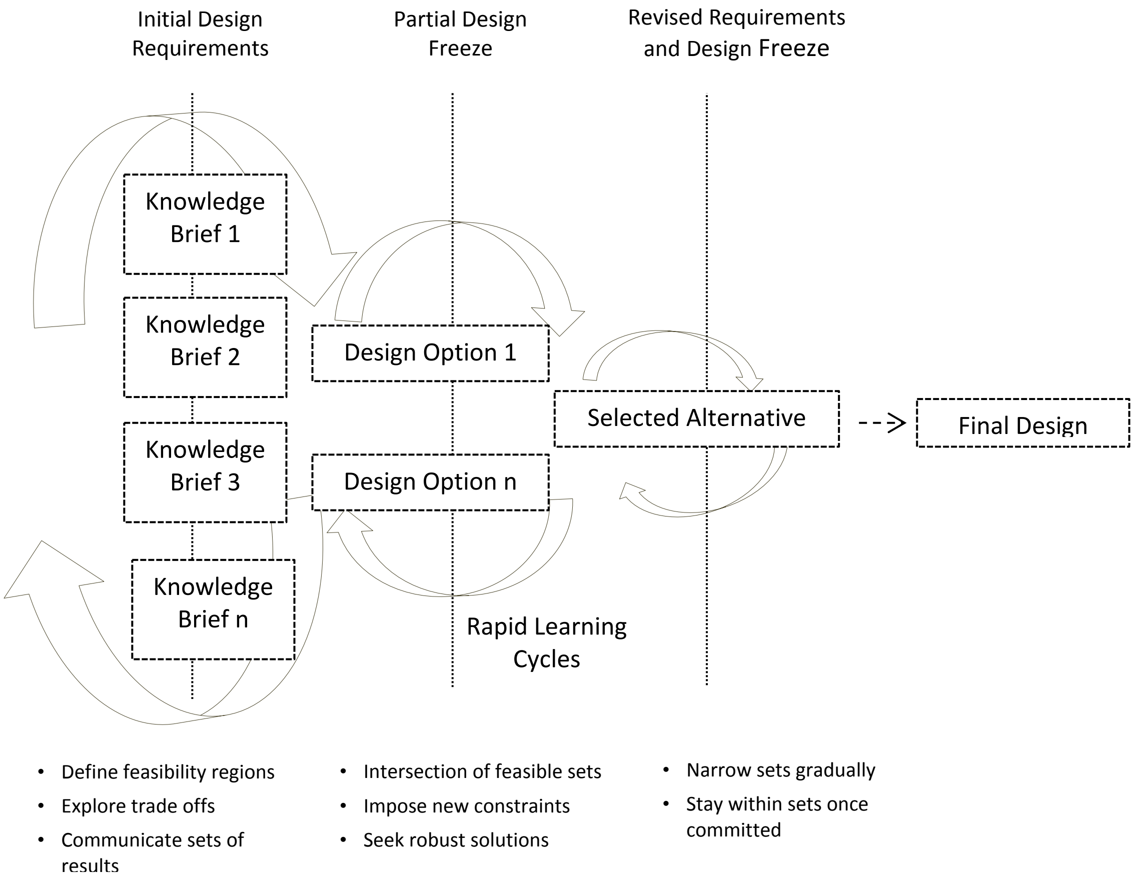
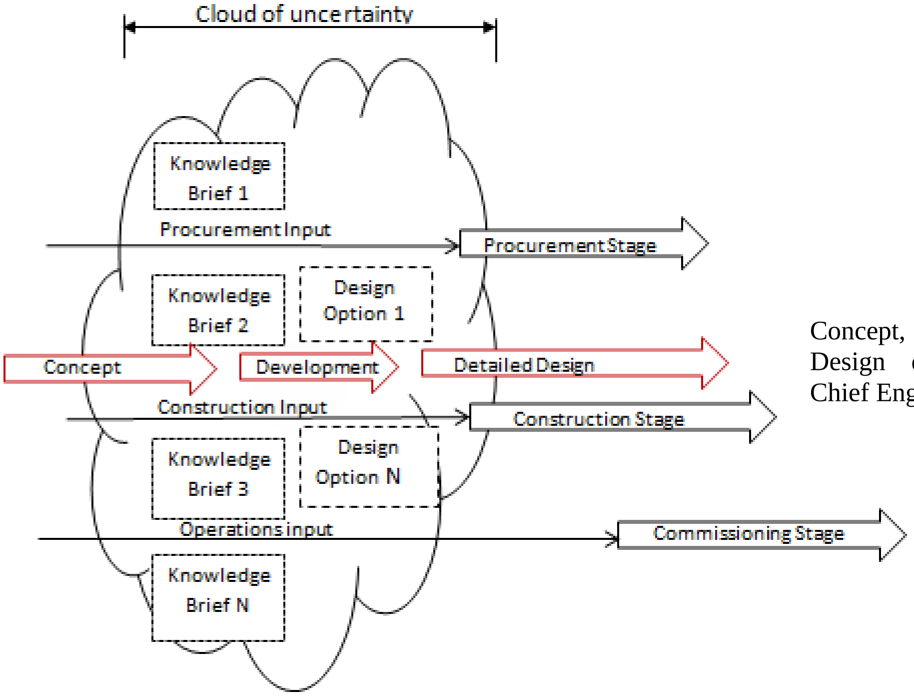


Figure 5.5 - Set-based concurrent engineering – multiple alternatives explored in a convergent process

This early learning process, facilitated by a chief engineer, is a source of reusable knowledge. It focuses and shifts the "cloud of uncertainty" to earlier in the project and narrows its width as shown in Figure 5.6 (Kennedy et al. 2008).



Concept, Development and Design directed by the Chief Engineer

Figure 5.6 - Set-based concurrent engineering – engaged parties

A critical element of Lean Product Development is the role of a chief engineer who has full authority over product decisions and specifications (Raudberget 2012). Clark and Fujimoto (1991) label chief engineers as “heavy-weight program managers.” Chief engineers offer continuity and are the most important technical decision makers on the team. Teams are comprised of personnel with deep technical expertise in both engineering and management. The system also requires suppliers and contractors to possess a high engineering capability and a close but demanding relationship between the parent company and the suppliers.

Time to market, product quality, and costs are useful measures of the efficacy of set-based concurrent engineering. For example, Toyota is an industry leader in quality, innovation, and speed to market; it also has industry low engineering costs per new model (Ward and Sobek 2014). In a three-year study of industrial experiences with set-based concurrent engineering, Rauderbert (2012) noted implementation challenges and found that set-based concurrent engineering has positive effects on many aspects of product development and performance, including improvements over traditional practices in product performance, product cost, and levels of innovation.

Parrish (2009) investigated the introduction of Lean's set-based design approach to reinforced concrete structures. The approach included developing multiple designs, postponing commitment to a specific design, and communicating the designs to other stakeholders before coming to an optimal solution. The research found that set-based design was effective in reducing rework and facilitating innovation. CII's *Lean Implementation at the Project Level* (2004) reported that set-based concurrent engineering is at odds with current construction industry practices in which each design discipline narrows their alternatives rapidly to a single point solution and only coordinates with other disciplines when conflicts arise. In doing so, a path is chosen before the team knows whether it is optimal or will work at all.

5.6.4 Agile Project Management

Agile project management (APM) originated in the fast-paced software development industry, where Lean principles evolved to address the needs of an aggressively dynamic market with increasing and changing customer demands. APM has been successful in increasing customer satisfaction and decreasing time and cost to market under uncertain conditions. It has also been described as a game changer (Burrows 2014). Sutherland (2014) credited APM's principles of careful alignment, unity of purpose, and clarity of goals as regularly providing a four-fold increase in productivity and a doubling of quality. APM embraces Lean practices, and incorporates a highly iterative workflow with a strong emphasis on stakeholder involvement. APM's ability to respond to change readily, among other practices, has been shown to improve productivity, quality, predictability, and personnel development significantly (Owen 2006).

Owen (2006) cautioned that there are significant differences between Lean and APM. While Lean focuses on the efficient use of resources, APM focuses on how fast the product is delivered and how good it is (Sutherland 2014). Gosling et al. (2007) summarized a number of differences between Lean and Agile that are pertinent to Flash Tracking, as illustrated in Table 5.2.

Table 5.2 - Lean and Agile Project Management strategies (Gosling 2005)

	Differentiator	Lean	Agile
Outputs	Market winner:	Cost	Service level (speed) ✓
	Performance characteristics:	Cost efficiency	Delivery and flexibility ✓
	Product variety:	Suitable for low variety	Suitable for high variety[1]✓
	Variability:	Suitable for low variability	Suitable for high variability ✓
Inputs	Responding to the market:	Confirmed orders/smooth demand/level scheduling	Respond quickly to market changes ✓
	Supply chain relationships:	Close relationship with a small number of suppliers	Virtual/extended enterprise[2] ✓
	Sourcing decisions:	Cost and quality	Speed, flexibility and quality ✓
	Approach to waste:	Reduce the seven wastes	Focus on service level, not eliminating waste ✓
	Capacity:	Smooth capacity	Hold spare capacity ✓
	Time compression:	Shorten if it does not increase cost	Aggressively to reduce times ✓

1 – Methods to manage variability include increased levels of modularization, standard designs
2 – Selections based on speed of delivery, flexibility and quality

✓ - Advantage in Flash Tracking

APM works under high-level schedules with only key milestones defined. Detailed schedules are developed in an iterative series of short-term schedules or time boxes. This approach provides focused priorities and ensures a project flow that brings optimal value throughout the project (Owen 2006, Johansson 2012, Sutherland 2014). Johansson (2012) reported that, once defined, goals within a certain timeframe cannot be altered and are almost universally completed. This flexibility is in contrast to traditional construction planning, where on-time completion of scheduled activities hovers near 50% (Ballard 1994).

APM relies on a flat, multi-skilled, team-based structure in an environment of intense communication, which requires significant changes to traditional attitudes and practices, not the least of which is the attitude toward change itself (Owen 2006). In

APM, the stronger the communication, the more everyone knows and the faster the team completes tasks (Sutherland 2014). APM actively engages owners in an interactive process of defining and understanding their needs (Johansson 2012). It also seeks owners' active participation in the setting of time-box priorities (Owen 2006, Sutherland 2014).

A selection of studies has explored the applicability of and opportunities for employing APM in construction. Owen (2006) found that APM practices were adaptable to the uncertainties involved in pre-design and the interactive nature of the design process. In the construction phase, he focused on the benefits in construction planning, noting that Lean construction and the Last Planner system include elements of both Lean and APM. Court (2006, 2009), focusing on both Lean and APM systems, reported a case study of a major hospital project. The project exhibited a significant improvement in labor productivity and a 37% reduction in onsite workhours (Court et al 2009). Johansson (2012) reported that the major advantage of implementing an APM approach is increased owner involvement in reducing uncertainty and improving risk profiles.

5.7 Re-engineered EPC Model

As the research process evolved, elements of the re-engineered EPC model began to emerge. Early versions of the model were discussed near the midpoint of the research process, and they captured key elements of the industry workshop discussions summarized in this chapter. Key elements of the model included the following:

- early and continued engagement of key downstream stakeholders,
- commitment to Flash Track by the end of FEL 1 (feasibility planning), and

  - a distinguishing Flash Track decision process that relies on increased levels of concurrency and continuity of key participants.

Early engagement of key downstream stakeholders and early funding of the work were cited as essential practices in the first stages of the research process. Therefore, front end loading stages of conceptual design (FEL-2) and detailed scope development (FEL-3) were combined. It was noted in discussions that the consolidation of FEP 2 and FEP 3 is a common practice in the food and consumer products market sector where it is referred to as FEP 2+. In open discussions, the research team expressed that early investment in front-end engineering will likely be two or three times as much as the usual front-end planning process. Other FEP 2+ concepts were offered:

- Early engagement of key downstream stakeholders would serve as a means to develop and assess feasibility of conceptual ideas rapidly.
- Heightened partitioning of design and fabrication practices will entail the creation of a new project role of an integration or contract engineer.
- Establish a timeline to lock in one of the developed alternatives
- Reserving or buying shop time in advance of a fully defined deliverable
- Buying standard equipment and material
- Employing Design Assist contracts with key contractors or suppliers (preconstruction consulting contract).
- Employ 3-D modeling (BIM) to quickly evaluate alternatives (cost models).

CHAPTER 6
RESULTS

The results of this research include a two-tier prioritized listing of essential Flash Track practices, a list of Flash Track key risks, and an implementation tool. The purpose of the implementation tool is to guide an organization in assessing its readiness for Flash Track projects and identifying measures to execute them successfully.

6.1 Delphi Study Results

6.1.1 Delphi Survey Design

The initial data collection process identified 118 relevant fast track practices, including 66 items from the literature review, 14 from the EPC interviews, and 38 from the industry research team (RT311) discussions. In the beta test of the survey, members of the research team were asked to focus on whether each of the practices was absolutely essential for a successful Flash Track project. In doing so, the final listing of fast track practices was reduced to 66. The beta test also informed improvements of the survey's language and ease of use. The two early listings of Flash Track practices and the beta version of the survey are included in Appendices K and L. The beta testing revealed that industry experts found that only sixty (60) practices were both essential (i.e., Mode=5, SD<1; Mode=6, SD<2) and unique (i.e., Mode >5) to Flash Tracking. These results were used to critically review and update the survey. Six practices that were on the borderline of the defined threshold also were added.

Two sets of the beta test results are included in Appendix H. One version is limited to the 66 items chosen to be included in Round 1 and a second version inlcudes the items resolved to not be included in Round 1. As a result of the beta testing, it was also resolved that the Round 1 questions would include two prompts:

- Is the concept or practice absolutely ESSENTIAL for the success of Flash Track projects?
- How SUCCESSFUL has the industry been in implementing this concept or practice?

6.1.2 Expert Selection and Participation

Sixty-four oracles agreed to participate in the Delphi study. In the first round of the survey, 55 oracles completed surveys and reported background information (see Tables 6.1 to 6.4). The oracles were seasoned, well-balanced, and experienced, and had served in a variety of industry roles and capacities. Although the four industry segments of heavy industry, light industry, infrastructure, and building were represented in oracles' collective experience, oracles' experience was most commonly in heavy industry.

Table 6.1 – Selection Criteria versus Self-Disclosure of Oracles' Experience

Selection Criteria	Minimum Requirements	Self-Disclosure Response
Experience in the EPC or (AEC) industry	15 years	Mean = 28.2 years
Service in leadership roles	5 years	> 20 years*
Fast track experience	5 years or 2 projects	> 5 years*, > 2 projects*
Project life-cycle experience	2 project phases	Mean = 3.8 project phases

. *Based on narrative feedback

Table 6.2 – Oracles' Primary Contract Roles

Organization	Number	Percentage of respondents
Owner:	25	45%
Contractor:	18	33%
Engineer:	12	22%
Total	55	100%

Table 6.3 – Oracles' Project Life-Cycle Experience*

Phase	Number	Percentage of respondents
Development	45	82%
Design	51	93%
Construction	52	95%
Start-up/Commissioning	45	82%
Operations	18	33%

*Most oracles reported experience in multiple project phases

Table 6.4 – Oracles' Industry Experience

Experience Level	Heavy Industry	Light Industrial	Infrastructure	Buildings
Mean years of experience*	28.4	12.2	8.6	8.7
Maximum years of experience	45.0	43.0	38.0	20.0
Number of oracles reporting experience in this industry sector	48	21	21	14
% of Total: (Number reporting/Total responses)	87%	38%	38%	25%

*Mean when citing experience in this market sector

Other information collected from the oracles in the first round included their prior experience with relational contracting, 3-D collaborative modeling tools, and Lean Construction Practices, as shown in Tables 6.5, 6.6, and 6.7.

Table 6.5 – Oracles' Experience with Relational Contracting

Contract/Delivery method	Number	Percentage of respondents
Design-Build	26	69%
Engineer-Procure-Construct (EPC)	52	98%
Integrated project teams	43	84%
Integrated Project Delivery (IPD)	10	18%

Table 6.6 – Oracles' Experience with 3-D Collaborative Modeling Tools

Application	Number	Percentage of respondents
Visualization	41	75%
Coordination	31	56%
Constructability	43	78%
Fabrication & Installation	25	45%
No experience	9	16%

Table 6.7 – Oracles' Experience with Lean Construction Practices

Experience	Number	Percentage of respondents
Prior Lean Construction Experience	18	33%
No Lean Construction Experience	37	67%

The level of participation in the three rounds was high and reasonably consistent, as shown in Table 6.8.

Table 6.8 – Oracles' Participation Levels

Round	Number	Percentage of Total*
Recruitment round (73 invitations)	64	87.7%
Round 1	55	85.9%
Round 2	47	73.4%
Round 3	45	81.3%

*Rounds 1, 2 and 3 participation level based on 64

6.1.3 Delphi Round 1

In Round 1 of the Delphi study, oracles were asked to assess the 66 practices developed in the survey preparation process, as discussed in section 6.1.1, with respect to two questions:

- Is the concept or practice absolutely ESSENTIAL for the success of Flash Track projects?
- How SUCCESSFUL has the industry been in implementing this concept or practice?

Oracles were given the chance to comment on each of the practices, as well as offer any additional practices which they found to be essential for the success of a Flash Track project. The oracles reached consensus that 46 of the 66 practices were essential for Flash Track projects. However, the oracles reached consensus on only one practice that industry had successfully implemented: “identifying and procuring long lead time items”. The oracles also identified four additional practices for consideration in the subsequent round. The four additional practices were 1) frequent project review meetings, 2) Target Price/Value with shared cost savings, 3) open book contracting, and 4) time and material rate agreement.

Oracles also offered more than 600 comments. The practices which received the most comments included the following:

- setting clear, specific scoping requirements;
- engagement of operations and maintenance personnel in the development and design process;
- establishing clear change management procedures; and

- staffing with personnel with strong leadership capabilities.

The practice of “setting clear, specific scoping requirements” generated the most dialogue, suggesting its essential role in Flash Tracking. Discussion generally favored the “engagement of operations and maintenance personnel”. However, this was not unanimous, with a few comments citing a potential to slow the process and the challenges of securing reliable information. Comments on “change management” ranged from limiting changes to a need to address commercial issues in a timely manner. Oracles were nearly unanimous that leadership was central to a project’s success. The Round 1 questionnaire, survey results, and oracle comments are included in Appendix I.

6.1.4 Delphi Round 2

In Round 2, the oracles were asked to reconsider the twenty practices on which they had not reached consensus in Round 1, as well as the four new additional practices and the anonymous comments offered by the oracles in Round 1. Round 2 nominally differed from the first round, as oracles assessed each of the 24 practices with respect to the following question: is the concept or practice absolutely ESSENTIAL for the success of Flash Track projects?

Statistically, the oracles reached consensus on two issues in the second round, with a number of other practices on the borderline. The latter were difficult to dismiss, based on the slight variation in their standard deviations (e.g., 0.994 v. 1.008) and the better performance the lower scores offered on oracles’ ratings of “agree” or “strongly agree”. Of the top scored practices, only one had more than 70% “agree” or “strongly agree” responses; for the other practices, approximately 50% of oracles gave ratings at this level. On this basis, the single practice of “frequent project review meetings” was added to the Round 1 total. After two Delphi rounds, the total number of practices deemed essential for Flash Track projects was 47 (46 +1). The scoring on the 23 items that had not reached consensus had not changed materially from round 1. Consequently, it was resolved that the third round of the Delphi process would entail a top-ten ranking of only the 47 essential flash tack practices.

Oracles offered nearly 400 additional comments in Round 1. The practices which received the most comments included the following:

- executing single-source or no-bid contracts,
- explicitly designating the project as being "fast track", and
- increasing resource levels for project control.

The second round comments on “executing single-source or no-bid contracts” were more favorable than they had been in the first round, where oracles offered in cases where favorable to letting single-source or no-bid contracts to proven contractors with past favorable dealings. Oracles comments on “explicitly designating a project as being fast track” reflected a belief that that this practice was fundamental requirement. The issue of “increased resources for project controls” received considerably more dialogue in the second round, where comments focused on the need for skilled resources, rather than increased resources.

The Round 2 questionnaire, survey results, and oracle comments are included in Appendix J. The aggregate scoring of the first two rounds of the Delphi process, based on the relative index defined in the Methodology section (chapter 2), are included in

Appendix K. The top-ten items of the first two rounds, based on the relative index score, are shown in Table 6.9.

Table 6.9 - Top 10 Flash Track Practices Based on the Relative Index in Delphi Rounds 1 & 2

Rank	Practices (with Identification Numbers)
1	36. Identifying and procuring long lead time items
2	1. Setting clear; specific scoping requirements
3	43. Dedicating full-time personnel to the project
4	18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
5	10. Focusing procurement decisions on construction priorities
6	12. Staffing with personnel with strong leadership capabilities
7	7. Funding early critical efforts
8	30. Having open communication and transparency
9	5. Establishing clear change management procedures
10	11. Making timely selection and award contracts to subcontractors

6.1.5 Delphi Round 3

In Delphi Round 3, oracles were asked to select the top ten items absolutely essential for successful delivery of Flash Tracking from the overall list of 47. Their collective top ten practices were defined as the ten practices that oracles nominated most often. The Delphi Round 3 top ten practices are shown in Table 6.10.

Table 6.10 - Top 10 Flash Track Practices based on Delphi Round 3

Rank	Practices (with identification numbers)
1	1. Setting clear; specific scoping requirements
2	18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
3	43. Dedicating full-time personnel to the project
4	10. Focusing procurement decisions on construction priorities
5	30. Having open communication and transparency
6	7. Funding early critical efforts
7	11. Making timely selection and award contracts to subcontractors
8	36. Identifying and procuring long lead time items
9	9. Selecting team members and staff based on their fast track experience or qualifications
10	40. Recognizing and managing the additional fast track risks

Oracles offered 12 comments in Round 3 about the choices they offered. Three comments suggested that the decision on the “top-ten” could be situational. The Round 3 questionnaire, survey results, and the oracle comments are included in Appendix L.

6.2 The Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is another ranking method that provided weightings for the Excel-based tool to assess an organization's readiness to undertake Flash Tracking. Fifteen members of the research team participated in the AHP. The participants were both experienced in the EPC industry and versed on the principles of the AHP. During the process, each participant completed pair-wise comparisons of practices contained within the six categories of practice (contractual, delivery, organizational, cultural, planning, and execution), and also completed pair-wise comparisons of the six categories overall. The results of each participant's responses were combined into a single ranking using the geometric mean to produce aggregate weightings. The aggregate results are shown in Table 6.11 and 6.12.

Table 6.11 (a-f) – Practice Weightings from AHP

Contractual Considerations (a)	Weight
1. Setting clear, specific scoping requirements (Tier I)	23.0%
2. Establishing performance-based specifications	8.2%
3. Aligning project participants' interests through contract	13.5%
4. Establishing contract strategies specifically tailored to the project condition	11.4%
5. Establishing clear change management procedures (Tier I)	9.5%
6. Establishing an effective claims resolution process	4.9%
7. Funding early critical efforts (Tier I)	20.6%
8. Reducing risks through collective efforts of all stakeholders	8.9%
Total:	100%

Table 6.11 (a-f) – Practice Weightings from AHP (continued)

Delivery Considerations (b)	**Weight**
9. Selecting team members and staff on the basis of their fast track experience or qualifications (Tier I)	11.8%
10. Focusing procurement decisions on construction priorities (Tier I)	17.2%
11. Selecting and awarding contracts to subcontractors in a timely manner (Tier I)	15.4%
12. Staffing with personnel with strong leadership capabilities (Tier I)	18.1%
13. Employing innovative procurement practices	5.9%
14. Using highly integrated 3-D modeling, with all major users updating a common database	5.3%
15. Involving contractors, trades, and vendors in the design phase	14.5%
16. Seeking out suppliers and specialty contractors as sources of time-saving innovations	11.8%
Total:	100%

Organizational Considerations (c)	**Weight**
17. Engaging operations and maintenance personnel in the development and design process	9.1%
18. Establishing a fully integrated project team, including design, construction, specialty contractors, commissioning, and operations personnel (Tier I)	16.7%
19. Using team building and partnering practices	5.8%
20. Delegating authority to the project level (i.e., maximizing decision-making authority at the project level) (Tier I)	19.9%
21. Empowering the project team (ensuring that each organization is led by an empowered leader)	16.2%
22. Having an owner with sufficient depth of resources and organizational strength	8.6%
23. Selecting personnel with a can-do attitude and willingness to tackle challenging tasks	9.0%
24. Having an engaged and empowered owner's engineer (owner's representative)	8.3%
25. Staffing with multi-skilled personnel	6.4%
Total:	100%

Table 6.11 (a-f) – Practice Weightings from AHP (continued)

Cultural Considerations (d)	Weight
26. Accepting a non-traditional paradigm or mindset	9.4%
27. Having an active, involved, and fully committed owner	10.5%
28. Establishing flexible project teams that avoid rigid hierarchy	11.5%
29. Maintaining a no-blame culture and a mutually supportive environment	15.9%
30. Having open communication and transparency (Tier I)	20.9%
31. Staffing with cooperative and collaborative personnel	13.6%
32. Having an open-minded team	7.3%
33. Creating executive alignment among the contracted parties	10.9%
Total:	100%

Planning Considerations (e)	Weight
34. Emphasizing coordination planning during the design process (Tier I)	13.3%
35. Performing exhaustive front end planning	11.1%
36. Identifying and procuring long lead items (Tier I)	20.1%
37. Monitoring and driving corrective actions through the project controls process	6.8%
38. Providing enough resources for critical path items (Tier I)	17.4%
39. Considering speed of fabrication and construction during the selection of design alternatives (Tier I)	14.1%
40. Recognizing and managing the additional Flash Track risks (Tier I)	17.2%
Total:	100%

Execution Considerations (f)	Weight
41. Co-locating the project team (i.e., owner, designer, builder, and/or key vendors)	13.0%
42. Simplifying approval procedures (Tier I)	15.7%
43. Dedicating full-time personnel to the project (Tier I)	18.4%
44. Selecting appropriate construction methods (Tier I)	23.9%
45. Minimizing handoffs	13.3%
46. Employing innovative construction methods	9.2%
47. Conducting frequent and effective project review meetings	6.5%
Total:	100%

Table 6.12 – Category Weightings from AHP

Category	Weight
Contractual	8.9%
Delivery	15.8%
Organizational	17.1%
Cultural	16.6%
Planning	22.2%
Execution	19.4%
Total:	100%

The overall weighting of each of the 47 essential practices are included in Appendix N.

The AHP process afforded the opportunity for another ranking measurement. The rank order of the top ten AHP scores is shown in Table 6.13.

Table 6.13 - Top 10 Flash Track Practices from AHP

Rank	Practices (with identification numbers)
1	44. Selecting appropriate construction methods
2	36. Identifying and procuring long lead time items
3	38. Providing enough resources to critical path items
4	40. Recognizing and managing the additional fast track risks
5	43. Dedicating full-time personnel to the project
6	30. Having open communication and transparency
7	20. Delegating authority to project level (maximize decision-making authority to the project level).
8	39. Considering speed of fabrication and construction during the selection of design alternatives
9	42. Simplifying approval procedures
10	34. Emphasizing coordination planning during the design process

6.3 Prioritization and Ranking Methods

Three ranking methods were employed to distinguish the top-tier practices within the 47 practices. As a final prioritization measure, the results of the three methods were combined into a two-tiered ranking. Any practice which ranked within the top-ten of either the relative index (Table 6.9), Round 3 selection (Table 6.10), or the AHP (Table 6.13) was deemed a Tier I practice meriting a further emphasis in the decision process. All other practices were classified as Tier 2 practices. Appendix O shows the comparative rankings for all 47 essential practices.

Table 6.14 presents the eighteen practices that were identified as top ten by any of the three different methodologies employed. A moderate correlation (Pearson correlation coefficient, r=0.64) is shown between the Delphi oracles Relative Index ranking and its third round. Nominally lower moderate correlations exist between the Delphi Relative Index and AHP rankings (r=0.47) and the Delphi Round 3 and the AHP (r=0.54). Table 6.15 compares the category memberships of the top 10 practices according to the oracles ranking in the relative index and the Delphi round 3 and the AHP.

Table 6.14 - Essential Tier I Flash Track practices and rankings

Pract. No.	Category	Practice Description	Relative Index Rank	Delphi Round 3 Rank	AHP Rank
43	Execution	Dedicating full-time personnel to the project	3	3	5
30	Cultural	Having open communication and transparency	8	5	6
36	Planning	Identifying and procuring long lead time items	1	T6*	2
1	Contract.	Setting clear; specific scoping requirements	2	1	22
18	Org.	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	4	2	12
10	Delivery	Focusing procurement decisions on construction priorities	5	4	14
7	Contract.	Funding early critical efforts	7	T6*	26
11	Delivery	Making timely selection and award contracts to subcontractors	10	T6*	19
40	Planning	Recognizing and managing the additional fast track risks	15	10	4
12	Delivery	Staffing with personnel with strong leadership capabilities	6	T16*	11
9	Delivery	Selecting team members and staff based on their fast track experience or qualifications	35	9	24
20	Org.l	Delegating authority to project level (maximize decision-making authority to the project level).	19	T16*	7
34	Planning	Emphasizing coordination planning during the design process	13	T27*	10
5	Contract.	Establishing clear change management procedures	9	T19*	44
38	Planning	Providing enough resources to critical path items	17	15	3
39	Planning	Considering speed of fabrication and construction during the selection of design alternatives	24	12	8
42	Execution	Simplifying approval procedures	33	T27*	9
44	Execution	Selecting appropriate construction methods	21	T31*	1

. * “T” denotes a “tied” ranking

Table 6.15 – Category allocation of Relative Index, Round 3, and AHP Top 10 selections

Category	**Relative Index Rank**	**Delphi Round 3 Rank**	**AHP Rank**
Planning	1	2	5
Execution	1	1	3
Organization	1	1	1
Cultural	1	1	1
Delivery	3	3	0
Contractual	3	2	0

6.4 Development of a Flash Track Tool

The final element of the research was the development of an Excel-based Flash Track tool. This tool has two main components:

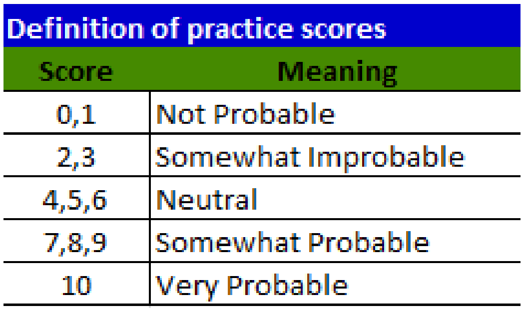
1. a metric, based on a prioritization of the essential Flash Track practices, for assessing an organization’s readiness to undertake a Flash Track project, and
2. an implementation resource tool that expands on the Flash Track practices and rankings to guide an owner in executing a Flash Track project.

A detailed discussion of the tool’s features and mechanics is included in CII 311-2, *Flash Track Tool, Users Guide.* The following section highlights some of the tool’s features.

6.4.1 Flash Track Readiness Metric

The information derived from the AHP and the prioritization process the foundation for the Excel-based tool, which, together with user input, calculates an organization’s readiness for Flash Tracking. It can also be used as a measure of a project’s adherence to the tool’s recommended practices.

The tool is best employed in a small group led by a facilitator. The tools starts with a self-assessment of an organization's readiness for 47 the essential practices for a successful Flash Track project. These practices are grouped within the six practice categories (contractual, delivery, organization, culture, planning, and execution). Scoring is on a 10-point scale, from scores of 0-1 reflecting that it is not probable the practice would be employed to a score of 10 where the practice is very probable, as shown in Figure 6.1.

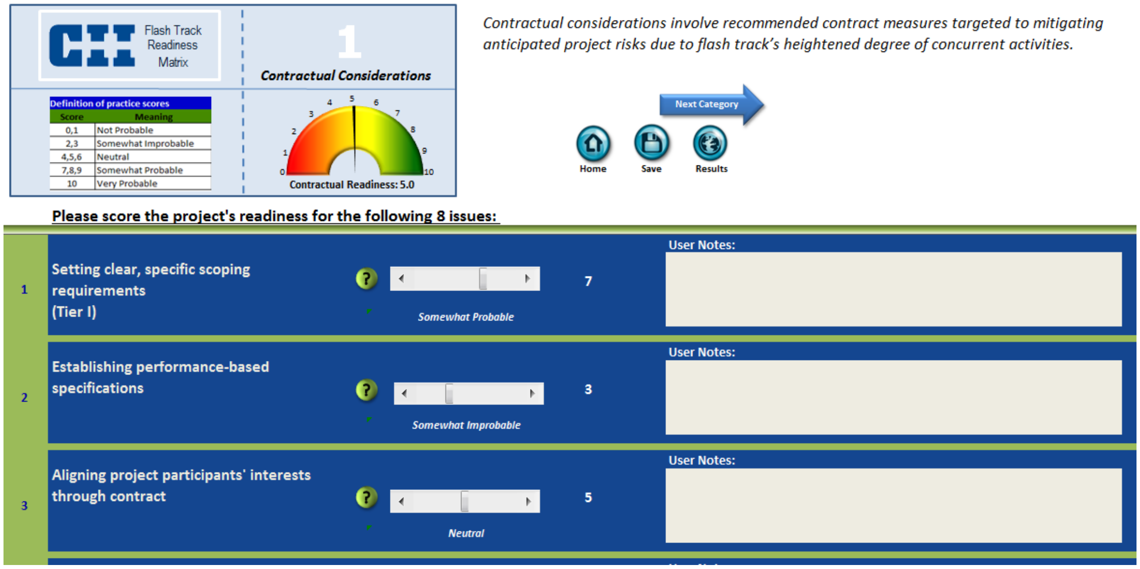


Definition of practice scores

Score	Meaning
0,1	Not Probable
2,3	Somewhat Improbable
4,5,6	Neutral
7,8,9	Somewhat Probable
10	Very Probable

Figure 6.1 – Flash Track Tool, Scoring Definitions

User input is requested on six category pages. The input includes scoring for the self-assessment of readiness and comments on the practice. These comments ultimately appear on the tool's report page. A sample copy of a user's scoring sheet in shown in Figure 6.2.



Contractual considerations involve recommended contract measures targeted to mitigating anticipated project risks due to flash track's heightened degree of concurrent activities.

Definition of practice scores

Score	Meaning
0,1	Not Probable
2,3	Somewhat Improbable
4,5,6	Neutral
7,8,9	Somewhat Probable
10	Very Probable

Please score the project's readiness for the following 8 issues:

1	Setting clear, specific scoping requirements (Tier I)	7	Somewhat Probable	User Notes:
2	Establishing performance-based specifications	3	Somewhat Improbable	User Notes:
3	Aligning project participants' interests through contract	5	Neutral	User Notes:

Figure 6.2 – Sample User Score Sheet in the Flash Track Tool

The tool computes a category score (based on the user's ratings of practices within a category) and an overall score based on Equations 6.1 and 6.2 below. Additional category and overall scores based only on the 18 Tier 1 practices are also reported (Equations 6.3 and 6.4). Scoring results are shown in the tool's dashboard (see Figure 6.3). By generating an overall readiness score, along with category and practice scores, the tool focuses users on the issues most critical to Flash Track success.

Category Readiness Score:

$$\sum_{\substack{Category\\Level}} RL * PW$$

RL= Readiness Level (user)
PW = Practice Weight

(Eq 6.1)

Overall Readiness Score:

$$\sum_{\substack{Overall\\Level}} RL * PW * CW$$

RL = Readiness Level (user)
PW = Practice Weight
CW = Category Weight

(Eq 6.2)

Tier I Category Readiness Score:

$$\frac{\sum_{\substack{Tier\,I\\Category\\Contribution}} RLI * PWI}{\sum_{\substack{Tier\,I\\Category\\Weights}} PWI}$$

RLI= Readiness Level (user)(Tier I)
PWI = Practice Weight (Tier I)

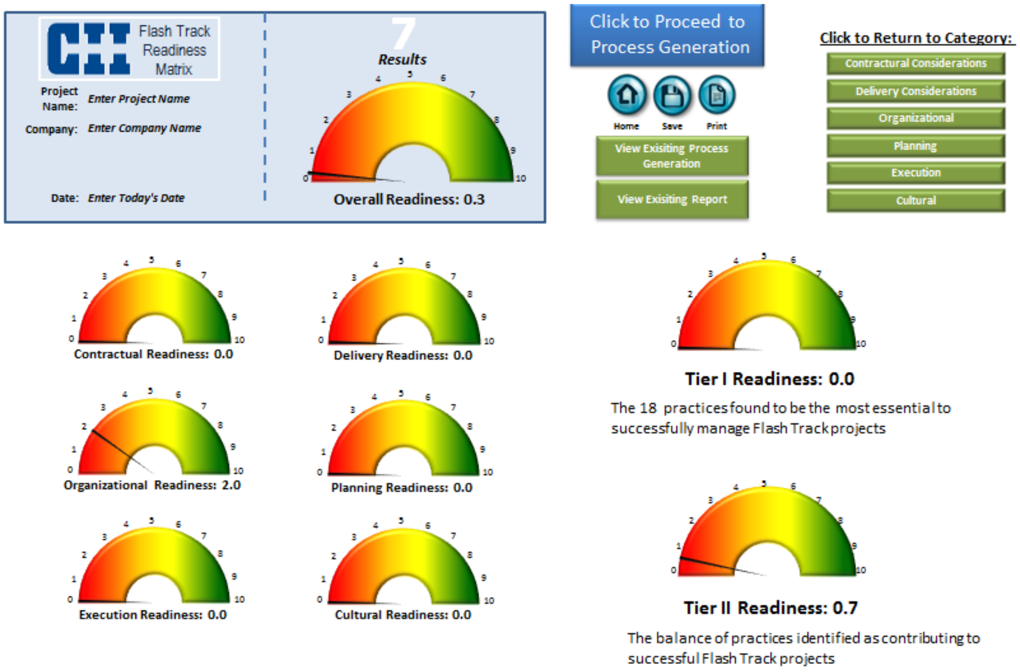
(Eq 6.3)

Tier I or II Overall Readiness Score:

(Eq 6.4)

$$\sum_{\substack{Tier\,I\,or\,II\\Overall\\Level}} RL * PW * CW/(CCI\ or\ CCII)$$

RL= Readiness Level (user)
PW = Practice Weight
CCI=Conversion Constant for Tier I (=0.53796)
CCII=Conversion Constant (=0.46204)
(10 point scale)



Project Name: Enter Project Name

Company: Enter Company Name

Date: Enter Today's Date

Overall Readiness: 0.3

Contractual Readiness: 0.0

Delivery Readiness: 0.0

Organizational Readiness: 2.0

Planning Readiness: 0.0

Execution Readiness: 0.0

Cultural Readiness: 0.0

Tier I Readiness: 0.0

The 18 practices found to be the most essential to successfully manage Flash Track projects

Tier II Readiness: 0.7

The balance of practices identified as contributing to successful Flash Track projects

Figure 6.3 – Flash Track Readiness Dashboard

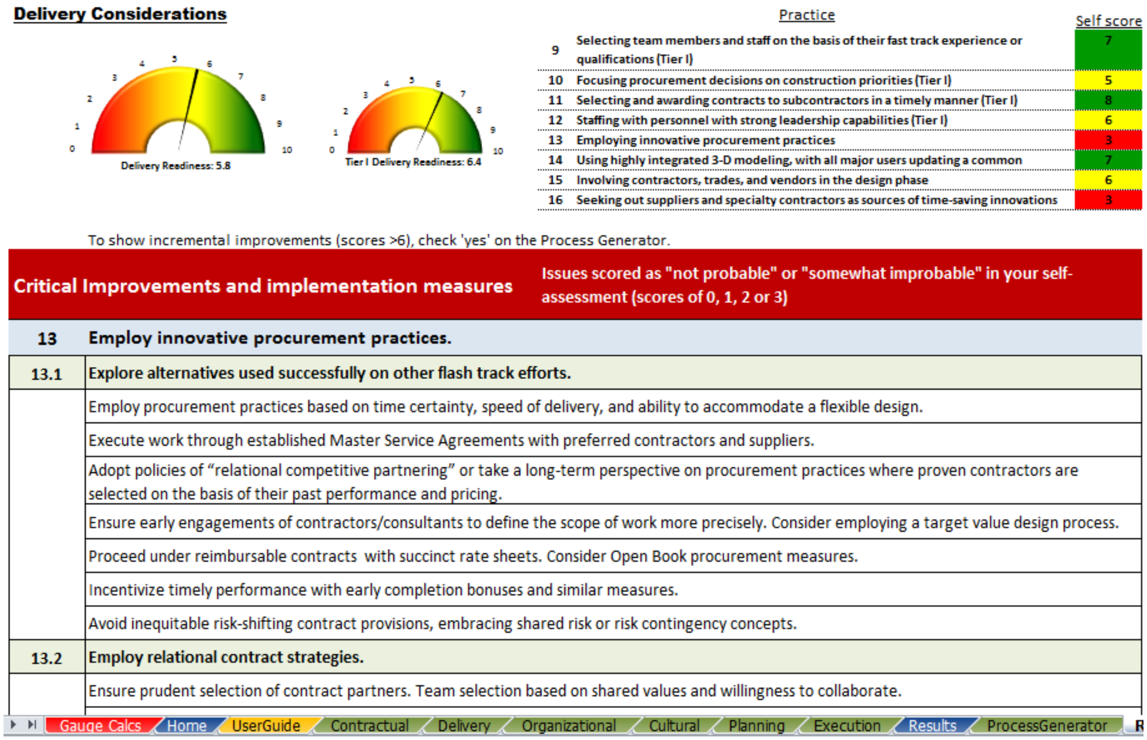
6.4.2 Flash Track Implementation Tool

6.4.2.1 Implementation Tool Overview

The second objective of the Flash Track implementation tool (CII, 2015) is to guide an organization in the efficient execution of a Flash Track project. The tool was developed through a series of small group workshops with the research team. In these workshops, small groups of four to five discussed innovative implementation measures, barriers, risks, and mitigation measures encountered on a Flash Track project. These groups then documented their work on worksheets. The results of each small group were subsequently checked by the other small groups and then discussed within the full research team. These worksheets served as the prime source for the research's final recommendations which are included in the tool.

The tool’s recommendations are based on a user’s self-assessment scores on each of the 47 essential practices. Practices with scores of 0-3 (not probable and somewhat improbable) are characterized as in need of critical improvements. Practices with neutral scores of 4-6 are marked as subject to improvement. Practices with scores of 7-10 (somewhat probable and very probable) are considered as areas of incremental improvement. By default, the tool shows a listing of the recommendations for improvement for practices with scores of 6 or less. Recommendations for practices with scores of 7 or more can be viewed by changing a setting within the tool.

Research Team 311 developed the Flash Track implementation guidelines for the 47 essential Flash Track practices to complement the readiness metric. For example, if a user scores low on practice #42, “Simplifying the approval procedures”, the tool recommends establishing a weekly clearinghouse for approvals, delegating authority to the project team, and releasing adequate funds to project leadership early to resolve commercial matters that divert attention from the accelerated schedule. A sample of the tool’s report page is shown in Figure 6.4, followed by a expanded discussion of these recommendations. A complete listing of the tool’s recommendations is included in Appendix R.



Delivery Considerations

Delivery Readiness: 5.8

Tier I Delivery Readiness: 6.4

	Practice	Self score
9	Selecting team members and staff on the basis of their fast track experience or qualifications (Tier I)	7
10	Focusing procurement decisions on construction priorities (Tier I)	5
11	Selecting and awarding contracts to subcontractors in a timely manner (Tier I)	8
12	Staffing with personnel with strong leadership capabilities (Tier I)	6
13	Employing innovative procurement practices	3
14	Using highly integrated 3-D modeling, with all major users updating a common	7
15	Involving contractors, trades, and vendors in the design phase	6
16	Seeking out suppliers and specialty contractors as sources of time-saving innovations	3

To show incremental improvements (scores >6), check 'yes' on the Process Generator.

Critical Improvements and implementation measures	Issues scored as "not probable" or "somewhat improbable" in your self-assessment (scores of 0, 1, 2 or 3)
13	**Employ innovative procurement practices.**
13.1	**Explore alternatives used successfully on other flash track efforts.**
	Employ procurement practices based on time certainty, speed of delivery, and ability to accommodate a flexible design.
	Execute work through established Master Service Agreements with preferred contractors and suppliers.
	Adopt policies of “relational competitive partnering” or take a long-term perspective on procurement practices where proven contractors are selected on the basis of their past performance and pricing.
	Ensure early engagements of contractors/consultants to define the scope of work more precisely. Consider employing a target value design process.
	Proceed under reimbursable contracts with succinct rate sheets. Consider Open Book procurement measures.
	Incentivize timely performance with early completion bonuses and similar measures.
	Avoid inequitable risk-shifting contract provisions, embracing shared risk or risk contingency concepts.
13.2	**Employ relational contract strategies.**
	Ensure prudent selection of contract partners. Team selection based on shared values and willingness to collaborate.

Figure 6.4 – Potential Improvement Strategies, Flash Track Implementation Tool

6.4.2.2 Flash Track Recommendations

In addition to developing a two-tiered ranking of forty-seven (47) essential Flash Track practices and creating the Flash Track Tool (FTT), this research introduces the *cPEpC* project delivery process, the team’s re-engineering of the CII PEpC process. In the next six sections, Tables 6.16 through 6.21 present the essential practices by category, with each table being followed by a short discussion of the tool’s Flash Track recommendations. Excerpts of a sample report from the tool, including a listing of its recommendations across the 47 essential practices are included in Appendix Q.

CONTRACTUAL CONSIDERATIONS

Table 6.16 – Tier I and Tier II Contractual Considerations

Contractual Considerations	
Tier I Practices	Tier II Practices
1. Setting clear, specific scoping requirements 5. Establishing clear change management procedures 7. Funding early critical efforts	2. Establishing performance-based specifications 3. Aligning project participants' interests through contract 4. Establishing contract strategies specifically tailored to project conditions 6. Establishing an effective claims resolution process 8. Reducing risks through the collective efforts of all stakeholders

Tier I practices highlight the importance of clarity and simplicity of the process (see Table 6.16). Flash Track projects must be readily understood. Stable and sufficient funding must be provided to get the money issues out of the way and let the project team concentrate on achieving the schedule safely and with the right quality (Eastham 2002). Simple scopes and work processes are preferred where a “fit for purpose approach” will offer greater benefits. Tier II practices complement the Tier I practices by focusing on other essential Flash Track contractual considerations (see Table 6.16).

Traditional transactional contracting methods were repeatedly cited in the data collected as an obstacle to successful Flash Tracking. In contrast, flexible relational contracting approaches such as IPD and Alliance contracts, with shared and capped downside risks, allow project participants to focus on high-performance targets (Love 2011, Ashcroft 2012, Ballobin 2008, Matthews and Howell 2005).

DELIVERY CONSIDERATIONS

Table 6.17 – Tier I and Tier II Delivery Considerations

Delivery Considerations	
Tier I Practices	Tier II Practices
9. Selecting team members and staff on the basis of their fast track experience or qualifications 10. Focusing procurement decisions on construction priorities 11. Selecting and awarding contracts to subcontractors in a timely manner 12. Staffing with personnel with strong leadership capabilities	13. Employing innovative procurement practices 14. Using highly integrated 3-D modeling, with all major users updating a common database 15. Involving contractors, trades, and vendors in the design phase 16. Seeking out suppliers and specialty contractors as sources of time-saving innovations

Tier I practices underline the importance of building a solid project team and engaging the subcontractors in a construction-focused procurement system (see Table 6.17). Technical competence and prioritizing construction were seen as paramount, as were experienced personnel who will welcome and readily adapt to Flash Track practices. The Delphi oracles considered remedying inconsistencies in standard procurement practices as a top priority. This observation is also discussed in the literature (Ashcraft 2012, Cleves 2011, Sakal 2005, Rahman 2008, Bernstein 2014). Tier II practices include an assortment of methods that complement the Tier I practices (see Table 6.17). Oracles commented that 3D modeling has time-saving benefits and has been underutilized in collaborations.

“Relational Competitive Partnering” has been offered as a remedy for traditional construction industry procurement practices conflict with the Flash Track objectives of focused, goal oriented teamwork. With Relational Competitive Partnering, firms compete on future work and are allocated a percentage of the current and future work based on their performance and pricing. When introduced to the American auto industry, this collaborative procurement practice reduced start-up times by an order of magnitude, decreased lead times 3-fold, and deepened supplier involvement in the design process for competitive advantage (Patty and Denton 2010, Vorster 1998).

ORGANIZATIONAL CONSIDERATIONS

Table 6.18 – Tier I and Tier II Organizational Considerations

Organizational Considerations	
Tier I Practices	Tier II Practices
18. Establishing a fully integrated project team, including design, construction, specialty contractors, commissioning, and operations personnel 20. Delegating authority to the project level (i.e., maximizing decision-making authority at the project level)	17. Engaging operations and maintenance personnel in the development and design process 19. Using team building and partnering practices 21. Empowering the project team (ensuring that each organization is led by an empowered leader) 22. Having an owner with sufficient depth of resources and organizational strength 23.Selecting personnel with a can-do attitude and willingness to tackle challenging tasks 24. Having an engaged and empowered owner's engineer (owner's representative) 25. Staffing with multi-skilled personnel

Tier I organizational practices focus on developing a fully integrated team and delegating authority to the project level (see Table 6.18). The Delphi oracles noted that better integration and communication mean better project results, and added that lack of funding and/or organizational buy-in make fully integrated and collaborative teams rare. Oracles also reported that delegation to the project level was essential, but, rare. Tier II practices concern characteristics of strong contractor-owner teams and the means for developing them (see Table 6.18).

CII RT 130 emphasized the importance of developing integrated teams in its development of the PEpC delivery model. In the RT 130 study of owner-contractor-supplier relationships, the team reported that the early involvement of suppliers in the planning stages produced up to a 19.6-percent schedule savings. They also reported a 17.8-percent cost savings, compared to traditional approaches (Vorster et al. 1998). Recommended practices for establishing a fully integrated project team include early engagement, co-location of the integrated team, the embedding of skilled and empowered consultants on an owner's team, and other ways to increase face-to-face interaction of key project participants are considerations. The CII RT 124 study of exceptional projects found that increasing the authority of project engineering and construction managers was a distinguishing characteristic that appeared repeatedly in their case study investigations.

CULTURAL CONSIDERATIONS

Table 6.19 – Tier I and Tier II Cultural Considerations

Cultural Considerations	
Tier I Practices	Tier II Practices
30. Having open communication and transparency	26. Accepting a non-traditional paradigm or mindset 27. Having an active, involved, and fully committed owner 28. Establishing flexible project teams that avoid rigid hierarchy 29. Maintaining a no-blame culture and a mutually supportive environment 31. Staffing with cooperative and collaborative personnel 32. Having an open-minded team 33. Creating executive alignment among the contracted parties

Having open communication and transparency was the only cultural practice in Tier I (see Table 6.19). It was also one of the few practices ranked as a top tier practice in all three ranking approaches, affirming its influence on building intra- and inter-organizational trust and fostering improved project performance. The Tier II practices relate to the need for a new paradigm or mindset in developing significantly more engaged, cohesive, and collaborative project teams (see Table 6.19).

A variety of measures are included in the Flash Track implementation tool, including adoption of daily 15-minute stand-up talks as practiced in Agile Project Management and Lean Construction, use of highly visual communication media, such as Kanban Boards, and implementation of an interactive planning process. The interactive planning process, or creativity workshops, involves getting all key stakeholders, contractor, engineers, clients and key subcontractor, and suppliers together in a one-day session overseen by trained facilitator(s). The objective is to gain understanding and agreement about how the project is to be executed including any changes to standard company procedures (Eastham 2002).

PLANNING CONSIDERATIONS

Table 6.20 – Tier I and Tier II Planning Considerations

Planning Considerations	
Tier I Practices	Tier II Practices
34. Emphasizing coordination planning during the design process) 36. Identifying and procuring long lead items 38. Providing enough resources for critical path items 39. Considering speed of fabrication and construction during the selection of design alternatives 40. Recognizing and managing the additional Flash Track risks	35. Performing exhaustive front end planning 37. Monitoring and driving corrective actions through the project controls process

Planning considerations were the most represented category among Tier I practices (see Table 6.20 above), which reflects both the heightened importance of planning in Flash Tracking and the common belief that planning is the best investment any project can make (Gehrig 1990). The unique risks and need for greater coordination of planning in Flash Tracking require new approaches beyond conventional critical path planning. In the Flash Track case studies, identifying long lead time items took on a new dimension, as illustrated by the emergency rebuild of the Saint Anthony Falls I-35 Bridge. The accelerated schedule revealed a number of "surprises" on the critical path. For example, the ordering of light poles had a lead time of ten months, yet only eleven months were allowed for building the entire bridge. The two Tier II planning items echo the Tier I practices (see Table 6.20).

New approaches to planning include the early committed involvement of specialty subcontractors and suppliers, pull or workflow scheduling, critical chain scheduling, dynamic modeling, Agile Project Management's "plan, collaborate, and deliver" approach, and the near exclusive focus on task-level planning. In exploring case studies in the food and consumer products sector, it was learned that deciding to Flash Track at the feasibility phase (FEL-1) and combining the development phase (FEP-2) with the detailed scope phase (FEP-3) were effective in jump starting the Flash Track process on projects where time-to-market is imperative.

EXECUTION CONSIDERATIONS

Table 6.21 – Tier I and Tier II Execution Considerations

Execution Considerations	
Tier I Practices	Tier II Practices
42. Simplifying approval procedures 43. Dedicating full-time personnel to the project 44. Selecting appropriate construction methods	41 Co-locating the project team (i.e., owner, designer, builder, and/or key vendors) 45. Minimizing handoffs 46. Employing innovative construction methods 47. Conducting frequent and effective project review meetings

The Tier I execution practices emphasize the need for simplifying the approval process, dedicating full-time personnel, and selecting appropriate construction methods at the outset of the project (see Table 6.21). Dedicating full-time personnel to the project was deemed a top-tier item in all three ranking approaches, further emphasizing its importance in Flash Track projects for creating capacity and enabling timely decision-making. The critical need for dedicated personnel was echoed in Delphi oracle comments about staffing the project with personnel who “eat, sleep, and breathe” the project. The Tier II practice of “frequent project review meetings” was the single practice introduced by the oracles in the Delphi process (see Table 6.21). On the subject of meetings, oracle comments were brief and pointed that effective meetings should be quick and simple. Meeting participants should know why they are there and what decisions are needed, and then proceed to make those decisions.

6.5 cPEpC Model: Re-engineered EPC Process

The research team re-engineered the workflow process by re-examining the 47 essential Flash Track practices in the light of the CII PEpC process. By adding a “little c” at the beginning of the CII PEpC project delivery process, the team wanted to stress the importance of involving key specialty contractors in the preliminary conceptual design phase. These “little c” contractors should join the stakeholders and key strategic suppliers that are brought into the team during the main procurement phase of the process (i.e., “big P”).

Recent developments in project delivery enable the cPEpC workflow. These new approaches are characterized by relational contracting practices, Lean Construction principles, and BIM-enabled applications. Relational project delivery methods differ from transactional approaches in that their collaborative organization relies on trust, and their operating systems are based on integration and management by means (Abdelhamid 2012). The five core elements of relational contracting are the following: 1) commitment; 2) trust; 3) cooperation; 4) communication, common goals, and objectives; and 5) a win-win philosophy (Yeung et al. 2012). The cPEpC workflow process benefits from the following policies, conditions, and characteristics:

- procurement policies that promote an engaged, relational supply chain (full engagement of key suppliers and specialty subcontractors in preconstruction, and their subsequent performance-based competitive selection);

- dedicated, integrated project teams employing highly visual 3D collaboration tools;
- earlier and continued engagement of project stakeholders;
- a higher level of collaboration;
- critical chain/pull scheduling;
- modularization and pre-fabrication;
- empowered project-level decisions;
- creation of an organizational structure with sufficient resources and flexibility, focused on available capacity rather than utilization of personnel; and
- streamlined work processes and elimination of non-value added activities.

A comparative conceptual model of the traditional EPC and cPEpC concepts is shown in Figure 6.5. The cPEpC model illustrates the early engagement of downstream stakeholders during the development process and an increased level of concurrency throughout the process. A primary benefit of the early engagement of downstream stakeholders in the development process is an opportunity to provide significantly improved scope of work. This Tier I consideration has also been cited as a key success factor in a number of other studies (Vorster et al. 1998, Songer and Diekmann 2000, CII 2007a, CII 2011). The increased level of concurrency was evident in successful case studies, commonly manifested in prefabrication and modularization. It is also evident in the transformation of the shipbuilding industry where modularization of the design process has led to increased innovation in a sophisticated supply chain and enabled extraordinary timely designs and assemblies.

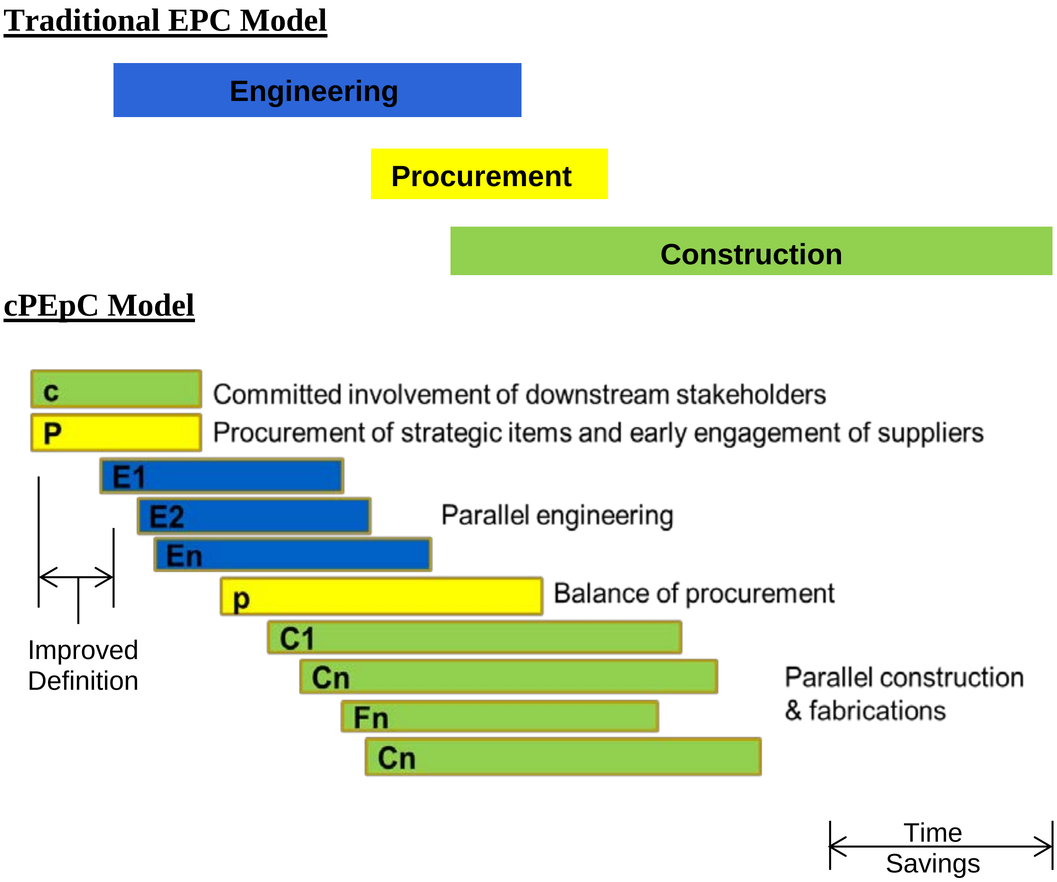


Figure 6.5 - Flash Track Model

As shown in Figure 6.6, the Flash Track Tool should be deployed upstream during FEP-1, FEP-2/3, and downstream after the project team has captured the lessons learned.

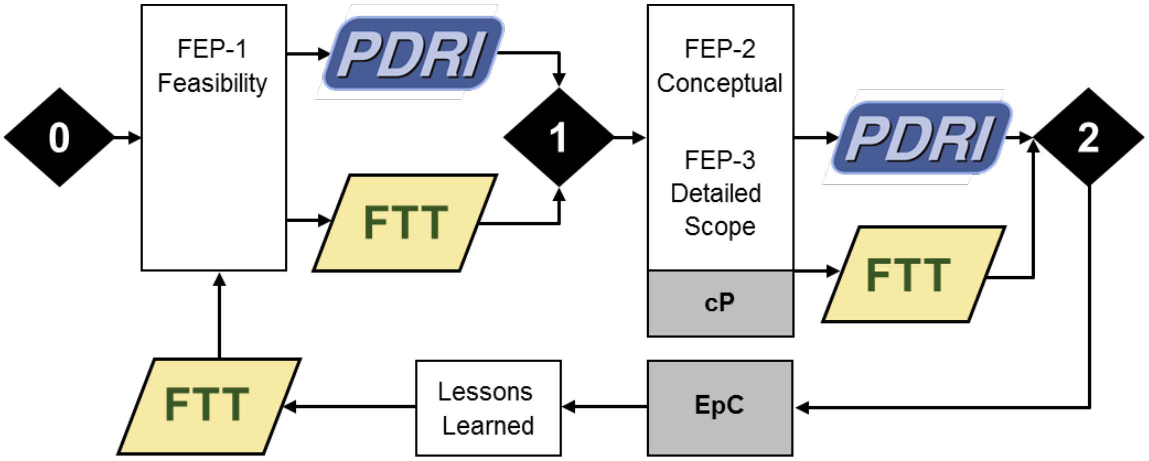


Figure 6.6 - Flash Track Stage Gates (FTT = Flash Track Tool)

6.6 External Validation

The research team validated the Flash Track readiness metric and implementation guidelines to ensure that they provide meaningful scoring metrics and substantive implementation strategies. Projects were selected and senior level representatives were asked to complete the readiness metric for them after reflecting on these efforts. After completing the self-assessment portion of the tool, they compared the tool's recommendations to the actual events they experienced on those projects.

The external validation process entailed the testing of the Flash Track tool by applying it retrospectively to 13 Flash Track projects from such sectors as the power and transmission (4), process (4), manufacturing (2), food and consumer products (2), and transportation (1) industries. Table 6.22 presents the reasons why these projects selected a Flash Track delivery strategy.

Table 6.22 – Reasons for Using Flash Track Delivery in Validation Projects

Reason for using Flash Tracking	Number of projects
Time to market	7
Emergency rebuild	2
Regulatory compliance	4

Participants in the validation effort were asked to rate the effectiveness of the readiness metric score in light of the project's outcomes. They were also asked to assess the implementation guidelines, in terms of whether these recommendations would have been beneficial at the onset of their projects. The validation questionnaire is included in Appendix S. Figure 6.7 presents participants' average validation ratings of the Flash Track tool. It shows that on all four dimensions of validity, the tool had an average score above 3.0, which corresponds to "Agree." Figure 6.8 shows that the rating for ease of use averaged a 7.9 score on a 10-point scale.

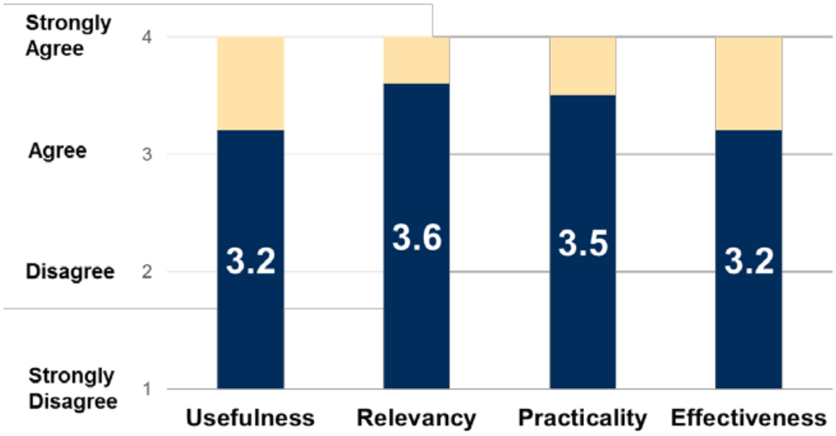


Figure 6.7 - Assessment of Tool's Validity (n = 13 participants)

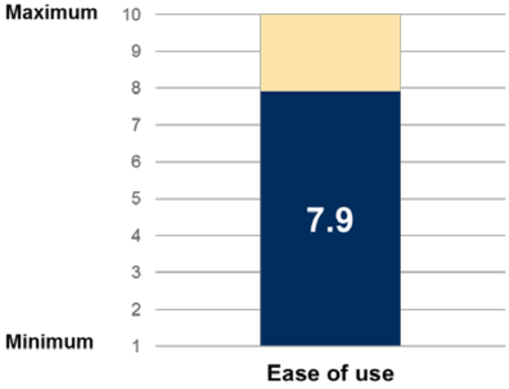


Figure 6.8 - Assessment of Tool's Ease of Use (n = 13 participants)

The validation effort also entailed measures to ensure that the tool provides meaningful scoring metrics. In addition to returning a questionnaire, validation study participants also provided copies of their completed Flash Track tools. A comparison between participants' responses to the retrospective self-assessment question of "How ready were you to undertake this project on a Flash Track basis" (i.e., Question 2.1) reflected a moderately strong correlation (r =0.76). A comparison between participants' responses to the retrospective self-assessment question of "Overall, how successful was the project (i.e., Question 3.7) also reflected a moderately strong correlataion (r=0.78). These comparisons are shown in Figures 6.9 and 6.10.. Similar comparisons on were completed for readiness within each category, yielding comparable results (see Appendix T).

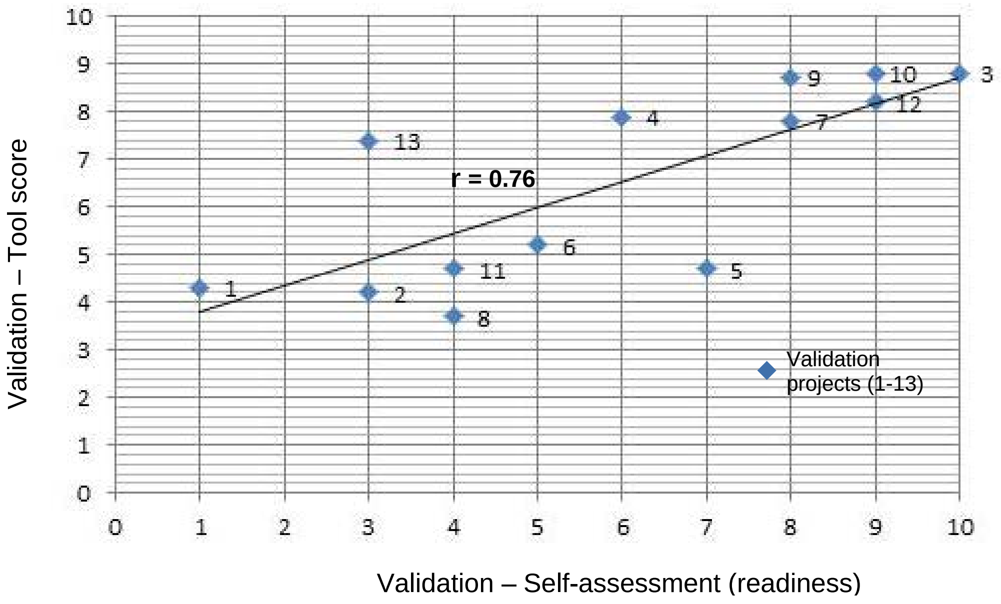


Figure 6.9 – Users' Self-Assessment (readiness) and Tool Scores (n = 13 participants)

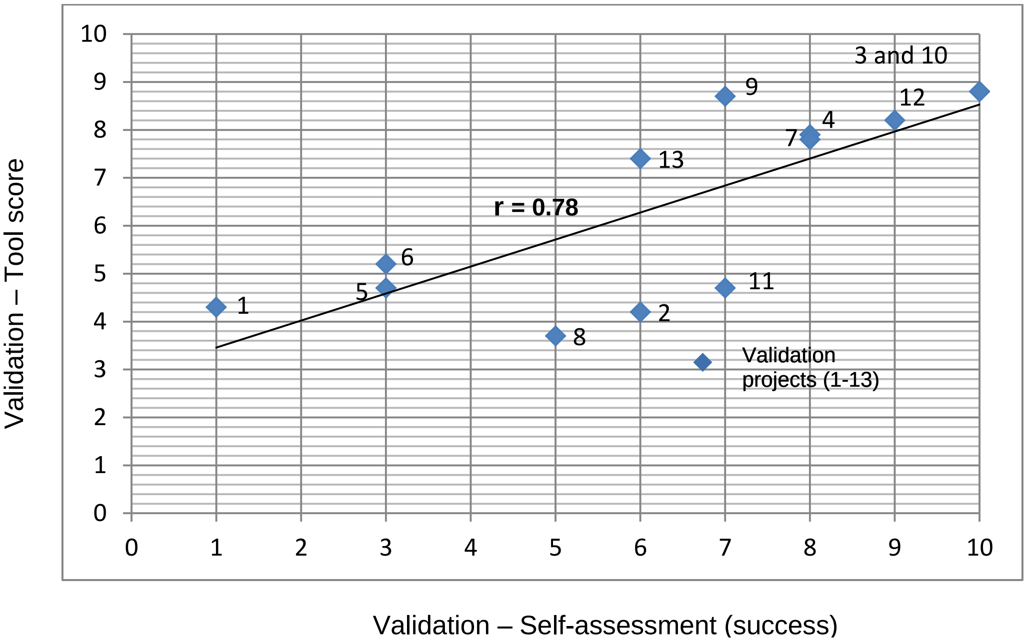


Figure 6.10 – Users' Self-Assessment (success) and Tool Scores (n = 13 participants)

When asked to list any issues they faced during project execution, the participants reported 189 issues. The research team then cross-referenced these issues with the 47 essential Flash Track practices. All 47 essential Flash Track practices were found relevant to these field issues, with an average of more than eight citations per practice. Similar to the research's Tier I/Tier II priority ratings, validation study respondents reported planning considerations as their top issues. The two most common issues cited by the validating projects were aligned with practice #1, Setting clear, specific scoping requirements", and practice #7, "funding early critical efforts." The questionnaire on issues encountered in the 13 validation projects is included in Appendix W.

In the final element of the validation process, participants were asked for any suggestions that could improve the tool. Validators and others offered 58 suggestions for improvements, which included items ranging from editorial adjustments to expanding discussion in the tool's recommendations. The proposed improvements and comments are shown in Appendix W. Each of the comments were addressed in the final version of the tool.

6.7 Flash Track Network Analysis Results

6.7.1 Flash Track Network

The full Flash Track Network is shown in Figure 6.11with the graph layout based on the Fruchterman-Rheingold spring embedder algorithm (Hansen et al. 2011). Although not a primary focus of this anaysis, the network structure is comprised of a single component where all practices have a path leading to each of the other practices. This means that practices together form a single interconnected and interdependent whole. The top four practices with the highest out-degree centrality are not clustered. Three of these practices, namely: *#3. Aligning project participants' interests through contract, #31. Staffing with cooperative and collaborative personnel and #41. Co-location of project team (owner; designer; builder; and/or key vendor* enable the fourth practice with a very high out-degree *#18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel).* These relational ties result in a more central position in the graph for practice #18 based on its higher in-degree centrality or status. The graph also shows that the different categories of practices are likewise dispersed throughout the network.

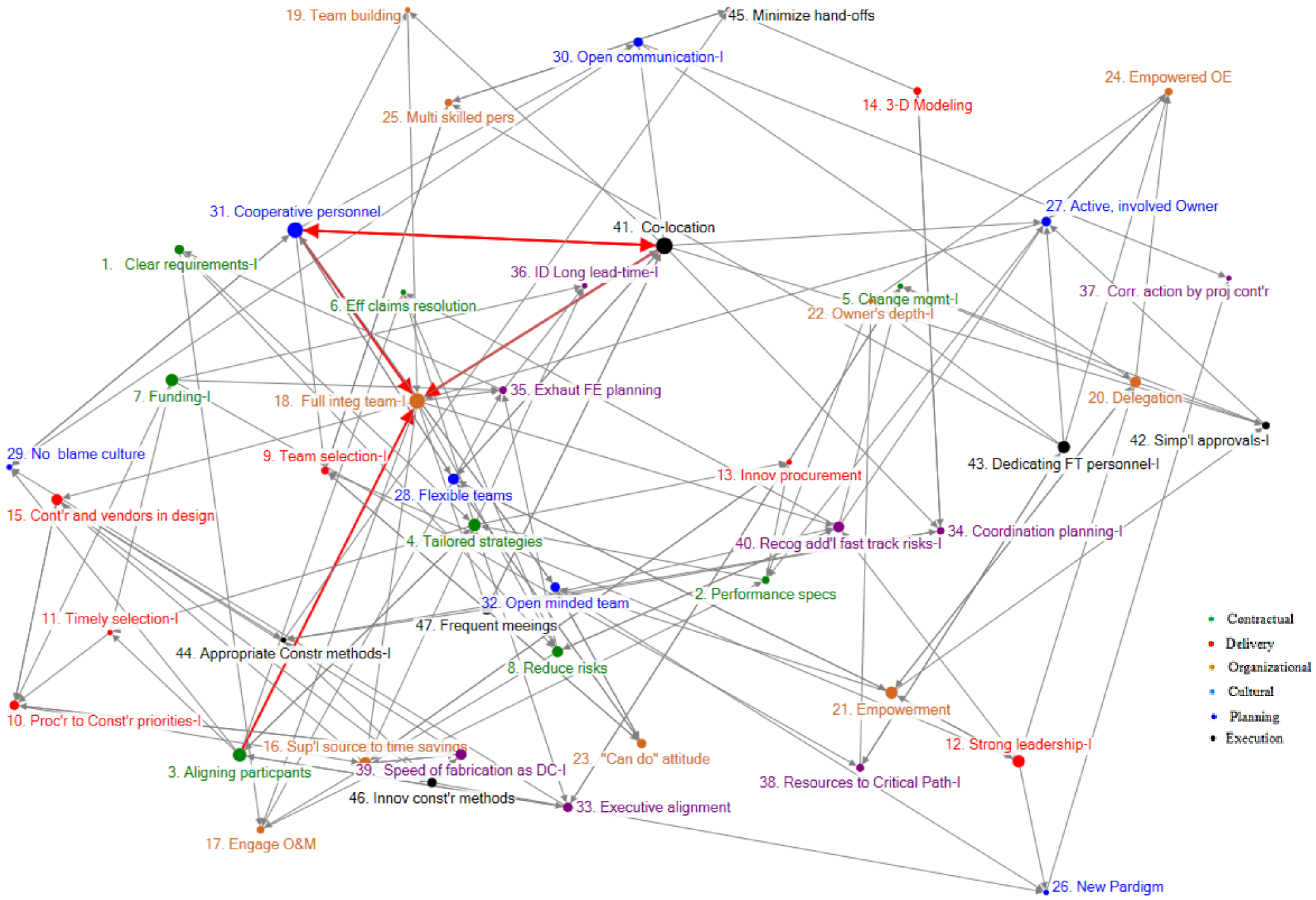


Figure 6.11 Full Flash Track network

Node size based on out-degree centrality. (Ties between the top 4 out-degree centrality practices shown in red.)

Figure 6.12 is an excerpt of the full Flash Track network. Flash Track practice 4, “Establishing contract strategies specifically tailored to the project condition,” enables five other practices and is enabled by three practices. One practice (#3) is both an enabler (out-degree) and is enabled (in-degree) by practice #4. Arrows indicate the direction of enabling – from the enabling practice to the enabled practice. The relational ties depicted in Figure 6.12. can also be expressed in tabular form (Table 6.23).

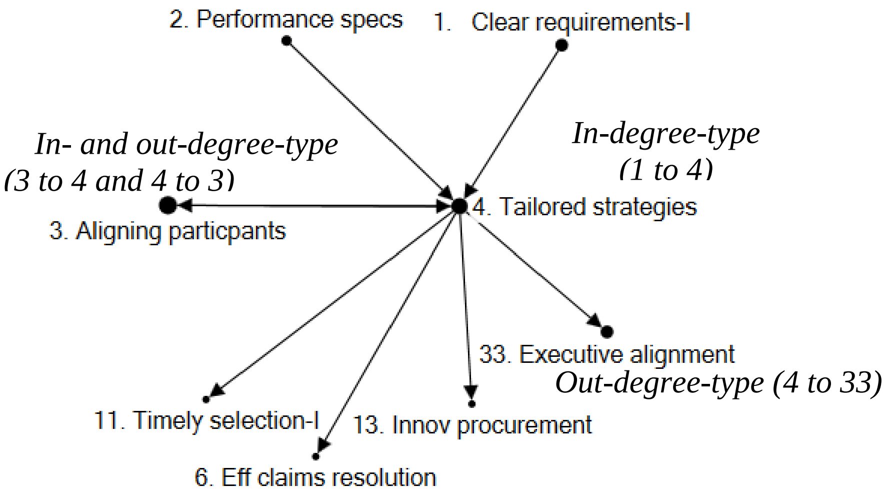


Figure 6.12. Flash Track Network nomenclature
(Node size based on out-degree centrality)

Table 6.23 - Relational ties to/from "4. Establishing contract strategies specifically tailored to the project condition"

Practice #4 enables…	Practice #4 is enabled by …	Practice #4 enables and is enabled by …
6. Establishing an effective claims resolution process	1. Setting clear, specific scoping requirements-I	3. Aligning project participants' interests through contract
11. Making timely selection and award contracts to subcontractors-I		
13. Employing innovative procurement practices	2. Establishing performance based specifications	
33. Creating executive alignment amongst the contracted parties		

Note: The suffix "I" denotes a Tier I practice

6.7.2 Network Quantitative Analysis

Table 6.24 shows the top ten practices in terms of non-directional (overall degree and eigenvector centrality) and directional (in-degree and out-degree) centrality measures respectively. Overall degree (non-directional) and eigenvector centrality measures produced similar rankings of practices. There is a strong Pearson correlation between the overall degree and eigenvector centrality measures ($\rho = 0.82$). There was a moderately strong Pearson correlation between the overall degree and out-degree centrality ranks ($\rho = 0.74$). In-degree centrality produced a distinctly different ranking of practices from out-degree, as the two were weakly correlated ($\rho = 0.23$). Practices #7 (*Funding early critical efforts)*, #12 (*Staffing with personnel with strong leadership capabilities)*, and #43 (*Dedicating full-time personnel to the project)* were characterized by high out-degree (enabling many other practices) but low in-degree (showing low dependency on other practices).

Table 6.24 - Comparing Overall Degree, Eigenvector, In-degree and Out-degree Centrality Measures (Ranks)

	Non-directional		Directional	
Practices	**Overall Degree**	**Eigen vector**	**In-degree**	**Out-degree**
41. Co-location of project team (owner; designer; builder; and/or key vendors)	**2**	**2**	**9****	**1**
18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	**1**	**1**	**1**	**2**
31. Staffing with cooperative and collaborative personnel	**3**	**5**	**9****	**3**
3. Aligning project participants' interests through contract	**8**	12	39	**4**
4. Establishing contract strategies specifically tailored to the project condition	**4**	16	22	**5**
7. Funding early critical efforts	14	32	47	**6**
12. Staffing with personnel with strong leadership capabilities	16	33	45	**7**
16. Seeking out suppliers and specialty contractors as a source for time saving innovations	**5**	9	**9****	**8**
21. Empowering the project team (each organization led by an empowered leader)	18	30	23	**9**
43. Dedicating full-time personnel to the project	22	37	46	**10**
8. Reducing risks through collective efforts of all stakeholders	**9**	**6**	24	11
40. Recognizing and managing the additional fast track risks	**7**	**3**	**9****	16
27. Having an active; involved and fully committed owner	**6**	**4**	**2**	21
28. Establishing flexible project teams that avoid rigid hierarchy	34	20	**9****	14
10. Focusing procurement decisions on construction priorities	15	23	**9****	19
35. Performing exhaustive front end planning	12	8	**9****	33

Table 6.24 - Comparing Overall Degree, Eigenvector, In-degree and Out-degree Centrality Measures (Ranks) (continued)

	Non-directional		Directional	
Practices	**Overall Degree**	**Eigen vector**	**In-degree**	**Out-degree**
15. Involving contractors; trades and vendors in the design phase	**10**	11	26	12
17. Engagement of operations & maintenance personnel in the development and design process	17	**10**	27	29
6.Establishing an effective claims resolution process	28	17	**9****	45
9. Selecting team members and staff based on their fast track experience or qualifications	29	38	**9****	27
47. Frequent project review meetings	25	**7**	43	17
29. Maintaining a no blame culture and mutually supportive environment	35	24	9**	42
5..Establishing clear change management procedures	27	28	**9****	36
39. Considering speed of fabrication and construction during the selection of design alternatives	20	25	**9****	15
44. Selecting appropriate construction methods	23	26	**9****	43

Note: Heavily shaded cells show top-ten practices, and lightly shaded cells show practices with in-degree centrality ranks equivalent to the lowest top-ten practice
** Practices 5, 6, 9, 10, 16, 28, 29, 31, 35, 39, 40, 41 and 44 have the same in-degree count (4 incoming ties w/ median rank of 9). Only 10 of these are shown in darker shading.

6.7.3 Comparisons to Delphi Method and Analytic Hierarchy Process rankings

Table 6.25 compares the top ten practices according to out-degree and in-degree centrality and the top ten practices according to the Relative Index (mean rating in Delphi study), Delphi Round 3 results, and AHP, which indicated how essential the practices were perceived for Flash Tracking. Ten of the top in-degree and out-degree practices fell within the Tier I practices. The Pearson correlation coefficient between the out-degree and in-degree centrality measures and the Delphi Relative Index, Delphi Round 3, and AHP rankings are shown in Table 6.26. Both centrality measures are only negligibly to mildly associated with the rankings by the other methods, indicating that the centrality measures provide a very different view.

Table 6.25 - Comparing the ranking of top 10 practices according to Out-degree and In-degree centrality with Tier I practices, identified through Delphi study RI, Delphi study Round 3 and AHP Top 10 rankings

Tier I Practices	Out-degree	In-degree	RI Rank	Round 3 rank	AHP Rank
18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel-I E	**2**	**1**	**4**	**2**	12
7. Funding early critical efforts-I	**6**	47	**7**	**6***	26
12. Staffing with personnel with strong leadership capabilities-I	**7**	45	**6**	16	11
43. Dedicating full-time personnel to the project-I	**10**	46	**3**	**3**	**5**
40. Recognizing and managing the additional fast track risks-I E	16	**9****	15	**10**	**4**
39. Considering speed of fabrication and construction during the selection of design alternatives –I	15	**9****	24	12	**8**
10. Focusing procurement decisions on construction priorities-I	19	**9****	**5**	**4**	14
1 .Setting clear; specific scoping requirements-I	18	44	**2**	**1**	22
5. Establishing clear change management procedures-I	36	**9****	**9**	19	44
9. Selecting team members and staff based on their fast track experience or qualifications	27	**9****	35	**9**	24
11. Making timely selection and award contracts to subcontractors-I	37	16	**10**	**7***	19
20. Delegating authority to project level (maximize decision-making authority to the project level) –I E	13	17	19	16	**7**
30. Having open communication and transparency-I	22	37	**8**	**5**	**6**
34. Emphasizing coordination planning during the design process-I	32	18	13	27	**10**
36. Identifying and procuring long lead time items-I	46	19	**1**	**8***	**2**
38. Providing enough resources to critical path items-I	34	38	17	15	**3**
42. Simplifying approval procedures-I	35	20	33	27	**9**
44. Selecting appropriate construction methods-I	43	**9****	21	31	**1**

Table 6.25 - Comparing the ranking of top 10 practices according to Out-degree and In-degree centrality with Tier I practices, identified through Delphi study RI, Delphi study Round 3 and AHP Top 10 rankings (continued)

Tier II Practices	Out-degree	In-degree	RI Rank	Round 3 rank	AHP Rank
41. Co-location of project team (owner; designer; builder; and/or key vendors)[E]	**1**	**9**[**]	30	19	17
31. Staffing with cooperative and collaborative personnel[E]	**3**	**9**[**]	14	13	21
3. Aligning project participants' interests through contract	**4**	39	37	42	38
4. Establishing contract strategies specifically tailored to the project condition	**5**	22	29	19	40
16. Seeking out suppliers and specialty contractors as a source for time saving innovations	**8**	**9**[**]	36	35	25
21. Empowering the project team (each organization led by an empowered leader)	**9**	23	16	23	31
27. Having an active; involved and fully committed owner[E]	21	**2**	12	47	29
6. Establishing an effective claims resolution process	28	**9****	38	46	47
28. Establishing flexible project teams that avoid rigid hierarchy	34	**9****	42	35	23
29. Maintaining a no blame culture and mutually supportive environment	35	**9****	32	24	15
35. Performing exhaustive front end planning	12	**9****	47	11	18

Notes: Heavily shaded cells show top-ten practices, and lightly shaded cells show practices with in-degree centrality ranks equivalent to the lowest top-ten practice
** Practices 5, 6, 9, 10, 16, 28, 29, 31, 35, 39, 40, 41 and 44 have the same in-degree count (4 incoming ties w/ median rank of 9). Only 10 of these are shown in darker shading.

Table 6.26 - Pearson correlation coefficients between in- and out-degree centrality to RI, Round 3 and AHP rankings

	Out-degree	In-degree
Delphi Relative Index	0.26	0.03
Delphi Round 3	0.30	0.04
AHP	0.06	0.18

Table 6.27 shows the number of practices in each of the categories that were ranked in the top ten by the network analysis measures, Delphi method and the AHP. This comparison shows a generally balanced representation of the six categories within the top ten selection of each ranking method, with the exception of the AHP.

Table 6.27 - Category allocations across the respective top ten practices

	Completed by RT 311					Completed by Delphi	
	Network Analysis Centrality Measures				Pair-wise comparison	Weighted score of 64 practices	Selection from 47 practices
	Degree	EC	ODC	IDC	AHP	RI	R3
Contractual	3	1	3	1	0	3	2
Cultural	2	2	1	2	1	1	1
Delivery	2	1	2	2	0	3	3
Execution	1	2	2	2	3	1	1
Organizational	1	2	2	1	1	1	1
Planning	1	2	0	2	5	1	2

Degree-overall degree centrality, EC- eigenvector centrality, ODC-out-degree centrality, IDC-in-degree centrality, AHP-Analytic Hierarchy Process, RI-Relative Index, R3-Round 3

6.7.4 Comparative Strength of the Relational Ties

The level of agreement among the nine survey respondents varied on whether a given pair of practices included an enabling relationship. Table 6.28 shows the frequency distribution of the number of respondents endorsing a tie for the 270 pairs of practices.

Table 6.28 - Strength distribution for qualifying[*] enabling practices (Out-degree Centrality)

Selection of Tie strength based on number of RT 311 survey respondents	Count	Percentage
Equal to 9	18	6.7%
Greater than or equal to 8	46	17.0%
Greater than or equal to 7	72	26.7%
Greater than or equal to 6	109	40.7%
Greater than or equal to 5*	143	53.3%
Greater than or equal to 4	176	65.6%
Greater than or equal to 3	212	78.9%
Greater than or equal to 2	244	90.7%
Greater than or equal to 1	270	100%

.* Strength threshold employed in the main analysis, reflecting that a majority of the respondents (5 of 9) concurred that a relational tie existed

When the threshold for defining a tie (one practice enabling another) is set at 7 or more respondents who reported the tie, the key results are similar to those already described. With the higher threshold, the top-ten out-degree (enabling) practices did not appreciably change (i.e., 7 of 10 remained), although the top ten in-degree (enabled) practices changed substantially (i.e., 3 of 10 remained). The Pearson correlation coefficient between the out-degree and in-degree centrality measures and the Delphi

Relative Index, Delphi Round 3, and AHP rankings are roughly the same with the highest correlation of 0.34 between out-degree centrality and the Delphi relative index.

6.7.5 Interpreting the Results

Practices #41, #18, #31, and #3 were the top four ranked enabling practices due to their relational ties, and practice #18 is considered the most essential of these. The benefits of an Integrated Project Delivery contract, selection of collaborative team members and colocation were points of emphasis in the new Maine General Hospital project as indicated in an earlier phase of this research. The differing respective top-ten lists (Table 6.25) and poor correlations (Table 6.27) between the two network analysis centrality measures and the three earlier ranking methods, show that the extent to which a practice *enables* or *is enabled* by other practices is a fundamentally different question than identifying which practices are the most essential. While different, the measures of in-degree, out-degree and other centrality measures could be considered as offering a deeper insight into *why* a practice is considered essential.

When reviewing the category allocations across the now seven different ranking methods, the AHP appears as an outlier as the only approach that failed to identify a single contractual or delivery method consideration within its top ten practices. Prior to this pilot study, the differences between the AHP and the Delphi method were attributed, in part, to the composition of the respective participants. The Delphi oracles were principally senior or top-level personnel who would be more focused on the type of practices that comprised those categories (e.g., contractual and delivery methods). In this study, the RT 311 completed the network analysis survey (as they did for the AHP) with multiple contractual and delivery methods selections, suggesting other factors (including the categorization process) are contributing to the differing results between the AHP and other methods.

Table 6.28 shows that varied responses were obtained from the nine respondents on which ties existed, the majority of respondents (5 of 9) were in agreement on 53.3% (143 ties) of the potential (270) ties included in the survey. This low level of agreement suggests that improvements are warranted in the Implementation worksheet pre-screening process. Ties meeting this threshold were included in the Flash Track network. When the qualifying threshold level was raised from five to seven respondents, some changes were noted in the out-degree and in-degree top-ten practices. However, with the higher threshold, the key results remained the same, including the top-four practices in terms of out-degree centrality relating to fully integrated teams, personnel selection, contractually aligning project participants, and co-location and the weak correlations between the centrality rankings and the three prior ranking methods .

If both enabling (out-degree) and enabled (in-degree) centrality measures are considered as being important to the success of Flash Tracking, a combined total of ten fell within the Tier I practices which matches the contribution of the previous ranking methods. From that perspective, the network analysis has provided a new basis for *why* a practice is deemed to be of greatest importance. Noteworthy exceptions to the Tier I/II assignments are shown in Table 6.25. Considerations for an improved improved Tier I/Tier II allocation are shown in Table 6.29.

Table 6.29 – Proposed refinements to the Tier I/ Tier II assignments

Proposed new Tier I practices	
Practice	Reason
41. Co-location of project team (owner; designer; builder; and/or key vendors) ^{E} -OD	Top ten eigenvector and out-degree centrality practice
31. Staffing with cooperative and collaborative personnel ^{E} -OD	Top ten eigenvector and out-degree centrality practice
16. Seeking out suppliers and specialty contractors as a source for time saving innovations ^{E} -OD	Top ten eigenvector and out-degree centrality practice
Proposed new Tier II practices	
Practice	Reason
34. Emphasizing coordination planning during the design process-I (source AHP)	Only identified as top-ten in AHP, possible weakness in categorization
38. Providing enough resources to critical path items-I (source AHP)	Only identified as top-ten in AHP, possible weakness in categorization
42. Simplifying approval procedures-I (source AHP)	Only identified as top-ten in AHP, possible weakness in categorization

Note: The suffix “I” denotes a Tier I practice. Suffixes ID and OD denote out- and in-degree centrality top ten practices. Superscript “E” denotes eigenvector centrality top-ten practices.

CHAPTER 7

DISCUSSION

The primary purpose of this research was to investigate and propose a re-engineered EPC process to facilitate successful execution of faster Fast Track, or Flash Track, projects. Two key questions drove the research:

1. What innovations in project delivery methodology can help compress project durations while maintaining safety, quality, and risk tolerance?
2. How are barriers to delivering shorter project durations overcome?

This discussion section offers the author's perspective on the research methodology and results. A summary of the research's contribution to the field and recommendations for future studies are included in the final chapter.

7.1 Methodology

A unique feature of this study is the breadth of methodologies used to identify essential practices. The methodology ranged from simple content analysis and focus groups to multi-criteria decision analysis techniques. A Modified Delphi method was employed for criteria selection and as a ranking method, and the Analytic Hierarchy Process (AHP) method was employed as a weighting method and as an alternative approach for ranking the essential practices. The multiple methodological approaches led to the prioritization of 18 essential Flash Track practices that serve as a foundation for defining innovative implementation measures. Here, is a short discussion of the strengths and weaknesses of the methods employed.

7.1.1 Data Collection Methods

The volume of data collected during this research was valuable in addressing the key questions. Resources were drawn from academic works, case studies, and industry workgroups. The literature search process served multiple purposes. To begin with, it formed a basis for generating ideas to use during the analysis phase. Throughout the rest of the research process, it continued to enhance our understanding of the issues and suggest means of addressing implementation barriers. The combination of structured interviews, testimonials and a small set of historical case studies introduced new considerations and reinforced previously defined concepts.

The literature review spanned writings from as early as 1969 to contemporary discussions, offering a view of the evolution of perspectives on accelerated project deliveries. Most discussions could be characterized as practical commentaries, case studies or comparative studies. In contrast with this research, few if any of the reviewed documents used multiple approaches. Most studies on construction industry accelerated project deliveries share common themes; the benefits of collaborative teams and an interactive planning process are at the forefront. Other common themes include the benefits of trust, open communication, equitable risk allocation, and relational contracting. Research results generally agree on the advantages of these common themes. A few notable differences appear in discussions of challenges of concurrent engineering; some authors view these as shortcomings of the process, whereas others focus on implementing appropriate mitigation techniques. There were also varied opinions on comparative costs of accelerated project ranging from estimates of potential cost savings in the range of 17.8% (Vorster et al. 1998) - to 7.5% cost premiums (Kwakye 1991) when compared with traditional approaches. Our research recognizes the benefits of eliminating non-valued added tasks, work process simplifications as well as the commercial burden of early engagements and other measures required to effectively staff and manage a Flash Track effort. However, this research did not quantify the cost impacts.

Each element of the data collection process contributed to the list of 47 essential practices. Approximately half of the practices in all six categories were identified via the literature review. The RT 311 workshops provided nearly 40% of the practices, again contributing to all six categories, and the EPC interviews provided approximately 10%: three cultural practices and a single contractual practice. The EPC interviews and other case studies, served as a valuable tool in exploring the research questions in a real-world context (Rowley 2002). The emphasis on cultural practices or positive working relationships in the structured EPC interviews was a distinguishing characteristic. A benefit of the three data collection methods was the repetition of common themes and practical implementation measures.

7.1.2 Analysis

The use of both the Modified Delphi method and the Analytic Hierarchy Process afforded the opportunity to develop results that served as a means to confirm and refine previous results. The two methods also served as a means to prioritize the practices into tier I and tier II. The techniques employed helped to obtain results in a timely manner. It was later realized that the two techniques afforded an opportunity to explore the differences in priorities of mid- and senior-level managers, as discussed below in 7.1.3.2.

7.1.2.1 Modified Delphi Process

The measures employed in this research effectively balanced the common shortcomings and weaknesses cited by Hallowell and Gambatese (2010) in their discussion of the Delphi Method within construction engineering and management. RT 311’s selection of subject matter experts or oracles was based on predefined criteria; the focus on avoiding biased questions and using a well-defined method of analysis served as a basis for high-quality feedback. This selection method allowed oracles to reach consensus quickly on 46 of the 66 practices in the initial round; they later introduced a single further practice, bringing the total number of essential practices to 47. To ensure quality, the survey was subject to an independent review and beta testing prior to its distribution to the oracles. The high level and continuity of participation was indicative of the integrity of the survey and the interest in the subject. The need for industry improvements was recognized, as evidenced by the first round of the survey, which included a question on whether the industry had been successful in implementing the identified practices; only one item (i.e., identifying and procuring long lead time items) was rated favorably. More than 1,000 comments were received from the oracles, which helped us better understand their scores and identify common trends in the development of the implementation measures.

7.1.3.2 Analytic Hierarchy Process

Critics of the AHP cite the subjectivity inherent in structuring the problem and the inability to account for dependencies and interrelatedness between elements as limiting factors because different structures may lead to different final rankings. These limiations are evident in the results of this research, in which items falling within the lowest-ranked categories (i.e., “contractual considerations” and delivery methods, weighted at 8.9% and and 15.8%, respectively) understandably displayed lower overall scores than the highest ranking category (i.e., ‘‘planning consideration”, weighted at 22.2%). Consequently, the AHP ranking of top-ten practices does not include a single contractual or delivery method consideration; instead, it includes five planning considerations. The results are notably different than those generated by the other two top-ten ranking methods, rooted in the Delphi Method, where 5-6 contractual and delivery practices were selected. If the scores between the categories were more evenly distributed, the AHP’s top-ten listing would significantly differ.

Although the results are surprising, because the AHP was conducted as part of consensus discussion within the research team, the results reflect consensus opinion rather than a flaw in the process. Consistent with Saaty (2006), two sets of AHP pairwise comparison surveys were completed; the results were shared with the participants before being accepted. Upon further investigation, the lower ranking in the contractual (and delivery method) practices could reflect differences between the composition of the RT 311 team and that of the Delphi oracles. The oracles’ experience level significantly exceeded the minimum requirement, with more than 28 years of experience; this suggests that the participants had senior roles in industry that would lead them to focus on broader project issues, such as contractual considerations. In contrast, RT 311 membership ranged from mid- to senior-level positions, with a collective focus on project execution. The AHP rankings may also reflect the industry's lack of appreciation for contracts in building system-based trust (Khalftan et al. 2006).

As the two-tier structure was assembled in an inclusive manner based on the union of three ranking methods, the comparative strengths of the AHP and modified Delphi process have been captured. In doing so, potential limitations of the AHP, as well as the other ranking methods (e.g. Relative Index and Delphi round 3) were effectively mitigated.

7.1.3.3 Network Analysis

The objective of the network analysis was to evaluate the relationships and interdependencies of 47 essential Flash Track practices. In examining the relationships and interdependencies, a network model was constructed based on survey responses completed by the RT 311 that posed a fundamentally different question than undertaken in the Delphi method or AHP. In the Delphi method and AHP, survey participants were asked to identify and then rank the most important practices that were *absolutely essential* for the success of Flash Track projects. In contrast, the Flash Track Network survey solely focused on the relationships and interdependencies, asking survey participants to identify which practices best f*acilitated or enabled* (i.e., out-degree centrality) a target practice. This network analysis provides a differing and more granular index – discribing why agiven practice is important.

While no prior comparable semantic network analyses in construction management were identified, several construction-related social network analysis papers discussed the shortcomings of traditional construction research methods, with each advocating the benefits of a network analysis approach for dealing with the complexities of the construction industry (Loosemore 1998, Pryke 2005, Chinowsky et al. 2008). In addition to identifying the shortcoming of traditional research methods, Loosemore (1998) cautions on the dangers of relying on a single method in isolation.

This network analysis study brought to light possible shortcomings of the categorization process completed in the AHP, suggesting that a Flash Track network analysis can be used as a means to better assess AHP categorization process for improvements to interval measurements (Lebowitz 2005).

7.2 Results

The research results are embedded in a re-engineered EPC model that displays a significantly higher level of concurrency than traditional EPC practices, requiring high quality management, early engagement of stakeholders, and a well-defined scope. While fast track projects are characterized by inter-phase integrations—achieved through overlaps across different phases of engineering, procurement, and construction—flash track projects demand inter-phase and intra-phase overlaps. This overlapping is enabled by parallel work packaging within each phase. This increased partitioning or fragmentation greatly complicates the management of the work, requiring both significant improvements to traditional project management practices and innovative approaches. The essential practices bring forward Flash Tracking's need for a hands-on leadership approach -- through calls for strong leadership, empowerment and delegation of authority, together with a strong, active, involved and fully committed owner led by an empowered representative.

A central element in the successful execution of a Flash Track project is the ability to create and effectively manage motivated project teams with shared goals driven by an imperative need. The singularity of focus is evident in throughout the literature (Vorster et al. 1998, Songer and Deikmann 2000, Eastham 2002) and case studies (Knott 1996, Thimsen 2004).

While there may be no "silver bullet" for radical reduction in project deliveries (CII 2004), three overarching principles embody the two-tiered, 47 practices and associated implementation measures – innovative procurment approaches; improved comminication and decision making process; and early, continuing and committed engagement of key stakeholder.

7.2.1 Innovative Procurement Approaches

The re-engineered EPC model is a response to calls for a paradigm shift in search of a better way to deliver Flash Track projects (Vorster et al. 1998, Songer and Diekmann 2000, Eastham 2002, Ballard et al. 2012). Two of the 47 essential practices speak to innovation in procurement practices, and a third calls for innovative construction practices. Calls for innovation in procurement (Tatum 1987, Vorster et al. 1998, Walker and Hampson 2003), planning (Howell and Ballard 1996, Ballard 1996, Scitor Corp. 2000, Zhoa et al 2010), and construction practices (Yahya 2011, Eastham 2002) are also evident in the literature. These calls for innovation are rooted in the finding that traditional practices, such as cost-focused and risk-averse procurement practices (Ashcraft 2012, Cleves and Meyer 2011, Sakal 2005, Rahman and Kumaraswamy 2008, Bernstein 2014) and rigid master schedules (Eastham 2002, Williams 1995), are incompatible with the dynamic nature of highly accelerated projects. These *new procurement* (Pryke 2005*)* practices rank highly as enabling practices in the Flash Track network analysis. Innovative approaches additionally include supporting Flash Track needs through the dedication of the best resources and an organizational focus on available capacities rather than high utilization rates (Factory Physics 2006, Gosling 2005, Owen 2006, Sutherland 2014). The use of highly integrated 3-D modeling was found to be an essential practice, and the EPC structured interviews and RT 311 discussions suggest that organizations that have completed successful Flash Track efforts have been early adopters.

7.2.2 Improved Communications and Decision Making Processes

As the RT 311 research team explored implementation measures for the essential practices, a common theme emerged: Flash Track practices require improved communications and a unique decision-making process. Key elements stem from the heightened degree of uncertainty and the need to collect information to accelerate the decision process. In addition to a Tier I practice of simplifying approval procedures; six other essential practices speak to a need for engagement, integrated teams, co-location and empowerment of project personnel to enable Flash Track decisions. RT 311's discussions led to an extended literature review in which the decision-making process under emergency situations was found to face similar challenges and utilize similar approaches as those apparent in making timely and effective decisions in conditions of heightened uncertainty of Flash Tracking. Cosgrave (1996) and Kessler (1995) offer insights regarding delegating decisions to those closest to the work and the advantages of a consensus environment to foster understanding and aid in making better decisions. Similar concepts of consensus decision-making are evident under set-based concurrent design practices, which have proven to be highly effective in other industries. Although notably different from conventional approaches, set-based design has been cited as a viable alternative in the construction industry (CII 2007b, Raudberget 2012). Parrish (2009) reports, in his study of set-based approaches in reinforced concrete design, that the practice was effective in reducing rework and facilitating innovation.

7.2.3 Early Engagement of Key Stakeholders

Approaches closely tied to early, continuing and committed engagement of key downstream stakeholders at the earliest stages of the project help overcome a key obstacle to any successful project: failing to establish a clear and specific scope. Existing literature (Thomson 2014, Frazer 2013, Vorster et al. 1998, Tatum 1989, Egan 1998, Griffith and Gibson 1997, Eastham 2002, Salem and Miller 2008), RT 311 discussions, and case studies (Knott 1996) all speak to the benefits of early stakeholder involvement as a means to rapidly converge on optimum project scopes. A need for continuity during early development and throughout the execution of the work was also stressed in research team discussions and in the literature (Caudill Rowlett and Scott 1969, Kwakye 1991, Kennedy et al 2008, Mascitelli 2011). The early engagement of key downstream stakeholders is also key in optimizing modularization opportunities during construction efforts (Smock 1992), as well as having a prominent role in the Flash Tarck network analysis. The impact of modularization appears to be in its infancy in the construction industry compared with the dramatic improvements realized in the shipbuilding industry. For example, in ship design, the industry's sophisticated supply chain now employs databases replete with scalable designs (CII 2007a, CII 2011), which have markedly reduced design schedules and costs, as well as speeding the shipbuilding process.

7.3 Limitations

A key assumption of this research is that it assumes that users of the re-engineered EPC process and tool already have an understanding of and experience with PDRI, PEpC, and other concepts related to Front-End Planning. The generalized framework will be applicable to most projects, especially those in the North American market. Other limitations include the limited depth of information on the applicability of promising practices employed in the shipbuilding industry, Agile Project Management and set-based concurrent engineering to the construction industry. Whereas outstanding results have been achieved in other industries, the information shared in this research is based on a small population of construction industry studies.

The inclusive nature of this research's methodology is believed to have captured the essential practices of Flash Tracking; however, further opportunities to refine and improve upon these results are possible through a more comprehensive semantic network analysis, as well as refinements to the AHP process, includine a sensitivity analysis and factor analysis in defining the grouping of practices, as another means of identifying the relative importance of identified practices.

Despite this study’s limitations, to the best of the authors’ knowledge, this research presents the broadest view and most substantial support yet published of key practices in implementing Flash Track construction projects. The findings were supported by the use of a variety of methodologies at each step. Practices were identified via a literature search, case studies, interviews, and discussion groups, and they were ranked by both the Modified Delphi Method and the AHP, which were further refined in a pilot semantic network analysis. The results include a robust set of 47 practices essential to successful Flash Track projects and a re-engineered EPC process that can be used by practitioners in the future.

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

Throughout the construction industry, there are continued calls for timelier project deliveries. This research offered a series of innovative approaches to meet this demand. This work also identified barriers to and risks of accelerated project deliveries when quality and safety are imperatives. A re-engineered EPC model was proposed, with a heightened level of concurrent activities and a Flash Track decision-process. The decision tool derived from this research helps practitioners assess their readiness to undertake a Flash Track project and guides them through a process for successful project completion.

8.1 Contribution to the Body of Knowledge

The findings of this research answer earlier industry calls for innovative approaches to project delivery, reevaluation of prevailing practices, and new paradigms for accelerated projects. This re-engineered EPC model embraces relational contracting practices, an enhanced level of communication, and the early and continuing involvement of key stakeholders. An easy-to-use, Excel-based Tool has been developed which allows owners and practitioners to assess their readiness when considering Flash Tracking, which can also be used to monitor their performance and report on lessons learned. The Tool's results are customized based on a user's self-assessment for on each of the 47 practices, offering tailored improvement recommendations, suggestions for innovative implementation measures and risk consideration. The Tool also allows users to add commentaries on each of the practices for the project's future reference..

The Flash Track tool enables organizations to assess the risks inherent to Flash Tracking effort and provides the following benefits:

- an objective measure of an organization's readiness to undertake a Flash Track project;
- detailed information on Flash Track barriers, risks, and mitigation measures;
- project-specific recommendations for improvement; and
- innovative implementation measures for each essential practice.

Support for the Flash Track model is rooted in recommendations offered in CII's PEpC framework and other studies, case studies, surveys, and statistical analysis of the collected data. The prioritized rankings and tier structure integral to the tool were developed with information gained from a panel of more than 57 industry subject matter experts and 13 industry practitioners. The research identified more than 150 Flash Track implementation measures for the 47 Flash Track practices, 44 notable risks involved with Flash Track projects, and several techniques for executing a Flash Track project, as shown in Appendix R. The research's results were corroborated by industry practitioners. The tool developed from the results was retrospectively validated with 13 Flash Track projects. The validation process yielded favorable reviews and generated a list of recommendations that were subsequently incorporated into the final version of the Flash Track tool.

A semantic network analysis enhanced prior findings by focusing on enabling and enabled Flash Track practices. This focus yielded a better understanding of *why* a particular practice is important. In the semantic network analysis, pairwise comparisons of the 47 essential Flash Track practice were possible without *a priori* categorization, as required by some other research methods (including AHP). This network analysis identified four top enabling practice, namely in order of their influence: *#18 establishing a fully integrated team,* followed by *#3. Aligning project participants' interests through contract, #31. Staffing with cooperative and collaborative personnel* and *#41. Co-location of project team (owner; designer; builder; and/or key vendors).* To the author's knowledge, the semantic network analysis methodology employed has had limited, if any, applications in prior construction management research.

8.2 Areas of Future Study

This research explored all aspects of project delivery to identify the main factors underlying the successful delivery of Flash Track projects. There are several lines of investigation that could expand knowledge of Flash Tracking:

1. *Refine the Flash Track readiness score and recommendations.*

   Flash Track implementation measures were defined through research charrettes involving 12-15 industry practitioners in a manner similar to the development of CII's Project Definition Rating Index (PDRI). The present research used methods roughly similar to those described by Gibson and Whittington (2009), a further study could improve on these aspects of the methodology and create a go-no predictive index for assessing an organization's readiness at various stage gates.

2. *Further explore the interrelations and interdependencies of the essential practices.*

In addition to more extensive network analysis, refined and alternate methods such as an AHP sensitivity analysis, and factor analysis, could be employed to further explore the interrelations and interdependencies of the practices. Such additional efforts could inform the best allocation of resources for the successful completion of a Flash Track project.

3. *Quantify the anticipated costs of Flash Tracking.*

   RT 311 had multiple discussions on the cost impact of Flash Tracking based on their prior experience and other's research . The studies and projects considered were not sufficient for reaching a consensus opinion within RT 311 of either the direction or magnitude of Flash Tracking's impact on costs. A subsequent study that includes cost considerations would be useful.

4. *Explore supply chain integration more deeply. In particular, examine scalable, modular designs and modularization in the shipbuilding industry to find enablers of their adoption in the construction industry.*

5. *Explore more deeply the applicability and adoption of set-based concurrent engineering and Agile Project Management in the construction industry.*

6. *Study leadership and the decision-making process in highly accelerated projects.*

SUCCESSFUL DELIVERY OF FLASH TRACK PROJECTS

A Dissertation
Presented to
The Academic Faculty

VOLUME II
APPENDICES AND REFERENCES

By

Robert B. Austin

LIST OF APPENDICES

APPENDIX A

RT 130, PEpC Abstract

The RT 311 research on the Successful Delivery of Flash Track Projects built upon earlier research by CII's Research Team 130, *PEpC, A Breakthrough Project Delivery System that Improves Performance by Reforming Owner, Contractor, Supplier Relationships* (Vorster et al 1998). The following is an excerpt from the Research Summary (CII 1998) as a reference for the reader.

PEpC Executive Summary (Taken from RS130-1, p.v, 1998)

By expanding its membership to include suppliers, CII recognizes that suppliers of key engineered systems and components can and should play a significant role in the pursuit of CII goals. CII, therefore, established the Reforming Supplier Relationships Research Team to explore the potential for reforming traditional owner/contractor/supplier relationships in engineer-procure-construct (EPC) projects to enhance the ability of suppliers to contribute more meaningfully to this process.

Believing that a breakthrough approach would be required to facilitate such a reformation, this research team concluded that if the role of suppliers of the most critical components and systems in a project is to be enhanced, then one must both enhance and prioritize the point of definitive contact with those suppliers: the procurement process. A new project delivery system was envisioned that divides the procurement process into "big P" — strategic procurement items, including complex engineered equipment and systems essential for project performance, and "little p" — the balance of items to be procured; and then reconfigures the traditional EPC model into Procurement, Engineering, procurement, and Construction, or PEpC.

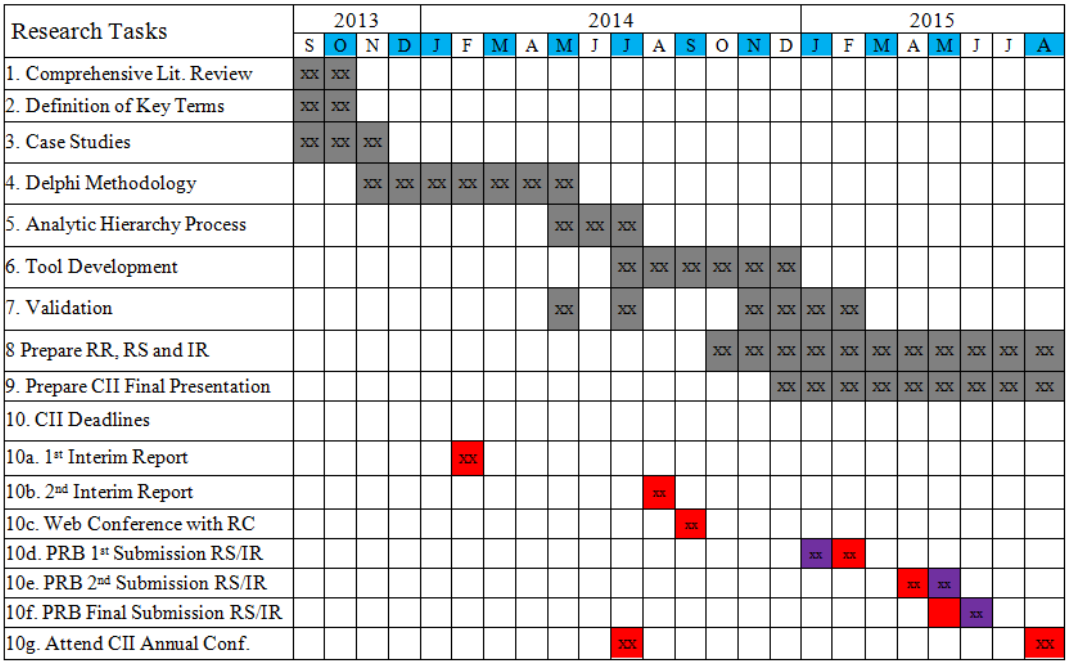
In traditional EPC, procurement follows engineering, both sequentially and in the fact that engineering specifies and defines the items to be procured. In PEpC, the most strategic and project-critical procurement transactions occur prior to detail engineering, and those procured items then influence and define subsequent detailed engineering. Further, the core competencies of the supplier, which are often unique and beyond those possessed by either the owner or contractor, are provided directly into the project delivery system.

Utilizing a sophisticated simulation model of the classic EPC process, the research team compared the impact of a PEpC approach to project execution with traditional EPC. In both theoretical and field implementations, the results indicated that PEpC could produce savings in excess of 10 percent to 15 percent of the time and four to eight percent of the cost of the traditional EPC process.

APPENDIX B

Research Schedule as Conducted

The illustration below shows the time-line for the key research activities.



Research Tasks	2013				2014												2015							
	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A
1. Comprehensive Lit. Review	xx	xx																						
2. Definition of Key Terms	xx	xx																						
3. Case Studies	xx	xx	xx																					
4. Delphi Methodology			xx	xx	xx	xx	xx	xx	xx															
5. Analytic Hierarchy Process									xx	xx	xx													
6. Tool Development											xx	xx	xx	xx	xx	xx								
7. Validation									xx		xx				xx	xx	xx	xx						
8 Prepare RR, RS and IR														xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
9. Prepare CII Final Presentation																xx	xx	xx	xx	xx	xx	xx	xx	xx
10. CII Deadlines																								
10a. 1st Interim Report						🟥 xx																		
10b. 2nd Interim Report												🟥 xx												
10c. Web Conference with RC													🟥 xx											
10d. PRB 1st Submission RS/IR																	🟪 xx	🟥 xx						
10e. PRB 2nd Submission RS/IR																				🟥 xx	🟪 xx			
10f. PRB Final Submission RS/IR																					🟥	🟪 xx		
10g. Attend CII Annual Conf.											🟥 xx													🟥 xx

🟪 CII Updates

🟥 Original Research Schedule

Research Team progress meetings and workshops

Austin, Texas	May 20-21, 2013
Denver, Colorado	July 1-2, 2013
Portland, Oregon	August 7-8, 2013
San Francisco, California	October 22-23, 2013
Houston, Texas	December 5-6, 2013
Dallas, Texas	January 22-23, 2014
Nashville, Tennessee	March 13-14, 2014
Milwaukee, Wisconsin	May 13-14, 2014
Indianapolis, Indiana	July 21, 2014
Kansas City, Missouri	September 18-19, 2014
Washington, D.C.	November 20-21, 2014
Dallas, Texas	January, 22-23, 2015
Atlanta, Georgia	March 19-20, 2015
Knoxville, Tennessee	May 14-15, 2015
Boston, Massachusetts	August 3, 2015

APPENDIX C

Questions Used in EPC Flash Track Project Interviews

Three projects were examined in structured interviews where the questions were presented in advance and each respondent interviewed was presented with exactly the same questions in the same order. The following pages show the interview questions.

1. Project Information: A brief introductory summary on project type, size, schedule, cost, safety performance, project delivery method, and overall project success precedes the responses to the interview questions.

2. What is your definition of Flash Tracking (super fast tracking) and what traits qualify the project as a Flash Track project?

3. At what point in the project was the decision made to go with Flash Tracking? What was the reason behind Flash Track delivery?

4. What extraordinary processes, tools, or techniques facilitated Flash Tracking?

    a. ***Procurement***: Describe the procurement process. At what stage did each project stakeholder become involved in the project? How has the procurement process contributed to the successful delivery of this Flash Track project?

    b. ***Contracting***: Describe the contract type. How have the contractual strategies been effective in facilitating Flash Track delivery?

    c. ***Technologies***: Please describe any technological tools or techniques implemented in this project which have been effective in facilitating Flash Track delivery.

    d. ***Front-End Planning***: Please describe any pre-project planning, such as front-end planning, team alignment, or organizational integration efforts, which have been effective in successful delivery of the Flash Track project?

    e. ***Re-engineered work process***: Have you implemented any re-engineered work processes which have been influential in facilitating Flash Tracking?

    f. ***Management by means***: Please describe any production technique or management by means (e.g., Lean) which was influential in successful delivery of Flash Track?

g. ***Pre-fabrications and/or site fabrications***: Have you utilized pre-fabrication or site fabrications for any portion of the project? Has either been effective in facilitating Flash Tracking?

h. ***Establishment of design freeze points***: How do you see the concept of "Design Freeze Points" as influencing the successful delivery of this Flash Track project?

i. ***Innovations:*** Please describe any innovative products, equipment, tools, or construction methods employed to speed construction.

j. ***Other:*** Please comment on any other significant aspects that have positively contributed to a high-performance team and other lessons learned.

5. Among the strategies you listed above, which practices are sustainable, meaning that they can be applied in future projects to achieve Flash Track results? Have you implemented any of these strategies on other projects and obtained positive results?

APPENDIX D

Responses to EPC Flash Track Interviews

Four interviews were conducted, including two on an Integrated Project Delivery (IPD) project (the Maine General Medical Center), one on an emergency rebuild (the Saint Anthony Falls I-35 Bridge Reconstruction), and one a Lean Construction project (ThyssenKrupp's new $3.7 billion steel processing facility). In addition to interview responses, each of the case studies includes background information which was collected in advance of the interviews. This appendix includes the questions asked and responses given in the interviews. The following index guides the reader to the applicable pages.

D-1, Maine General Medical Center

D-1.1, Maine General Medical Center, interview with the project architect

11:00a.m., October 8, 2013

RT 311 participants: Pardis Pishdad-Bozorgi, Professor Jesus de la Garza, and Bob Austin

1. Project Information: This included a brief introductory summary of project type, size, schedule, cost, safety performance, project delivery method, and overall project success.

Maine General Medical Center, New Regional Hospital
Owner: Maine General Medical Center   Location: Augusta, Maine
Size: 640,000 sq. ft.   Cost: $225,000,000
Completion Date: November, 9th 2013   Architect: SMRT and TRO Jung|Brannen
Contractor: Joint venture of Robbins & Morton (Birmingham, AL) & HP Cummings (Winthrop, ME)

Description: The Maine General Medical Center, New Regional Hospital, comprises approximately 640,000 square feet of building on four levels located on Maine General's campus in North Augusta. Work included surface parking, site circulation and access roadways, storm water management, underground utilities feeders and distribution, and landscaping. The site was approximately 172 acres of rolling fields, intersected by Stone Brook, an environmentally significant stream and a small tributary. The new state-of-the-art 192-bed facility served to consolidate two older local hospitals, resulting in savings of $7.1 million annually in operating costs.

Key sustainable construction practices in this project were as follows:

- maximize day lighting,
- maximize views,
- establish positive distractions,
- create efficient circulation,
- build organization supports for Lean operations,
- enable flexibility and modularity in planning, and
- allow independent expansion of building components.

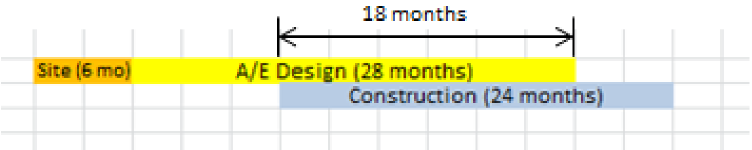
The project was originally planned to achieve LEED Silver certification. In the course of the work, the IPD Project Management Team (PMT) chose to upgrade to LEED Gold certification. The facility is expected to save $1.2M in operating costs and 12 million gallons of water annually through the use of efficient heating and cooling systems and local building materials.

Maine General’s President and CEO reported that when hospital administrators were looking at the design of the new hospital, “we asked all of our administrative managers to go look at evidence-based design, where it's been proven that the design of a hospital can increase safety and quality." He cited, for example, how the use of a handrail between a patient's bed and bathroom can help reduce slips and falls by 10%. "When we were thinking about how to manage the project, we decided to take the same approach and ask, 'What are all the ways you can run a project, and what is the best method?'"

SMRT has served on the project since its early stages. The architect who was interviewed indicated that providing a high quality, state-of-the-art facility was the driving force throughout the project. She added that although the project broke barriers in its schedule performance, doing so was not at the expense of either the quality of the project nor the relationships between the project members. The following paragraphs summarize the architect’s insights regarding the project history and schedule.

The occupancy date for the hospital is now set for November 9, 2013, eight months earlier than the originally planned completion date of June, 2014. Substantial completion and beneficial occupancy were achieved in August, 2013.

The design period overlapped the construction schedule by 18 months. During the ten months prior to the start of site construction, design focused on site development (see illustration below).



Original Timeline – Maine General early design, design and construction activities

Project design elements were worked in concert with construction activities, which were broken down by discipline, geography, and in some cases, by specialty. A snapshot of the work package breakdowns is shown below:

Early design

- Six months for site development
- Ten months for architectural and Mechanical, Electrical and Plumbing (MEP)

Discipline breakdown

- Site work
- Permitting
- Architectural (core/shell → followed by fit out)

- Engineering
- MEP
- Electrical (high voltage → followed by low voltage)

Geographical breakdowns (25,000 sf areas*)

- Wings
- Levels
- Zone

*Area restricted to less than or equal to 25,000 sf, corresponding to areas which a single superintendent could oversee

Superintendents were further assigned to specialties, such as prefabrication efforts. The architect indicated she would forward additional information on the dollar value of the project's prefabrication efforts.

This was SMRT and the other team members' first experience with Integrated Project Delivery (IPD). However, a number of the firms had teamed together on earlier projects.

2. What is your definition of Flash Tracking (super-fast tracking) and what traits qualify the project as a Flash Track project?

RT-311 definitions

Fast Track: A time-driven project which by necessity requires some degree of concurrency between engineering, procurement, and construction.

Flash Track: A time-driven project which by necessity requires a heightened degree of concurrency between engineering, procurement, and construction, as well as relational contracting methods and exceptional execution.

Maine General's design overlap was expected to save six to ten months between design and construction. The Architect said that construction was completed in twenty-five months, eight months ahead of schedule. This schedule reflects construction of 25,600 sf of space each month, on average, which is a substantial achievement.

3. At what point in the project was the decision made to go with Flash Tracking? What was the reason behind Flash Track delivery?

The motivation for fast-track/IPD was a prior successful experience, the Harold Alfond Center for Cancer Care (HACCC). That project was originally Harold Alfond Center for Cancer Care. The project was scheduled to run 24 months, but was completed in 16.5 months, resulting in a $2M gift, because the project was within 3% of budget yet involved a 2% increase in scope.

After commissioning research on integrated project delivery (IPD) and analyzing impressive results in California and Washington, Maine General President and CEO Chuck Hays' team decided the collaborative approach was a perfect fit for the largest health care construction project in Maine's history. The IPD contracting decision was made by the owner during the project development.

The Architect said that the decision to go with IPD for this large, complex project was largely based on a belief that there "had to be a better way to execute the project" and mitigate risk. Each project-level decision was made by a consensus of the PMT. If a decision could not be reached an issue could be elevated to a higher senior management level. It was noted that there was a single instance where a decision was referred to the higher level.

All IPD participants had agreed at the outset to the fast/flash-tracking process based on their common goal of providing the greatest value to the Client. By fast tracking, tremendous costs savings were realized, including 1) the sunk costs of operating the existing aged facilities that had sunk annual costs of $60M ($40M saved in the project) and 2) general conditions during construction which were $800,000/month ($6.4M saved in the project). Energy savings ($1.2M/annually) and lower investment costs would also be realized by an earlier completion date.

Another advantage of the concurrent design-construction process was the ability to delay a decision on equipment, notably the imaging equipment, which served to permit the installation of the latest technology.

Throughout the conversation, the Architect interjected that the single greatest benefit of the IPD process was that all stakeholders had "skin in the game".

Members of the PMT were co-located throughout the project. In the beginning, PMT members were at a remote rented facility. Once site preparations had sufficiently progressed, the project team was based in temporary offices at the project site.

4. What extraordinary processes, tools, or technique did facilitate Flash Tracking?

    a. ***Procurement***: Describe the procurement process? At what stage each project stakeholder became involved in the project? How has the procurement process contributed to the successful delivery of Flash Track project?

The decision to go with IPD for was driven by the owner from the onset. Several of the firms involved had prior teaming experience the hospital.

- IPD Team - Robbins & Morton, HP Cummings Const'r and SMRT & Jung Brannen (architect)

- Continuity of team members – with a few having worked together on the successful HACCC
- Maine’s first IPD project

The Architect further emphasized that all stakeholders had skin in the game by having their full profit at-risk. If the project was completed on-target parties would receive their full profit, if not a reduced profit would be realized. If the project exceeded its budget the owner would continue to pay direct costs with the IPD contractors losing a portion of their at-risk profit. In the case of SMRT, 10% of their fee was designated as at-risk profit. If the project exceeded schedule target and increased profit would be realized. It was noted that this performance bonus was “not a significant amount”.

Under the IPD agreement, the owner paid all direct costs.

By emphasizing communication and minimizing conflicts between contractors, the IPD system allowed the team to be very nimble in its approach to purchasing. This nimbleness enabled the purchase the most up-to-date equipment without worrying whether it will fit through a door that was designed months earlier. This gave them the flexibility to wait to the absolute last moment to purchase so they have the best bells and whistles. The chance to buy materials in advance was another advantage.

The Architect spoke at length on the benefits of the IPD process reporting that notable architectural and engineering benefits were realized due to the collaborative effort including:

i. Organizations work in the interest of the project verses a silo mentality
ii. Co-location of personnel facilitated a truly collaborative effort
iii. Design professional access to subcontractor personnel during the design process
iv. An enormously satisfying experience
v. Tangible benefits to the Client

The Architect was very positive on the benefits of direct communication with specialty subcontractors, saying they had a seat at the design table.

From SMRT’s perspective the IPD process “had everything to do with the project’s success where the project continually aimed for and exceeded higher targets.

Points of special note included, the qualification based selection of contractors. In addition to qualification, a contractor’s “ability to play in the IPD sandbox” was often a tipping point in the selection process to facilitate the “ability to innovate together”. The selection of the “right” subcontractors was deemed critical to the project’s success.

The project was managed to a “target cost”. IPD parties were not incentivized to lower costs to increase their profits; rather parties were incentivized to increase the value to the Client. The central or common goal of the project was to increase Client value rather than profit optimization. On this note a question was raised on the added costs of achieving LEED Gold v. the original performance requirement of LEED Silver. The Architect noted that this betterment would have come into play under the IPD Quality Bonus. It was added that the cost incurred (reimbursable from the Client), exceeded the amount of the Quality Bonus.

b. ***Contracting***: Describe the contract type? How have the contractual strategies been effective in facilitating Flash Track delivery?

Integrated Project Delivery is a collaborative form of construction management requiring all project stakeholders to contractually agree to share in the risks and rewards associated with a large-scale construction project. The IPD method requires players to pool their risk, giving subcontractors a tangible stake in the success of the project and helping to combat the sort of passing of the buck that can occur on such large-scale contracts.

All the major contractors who are part of the IPD contract have all of their profit at risk. If the project comes in on budget, they get the budgeted amount; if it's under budget, they split the difference and 50% goes into their profit pool. If it's over budget, it comes 100% out of their profits."

The approach did raise some issues over liability. Maine General struggled to find an insurance company with experience in crafting the sort of shared-responsibility package it wanted. The insurance companies were not prepared for a contract that holds everyone responsible.

A standard Hanson Bridgett, three party agreement was used as a starting point for the IPD (single entity) contract that was tied schedule, cost and program (quality) of the project which was described a “fluid and/or nimble” contract.

The Architect reported that at the onset parties in the IPD agreed to waive claims against each other and all risks were effectively shared.

This reduced liability encouraged open communication and the creativity necessary to drive the project in innovative directions.

c. ***Technologies***: Please describe any technological tools or techniques implemented in this project, which have been effective in facilitating flash track delivery?

The design and construction is documented in a fully shared Building Information Management (BIM) model. The benefits of the shared model include a more accurate coordination and faster cost estimating. The downside for us (EDI) was the significantly slower Revit performance. At times, when the shared model was being used by 7 or 8 people from different firms, it could take up to 2 hours to load the model.

The Architect noted that BIM was considered a fundamental and essential tool on the project. BIM was cited as being a key tool for the delivery of just-in-time information. She noted that BIM 360 was used for tracking, punch lists and JIT deliveries. She also noted that the project employed Converge as a giant file transfer system.

The Architect also noted that the project employed pull scheduling, just-in-time design and was in a continuous effort to Lean-up the activities.

d. ***Front-End Planning***: Please describe any pre-project planning, such as front-end planning, team alignment and organizational integration efforts which have been effective in successful delivery of the Flash Track project?

The Architect advised that there was a tremendous amount of front end planning, adding that BIM was an excellent tool in the planning process. Design planning was dictated by the construction schedule.

When question on the indoctrination, the Architect noted that a considerable amount of education was part of the process highlighting recognition and rewards for collaboration. She added that efforts were made to staff the project with natural collaborators. On occasion some were found to be too ridged in their opinions or positions. In some cases, people were ‘voted off the island”

e. ***Re-engineered work process***: Have you implemented any re-engineered work processes which have been influential in facilitating flash tracking?

The collaboration for the Maine-General project has an office set up and six people responsible for all the decisions on the project—two representatives from the owner, two from the architect/design team, and two from the construction team. The group is known as the PMT or “project management team.” The PMT and other team members will work out of a co-location office space, allowing the team to proceed in a collaborative manner.

The Architect noted that the structural steel design had a significantly stream-lined process where the structural engineer developed a rough sketch for the fabricator who then developed the detailed drawing and shop details for the structural engineers sign-off.

The Architect reiterated that IPD was critical to the project success, where whenever an issue arose the response was not to assign blame; but to rather to say “how do we fix this”. This process eliminated redundancies in staff and pricing was not based on (risk) contingencies upon contingencies.

f. ***Management by means***: Please describe any production technique or management by means (e.g. lean) which was influential in successful delivery of flash track?

There were explicit contract requirements for Lean practices (continuous improvements). IPD parties strove to continually improve the process every time they could. When no value added items were discovered they were eliminated.

g. ***Pre-fabrications and/or site fabrications***: Have you utilized pre-fabrication or site fabrications for any portion of the project? Has either been effective in facilitating Flash Tracking?

“Because the whole project is modeled in BIM, as well as interfaced to subcontractors’ 3-D modeling packages, subcontractors can prefabricate components and then drop them in place.” “When they looked at the efficiencies gained through prefabrication, there was a large jump in how fast the work could get done.”

The Architect noted that there was extensive use of prefabrication, citing that the amount of prefabrication was a distinguishing part of the Maine General effort. She also made note of the extensive multi-trade prefabrications, citing the head walls at eh head of a patient’s bed where medical gas, power were all pre-piped and pre-powered. She also cited the prefabrication efforts for the exterior skin of the buildings, bathrooms, etc…. The Architect credited BIM as a critical tool for the development of prefabrication and site assembly efforts.

A question was raised on the prefabrication or innovations on the custom metal door frames provided by J/R Metal Frames (2,400 frames). The Architect was unaware of anything unique about the frames, indicating she would look further and advise.

h. Establishment of design freeze points: How do you see the concept of “Design Freeze Points” as influencing the successful delivery of Flash Track project?

The Architect noted that the design process was finely tuned and orchestrated to support the construction effort advising the following design freezes were defined and followed:

- Footprint lock
    - Stair well lock

- Core/Shell lock
- Fit up lock
- MEP lock

i. ***Innovations:*** *Please describe any innovative products, equipment, tools or construction methods employed to speed construction?*

Conversations at this juncture focused on technical, rather than process innovations.

The Architect offered that although there were no first of their kind prefabrications, the extent and character of the prefabrication and site fabrication was to a “whole new level”.

Maine General had a tremendous amount of mock-ups and pre-planning were done such that everything was thoroughly test and vetted prior to proceeding.

Although not discussed under this question, the overall conversation touched on the IPD team’s efforts to continually evaluate work processes in search of a better, more efficient ways to work.

j. ***Other:*** *Please comment on any other significant aspects that have positively contributed to a high-performance team and lessons learned.*

Lessons-learned

i. Importance of careful selection of IPD partners (Pick your partners)
ii. Great value of collaboration, trust and mutual respect
iii. Amazing the amount of can be done in the absence of silo-mentalities and risk aversion
iv. Benefits of early engagement of subcontractors

There was a discussion on IPD variants such as IPD lite, and Design Assist. The Architect did not speak favorably of these measures seeing them as not being consistent with the IPD effort on Maine General

The Architect sees Maine General’s IPD endeavor favorably and a as a fundamental game changer.

5. Among the strategies you listed above, which practices are sustainable, meaning that they can be applied in future projects to achieve Flash Track results? Have you implemented any of these strategies on other projects and obtained positive results?

The Architect indicated that she’d look forward to working on another IPD project believing that the concepts of shared success with a common goal are critical project elements, uniquely suited to fast/Flash Track efforts.

6. Additional questions/feedback

Involvement of the Owner:

The Architect indicated that from the onset the Owner had an unwavering commitment to the IPD process and served as an active driving force. Impact of differing site conditions, report of favorable cost-savings resolution:

During site preparation the project encountered considerably more rock than anticipated. The Architect reported that boulders the size of school buses were uncovered. The Architect reported that the geotechnical engineer assessed the condition and developed a two to three cookbook solutions for alternate pier caps that were to be installed under prescribed conditions. This solutions-oriented approach enabled construction to proceed efficiently.

The Architect added that the geotechnical engineer had drafted a paper on the subject with further particular that she would forward.

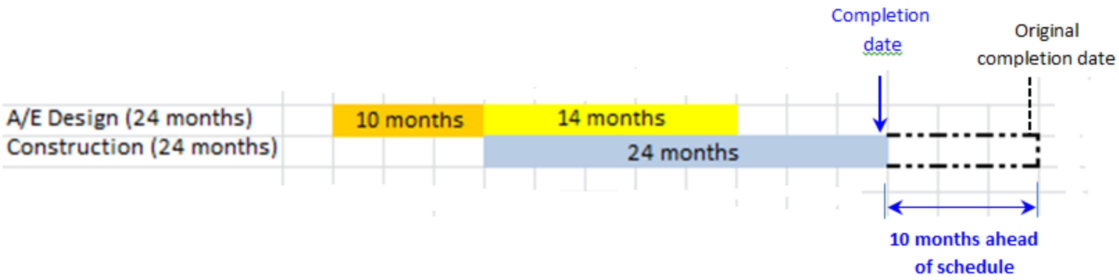
Professor Pishdad-Bozorgi advised that the CII RT311 report would be completed and present in August of 2015. The case study information on Maine General will be shared with The Architect prior to completion of the report for fact checking and copy of the completed report will be shared.

D-1.2, Maine General Medical Center, Interview with the Contractor's Project Manger
12:30 p.m., 10/9/13
RT 311 participants: Pardis Pishdad-Bozorgi , Professor Jesus de la Garza, and Bob Austin (PT)

1. Project Information: This included a brief introductory summary on project type, size, schedule, cost, safety performance, project delivery method, and overall project success.

Maine General Medical Center, New Regional Hospital
Owner: Maine General Medical Center   Location: Augusta, Maine
Size: 640,000 sq. ft.   Cost: $224,000,000

The Project Manager offered the following insights regarding the project history and schedule. The original construction schedule was 36 months long, and it was subsequently reduced to 24 months. The design schedule was 24 months long, and design and construction overlapped for 14 months (see illustration below).



Timeline comparison – Maine General's design and construction activities

The 14 month overlap between design and construction was significantly longer than the typical overlaps of 2-4 months in non-Flash Tracking projects. The IPD team knew from the outset that it was possible to finish the project in less time than originally scheduled.

Comment: In the May 2013 edition of Construction Executive, Maine General's President and CEO indicated that six weeks of the schedule gain was attributable to unexpectedly good weather.

2. What is your definition of Flash Tracking (super-fast tracking) and what traits qualify the project as a Flash Track project?

RT-311 definitions

Fast Track: A time-driven project which by necessity requires some degree of concurrency between Engineering, Procurement and Construction.

Flash Track: A time-driven project which by necessity requires a heightened degree of concurrency between Engineering, Procurement and Construction; relational contracting methods and exceptional execution.

No new input

3. At what point in the project, the decision to go Flash Tracking was made? What was the reason behind Flash Track delivery?

No new input

4. What extraordinary processes, tools, or technique did facilitate Flash Tracking?
    a. ***<u>Procurement</u>***: Describe the procurement process? At what stage each project stakeholder became involved in the project? How has the procurement process contributed to the successful delivery of flash track project?

Subcontractors were selected before major design had started using a qualification bases selection process based on a conceptual design and a narrative.

A fixed target cost was set and the project was designed to that cost.

The IPD contract was cost-plus to a guaranteed maximum price

100% of the IPD members' pure profit was at risk. The costs for overhead were covered under the contract.

    b. ***<u>Contracting</u>***: Describe the contract type? How have the contractual strategies been effective in facilitating flash track delivery?

No new input

    c. ***<u>Technologies</u>***: Please describe any technological tools or techniques implemented in this project, which have been effective in facilitating flash track delivery?

BIM was a critical tool in getting subcontractors engaged in working with the designers

d. ***Front-End Planning***: Please describe any pre-project planning, such as front-end planning, team alignment and organizational integration efforts which have been effective in successful delivery of the Flash Track project?

There was a considerable front end planning effort (3-4 month) at the start of the project.

Planning efforts were similar to Lean Construction’s “Last Planner”

Lean practices were part of a structured training program that was under an in-house coach. The coach served in a dual role as the Lean facilitator/trainer and as a MEP coordination capacity.

e. ***Re-engineered work process***: Have you implemented any re-engineered work processes which have been influential in facilitating flash tracking?

The shop drawing submission process was streamlined in a number of instances, including:

- Structural steel
- Case work/cabinets
- Curtain walls
- HVAC duct work

Subcontractor’s personnel did all of the detailed design effort/shop drawings which were submitted for the A/E’s approval.

The process was facilitated due to the collocating of personnel at the project site.

As a result of the steam-lined process, A/E detailed design personnel were limited. A/E as a rule engaged higher rate personnel in the development and review/approval process.

f. ***Management by means***: Please describe any production technique or management by means (e.g. lean) which was influential in successful delivery of flash track?

The Lean process was a journey throughout the project.

Construction foreman were continuously engaged on finding better work practices. The project had daily stand-up (pre-activity) meetings to ensure continuous communication. Daily meeting typically lasted 15 minutes.

Benefits of MBM/Lean engagement of work crews included:

i. Fire wall and overhead work in sequencing intermittent work crews to mitigate cutting in work later
ii. The process was aided by the BIM process

g. ***Pre-fabrications and/or site fabrications***: Have you utilized pre-fabrication or site fabrications for any portion of the project? Has either been effective in facilitating flash tracking?

There were extensive prefabrication and site assemblies, including:

- 60% of the exterior walls (off-site)
- 190 bathrooms (on-site)
- 200 headwalls (on-site)

Due to the early completion of an area that created considerable free space, some prefabrication efforts were able to be completed on-site thereby reducing logistical and transportation challenges of off-site prefabrication work'

Prefabrication efforts were typically driven by subcontractors' efforts

h. ***Establishment of design freeze points***: How do you see the concept of "Design Freeze Points" as influencing the successful delivery of flash track project?

Design frees points were a critical element of the project which had been defined early by the IPD team.

1. Footprint lock
   - Floor plan lock
2. Core/Shell lock
3. Fit up lock
4. MEP lock

i. ***Innovations:*** *Please describe any innovative products, equipment, tools or construction methods employed to speed construction*?

Conversations at this juncture touched on focused on technical and process innovations.

Technical innovations – the project used a laser scan (LiDAR) to identify floor irregularities that required further preparations. Traffic areas were identified for further efforts and areas defined for mechanical space, storage, etc… received less emphasis. By precisely targeting traffic areas unnecessary work was avoided. The floor flatness requirement was ¼” in 10 feet.

Process innovations – the qualification based and interview process of selecting subcontractors was seen as a great value. The IPD team conducted more than 200 interviews in their contractor selection process.

j. ***Other:*** *Please comment on any other significant aspects that have positively contributed to a high-performance team and lessons learned.*

Refer back to earlier discussion items

5. Among the strategies you listed above, which practices are sustainable, meaning that they can be applied in future projects to achieve Flash Track results? Have you implemented any of these strategies on other projects and obtained positive results?

The qualification based and interview selection process was seen as sustainable. Steve questioned indicated he didn’t know why interviews could not be done on future projects.

The Project Manager mentioned that there were not a lot of pure IPD projects; many are seeking the collaborative benefits of IPD – but, not under a pure IPD structure.

The spirit of working together was favorably viewed.

The Project Manager considered it a personal challenge to not revert back to a more traditional mindset.

References:

Masterson , Jonna, “Efficiency Reigns on Hospital Projects, Lean, Integrated Practices Improve Delivery of New Medical Centers”, Construction Executive, May, 2013, http://www.constructionexec.com/Issues/May_2012/Features.aspx

D-2, Saint Anthony Falls I-35 Reconstruction, Minneapolis, MN

D-2 Saint Anthony Falls I-35 Reconstruction, Interview with the Project Architect
November 22, 2013
RT 311 participants: Pardis Pishdad-Bozorgi, Professor Jesus de la Garza, and Bob Austin

1. Project Information: This included a brief introductory summary on project type, size, schedule, cost, safety performance, project delivery method, and overall project success.

The original bridge, built in 1967, was 1,907 feet long and had 14 spans. By 2007, the bridge carried a daily average of 140,000 vehicles. The vehicle count made it one of the busiest bridges over the Mississippi River in the country. On the evening of August 1, 2007, the 40-year old bridge collapsed without warning, killing 13 and injuring 121 others.

The project had many daunting challenges:

1) sensitive emergency recovery, removal, investigative, and clean-up operations were taking place;
2) large areas of the site contained contaminated materials from past industrial uses (including a super fund site);
3) the roadway approaches did not meet current capacity and geometric design standards;
4) citizen groups and stakeholders had divergent views on how bridge design should be approached in terms of sensitivity to context, multimodal functions, and visual quality;
5) the site was located next to a historic district as well as locks, a dam, and other operations run by the Army Corps of Engineers;
6) units of the National Park Service, Minneapolis Parkway system, a National Scenic Byway, and the state designated Mississippi River Critical Area all passed through the project area;
7) six railroad tracks passed under the bridge along with major utilities; and
8) approaches and areas adjacent to the bridge had limited rights of way and were marked by extreme topographic variation.

The new I-35 bridge is 189 feet wide with five lanes of traffic running in each direction. The overall length of the bridge is 1,223 feet from abutment to abutment. The bridge was designed and constructed to be ready for the construction of future light rail features. The project also entailed provisions for a future bike path along the river bank (precast concrete tunnel sections were installed).

The new I-35 bridge is one of the most impressive infrastructure projects of the decade, with the complete replacement of a major bridge in little more than a year. The project has received wide praise as much for innovation in its construction techniques as for innovation in its project management. Construction began well before the final design was completed, with teams of contractors working 12-hour shifts in brutal subzero temperatures. When conditions on the ground* necessitated a shift in the overall bridge design, FIGG made the adjustments on the fly.

By shaving off more than three months from the Christmas Eve deadline, FIGG, Flatiron and Mason have earned themselves a hefty bonus ($27M – ENR 9-17-08- this value seems to also reflect other performance bonuses, including $7M for no claims).

* Site constraints that affected where piers and abutments could be placed included the Mississippi River, the foundations from the previous bridge, several roads and trails, large drainage tunnels under the bridge on each side of the river, a historic stone retaining wall, a railroad, a large area of capped hazardous materials, and various utilities. The substructure locations were carefully located to accommodate these site elements.

The north back span pier (Pier 4) was a particular challenge. Design work had preceded with preliminary survey data, but once the debris from the previous bridge was removed and accurate survey data obtained, it was discovered that the planned location of Pier 4 conflicted with the existing historic stone wall at the site. As a result, the design location of Pier 4 was moved approximately 20 feet towards the river, which created an unbalanced back span on the north side. To compensate, the thickness of the box girder webs and bottom slab were increased, providing the necessary counter-weight for cantilevered construction of the main-span without uplift at Pier 4.

At the north river bank the main pier for the northbound bridge (Pier 3) had to be positioned over a large 22- by 22-foot storm outlet. Moving the storm outlet would have required too much time and expense. So the eight-foot diameter drilled shaft foundations were placed on either side of the storm outlet, and the footing was designed to straddle over the top of the outlet while remaining structurally isolated from it.

Benchmarks:

FHA costs of conventional bridge in 2007
- $213 to $275/sf (assumed as smaller, short span structures (overpasses))
New I-35 bridge - $234,000,000/(189*1,225) = $1,010/sf; w/ Bonus - $1,127/sf

Question on anticipated time if the project wasn't accelerated:

The Architect offered a comparable bridge in Pert Amboy/Sayreville, NJ (3,971') which was completed by a first-time contractor, who had not undertaken a structure of this type before. On that structure the first bridge took 15 months and the second similar structure took 9 months; a total of 24 months .

Note- Prorating the above estimate was not discussed and isn't believed to be applicable, given differing conditions and complexities. Rather, the above was offered in the spirit of an approximate 1:1 comparison

Question on premium costs for accelerated construction:

The Architect offered that the added costs were:

- Costs for multiple forms v/ cycling forms
- Double shifts
- (Bad weather conditions)

She added that the cost should be viewed as a cost-benefit; whereas the estimated cost of the bridge being out of service was from $400M to $1M/day (increased vehicle gas use, wear and tear on alternate routes, maintenance on those alternate routes + impact on local business).

2. What is your definition of Flash Tracking (super-fast tracking) and what traits qualify the project as a Flash Track project?

CII RT 311 – Definitions:
RT-311 definitions
Fast Track: A time-driven project which by necessity requires some degree of concurrency between Engineering, Procurement and Construction.

Flash Track: A time-driven project which by necessity requires a heightened degree of concurrency between Engineering, Procurement and Construction; relational contracting methods and exceptional execution.

Notable fast track elements on the Saint Anthony Falls (I-35) Bridge:

- Completion 339 days after the start of construction; a notable achievement by both the agency and the design-builder

Major tools used to expedite the emergency replacement of the I-35W St. Anthony Falls Bridge:

- Used two-step right-of-way acquisition with right of entry easements to provide immediate access to the construction site followed by a guaranteed timeline for financial closure on each parcel;

- Obtained single points of contact within each resource agency for all permit communication and a commitment to expedite the issuance of project permits;
- Kept tight control of project scope to avoid unintentional delays as the result of exceeding permit constraints;
- Encouraged a highly interactive pre-proposal period, including regularly scheduled one-on-one meetings with each competitor, whose contents were kept confidential;
- Accepted confidential ATC/PAEs prior to proposal submission for review and decision;
- Created a completely transparent evaluation plan and award algorithm that withstood a protest; and
- Developed incentives that were directly related to the preeminent project success factor, timely completion.*

The brute force to increased construction expenditures for duplicate forms and equipment, a sizable local workforce and three work shift-seven days a week were critical to the fast track schedule.

The use of close monitoring and adjustment to the concrete mix (e.g., heated aggregate in cold weather), high-performance, self-consolidating concrete as another construction practices that helped accelerated the work.

* Quality and Safety benchmarks were developed shortly after award of the contract. The benchmarks were jointly developed where the contractor was obligated to set aside part of its fee as being contingent on reaching the agreed upon milestones (i.e., having skin in the game)

Example – a quality benchmark was set on the permeability of the concrete (a key metric in future corrosion rates). The Architect offered that as she recalled the metric was set at about half of the Code required maximum (2,000 coulombs) at 1,000 coulombs – the project achieved a rate of 250 coulombs.

The project also included incentive bonuses of up to $500,000 for safety, public relations, and quality programs (ENR, 8/24/07).

3. At what point in the project, the decision to go Flash Tracking was made? What was the reason behind Flash Track delivery?

Immediately.

The unexpected and sudden collapse of the highly trafficked bridge was one of the three principle arteries into downtown Minneapolis had an economic impact to the City estimated at between $400,000 to $1,000,000 per day.

Within days of the August 1st collapse, statements of qualifications were sought from the design-build team along with a $200M bond commitment. A formal Request for Proposal (RFP) was issued on August 23rd, with responses due in three weeks. The proposal were reviewed and scored (by 24 individuals in 18 agencies) on September 18th. Commercial bid submissions were open on September 19th and the award was made on October 8th. The full process took 68 days from the date of the collapse.

- Source telcon with the Architect

Verification: The report titled "St. Anthony Falls (I-35W) Bridge Replacement Project Protest Determination (October 8, 2007) cites: "The TRC (technical review committee) is comprised of six individuals from both state and non-state organizations" – The reference to a larger number is assumed as either a transcription error or reviews other than those performed by the TRC.

4. What extraordinary processes, tools, or technique did facilitate Flash Tracking?
   a. ***Procurement***: Describe the procurement process? At what stage each project stakeholder became involved in the project? How has the procurement process contributed to the successful delivery of flash track project?

Procurement: The procurement process for this major project was completed in "record time". See discussion under question #3

The RFQ stated, "The project is anticipated to consist of: Reconstructing a major river crossing with 5 lanes in each direction with shoulders over the Mississippi River with minor grading, hydraulics, utilities, ITS, lighting, paving and other miscellaneous work." In order for the contractor to be qualified, it needed to meet the following requirements:

- Able to meet an aggressive project delivery schedule
- Committed to quality
- Having proven experience in the design and construction of major river crossings
- Having familiarity with innovative design-build approaches to ensure timely completion
- Willing to partner with federal, state, and local agencies for mutual success

MnDOT told all contractors that the process would be design-build with an A+B clause having a no-excuse bonus. This meant that the clause had two elements: A is price, and B is schedule. All contractors were notified that their schedule must be within the 337-437 calendar days range. MnDOT set each day at a value of $200,000. The formula used these components in the equation (Price + Days ($200,000) / Technical Score =

Adjusted Score. The RFQ also stated what the statement of qualification must contain and how it must be presented. The contractors were also notified that all unsuccessful bidders would receive a stipend of $300,000. This would go only to contractors that submitted a responsible proposal. Only five companies submitted RFQs, and four of them eventually submitted bids: Ames/Lunda, C.S. McCrossan, Flatiron/Manson (FIGG), and Walsh Construction/American Bridge.

Other distinguishing elements for this best-value, design-build contract included:

Site Access

The Architect offered at the onset of our discussions that a challenging element of the RFP submission is that the site was not available for inspection as it was secured as part of the forensic evaluations. She referred to the site restrictions as being equivalent to a crime scene.

Best Value Approach

- Prior experience on six previous Best-Value, Design/Build projects
- A select committee reviews each of the technical proposals and scores them according to criteria that were made public in advance. (27individuals from six agencies participated in reviewing and scoring)
- Once the scores are compiled, the cost proposals are opened in an open forum
- The Best Value is the Design/Build proposal whose cost divided by its technical score results in the lowest value. For the I-35W Replacement project, the Best Value included a cost of $200,000 per day for each contract day.
- The equation was SCORE = [COST + (DAYS*$200,000)]/TECHNICAL SCORE.

Preapproved Elements (PAE) process

MnDOT conducted “private and confidential pre-proposal meetings,” whose purpose was to limit the number of alternative technical concepts (ATCs) that a given proposer could generate to focus on high-value ATCs. Once an ATC had been submitted, a review panel made up of technical experts who were not on the proposal evaluation panel met with the proposer. If the ATC was acceptable, it was approved and incorporated into the proposer’s scope of work as a PAE, permitting the proposer to include the ATC-turned-PAE in both its technical package and its price proposal.

The Architect offered that FIGG offered a few ATC’s in order to gauge their boundaries on what would be considered acceptable. She added that some of the ATCs were generated anticipating that the RFP had elements that could be low-balled by the competing firms. She further added that FIGG had encountered the PAE process on other design-build projects. She also offered that she considered the pre-proposal meetings as a great time saver.

Agency Accessibility

Mn/DOT scheduled and conducted three 30-minute individual conference calls each week with each of the five competing teams, as well as two weekly 2-hour face-to-face meetings, which meant the agency invested 27.5 hours per week for the 3-week proposal preparation period.

The Architect had offered that the Owner was “very accessible, “incredibly engaged” and that this leadership was a critical element in the success of the project.

Professor de la Garza later recounted that he had encountered a paper on the project that highlighted that MNDOT had assigned their very best people to the project, their “cream of the crop”

Clearly Defined Scope, Scoring Criteria and Brevity of Submissions

The clear definition of best value was also cited as important to the success of the selection. One example was awarding a 15-point bonus for eliminating up to six design exceptions, which clearly portrayed MnDOT’s desire to build the project without design exceptions and its willingness to reward creativity and innovation during proposal preparation.

The Architect offered that the scoring criteria for the proposal submission were:

- Quality: 50%
    - experience and authority of key individuals
    - design and construction relationships necessary to meet the project goals
    - approach and commitments toward implementing a safety incentive
    - measures to evaluate performance in construction

  Flatiron/FIGG received an average score of 94.2%, ranking first by all six evaluators. The next closest responder received an average score of 71.7%

- Visual aesthetics: 30% (20% - correction*)
    - proposers’ level of commitment to enhance the aesthetic requirements stated in the RFP.
    - narrative describing their approach and commitment to involving stakeholders into the design process and to describe enhancements to the aesthetic features using *context sensitive design*.

  Flatiron/FIGG received an average score of above 97%. The next closest responder received an average score of ~65%
  Protesters had assert that they were misled to believe that low cost and expedited construction were the state’s primary objectives which, in their view, necessitated use of steel rather than concrete. Apparently – Flatiron/FIGG was the only D-B team to submit concrete bridge. Protesters argued that a concrete bridge would take longer to construct.

- Geometric (10%) and Structural Enhancements (5%): 15%

  Engineering resolution of traffic flow (congestion) problems (6 included in the RFP): 15%

  - enhance the geometric features of the project and eliminate or minimize design exceptions.
  - vertical profiles to avoid/reduce increase in elevation of University Ave and 4th Street Interchanges
  - maximize the benefits to road users taking into consideration *context sensitive design features*.
  - innovative procedures and/or materials to minimize the life cycle costs

  Average scores for Geometric enhancement ranged from 92.5% (Flatiron/FIGG) to only 5.8%

  Average scores for Structural enhancements ranged from 94.7% (Flatiron/FIGG) to only 27.7%

  Flatiron/FIGG scores were notably higher than the next highest scores. All six evaluators independently ranked Flatiron the highest in this category.

  The Architect had cited this as the criteria which distinguished Flatiron/FIGG from the others who had submitted

- Public outreach: 15%
  - qualifications and experience of their Public Information Coordinator
  - describe their approach and commitment to involving stakeholders, designers, and construction personnel in the public relations process.
  - describe their approach and commitment to mitigate nighttime noise.

  Flatiron/FIGG received an average score of above 92.3%. The next closest responder received an average score of 75.6%

  * "St. Anthony Falls (I-35W) Bridge Replacement Project Protest Determination" (October 8, 2007)

The Statement of Qualifications (SOQ), Request for Proposals (RFP), and the RFP evaluation and scoring criteria emphasized the importance and requirements for a CSS approach with particular emphasis on effective public involvement and visual quality management.

After the TRC members were given the proposals, they were allowed to discuss their contents and then interview the proposers. This process resulted in a score that based not solely on the technical aspects of the proposal but also on the quality of presentation and interview

MnDOT also limited the proposal to no more than 20 pages with another 20 pages allowed for appendixes (typical MnDOT DB proposal page limits run 120 to 150 pages). This limitation served to focus the proposers on the elements that were critical to the success of the project

Question on FIGG performance on the public evolvement and CSS aspects of the proposal

The Architect offered that she hadn't focused on the results of those specific sections (see commentary on protest later). She had noted that she felt the other bidders were more focused on price than the questions poised in the RFP which here office had invested considerable effort. She particularly noted that RFP evaluation on "Geometric and Structural Enhancements" which had included six congestion or traffic flow challenges.

b. ***Contracting***: Describe the contract type? How have the contractual strategies been effective in facilitating flash track delivery?

($234 million- BV-DB contract only) Lump Sum + time incentive and no-excuse bonus. Winning proposal offered to complete the project within 15 months, as stated in the RFP. Two of the four competing short-listed proposal offered early completions (70 days and 45 days)

Procurement Decision Rationale

MnDOT chose to deliver the replacement bridge using DB because it had extensive experience with the method and believed that it could attract highly experienced DB teams.

An early incentive bonus of $2 million for every 10-day period the project was completed early, up to a maximum of $20 million. MnDOT justified both incentives based on the $400,000 per day user cost that was being borne by the traveling public during the bridge outage.

The Architect added that the contract included a $7M incentive if the project was completed without any claim. She added that in her opinion contract incentives were more effective that damages.

Review Question: The selection equation was SCORE = [COST + (DAYS*$200,000)]/TECHNICAL SCORE – yet there was based on a $400,000/day bonus. Score equation is based on total project days.

Adjusting the scores on the delta w/ days differential

Flatiron adjusted score to McCrosan – [(437-367)*200,000]/tech score + Flatiron score =3,664,185.01 (still 3.6% better)

Flatiron adjusted score to Ames/Lunda – [(437-392)*200,000]/tech score + Flatiron score =3,606,397.09

* Cost/day in the submission criteria reflects a weighted average of anticipated + early completion, reflected in discussion with the Architect as she recounted the formula as "400,000/2". Nevertheless, above reflects that Flatiron/FIGG remains the top ranked submitter

Discussion with the Architect:

Project had a structured/contractual "Partnering" process; however, in the formal session there were few items requiring resolution or discussion. The Architect cited the basis for this as rooted in the co-location of all key parties with several informal meetings. She recounted several instances where ad hoc meetings in the cafeteria had a back of the napkin solutions to some of the project's challenges. In her opinion, there was little need for the formal sessions since "partnering" was a continual process.

c. ***Technologies***: Please describe any technological tools or techniques implemented in this project, which have been effective in facilitating flash track delivery?

The bridge design includes "smart technology" with a state-of-the-art sensor system that allows for comprehensive structural and traffic monitoring throughout the structure life-time.

Sensors were placed throughout the bridge to monitor the structure during construction and service. Monitoring items include concrete maturity, displacements, and stresses, along with thermal sensing. An anti-icing system will also monitor the humidity, bridge deck and ambient air temperatures, automatically engaging when certain conditions are reached. The anti-icing fluid is distributed through recessed deck sprayers.

BIM

The Architect offered that BIM was a great tool for constructability reviews in the cold weather of Minnesota where it was not unusual to have winter temperatures of -40°F. In lieu of braving the extreme condition, 3D modeling and other methods were employed to piece together the construction process.

The Architect further recounted that the weather was a critical factor in fast-track the project. Employing local materials and suppliers who were used to working in these conditions was a critical need. Note: Its common practice in Minnesota to schedule construction around the full winter season.

d. ***Front-End Planning***: Please describe any pre-project planning, such as front-end planning, team alignment and organizational integration efforts which have been effective in successful delivery of the Flash Track project?

The emergency rebuild limited the extent of any front end planning. However a number of early project activities were noteworthy elements for the project's success.

Right-of-Way:

The replacement bridge required 13 parcels of land. Innovative two-step process:

1. An initial "Right of Entry" easement was negotiated with each landowner, each of whom was paid a nominal $1,000.
2. Owners were then given a guaranteed time line for closing the financial part of each deal.

Permitting

This project required 10 permits as a well as an emergency environmental impact analysis. Early project planning and its scope were dictated by a direction to "build the largest project possible with the smallest environmental process".

The following tools to obtain the necessary permits in an expedited fashion:

- Held permitting kickoff meeting with the heads of local, state, and federal permitting authorities to "ensure buy-in from the top down"
- Obtained an agreement from the resource agencies to make sure each document received "the priority of the reviewer and it was immediately reviewed and comments returned in a very timely manner"
- Delegated the authority to make project scope and specific design decisions to the individuals who managed the project and prepared the permit applications.
- Took full advantage of existing programmatic agreements and categorical exclusions, wherever appropriate.
- Ensured that any capacity additions were for less than the mandated 1.0 mile in length to avoid the requirement for an Environmental Assessment triggered at that length.
- Convened a meeting with the competing proposers and the affected utility companies during the procurement phase to furnish firsthand information on potential utility relocations and to provide an opportunity for the industry to ask the utilities direct questions rather than rely on the request for information process.
- Mn/DOT assumed the risk of obtaining all but two of the permits (USCG Navigation and the NPDES permits). MnDOT was able to obtain its eight permits within two weeks of the collapse.

Public engagement

Minnesota Department of Transportation (Mn/DOT) worked closely, rapidly, collaboratively and successfully with all stakeholders and the public to define the scope of the replacement reconstruction project (sufficient to meet anticipated future needs and demands) and to obtain nearly all of the regulatory clearances and permits that would be required within a matter of days and weeks after the bridge collapse.

Within days after the bridge collapse, Mn/DOT began scheduling and facilitating public open house meetings to inform the process and expectations. Mn/DOT structured the Statement of Qualifications (SOQ), Request for Proposals (RFP), and the RFP evaluation and scoring criteria to emphasize the importance and requirements for a Content Sensitive Solution (CSS) approach with particular emphasis on effective public involvement and visual quality management. The RFP evaluation and scoring criteria related to CSS, public involvement, and visual quality management (approximately 35% of the evaluation score).

The I-35W Bridge was designed to be flexible so the usefulness of the bridge can accommodate needs throughout its life of 100 years or more. The I-35W Bridge is mass transit ready with expansion space for light rail, bus or HOV lanes. It is also designed to allow the load for a future pedestrian bridge to be suspended from the underside of the new bridge connecting existing & future trail systems on both sides of the river

The Design/Build Team allowed the community a choice of pier concepts and they chose a solid, strong curved pier shape. The unique 70' (21.33m) tall main pier profile, when viewed from the longitudinal side, curves inward from a 26' (7.92m) wide base, to an 8' (2.44m) width at mid-height, and outward again at the superstructure.

Informative and Interactive Project Updates- Formal outdoor talks were given every Saturday morning at 11:00 a.m. to keep the community up-to-date on current construction activities. Labeled "Sidewalk Superintendent Talks", up to 250 people have attended at one time and quite a few individuals come back regularly each week.

The Architect shared that the project was extraordinarily visible in the media in an environment of ever increasing news cycles. She offered that they few headline news on a near daily basis.

The Architect discussed the public involvement and school outreach programs at length, reporting that the outreach to schools had a much higher level of participation than anticipated. She added that it was hard to quantify the value of the public outreach effort but indicated it was a driving factor for the project’s enthusiasm.

e. ***Re-engineered work process***: Have you implemented any re-engineered work processes which have been influential in facilitating flash tracking?

FIGG's practice of proactively addressing public interest in Bridge Design Charrettes seemed to be a distinguishing element for their selection, as well as the execution of the work. As offered earlier, The Architect cited the public outreach effort as a driving factor for the enthusiasm for the project.

The Architect had expressed at the onset of our discussion the importance of a positive constructive working relationship with the contractor, which there is a give and take. When questioned whether the design was driven by construction, she reiterated it was a matter of give and take and that contractors needed to be open-minded. As an example she offered the curved concrete surfaces on the New I-35 Bridge's piers, although time-intensive, the contractor was in agreement on the its value to the submission.

As part of a follow-up discussion, The Architect had offered that Flatiron had been their contractor of choice to pursue the project. FIGG has worked with Flatiron on past occasions. However, they had originally declined citing the bidding characteristics of the new I-35 bridge (5 short-listed firms v. preference for 3). The Architect added when Flatiron reconsidered and choose to pursue, FIGG had its partner. Otherwise, FIGG would not have participated in the pursuit.

Management by means: Please describe any production technique or management by means (e.g. lean) which was influential in successful delivery of flash track?

When question on management by means (Lean practices), The Architect spoke of recycling formwork elements for other uses reporting that these had been up-cycled for Habitat for Humanity.

She also spoke of the project's extensive QA program (see discussion under "innovation"). On this matter she referred to an "over the shoulder" review process that was seen a streamlining of the process. She also spoke of constructability reviews.

Continuous improvements

The earlier discussion on the single points of contact (Q #2), the permitting process and ROW acquisition can be considered as management by means in seeking the most efficient means of completing these tasks in lieu of a business as usual approach.

The Architect had offered that the "single point of contact" began with the strong central client project manager as the team leader. The concept of a single point contact or hot-lines soon extended to a variety of topics; such as permitting, IT and a variety of other services and project factions

f. ***<u>Pre-fabrications and/or site fabrications</u>***: Have you utilized pre-fabrication or site fabrications for any portion of the project? Has either been effective in facilitating flash tracking?

<u>Main Span Superstructure</u>

Segmental concrete girders were the principal prefabrication effort. Taking advantage of an existing site feature to save time, Flatiron-Manson set up a casting yard on the closed interstate highway pavement just south of the bridge and immediately constructed the majority of the formwork with timber. Prefabricated metal buildings on rollers were used to provide shelter for the precasting operations through the cold Minnesota winter. The first segment was cast on January 30, 2008, only 107 days after construction started, when the high temperature was -2°F.

On-site, pre-stressed concrete: Eight long-line casting beds were utilized for precasting. These beds were constructed on top of the existing southern highway approach for the previous bridge. All long-line beds were operational at the same time and were used only once. Rolling heated structures, following the segment casting, provided a suitable work and curing environment during the winter months. The precasting was complete by early June 2008.

The Architect offered that segmental box girder supplier DSI (verified)

g. ***<u>Establishment of design freeze points</u>***: How do you see the concept of “Design Freeze Points” as influencing the successful delivery of flash track project?

Unknown. Subject raised but not discussed to a significant extent.

h. ***<u>Innovations:</u>*** *Please describe any innovative products, equipment, tools or construction methods employed to speed construction?*

Based on the literature review, it seems like the level of detail in the best value, design-build selection process was collectively innovative in the inclusion of a number of considerations, as well as the aggressiveness of the owner in answering questions and assuming a leadership role.

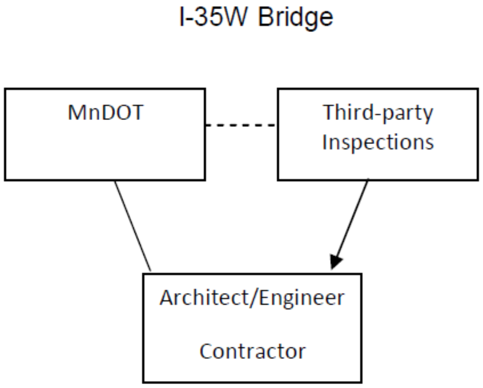
Items of note…..

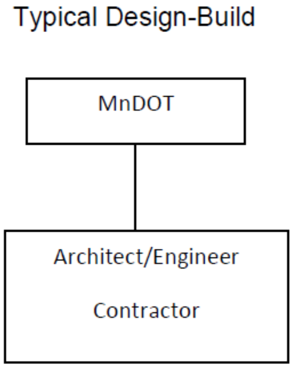
- Alternative Technical Concept (ATC) process - allowed a Design/Build team to confidentially get approval from the Owner during development of the response to the request for proposal (RFP).

  If the Design/Build team has a concept that results in an improvement and cost savings that is not specifically allowed by the RFP, if approved, the Design/Build team could base their RFP response and cost proposal on this ATC. <u>ATC's are kept strictly confidential and not shared with the other Design/Build teams.</u> It encourages technological advances and innovations based on the best practices from national experts in design and construction.

- Content Sensitive Solutions process
- Contractor led design charrettes
- Owners appointment of the “cream of their crop”:
- Separation of Responsible Parties (Hilger, 2009)

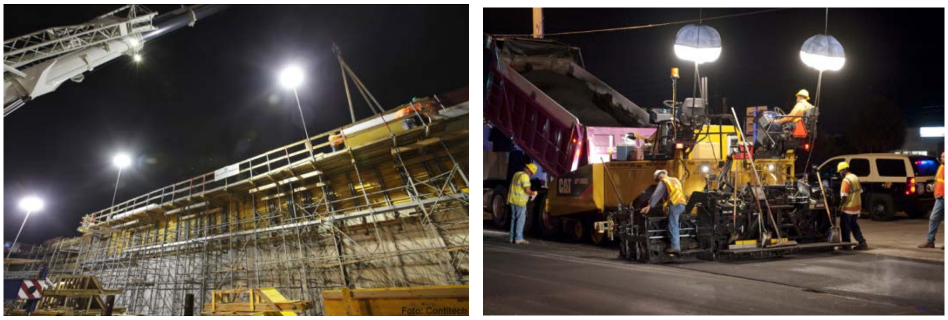
The I-35W Bridge was a unique situation, and the owner, architect, and contractor had a unique relationship as well. In a typical design-build project, the owner picks a design/construction firm in such a way that the architect/engineer along with the contractor hold one contract with the owner. With the new bridge, a hybrid was formed. MnDOT held a contract with a third-party inspection firm, and also held a contract with Flatiron.


I-35W Bridge


Typical Design-Build

- Light Balloons

Introduced under the management by means discussion, The Architect indicated that as crews work around the clock the use of light balloons (http://www.powermoon.com/lighting-balloon-photo-gallery; http://www.multiquip.com/multiquip/globug.htm) were very helpful. The light balloons lighting reduce glare, eliminate shadows and improve safety.



i. ***<u>Other:</u>*** *Please comment on any other significant aspects that have positively contributed to a high-performance team and lessons learned.*

The Architect cited the importance of early and aggressive planning, citing that in the accelerated schedule there were a number of surprises on the critical path. As an example, she offered that ordering light poles was a critical item with a lead time of ten months. She commented that she found it amazing they could build an entire bridge in eleven months, yet it took ten months to procure and fabricate the light poles. Without the early and aggressive planning – fully exploring required lead times this item could have been missed.

5. Among the strategies you listed above, which practices are sustainable, meaning that they can be applied in future projects to achieve Flash Track results? Have you implemented any of these strategies on other projects and obtained positive results?

The Architect saw many of the practices employed on the New I-35 Bridge project as being sustainable, citing in particular:

- The synergy between the engineer and contractor
- Having shared common goals
- Knowing the people that would be engaged on the project.
- She added that there was a scored interview with the design-build teams as part of the selection process. As she recounted that in the I-35 project she had heard that during some of the design-team interviews, the members of the D-B team argued amongst themselves.

<u>Commentary on the bid protest and the evaluation process:</u>

Areas of protest:

- Protesters assert that they were misled to believe that the cost and construction schedule were the key objectives. Although those are key objectives, the Request for Proposals (RFP) detailed other essential criteria (e.g. design, safety, impact on other roadways, community involvement, etc.) and precisely how all these elements would be weighed in the final formula.
- Protesters suspected that evaluation criteria tied to aesthetics and public relations resulted in Flatiron’s first place finish and argued that public relations services should not have been included in a design/build project. However, investigation showed that removing all scores in either one or both of these two areas would have had no impact on Flatiron’s first-place finish.

A review of evaluation data revealed detailed and well-documented rationale for the evaluators’ scores. It also showed a high degree of overall consistency among evaluators whether from Mn/DOT, the City of Minneapolis or the AGC.

All evaluators gave their highest scores to Flatiron’s technical proposal. Every evaluator scored Flatiron at least 13 points higher (on a scale of 100) than the highest-rated protesting responder in sectional scores, with the average difference between Flatiron and the highest-rated protester being 25.6 points.

The non-Mn/DOT evaluators, on average, scored a wider difference between Flatiron and the highest-ranked protester (26.9 points) than did the Mn/DOT evaluators (24.9 points).

These wide scoring differences on the technical proposals are central to understanding why the most costly proposal was successful after applying the statutory "best value" formula.

Two local contractors, C.S. McCrossan and Ames/Lunda claimed they were "misdirected" by Minnesota Dept. of Transportation "regarding the type of proposal desired by the state" and questioned the subjectivity of best-value procurement models. Both teams submitted costs significantly lower than the winner, Flatiron/Manson, which proposed a price tag of $233.8 million and a schedule of 437 days. The lowest bid, proposed by C.S. McCrossan, was $57 million lower and 70 days shorter than the Flatiron/Manson bid.

However, Flatiron/Manson had the highest technical score of 91.47, C.S. McCrossan a grade of 65.91, while Ames/Lunda received a score of 55.98. The next highest grade, 67.88, assigned to Walsh Construction and American Bridge (ENR, 9/24/07).

References (language liberally used from):

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Hilger, Peter, Best Value Procurement: Lessons Learned, A Review of Best Practices in Minnesota: 2008-2009, University of Minnesota, September 17, 2009

I-35W St. Anthony Bridge Collapse and Reconstruction Over Mississippi River Submission Form http://contextsensitivesolutions.org/content/case_studies/i_35w_st__anthony_bridge_collap/ - Referenced in FHA webpage on Content Sensitive Design at http://contextsensitivesolutions.org/content/case_studies/i_35w_st__anthony_bridge_collap/

Minnesota Administration of Materials Management, St. Anthony Falls (I-35W) Bridge Replacement Project Protest Determination, October 8, 2007

Western, Kevin L., et al, “The New Minneapolis I-35W Bridge, Designed and Built in Only 11 Months” Structural Magazine, April, 2009

D-3, ThyssenKrupp’s New Steel Processing Facility

D-3, ThyssenKrupp’s New Steel Processing Facility, Interview with the Contractor’s Lean Champion
10:00 a.m., January 2, 2014
RT 311 participants: Pardis Pishdad-Bozorgi, Professor Jesus de la Garza, and Bob Austin

1. Project Information: This included a brief introductory summary on project type, size, schedule, cost, safety performance, project delivery method, and overall project success.

    Owner: ThyssenKrupp Steel USA, Mobile, Alabama
    General Contractor: ThyssenKrupp Steel USA
    Engineer of Record: CH2M Hill
    Project Schedule: Mar. 2008 - Nov. 2009, 21 months

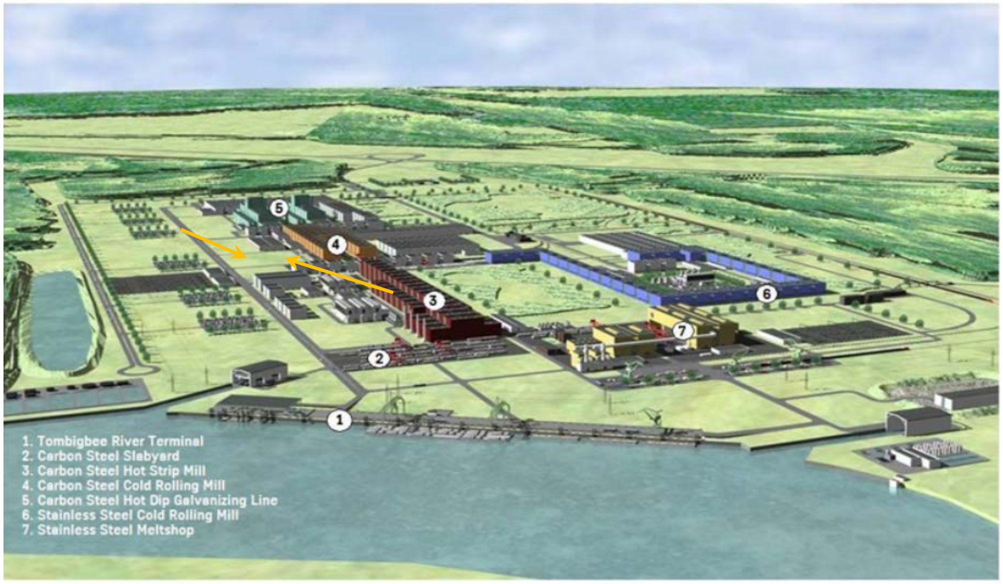
In 2007, ThyssenKrupp AG invested in a world class, state-of-the-art steel processing facility in the state of Alabama to meet the demand for advanced flat carbon steel products in the NAFTA region. The facility employs advanced technology processes and equipment to make high quality, competitively priced carbon steel products. As part of its NAFTA growth strategy, ThyssenKrupp’s new $3.7 billion steel processing facility supplies economically crucial industries such as automotive, construction, utility, and engineered products.

The new facility is state-of-the-art. It includes a hot strip mill and processes slabs from ThyssenKrupp Steel's new steel making facility in Brazil. It also features cold rolling and hot dip coating capacity for high-quality end products of flat carbon steel. The facility has an annual capacity of 5.3 million metric tons.

ThyssenKrupp issued construction contracts totaling over $1.5 billion with companies in Alabama, Mississippi, Florida, and other southeastern states during the construction phase of the project, including $750 million in Alabama. The project employed thousands indirectly through contractors and vendors during this construction phase as well. The original budget for the project of $3.7B increased to $5B in spite of intense competition among contractors and lower materials costs due to the timing of the work (2008 recession). The project is believed to be the single largest industrial project in the United States.

Baker Concrete Construction was engaged as the concrete construction subcontractor on six separate projects totaling over $200 million. This case study is focused principally on the sixth project awarded to Baker, the project’s second Hot Dip

Galvanizing Line (HDGL #2). At the time of the bidding on the design-build project, Baker was three months into a nearby sister project (HDGL #1). Both HDGL #1 and #2 had nine month construction schedules. The original schedules were staggered with the expectation that the two projects would start three months apart and end three months apart. Baker elected to execute HDGL #2 under Baker's Lean Construction program. The lump sum pricing for HDGL #1 was $38M and the identical HDGL #2 was $32M.



The four continuous galvanizing lines will have the capability of producing 1.8 million tons of coated products for exposed and unexposed applications including construction. Two of these lines will produce product up to 1870 mm wide, the other two up to 1670 mm wide. One of these lines will also be capable of producing both cold rolled and coated products.

Notable aspects of HDGL #2
5,000 tons of reinforcing steel, 100,000 cy of concrete and five ft thick foundation

Start: May 2009; Complete: November 2009; Contract due date: Feb'r 2010

Given that there was an identical project on the site, the case study offers a number of interesting comparisons between a conventional project execution and Lean Construction

	Traditional Execution (HDGL #1)	Lean Construction Execution (HDGL #2)
Bid price (Lump sum, fixed-price):	$38M	$32M
Cost of construction:	$35M	$30M
Peak manpower:	420	270
Formwork rental:		75% lower than traditional (HDGL #1)
Equipment rental:		28% lower than traditional (HDGL #1)
Duration:	9 months	~7 months (19% lower)
End of job overtime:		68% lower than traditional (HDGL #1)
Labor productivity:		12% higher than traditional (HDGL #1)
Foundation productivity(1):		8% lower than traditional (HDGL #1)
Wall productivity:		29% lower than traditional (HDGL #1)
Column productivity(2):		61% lower than traditional (HDGL #1)
Costs:		10-28% lower than traditional (HDGL #1) Overall savings ~17.4%
Safety:	Both projects were significantly better than industry average (65% better)	

1. Concrete placement/week - HDGL#2 = 4,200cy/week, HDGL#2 = 2,600 cy/week, Conventional industrial project 500-1,000cy/week
2. The more complicated the work, the greater the realized saving in Lean

2. What is your definition of Flash Tracking (super-fast tracking) and what traits qualify the project as a Flash Track project?

The following definitions were offered to the Lean Champion in the course of the conversation, who had question the use of “flash track”

CII RT 311 – Definitions:

<u>RT-311 definitions</u>

Fast Track: A time-driven project which by necessity requires some degree of concurrency between Engineering, Procurement and Construction.

Flash Track: A time-driven project which by necessity requires a heightened degree of concurrency between Engineering, Procurement and Construction; relational contracting methods and exceptional execution.

Why is Lean Construction well suited to accelerated projects?

The Lean Champion offered that Lean was well suited to accelerated projects as it eliminates wastes, removing gaps in activities and tightly coupling events to maximize the execution of the work.

3. At what point in the project, the decision to go Flash Tracking was made? What was the reason behind Flash Track delivery?

The project schedule of nine months was set by the owner in the bid documents. The decision to accelerate HDGL #2 to 6 months was Baker Concrete's (commercial reasons to lower costs, taking advantage of lessons learned, bid/market characteristics and anticipated Lean benefits)

4. What extraordinary processes, tools, or technique did facilitate Flash Tracking?
    a. ***Procurement***: Describe the procurement process? At what stage each project stakeholder became involved in the project? How has the procurement process contributed to the successful delivery of flash track project?

The project was bid as a conventional design-bid-build, with an accelerated schedule. The ongoing sister, HDGL#1 project had been bid incrementally and had challenges in the sequencing of the work due to the status of the plant's design and subcontractor coordination (e.g., piling contractor and structural steel erection).

It was noted that payment issues were common on the project and that Baker expended considerable effort in trying to mitigate the cash flow challenges.

The project had no incentives for early completion. The project had had considerable damaged for failure to complete within the defined contract duration of nine months. Baker constructions benefit for the accelerated effort and resulting three month early completion was cash expended and avoiding challenges of coordinating their efforts with later contracts.

    b. ***Contracting***: Describe the contract type? How have the contractual strategies been effective in facilitating flash track delivery?

Contact was a lump sum, D-B-B, hard bid. Baker Construction acted as a subcontractor. The Lean Champion was unsure of the GC, but indicated it may have been Parsons.

When question on the Owner's skill level, resources and level of involvement, the Lean Champion indicted that from his perspective the owner had minimal involvement.

News articles on the project indicated that ThyssenKrupp Steel USA acted as the general contractor.

c. ***Technologies***: Please describe any technological tools or techniques implemented in this project, which have been effective in facilitating flash track delivery?

ThyssenKrupp information on the project cites the project's use of Microsoft SharePoint 2007 and a state of the art video conferencing linking key decision sites of Troy Michigan, Brazil and Germany.

The Lean Champion indicated that Baker Construction had not been engaged in these aspects of the project suggesting that there elements seemed more applicable to the major equipment suppliers, etc….

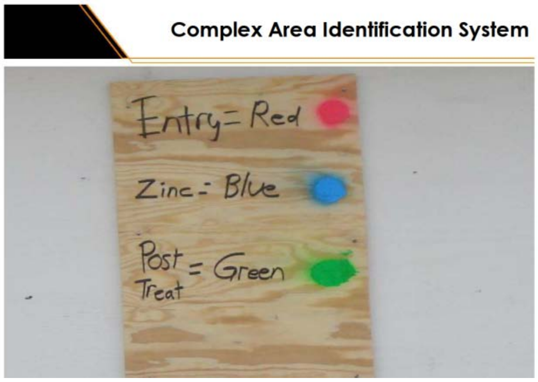
The Lean Champion later added that on this project, Baker Construction did not use BIM, I-pads or other technologies to facility the work. He added that Baker has traditionally been an early-adopter of work place improvements, including BIM. The project had used some advance surveying equipment, which the Lean Champion didn't consider as technologically noteworthy. On the HDGL projects there was no need for super-flat floors or other unique aspects of concrete placement.

d. ***Front-End Planning***: Please describe any pre-project planning, such as front-end planning, team alignment and organizational integration efforts which have been effective in successful delivery of the Flash Track project?

The Lean Champion reported that Baker Concrete had no involvement in the pre-project planning; indicating that other concrete work may have been performed before Baker mobilized on its first project at the facility.

e. ***Re-engineered work process***: Have you implemented any re-engineered work processes which have been influential in facilitating flash tracking?

The Lean Champion didn't cite any unique elements of re-engineering the work process other than the Lean principles of the five S's 9sort, straighten, shine, standardize and sustain). An example of this was the overall projects challenges in location materials, which through the Five S process, HDGL#2 introduced a simple color coding process (marking or pre-marking supplies with a color designation tied to its project areas; i.e., Entry-Red, Zinc-Blue, Post treat-Green). See below from LCI presentation.



f. ***Management by means***: Please describe any production technique or management by means (e.g. lean) which was influential in successful delivery of flash track?

The project was executed under Baker's Lean Construction Program "Baker 2.0" which stresses collaborative building through disciplined teams. Baker Concrete has been exploring and implementing the unique and proven principles of Lean Construction since 2005, primarily in their commercial division (schools, hotels, casinos, hospitals). This was the first use of Lean in one of their industrial projects. In keeping with Baker's culture, the Lean approach raises the bar in safety, quality, and production.

In addition to Baker's ISO 9001 quality standards, the project featured.

- Last Planner® System (LPS)
- Milestone Planning – An overview of the project where historical data is applied to the major phases to determine schedule feasibility and resource requirements
- Pull Planning – An in-depth look at the various resources and hand-offs that are required to complete the work
- Weekly Work Planning - Day-by-day planning for the handoffs that will occur in the upcoming week
- Daily Huddles – Daily review of detailed plans, last minute modifications, and transfer of plans to craft workers
- Percent Plan Complete – Examination of weekly performance where variances in production are studied, root causes are identified, and countermeasures are installed

Baker Construction has realized the following benefits of Lean Construction solidified its commitment to continuous improvement, greatly accelerating learning and collaboration on projects, fewer safety incidents, higher quality, improved schedule performance. Improved schedule performance has been attributed to less “firefighting” and more time to plan, collaborate, and solve problems.

The Lean Champion indicted that there were a number of cultural barriers when lean was introduced to their industrial sector, including:

- The industrial sectors lower emphasis on containing costs
- Industrial sectors perception that bigger is always better (large v. smaller pours)
- Inertia (the way we’ve always done it)

The Lean Champion also noted the last planner, weekly work planning, engagement of suppliers in the work process and scheduling was of great value to the project. Principle suppliers were reinforcing steel, embedments and forming. He noted that there was limited in-slab piping to contend with, as well as a limited interface with other contractors and the owner.

A higher level of office engineering support was incurred by all contractors on-site due to the size, complexity and schedule of work. It was noted that the HDGL#2 project had a comparable level of support but a higher level of effort in engaging suppliers and subcontractors in their planning process, as well as expediting deliveries, etc….. HDGL#2 took advantage of lessons-learned on the HDGL#1 project, as an example the sequencing of the early work by the piling contractor that preceded the mass concrete work. On HDGL#1 the piling contractor worked in a manner to optimize its production effort, often drilling in multiple areas and occasionally moving on to another area before all of the piles had been completed – on HDGL#2, this patchwork process was not permitted.

g. ***Pre-fabrications and/or site fabrications***: Have you utilized pre-fabrication or site fabrications for any portion of the project? Has either been effective in facilitating flash tracking?

The Lean Champion indicated that there wasn’t any unusual or unique prefabrication or site fabrication effort. He indicated that there were 4-5 batch plants, including a site based plant, adding that most of the concrete was batched off-site.

An inquiry was made and a select example was offered on formwork, rebar fabrication and site reinforcing steel detailing work on-site. The Lean Champion indicated that detailing and rebar fabrication was performed off-site using local contractors.

h. ***Establishment of design freeze points***: How do you see the concept of "Design Freeze Points" as influencing the successful delivery of flash track project?

N/A

i. ***Innovations:*** *Please describe any innovative products, equipment, tools or construction methods employed to speed construction?*

The nature of the heavy industrial project did not lend itself to any unique innovations, such as self-consolidated concrete or concrete pumping technologies. He indicated that the HDGL#2 project employed smaller concrete pours than its sister project, HDGL#1, resulting in less problems and an increased level of production. HDGL#2's schedule progress also avoided coordinating their work with the follow-on work of the structural steel erection. In the case of HDGL#1 this coordination often dictated their sequencing of the work.

j. ***Other:*** *Please comment on any other significant aspects that have positively contributed to a high-performance team and lessons learned.*

The Lean Champion indicated that the lower cost and three month early completion of the HDGL#2 was due to both lessons learned and the Lean Construction methods employed, indicating that assigning a set amount to either was indeterminate. He offered that the on-site personnel would have attributed 80% to the Lean Construction principles employed.

5. Among the strategies you listed above, which practices are sustainable, meaning that they can be applied in future projects to achieve Flash Track results? Have you implemented any of these strategies on other projects and obtained positive results?

Yes. Essentially all of the items above are basic practices with an emphasis on practical planning of the work and strong execution practices.

The Lean Champion offered that another key success factor was a continuous effort to limit the number of contractors and differing crafts in a work area (e.g., piling contractor and structural steel erection).

Other question:

a. The Lean Champion was asked if there were any aspects of Lean (Toyota Management System) that were not applicable to Lean Construction. He offer that in a production environment, the assembly moves through the production process; where as in construction works move to the production areas. As an example of a non-applicable Lean/TMS process, he offered six-sigma or other processes that demand repeatability of specific tasks.

b. In comparing design-build-build to design-build, he offered that in D-B-B, that contrary to common belief the design is typically not complete when the projects are bid. Designs are issued without sufficient consideration of constructability issues or with contractor input and often there is an unwillingness to amend the details to facilitate construction. In contrast, under D-B the engineer has “skin-in-the-game”, resulting in a vested interest in considering construction cost concerns.

   As another comparison, he emphasized the importance of a complete design being ahead of construction stating that the lack of a sufficient design (design out of sequence with construction) was as damaging as lacking basic materials.

c. An open-ended question was offered on change-orders, which the Lean Champion expressed a strong preference for no change orders (aside for increase scope of work, negotiated/non-bid awards). Regarding changes due to design errors, incomplete information, etc… he offered that a contractor never can fully capture the costs of out-of-sequence work caused by these changes.

d. Concerning “shared risks” on the HDGL#2 project, it was noted that there weren’t IPD similar shared risks. It was also noted that under the HDGL#2 project, Baker Construction’s principle risks were securing an adequate level of skilled crafts, cash flow, mobilization trails, etc….

e. Concerning competitive bidders on the HDGL#2 in light of Bakers work on the adjacent HDGL#1, the Lean Champion offered that it was an extremely competitive market in 2008 citing a number of quality regional GC’s (Yates), other concrete contractors (Capform, Southern Pan), as well as other GCs’ in search of work in the soft market.

f. The Lean Champion indicated that Baker Construction controlled their quality control process. He indicated that there must have been some level of ownership oversight; but, that external QC was not a notable issue.

APPENDIX E

Institutional Review Board Approval

The Institutional Review Boards (IRBs) of Georgia Institute of Technology and Virginia Polytechnic Institute and State University review proposed research plans to safeguard the rights and welfare of human participants in research. Prior to engaging external parties in the research process, the researchers completed required human subjects training and submitted the anticipated research protocols for approval.

The following pages are the approval notification from each institution.

Georgia Tech
Office of Research Integrity Assurance

Protocol Number: H13463
Funding Agency: Construction Industry Institute
Review Type: Exempt, Category 2
Title: Delphi Study -- Fast-Track Projects
Number of Subjects: 60

December 12, 2013

Pardis Pishdad-Bozorgi
Architecture
0155

Dear Dr. Pishdad-Bozorgi:

The Institutional Review Board (IRB) has carefully considered the referenced protocol . Your approval is effective as of **December 4, 2013**. The proposed procedures are exempt from further review by the Georgia Tech Institutional Review Board.

Project qualified for exemption status under 45 CFR 46 101b. **2.**

Thank you for allowing us the opportunity to review your plans. If any complaints or other evidence of risk should occur, or if there is a significant change in the plans, the IRB must be notified.

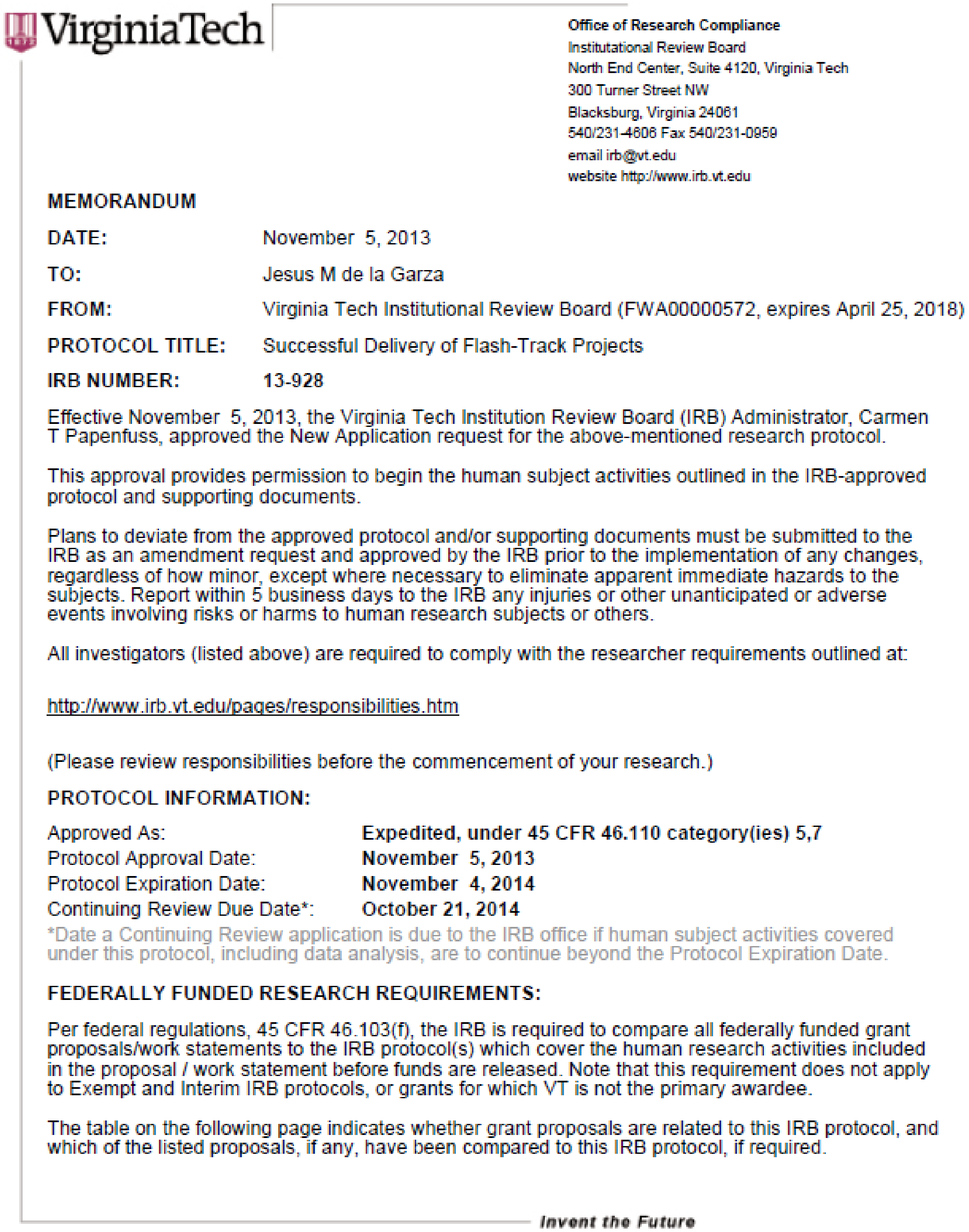
If you have any questions concerning this approval or regulations governing human subject activities,

please feel free to contact Dennis Folds, IRB Chair, at 404/407-7262, or me at 404 / 894-6942.

Sincerely,

Melanie Clark
Melanie J. Clark, CIP
IRB Compliance Officer

cc: Dr. Dennis Folds, IRB Chair
OSP



VirginiaTech

Office of Research Compliance
Institutational Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE: November 5, 2013

TO: Jesus M de la Garza

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)

PROTOCOL TITLE: Successful Delivery of Flash-Track Projects

IRB NUMBER: **13-928**

Effective November 5, 2013, the Virginia Tech Institution Review Board (IRB) Administrator, Carmen T Papenfuss, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	**Expedited, under 45 CFR 46.110 category(ies) 5,7**
Protocol Approval Date:	**November 5, 2013**
Protocol Expiration Date:	**November 4, 2014**
Continuing Review Due Date*:	**October 21, 2014**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

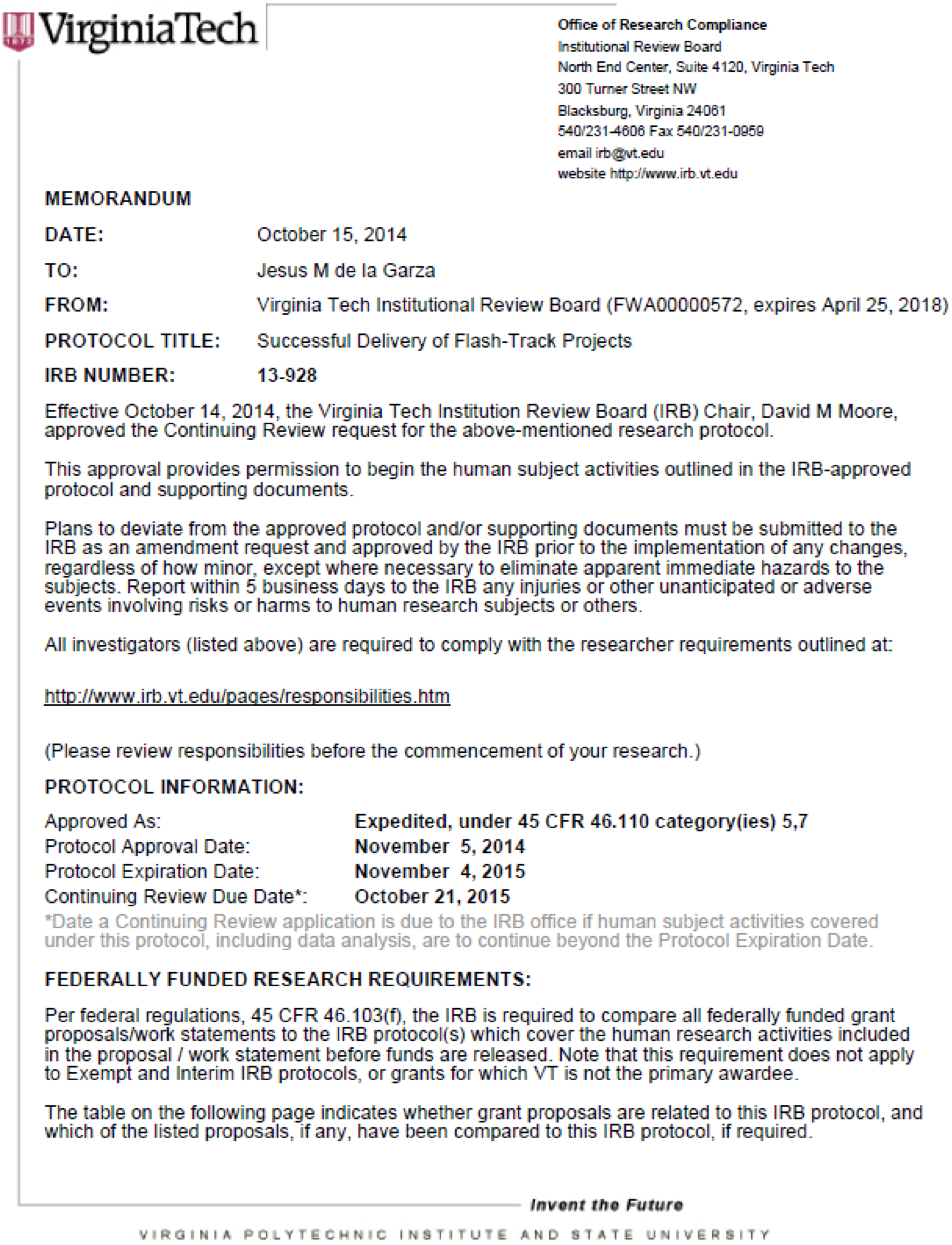
The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.



VirginiaTech

Office of Research Compliance
Institutional Review Board
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300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE: October 15, 2014

TO: Jesus M de la Garza

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)

PROTOCOL TITLE: Successful Delivery of Flash-Track Projects

IRB NUMBER: **13-928**

Effective October 14, 2014, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Continuing Review request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	**Expedited, under 45 CFR 46.110 category(ies) 5,7**
Protocol Approval Date:	**November 5, 2014**
Protocol Expiration Date:	**November 4, 2015**
Continuing Review Due Date*:	**October 21, 2015**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Date*	OSP Number	Sponsor	Grant Comparison Conducted?
01/08/2014	14041308	Construction Industry Institute	Not required (Not federally funded)

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

APPENDIX F

Recruitment Message and Consent Form

Candidates to serve as subject matter experts in the Delphi study, called oracles, were nominated by the RT 311 membership. A total of 75 candidates meeting the prescribed requirements were nominated.

Each of these prospects were sent the recruitment message, included as Attachment F, which advised them of the purpose of the research, the anticipated procedures, and an assortment of statements required by the two universities' IRBs. Nominated candidates were asked to review the short document, provide contact information, and to signify electronically their consent to participate in the research.

Consent form
- CII RT311, Successful Delivery of Flash-Track Projects

CII RT311: Successful Delivery of Flash-Track Projects

Consent Form
Thank you for agreeing to participate in this study, please review the following page. This page contains information on the research process and purpose, at the end of the page please electronically sign to indicate your consent to participate.

I. Purpose of this Research
The primary purpose of this research is to identify which innovative improvements in project delivery methodology are most effective in compressing project durations, while maintaining safety, quality, and project risk tolerances; as well as identifying barriers and enabling methods for the successful delivery of “faster” fast-track of flash-track projects.

We are asking your participation as an expert who has been deemed knowledgeable in the area of fast track construction. This research will use the knowledge gathered though this study to 1) better define the process by which organizations can successfully deliver fast- and flash-track projects; 2) create a metric to assess the readiness of the Owner and EPC organizations to undertake a fast- or flash-track project and 3) develop an implementation resource and recommendations for predicable positive results.

II. Procedures
The Delphi method is a structured communication technique which relies on a panel of experts. The experts will answer questionnaires in three rounds. After each round, a facilitator provides an anonymous summary of the experts’ forecasts from the previous round as well as the reasons they provided for their judgments. Thus, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel.

Participation in this research will be through a series of three electronically distributed surveys. These surveys are expected to take a maximum of one hour each time, in a test run of the survey it took participants approximately 30 minutes. If the survey is started but not completed, it can be saved and re-accessed at a later point in time to complete it.

We ask that by agreeing to participate in the study you will complete each round, and submit your answers by the deadlines.

III. Risks
We are not anticipating any risks that could arise from your participation in this research. However, if you encounter any difficulties or problems as a result of your participation please feel free to contact the research team.

IV. Benefits
This research aims to benefit engineers, contractors and owners to more successfully manage the notable coordination challenges resulting from heavily overlapped project life-cycle work-processes. The benefit of this research is both at the organizational and project level. Owner organizations will realize the prominent and crucial role they play in a Flash Track project. Engineers, Contractors, and those other firms in the Supply Chain will be better equipped to mitigate added risks and orchestrate faster project execution.

Upon the completion of this research the findings and the process that will be developed will be available through the Construction Industry Institute. More information will be sent to participants once these resources are available.

V. Extent of Anonymity and Confidentiality
These surveys will be kept anonymous. Individual responses will not be associated with the respondent. The survey software will strip identifying information from the responses when the surveys are submitted. To access the survey a link will be provided via email rather than the use of a username and password.

VI. Compensation
Participants in this study will not be receiving compensation.

VII. Freedom to Withdraw
While undesirable, participants are free to withdraw from the study at any time.

VIII. Subject's Responsibilities
I voluntarily agree to participate in this study. I agree to answer the three surveys honestly to the best of my knowledge by the provided deadlines.

Subject's Permission
I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent to participate in all three rounds of the study:

1. Please type your name in the box below in order to indicate your consent*
2. Please enter today's date*

Questions about the Study
Should I havve any pertinent questions about this research or its conduct and whom to contact in the event of a research-related injury to the subject, you may contact:

Dr. Pardis Pishdad-Bozorgi, Georgia Tech, Principal Investigator
pardis.pishdad@coa.gatech.edu (404) 894-7100

Dr. Jesús M. de la Garza, Virginia Tech, Co-Principal Investigator
chema@vt.edu (540) 231-5789

Mr. Robert B. Austin, Georgia Tech, Graduate Student
robert.austin@gatech.edu (646) 484-0263

Questions about Your Rights as a Research Participant:
If you have any questions about your rights as a research participant, you may contact

Ms. Melanie Clark, Georgia Institute of Technology Office of Research Integrity Assurance, at (404) 894-6942

or

David M. Moore 540-231-4991/moored@vt.edu
Chair, Virginia Tech Institutional Review
Board for the Protection of Human Subjects
Office of Research Compliance

APPENDIX G

Content Analysis

A content analysis of information collected in the literature review, structured EPC interviews, and RT 311 industry member discussions was completed early in the research to streamline and consolidate the large amount of information collected. During this process, the initial 151 items were identified and grouped into categories to facilitate a further review and consolidation effort.

The following pages show:

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
1	RT	Culture	RT-311, Denver meeting	a new paradigm or mindset is required when engaged on a fast track project
2	LS	Culture	Williams, G. V., "Fast Track Pros and Cons: Considerations for Industrial Projects", J. of Mgmt. in Engineering, Sept/Oct 1995	overcoming a status quo is a barrier to implementing fast track practices
3	LS	Culture	Manley, K., McFallan, S., and Kajewski, S., "Relationship between Construction Firm Strategies and Innovation Outcomes", ASCE JCEM, Aug 2009	innovative organizations are more successful in fast-track projects There are many significant difference between low- and high- level innovation firms
4	LS	Culture	Tatum, C. B., "Process of Innovation in Construction Firm, JCEM, Oct 1986	Increasing demands from owners incentivizes advances in construction technology. Undertaking construction innovation outside of a project appears to be a very unusual process. Changes in capabilities (technical breath) and climate (flexible structures) may be necessary to increase the rate of innovation.
5	RT	Culture	RT-311, Denver meeting	honesty is a desirable fast track team characteristic
6	RT	Culture	RT-311, Denver meeting	openness is a desirable fast track team characteristic
7	RT	Culture	RT-311, Denver meeting	trust is a desirable fast track team characteristic
8	RT	Culture	RT-311, Denver meeting	being mutually supportive is a desirable fast track team characteristic
9	CS	Culture	Maine General, RT-311, Denver meeting	a "no blame culture" is a desirable fast track team characteristic
10	CS	Culture	Maine General, RT-311, Denver meeting	flexibility is a desirable fast track team characteristic
11	LS	Culture	Ozorhon,Beliz, Analysis of Construction Innovation Process at Project Level, ASCE JCME, Oct 2013	fast-track schedule requirements is a driver for innovations
12	LS	Culture	Bossink, B., "Managing Drivers of Innovation in Construction Networks", Journal of Construction Engineering and Management, Nov, 2004	fast track schedules mandate exploration of time-savings innovations.
13	LS	Culture	CII, RR243-11, Enhancing Innovation in the EPC Industry	the EPC process promotes innovative methods and solutions
14	LS	Culture	CII, RR243-11, Enhancing Innovation in the EPC Industry	Innovation is a foundation of fast track efforts
15	LS	Culture	Horta, I.M., Camanho, A.S., Moreira da Costa, J., "Performance assessment of construction companies: A study of factors promoting financial soundness and innovation in the industry", Inter J of Prod Econ, Jan 2012	Client demands for faster projects drives innovation
16	LS	Culture	CII, RR124-1 - Exceptional Projects and Methods of Improving Project Performance	Early and continuing engagement of suppliers and subcontractors
17	LS	Culture	Tatum, C. B., "Managing for Increased Design and Construction Innovation", Journal of Management in Engineering, October 1989	Increased Design and Construction Innovation
18	LS	Culture	Winch, G., "How innovative is construction? Comparing aggregated data on construction innovation and other sectors – a case of apples and pears", Constr Mgmt and Econ (Sept 2003)	Measures to increase innovation
19	LS	Delivery methods	Bogus, 2011	time-savings and cost reduction benefits in fast track are a function of the delivery approach and repeatable designs

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
20	LS	Delivery methods	Bynum, S., "Construction Management and Design Build from the Perspective of a General Contractor", Law and Contemporary Problems, 46(1), Construction Management and Design-Build/Fast Track Construction (W 1983), 25-38	Standard contractual frameworks are ill-suited to fast-track projects
21	LS	Delivery methods	Elvin, George, "Proven practices in design-build and fast-track", Architectural Engineering, 2003	integrated, multidisciplinary teams working together to continuously improve design throughout the entire design, construction and occupancy project lifecycle is a keystone of fast tracking
22	LS	Delivery methods	Lu, W. , Liu, A., Rowlinson, S., Poon, S.W., "Sharpening Competitive Edge through Procurement Innovation: Perspectives from Chinese International Construction Companies", ASCE JCEM, March, 2013	Sharpening Competitive Edge through Procurement Innovation Chinese firms are gradually adopting procurement innovation as a competitive strategy.
23	LS	Design	Cho, Kyuman, et. al., "Partnering Process Model for Public Sector Fast-Track Design-Build Projects in Korea", Journal of Construction Engineering and Management, 2010	interfaces among the design participants is a key success factor for fast track projects
24	LS	Design	CII RR-222-11, Best Practices for Design of Fast Track Projects	constructability is a critical element of fast-tracking
25	LS	Design	CII RR-222-11, Best Practices for Design of Fast Track Projects	clear change management procedures are is a critical element of fast-tracking
26	LS	Design	CII RR-222-11, Best Practices for Design of Fast Track Projects	design effectiveness is a critical element of fast-tracking
27	LS	Design	CII RR-222-11, Best Practices for Design of Fast Track Projects	design for maintainability is a critical element of fast-tracking
28	LS	Design	Dehghan, R. and Ruwanpura, "The Mechanism of Design Activity Overlapping in Construction Projects and the Time-Cost Tradeoff Function", Proc of the 12th East Asia-Pacific Conf on Structural Engineering and Construction, 2011	Overlapping mechanisms for design and engineering activities in construction projects should be continually monitored
29	LS	Design	ECI, Eastham, 2002	a fully integrated design team offers higher quality and more expedient designs
30	RT	Design	RT-311, Denver meeting	the establishment of design freeze points is key to successful fast tracking
31	RT	Design	RT-311, Portland meeting	Designs should proceed to the point where concept is conveyed and not to perfection (no need to high level of detail)
32	RT	Design	RT-311, Portland meeting	The most up to date software should be employed to speed the design process.
33	RT	Design	RT-311, Portland meeting	clearly defined roles and responsibilities at the onset are needed to avoid redundant efforts
34	RT	Design	RT-311, Portland meeting	design sequences and options should be targeted to manufacturing and construction schedules.
35	RT	Design	RT-311, Portland meeting	concurrent interactive design methods are preferable
36	RT	Design	RT-311, Portland meeting	designs should strive for simplicity and repetition, including modularization and prefabrication

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
37	CS	Design	Maine General	Extensive development or mock ups resulted in reduced installation challenges
38	LS	Design	Bogus, et. al., "Concurrent Engineering Approach to Reducing Delivery Time", Journal of Construction Engineering and Management, 2005	the lower the sensitivity to changes in upstream information, the less risky it is to overlap activities.
39	LS	Design	Bogus, et. al., "Concurrent Engineering Approach to Reducing Delivery Time", JCEM, 2005	The faster the evolution of information in an activity, the less risky it is to begin a downstream activity before the upstream activity is finalized.
40	LS	Design	Dehghan, R. and Ruwanpura, "The Mechanism of Design Activity Overlapping in Construction Projects and the Time-Cost Tradeoff Function", Proceedings of the 12th East Asia-Pacific Conference on Structural Engineering and Construction, 2011	concurrent engineering of dependent and semi-independent activities must be closely monitored
41	LS	Design	Elvin, George, "Proven practices in design-build and fast-track", Architectural Engineering, 2003	the simultaneous design and construction process require the use of performance verses prescriptive specifications.
42	LS	Design	Fazio, P., et. al., "Design impact of Construction Fast-track", Construction Management and economics, 1988	fast tracking requires a greater emphasis on coordination planning, particularly in the early design process
43	LS	Design	Khoramshahi, F., "A Framework for Evaluating the Effect of Fast-Tracking Techniques on Project Performance", ASCE Construction Research Congress, 2010	Standard and conservative design practices are key elements of the fast-track process
44	LS	Design	Tighe, Joseph, J., "Benefits of fast tracking are a myth", International Journal of Project Management, Vol 9, Iss 1, Feb 1991, 49–51	less than optimum conservative design are a necessary element of the concurrent engineering and fast tracking
45	RT	Design	RT-311, Denver meeting	Innovative designs should be avoided in fast track projects
46	RT	Design	RT-311, Denver meeting	design schedules should be frequently updated and closely monitored
47	RT	Design	RT-311, Portland meeting	conservative or over-designs should be employed to avoid design holds
48	RT	Design	RT-311, Portland meeting	"critical chain" project controls
49	RT	Design	RT-311, Portland meeting	engaging contractors and suppliers yields higher quality designs and an expedited design process
50	RT	Design	RT-311, Portland meeting	standard or off the shelf designs should be employed as much as possible
51	LS	Execution	Cho, Kyuman and Hastak, Makarand, "Time and Cost–Optimized Decision Support Model for Fast-Track Projects", JCEM, 2013	successful fast track projects also do all the normal things well
52	LS	Execution	Cho, Kyuman, et. al., "Partnering Process Model for Public Sector Fast-Track Design-Build Projects in Korea", Journal of Construction Engineering and Management, 2010	a quick decision-making process is key to a successful fast track project
53	LS	Execution	Cho, Kyuman, et. al., "Partnering Process Model for Public Sector Fast-Track Design-Build Projects in Korea", Journal of Construction Engineering and Management, 2010	early involvement of the designer and contractor is key to a successful fast track project

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
54	LS	Execution	Cho, Kyuman, et. al., "Partnering Process Model for Public Sector Fast-Track Design-Build Projects in Korea", JCEM, 2010	co-locating engineers/designers, contractor and specialty contractors is beneficial
55	LS	Execution	CII RR-222-11, Best Practices for Design of Fast Track Projects	pre-project planning is a critical element of fast-tracking
56	LS	Execution	CII RR-222-11, Best Practices for Design of Fast Track Projects	team alignment is a critical element of fast-tracking
57	LS	Execution	CII RR-222-11, Best Practices for Design of Fast Track Projects	leadership selection is a critical element of fast-tracking
58	LS	Execution	CII RR-222-11, Best Practices for Design of Fast Track Projects	partnering is a critical element of fast-tracking
59	LS	Execution	CII RR-222-11, Best Practices for Design of Fast Track Projects	team building is a critical element of fast-tracking
60	LS	Execution	CII, RT113, Team Alignment During Pre-Project Planning of Capital Facilities	Timely and productive team meetings is a critical factor for successful fast tracking
61	LS	Execution	Devine, Lenora and Buss, Gary, "An Inside Look at Fast-track Construction", Health Care Facilities, May 2007	prefabrication and on-site fabrication are key factors in fast track projects
62	LS	Execution	Dulaimi, M. F., Ling, F., Ofori, G. and De Silva, N., Enhancing integration and innovation in construction, Building Research and Information, 2002	Clients play an important role in creating project conditions in which innovation can flourish. Need for integrated approach in construction New procurement and organizational structures Looking to government for leadership and funding Identify the activities and initiatives that will motivate and enable to achieve greater levels and volumes of innovation (Singapore)
63	LS	Execution	Eastham, George, The fast track manual: a guide to schedule reduction for clients and contractors on engineering and construction projects, European Construction Institute, 2002	a single authoritative project champion is key to a successful fast track project
64	LS	Execution	Eastham, George, The fast track manual: a guide to schedule reduction for clients and contractors on engineering and construction projects, European Construction Institute, 2002	committed, technically competent, experiences decisive problem solvers are key to a project's success
65	LS	Execution	Eastham, George, The fast track manual: a guide to schedule reduction for clients and contractors on engineering and construction projects, European Construction Institute, 2002	fast track teams must be simple, clear and devoid of rigid hierarchy
66	LS	Execution	Eastham, George, The fast track manual: a guide to schedule reduction for clients and contractors on engineering and construction projects, European Construction Institute, 2002	fully integrated fast track teams include design, construction, specialty contractors, commissioning and operations personnel
67	LS	Execution	Elvin, George, "Proven practices in design-build and fast-track", Architectural Engineering, 2003	flexible organizations are suited to fast-track projects

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
68	LS	Execution	Khoramshahi, F., "A Framework for Evaluating the Effect of Fast-Tracking Techniques on Project Performance", ASCE Constr Res Cong, 2010	exceptional project management practices are a critical element of fast-tracking
69	LS	Execution	Knecht, Barbara, "Fast-track construction becomes the norm", Architectural Record;Feb2002, Vol. 190 Issue 2, p123	advancements in communication and information technology have been a huge assistance in fast tracking
70	LS	Execution	O'Leary, Arthur, "Fast Track Construction Is It Too Good To Be True? Can It Really Deliver?" DC&D, 2013	Development of contractor estimates and schedules early and throughout the fast track project is imperative
71	LS	Execution	O'Leary, Arthur, "Fast Track Construction Is It Too Good To Be True? Can It Really Deliver?" DC&D, 2013	Early or incremental permitting of the project is an effective fast-tracking technique (provisional regulatory approval)
72	LS	Execution	O'Leary, Arthur, "Fast Track Construction Is It Too Good To Be True? Can It Really Deliver?" DC&D, 2013	Fast track project required the full, unwavering and active commitment of the owner
73	LS	Execution	Williams, Gareth Vaughan, "Fast Track Pros and Cons: Considerations for Industrial Projects", Journal of Management in Engineering, September/October 1995	effective communication and a high level of trust are critical element of fast-tracking
74	RT	Execution	RT-311, Denver meeting	effective communication is key to successful fast tracking
75	RT	Execution	RT-311, Denver meeting	a high level of trust is key to successful fast tracking
76	RT	Execution	RT-311, Denver meeting	early participation of team members is key to successful fast tracking
77	RT	Execution	RT-311, Denver meeting	active and decisive owners involvement is key to successful fast tracking
78	RT	Execution	RT-311, Denver meeting	a timely decision process is key to successful fast tracking
79	RT	Execution	RT-311, Denver meeting	Common shared goals is key to successful fast tracking
80	RT	Execution	RT-311, Denver meeting	Selection of team members and staffing are key to successful fast tracking
81	RT	Execution	RT-311, Portland meeting	Early participation of suppliers and specialty contractors is key to successful fast tracking
82	RT	Execution	RT-311, Portland meeting	Strong owner commitment, leadership, and motivation are central to a successful fast track effort
83	RT	Execution	RT-311, Portland meeting	dedicated and committed participation is key to successful fast tracking
84	CS	Execution	Maine General	fast track projects require cooperative personnel with a willingness to collaborate to achieve team objectives
85	LS	Execution	Baiden, B. K. , Price, A.D.F., Dainty, A.R. J., "The extent of team integration within construction projects", International Journal of Project Management, 2006	increased levels of team integration improves project performance
86	LS	Execution	Eastham, ECI, 2002	progress meetings should be focused on decision making rather than communication of matters purely for interest

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
87	LS	Execution	Williams, Gareth Vaughan, "Fast Track Pros and Cons: Considerations for Industrial Projects", Journal of Management in Engineering, September/October 1995	reduced project durations increases the importance of careful and through planning
88	LS	Execution	Williams, Gareth Vaughan, "Fast Track Pros and Cons: Considerations for Industrial Projects", Journal of Management in Engineering, September/October 1995	a streamlined work process where only tasks that offer "value added" is critical element of the fast track process.
89	RT	Execution	RT-311, Denver meeting	timely and well informed decisions is key to successful fast tracking
90	RT	Execution	RT-311, Denver meeting	alignment is key to successful fast tracking
91	RT	Execution	RT-311, Denver meeting	an experienced project team is key to successful fast tracking
92	RT	Execution	RT-311, Denver meeting	fast track projects require personnel with a high-level of technical competence
93	RT	Execution	RT-311, Denver meeting	fast track projects require decisive personnel
94	RT	Execution	RT-311, Denver meeting	fast track projects require "self-starters"
95	RT	Execution	RT-311, Denver meeting	fast track projects require personnel with a "can do" attitude and willingness to tackle challenging tasks
96	RT	Execution	RT-311, Denver meeting	fast track projects require cooperative personnel with a willingness to collaborate to achieve team objectives
97	RT	Execution	RT-311, Denver meeting	fast track projects require personnel with strong leadership capabilities
98	RT	Execution	RT-311, Portland meeting	Prefabrication and on-site fabrication are key factors in fast track projects
99	LS	Performance	Alhomadi, A.A, Dehghan, R. and Ruwanoura, "The Predictability of Fast-Track Projects", Science Digest, 2011	cost, quality, safety and schedule objectives are predictable under fast-tracking
100	LS	Performance	Cho, Kyuman and Hastak, Makarand, "Time and Cost–Optimized Decision Support Model for Fast-Track Projects", Journal of Construction Engineering and Management, 2013	High-profit construction projects are better candidates for the fast-track Fast tracking sometimes leads to unexpected results. Solid project management practices with skilled personnel mitigate variances
101	LS	Performance	Damanpour, F. and Gopalakrishnan, S., "Theories of organizational structure and innovation adoption: the role of environmental change" Journal of Engineering and Technology Management, 1998	a dynamic and unpredictable fast-track environment, promotes innovation.
102	LS	Performance	Lee, David, "Grand Lisboa hotel and casino, Macau: a fast-track high rise", Proceedings of ICU, Civil Engineering, 2010	Innovative practices are critical element of fast-tracking
103	LS	Performance	Williams, Gareth Vaughan, "Fast Track Pros and Cons: Considerations for Industrial Projects", Journal of Management in Engineering, September/October 1995	Fast track projects can be employed reducing normal project durations up to 60% or more
104	LS	Planning	Cho, Kyuman, et. al., "Partnering Process Model for Public Sector Fast-Track Design-Build Projects in Korea", JCEM, 2010	project controls plays a greater role in fast track projects
105	LS	Planning	CII, RT113, Team Alignment During Pre-Project Planning of Capital Facilities	Setting common goals is an essential aspect of the motivational process in managing groups

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
106	LS	Planning	CII-243, Lean Implementation at the Project Level	short-term look-ahead schedules, focused on material and resource availability and weather are key tools for fast-tracking Lean construction practices
107	LS	Planning	Eastham, George, The fast track manual: a guide to schedule reduction for clients and contractors on engineering and construction projects, European Construction Institute , 2002	fast track project controls entails both monitoring and implementing corrective action when deviations occur
108	LS	Planning	Howell, G. and Ballard, G., "Can Project Controls Do Its Job?", 4th Int'l. Conference on Lean Construction, Birmingham, U.K., 8/96	fast track project controls is a dynamic process with the ability to adopt to evolving circumstances. Project controls must be production based, with the ability to adopt to evolving circumstances, to: a) assess the significance of variances, b) identify root causes, , c) Take corrective actions, d) trigger changes to effect improvements
109	LS	Planning	Pena-Mora, F. and Li, M., "Dynamic Planning and Control Methodology for Design-Build Fast-Track Construction Projects", Journal of Construction Engineering and Management, 2001	Dynamic modeling employing and monitoring upstream "reliability" and downstream "sensitivity" metrics is an important element of fast tracking
110	RT	Planning	RT-311, Denver meeting	delaying decisions to the last responsible moment (JIT) is key to successful fast tracking
111	LS	Planning	CII, RT113, Team Alignment During Pre-Project Planning of Capital Facilities	Setting vague, non-specific goals does not produce maximum performance
112	LS	Planning	CII, RT113, Team Alignment During Pre-Project Planning of Capital Facilities	If performance goals are perceived as impossible, the goals will be rejected and performance will decrease
113	RT	Planning	RT-311, Denver meeting	effective change management is key to successful fast tracking
114	LS	Procurement	CII, RR130, Reforming Owner, Contractor, Supplier Relationships, aka PEpC	Suppliers should be part of the EPC process
115	LS	Procurement	Khoramshahi, F., "A Framework for Evaluating the Effect of Fast-Tracking Techniques on Project Performance", ASCE Construction Research Congress, 2010	having favorable prior working relationships with contractors is critical element of fast-tracking
116	LS	Procurement	O'Leary, Arthur, "Fast Track Construction Is It Too Good To Be True? Can It Really Deliver?" DC&D, 2013	Streamlining the procurement process through GMP and other mechanisms is recommended
117	LS	Procurement	O'Leary, Arthur, "Fast Track Construction Is It Too Good To Be True? Can It Really Deliver?" DC&D, 2013	Performance based specifications and contracting is a critical consideration in a fast track award
118	LS	Procurement	O'Leary, Arthur, "Fast Track Construction Is It Too Good To Be True? Can It Really Deliver?" DC&D, 2013	Cost-plus contracts are an effective fast-track mechanism
119	CS	Procurement	RT-311, Denver meeting, Saint Anthony Falls, I-35	a well developed contract strategy with performance incentives is key to successful fast tracking
120	RT	Procurement	RT-311, Denver meeting	Clear scope definition is key to successful fast tracking
121	RT	Procurement	RT-311, Denver meeting	simplifying approval procedures and delegation of authority to the project level are preferred
122	RT	Procurement	RT-311, Denver meeting	prequalifying contractors and suppliers speeds the procurement process
123	RT	Procurement	RT-311, Denver meeting	performance based procurement selection methods is a key element of fast tracking

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
124	RT	Procurement	RT-311, Portland meeting	performance incentives and rewards are a key element of fast tracking
125	CS	Procurement	Maine General	performance incentives and rewards are a key element of fast tracking
126	LS	Procurement	CII, RR130, Reforming Owner, Contractor, Supplier Relationships, aka PEpC	Including suppliers in the EPC process can produce significant cost and schedule benefits
127	LS	Procurement	O'Leary, Arthur, "Fast Track Construction Is It Too Good To Be True? Can It Really Deliver?" DC&D, 2013	Construction contracts can be awarded based on 60-70% complete designs.
128	CS	Procurement	Maine General	Aligning contractors through the contract
129	CS	Procurement	Maine General	Contractually shared risks and rewards
130	LS	Procurement	Tighe, Joseph, J., "Benefits of fast tracking are a myth", International Journal of Project Management, Volume 9, Issue 1, February 1991, Pages 49–51	cost plus contracting allows maximum flexibility for incorporating changes, but gives little incentive for the contractor to implement cost-savings measures
131	RT	Procurement	RT-311, Portland meeting	alternative standards, off the shelf and fit for purpose submissions should be sought
132	RT	Procurement	RT-311, Portland meeting	Supplier value engineering input should be encouraged
133	LS	Procurement	Mahmoud-Jouini, S.B., "Innovative supply-based strategies in the construction industry", Construction Management and Economics, January 2000	innovative supply-based strategies in the construction industry Transforming a design process is long, difficult and complex. Work methods and relationships must be redefined: a costly, conflict-ridden, and destabilizing process, undertaken only out of clear necessity. A need for all industry participants, and major contract-tors in particular, to link project management with skill development in order to develop strategies for innovative products and technologies. Proposed a design model containing six variables that would lend structure to the skill development process.
134	CS	Procurement	Saint Anthony Falls, I-35	Early completion bonuses, No claims bonus
135	LS	Risk	Eastham, George, The fast track manual: a guide to schedule reduction for clients and contractors on engineering and construction projects, European Construction Institute, 2002	an uninvolved Client is a detriment to successful fast tracking
136	LS	Risk	Eastham, George, The fast track manual: a guide to schedule reduction for clients and contractors on engineering and construction projects, European Construction Institute, 2002	risk management is a critical element of fast tracking
137	LS	Risk	Moazzami, M. et. Al. "Contractual risks of fast-track projects", Proceedings of the 12th East Asia-Pacific Conference on Structural Engineering and Construction, 2011	fast track projects are more successful under relational contracting (IPD, Alliance, Partnering)
138	LS	Risk	Moazzami, M. et. Al. "Contractual risks of fast-track projects", Proceedings of the 12th East Asia-Pacific Conference on Structural Engineering and Construction, 2011	equitable assignment of risks is a key success factor
139	NA	Risk	Multiple	untimely decisions is a key risk in fast tracking
140	NA	Risk	Multiple	concurrent engineering process introduces project risks that differ from conventional projects
141	NA	Risk	Multiple	standard contracts are ill suited to fast track efforts
142	NA	Risk	Multiple	there are no forms of contracts that are specific to fast track

Idea Generation - Original 151 points of relevancy

Item	Source	Prim topic	Principal Source	Delphi inquiry - Point of Relevancy
143	NA	Risk	Multiple	cancellation fees should be included in all procumbent contracts
144	RT	Risk	RT-311, Denver meeting	equitable risk distribution is key to successful fast tracking
145	RT	Risk	RT-311, Denver meeting	risks should be allocated to the party best able to control those risks
146	LS	Risk	Cho, Kyuman and Hastak, Makarand, “Time and Cost–Optimized Decision Support Model for Fast-Track Projects”, Journal of Construction Engineering and Management, 2013	successful fast track projects recognize and manage the additional risks introduced and they do all the normal things well
147	LS	Risk	Khoramshahi, F., “A Framework for Evaluating the Effect of Fast-Tracking Techniques on Project Performance”, ASCE Construction Research Congress, 2010	fast track projects impose additional risk and may negatively impact project performance
148	LS	Risk	Moazzami, M. et. Al. “Contractual risks of fast-track projects”, Proceedings of the 12th East Asia-Pacific Conference on Structural Engineering and Construction, 2011	cost overruns and inaccurate estimates are common fast track risks
149	LS	Risk	Moazzami, M. et. Al. “Contractual risks of fast-track projects”, Proceedings of the 12th East Asia-Pacific Conference on Structural Engineering and Construction, 2011	design errors and omissions is a common fast track risk
150	NA	Risk	Multiple	un-proven innovative designs represent an undue risk in fast track efforts
151	NA	Risk	Multiple	conservative and over designs result in added material costs

86	Literature search
49	Research team
9	Case studies
7	Not Assigned
151	Total

Consolidation - Souce allocation for 118 Flash Track practices (Beta test)

Item	Category	Practices essential to fast tracking	Literature review	RT-311 Industry Expert Panel Discussion	EPC interviews (Case studies)
1	Contractural	Aligning project participants' interests through contract			x
2	Contractural	Creating project-specific mutually equitable contracts	x		
3	Contractural	Employing Cost Plus & Fixed Fee		E	
4	Contractural	Employing Cost-Plus or Reimbursable contracts	x		
5	Contractural	Employing early completion bonuses			x
6	Contractural	Employing performance incentives to promote a high performance culture			x
7	Contractural	Establishing an effective claims resolution process	x		
8	Contractural	Establishing clear change management procedures	x		
9	Contractural	Establishing contract strategies specifically tailored to the project condition		E	
10	Contractural	Establishing performance-based specifications	x		
11	Contractural	Executing Single Source or no-bid contracts		x	
12	Contractural	Explicitly designating the project as being "fast track"		x	
13	Contractural	Funding early critical efforts	x		
14	Contractural	Having equitable shared risks and rewards			x
15	Contractural	Setting clear, specific scoping requirements	x		
16	Contractural	Tying performance incentives and rewards to project goals			x
17	Cultural	Accepting a new paradigm or mindset from traditional practices		I	
18	Cultural	Establishing flexible project teams that avoid rigid hierarchy			x
19	Cultural	Having an active, involved and fully committed owner	x		
20	Cultural	Having an open minded team		x	
21	Cultural	Having open communication and transparency		C	
22	Cultural	Maintaining a "no blame culture" and mutually supportive environment			x
23	Cultural	Staffing with cooperative and collaborative personnel			x
24	Delivery Method	Delivery under Integrated Project Delivery contracts	x		
25	Delivery Method	Focusing procurement decisions on construction priorities	x		
26	Delivery Method	Making timely selection and award contracts to subcontractors		x	
27	Delivery Method	Selecting preferred or alliance contractors	x		
28	Delivery Method	Selecting team members and staff based on their fast track experience or qualifications		x	
29	Delivery Method	Selecting the best value contractor			x
30	Delivery Method	Staffing with personnel with strong leadership capabilities	x		
31	Design	Considering "speed of fabrication" and construction during the selection of design alternatives	x		
32	Design	Employing conservative designs to avoid design holds	x		
33	Design	Stream-lining the design review process	x		
34	Design	Using BIM (3-D collaborative modeling tool) as a central design platform for a concurrent interactive design phase		E	
35	Design	Using standard repeatable designs and fewer design details	x		
36	Design	Colocation of project team (owner, designer, builder, and/or key vendors)	x		

Consolidation - Souce allocation for 118 Flash Track practices (Beta test)

Item	Category	Practices essential to fast tracking	Literature review	RT-311 Industry Expert Panel Discussion	EPC interviews (Case studies)
37	Execution	Dedicating full-time personnel to the project	x		
38	Execution	Employing Lean Construction practices	x		
39	Execution	Minimizing hand-offs		x	
40	Execution	Seeking provisional regulatory approvals	x		
41	Execution	Selecting appropriate construction methods		E	
42	Execution	Simplifying approval procedures	x		
43	Innovation	Employing innovative construction methods	x		
44	Innovation	Employing innovative procurement practices	x		
45	Innovation	Seeking out suppliers and specialty contractors as a source for time saving innovations	x		
46	Organizational	Creating executive alignment amongst project participants		E	
47	Organizational	Delegating authority to project level (maximize decision-making authority to the project level)		x	
48	Organizational	Empowering the project team (each organization led by an empowered leader)		x	
49	Organizational	Engagement of operations & maintenance personnel in the development and design process		x	
50	Organizational	Establishing a fully integrated project team including design, construction, specialty contractors, commissioning and	x		
51	Organizational	Having an engaged and empowered Owner's Engineer (Owner's representative)		x	
52	Organizational	Having an owner with sufficient depth of resources and strength of organization	x		
53	Organizational	Involving contractors, trades and vendors in the design phase	x		
54	Organizational	Selecting personnel with a "can do" attitude and willingness to tackle challenging tasks		C	
55	Organizational	Staffing with multi-skilled personnel		x	
56	Organizational	Using team building and partnering practices	x		
57	Planning	Emphasizing coordination planning during the design process		x	
58	Planning	Identifying and procuring long lead time items	x		
59	Planning	Increasing resource levels for project control	x		
60	Planning	Monitoring and driving corrective actions through the project controls process	x		
61	Planning	Performing exhaustive front end planning	x		
62	Planning	Providing enough resources to critical path items		x	
63	Risk	Capping contractor's down-side risk	x		
64	Risk	Executing liability waivers among key project participants	x		
65	Risk	Recognizing and managing the additional fast track risks	x		
66	Risk	Reducing risks through collective efforts of all stakeholders	x		
67	Contractural	Employing Design Assist contracts		x	
68	Contractural	Employing Fixed-Price or Lump Sum contracts	x		
69	Contractural	Employing Guaranteed Maximum Price (GMP) contracts	x		
70	Contractural	Employing Unit Price	x		

Consolidation - Souce allocation for 118 Flash Track practices (Beta test)

Item	Category	Practices essential to fast tracking	Literature review	RT-311 Industry Expert Panel Discussion	EPC interviews (Case studies)
71	Contractural	Including an incentive bonus for no claims			x
72	Contractural	Including cancellation fees in all procurement contracts		x	
73	Cultural	Establishing a fully intergrated design team	x		
74	Cultural	Establishing and maintaining trust within the project team	x		
75	Cultural	Having a single empowered project champion	x		
76	Cultural	Maintaining a strong customer focus	x		
77	Cultural	Maintaining the commitments to common project goals		x	
78	Cultural	Maintaining positive, construcutive working relationships with a goal that parties would welcome the opportunity to work together in the future		x	
79	Cultural	Making collaborative decisions			x
80	Delivery Method	Delivery under Construction Management contracts (CM Agency or CM@Risk)	x		
81	Delivery Method	Delivery under Design-Bid-Build contracts	x		
82	Delivery Method	Delivery under Design-Build or Engineering-Procurement-Construction (EPC) contracts	x		
83	Delivery Method	Seeking a higher levels of self performance by prime contractors		x	
84	Design	Defining design freeze points or scope lock early in the project		I	
85	Design	Encouraging increased levels of prefabrication, modularization	x		
86	Design	Establishing design criteria and standards at an early stage	x		
87	Design	Extensive use of physical mock ups			x
88	Design	Performing constructability issues in the design process	x		
89	Execution	Conducting timely and decision-focused progress and planning meetings	x		
90	Execution	Eliminating redundancy and duplication of staff		x	
91	Execution	Eliminating redundancy and duplication of support recources		C	
92	Execution	Employing BIM (3D Collaborative modeling) as a means for information sharing, visualization and coordination of the trades	x		
93	Execution	Employing the latest, compatible software platforms		x	
94	Execution	Improving work processes continually (continuous process improvements)	x		
95	Execution	Maintaining a commitment that quality will not be compromized in pursuit of schedule		x	
96	Execution	Maintaining a commitment that safety will not be compromized in pursuit of schedule		x	
97	Execution	Making timely and well informed decisions		x	
98	Execution	Prioritizing design sequences/options to best support construction/ manufacturing schedules	x		
99	Execution	Processing of change orders in a timely manner	x		
100	Execution	Providing sufficient staging areas and site control		CI	
101	Execution	Securing contractor input to detailed design, estimates and schedules	x		
102	Execution	Settling public grievances in a timely manner	x		

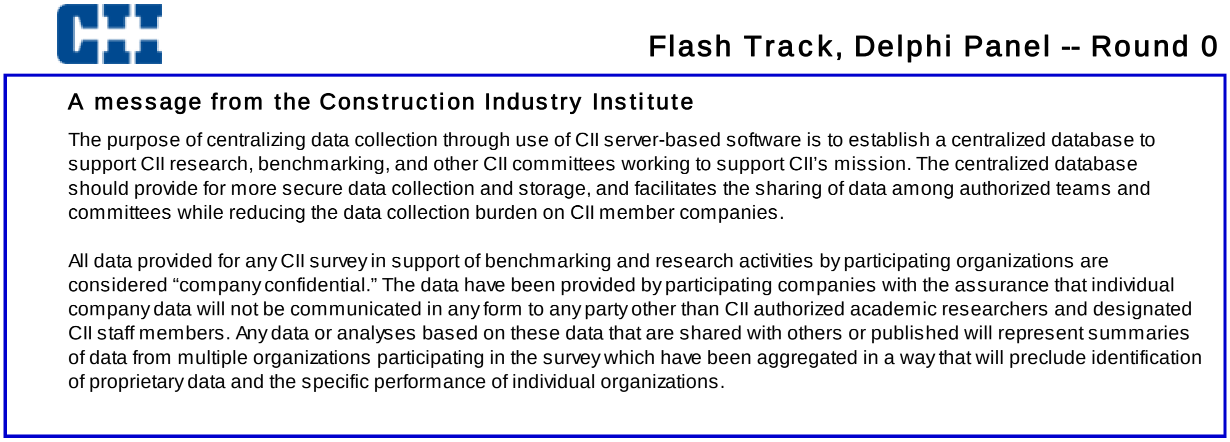
Item	Category	Practices essential to fast tracking	Literature review	RT-311 Industry Expert Panel Discussion	EPC interviews (Case studies)
103	Execution	Timely payments to contractors, subcontractors and suppliers		CI	
104	Execution	Using well established project management processes	x		
105	Innovation	Employing innovative products	x		
106	Organizational	Staffing with experienced personnel with a high-level of technical competence	x		
107	Organizational	Staffing with "self-starters"		C	
108	Planning	Creating schedule-driven contingency plans (weather, equipment breakdowns, spare parts, etc....)		x	
109	Planning	Developing an effective labor management plan		x	
110	Planning	Developing look-ahead schedules that are highly focused on material and resource availability			x
111	Planning	Employing Just-in-time deliveries.	x		
112	Planning	Employing production philosophies for a continuous and relaible work flow	x		
113	Planning	Employing Pull scheduling and Last Planner system			x
114	Planning	Employing the latest available planning, scheduling and project control tools	x		
115	Planning	Monitoring and adapting to changing circumstances	x		
116	Planning	Assigning risks to the parties best able to control those risks	x		
117	Risk	Employing a continual risk management process	x		
118	Risk	Mitigating impacts of changes and design errors & omissions (effective reviews, timely identification, prompt actions)	x		
		Practices included in discussion (some as introductory statements)(x,C or I)	66	33	14
		Practices introduced elsewhere, but expanded by Industry Expert Panel (E)		5	
		Total (118):	66	38	14

APPENDIX H

Delphi Beta Test – Questionnaire and Results

As a final quality measure, a beta test of the Delphi survey was conducted, using the list of 118 items developed in the content analysis (Appendix G). The survey was completed by the industry members of RT 311.

The following pages show:

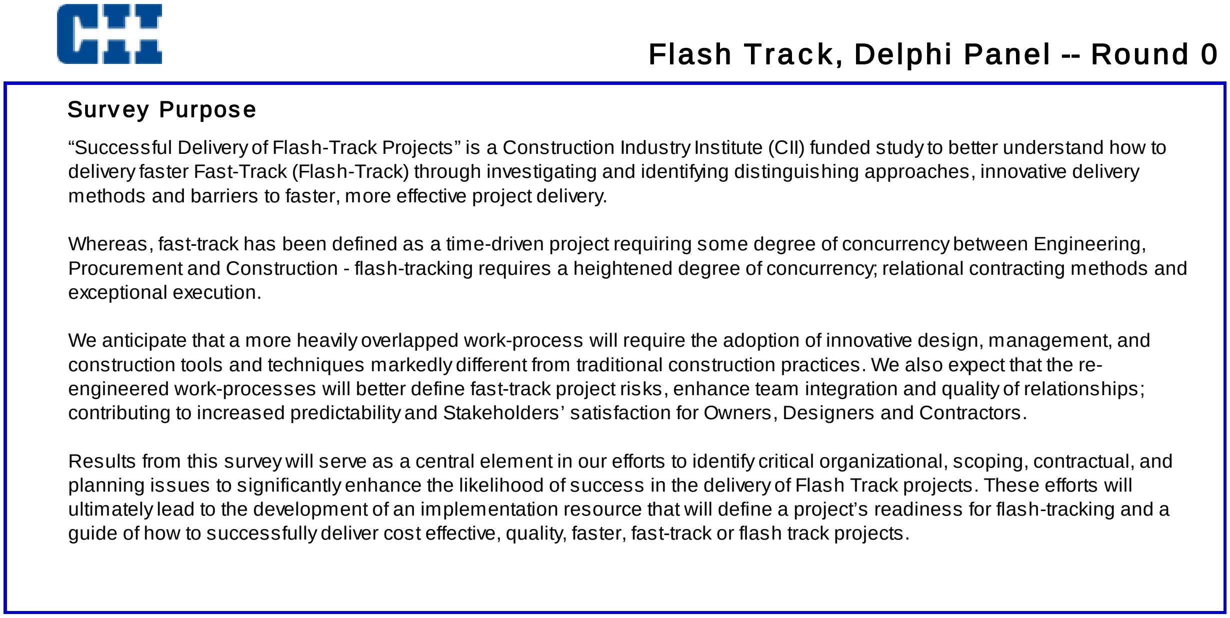


Flash Track, Delphi Panel -- Round 0

A message from the Construction Industry Institute

The purpose of centralizing data collection through use of CII server-based software is to establish a centralized database to support CII research, benchmarking, and other CII committees working to support CII's mission. The centralized database should provide for more secure data collection and storage, and facilitates the sharing of data among authorized teams and committees while reducing the data collection burden on CII member companies.

All data provided for any CII survey in support of benchmarking and research activities by participating organizations are considered "company confidential." The data have been provided by participating companies with the assurance that individual company data will not be communicated in any form to any party other than CII authorized academic researchers and designated CII staff members. Any data or analyses based on these data that are shared with others or published will represent summaries of data from multiple organizations participating in the survey which have been aggregated in a way that will preclude identification of proprietary data and the specific performance of individual organizations.



Flash Track, Delphi Panel -- Round 0

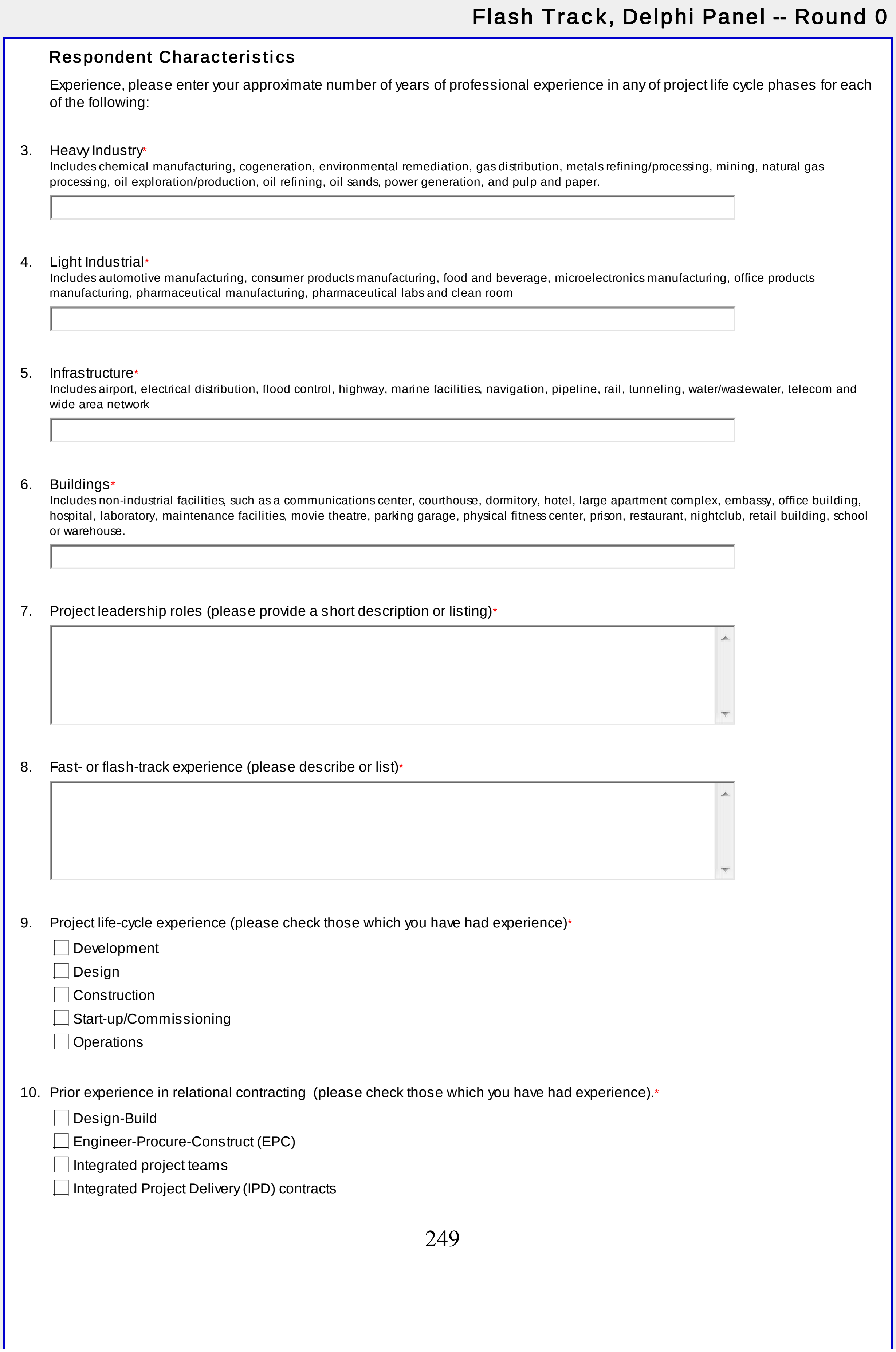
Survey Purpose

"Successful Delivery of Flash-Track Projects" is a Construction Industry Institute (CII) funded study to better understand how to delivery faster Fast-Track (Flash-Track) through investigating and identifying distinguishing approaches, innovative delivery methods and barriers to faster, more effective project delivery.

Whereas, fast-track has been defined as a time-driven project requiring some degree of concurrency between Engineering, Procurement and Construction - flash-tracking requires a heightened degree of concurrency; relational contracting methods and exceptional execution.

We anticipate that a more heavily overlapped work-process will require the adoption of innovative design, management, and construction tools and techniques markedly different from traditional construction practices. We also expect that the re-engineered work-processes will better define fast-track project risks, enhance team integration and quality of relationships; contributing to increased predictability and Stakeholders' satisfaction for Owners, Designers and Contractors.

Results from this survey will serve as a central element in our efforts to identify critical organizational, scoping, contractual, and planning issues to significantly enhance the likelihood of success in the delivery of Flash Track projects. These efforts will ultimately lead to the development of an implementation resource that will define a project's readiness for flash-tracking and a guide of how to successfully deliver cost effective, quality, faster, fast-track or flash track projects.



Flash Track, Delphi Panel -- Round 0

Respondent Characteristics

Experience, please enter your approximate number of years of professional experience in any of project life cycle phases for each of the following:

3. Heavy Industry*
Includes chemical manufacturing, cogeneration, environmental remediation, gas distribution, metals refining/processing, mining, natural gas processing, oil exploration/production, oil refining, oil sands, power generation, and pulp and paper.

4. Light Industrial*
Includes automotive manufacturing, consumer products manufacturing, food and beverage, microelectronics manufacturing, office products manufacturing, pharmaceutical manufacturing, pharmaceutical labs and clean room

5. Infrastructure*
Includes airport, electrical distribution, flood control, highway, marine facilities, navigation, pipeline, rail, tunneling, water/wastewater, telecom and wide area network

6. Buildings*
Includes non-industrial facilities, such as a communications center, courthouse, dormitory, hotel, large apartment complex, embassy, office building, hospital, laboratory, maintenance facilities, movie theatre, parking garage, physical fitness center, prison, restaurant, nightclub, retail building, school or warehouse.

7. Project leadership roles (please provide a short description or listing)*

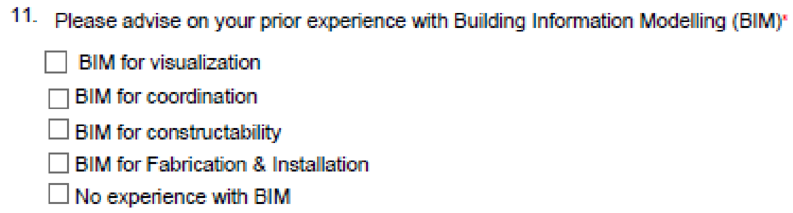
8. Fast- or flash-track experience (please describe or list)*

9. Project life-cycle experience (please check those which you have had experience)*

☐ Development
☐ Design
☐ Construction
☐ Start-up/Commissioning
☐ Operations

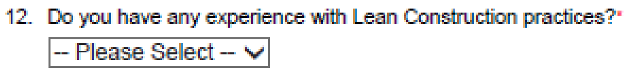
10. Prior experience in relational contracting (please check those which you have had experience).*

☐ Design-Build
☐ Engineer-Procure-Construct (EPC)
☐ Integrated project teams
☐ Integrated Project Delivery (IPD) contracts



11. Please advise on your prior experience with Building Information Modelling (BIM)*

☐ BIM for visualization
☐ BIM for coordination
☐ BIM for constructability
☐ BIM for Fabrication & Installation
☐ No experience with BIM



12. Do you have any experience with Lean Construction practices?*

-- Please Select --

Instructions

The practices listed in the following pages have been identified from published documents, focus group discussions and case-study interviews as prevailing concepts or methods required for the successful execution of faster fast-track or flash-track projects. In this survey, we are seeking to assess the importance, uniqueness and implementation success of each practice for flash-track projects and to further identify any other important flash-track practices.

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?

2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?

3. How SUCCESSFUL has the construction industry been in implementing this practice?

The questions have been grouped into the following categories:

I. Contract Considerations (20 questions)
II. Delivery Method Considerations (10 questions)
III. Organizational Considerations (13 questions)
IV. Cultural Considerations (14 questions)
V. Planning Considerations (14 questions)
VI. Design Considerations (10 questions)
VII. Execution Considerations (23 questions)
VIII. Innovation Considerations (4 questions)
IX. Risk Considerations (7 questions)

Please answer each question. The survey will allow you to offer comments on each question. At the end of each section and the survey, you will have the opportunity to offer comments and additional items which were not included, but you believe are important or distinguishing characteristics of successful flash-track projects.

You can either complete the survey in one sitting or incrementally. If you close the survey before completing it, you can return to the e-mailed link, click the survey link and you will be forwarded to the first uncompleted page and be allowed to finish the survey. Once the survey is completed you will not have the ability to update your answers. In test runs of this survey, it took respondents about 60 minutes to complete.

Please note that the survey software does not function correctly in Google Chrome; as a result we suggest the use of Internet Explorer or Firefox.

We look forward to seeing your responses and input.

Glossary of Terms

The following terms which are used in the survey are offered as a reference for your review or future reference as you share your thoughts on the delivery of enhanced or faster, fast-track project deliveries. These definitions are either rooted in other Construction Industry Institute resources or defined by this study's research team.

Alignment: The condition where appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives.

Building Information Modelling (BIM): A digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition. Software that enables 3D modelling and information management is the technical core of BIM.

Concurrent Engineering: A systematic approach to the integrated, concurrent design of a project, including construction, maintenance and operations. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal including quality, cost, schedule and user requirements"

Constructability: The optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives.

Delivery Method: A structured approach used to organize a project team so as to manage the delivery of a project.

Design Assist contract: A procurement method by which, prior to completion of design, a consulting construction contract is award where a contractor provides design assistance, constructability reviews, budget and/or schedule services to the architect or engineer of record.

Design-Build: An integrated delivery process which combines architectural and engineering design services with construction performance under one contract agreement.

Fast Track: A time-driven project which by necessity requires some degree of concurrency between Engineering, Procurement and Construction.

Flash Track: A time-driven project which by necessity requires a heightened degree of concurrency between Engineering,

Procurement and Construction; relational contracting methods and exceptional execution.

Front End Planning (FEP): The essential process of developing sufficient strategic information with which owners can address risk and make decisions to commit resources in order to maximize the potential for a successful project. FEP is often perceived as synonymous with front-end engineering design, front end loading, pre-project planning, feasibility analysis, programming and conceptual planning.

Integrated Project Delivery: A collaborative alliance of people, systems, business structures and practices into a process that harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.

Just-in-Time: An execution strategy employed to increase efficiency and decrease waste by receiving materials or equipment only as they are needed in the construction process, thereby reducing inventory costs or realizing other benefits.

Last Planner: A collaborative, commitment-based planning system that integrates should-can-will-did planning (pull planning, lookahead planning with constraint analysis, weekly, etc…).

Lean Construction: A combination of original research and practical development in design and construction with an adaption of lean manufacturing principles and practices (i.e., Toyota Management System) to the end-to-end design and construction process. Lean construction is concerned with the alignment and holistic pursuit of concurrent and continuous improvements in all dimensions of the built and natural environment: design, construction, activation, maintenance, salvaging and recycling

Partnering: A long-term commitment between two or more organizations as in an alliance or it may be applied to a shorter period of time such as the duration of a project. The purpose of partnering is to achieve specific business objectives by maximizing the effectiveness of each participant's resources.

Pull Scheduling: A Lean technique for scheduling where real-time feedback from construction and off-site fabrication/manufacturing activities are provided to so process steps can be re-sequenced opportunistically. In “pulling” the required information and resources through the supply chain, pull-driven scheduling reduces uncertainties and improves work-plan reliability.

Successful: A common understanding to deliver a project that fulfills project goals, such as function, time, cost, quality & safety, and also meets stakeholders' expectations such that they welcome future opportunity to work together.

Team Building: A project-focused process that builds and develops shared goals, interdependence, trust and commitment, and accountability among team members and that seeks to improve team members' problem-solving skills

Part I of IX, Contract Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?
2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?
3. How SUCCESSFUL has the construction industry been in implementing this practice?

17. Creating project-specific mutually equitable contracts*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

18. Explicitly designating the project as being "fast track"*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

19. Setting clear, specific scoping requirements*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

20. Establishing performance-based specifications*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

21. Tying performance incentives and rewards to project goals*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

22. Including cancellation fees in all procurement contracts*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

23. Having equitable shared risks and rewards*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

24. Aligning project participants' interests through contract*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

25. Establishing early completion bonuses*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

26. Including an incentive bonus for no claims*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

27. Employing performance incentives to promote a high performance culture*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

28. Establishing contract strategies specifically tailored to the project condition*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

29. Employing Design Assist contracts*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

30. Executing Single-source or no-bid contracts*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

31. Establishing clear change management procedures*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

32. Establishing an effective claims resolution process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

33. Funding early critical efforts*

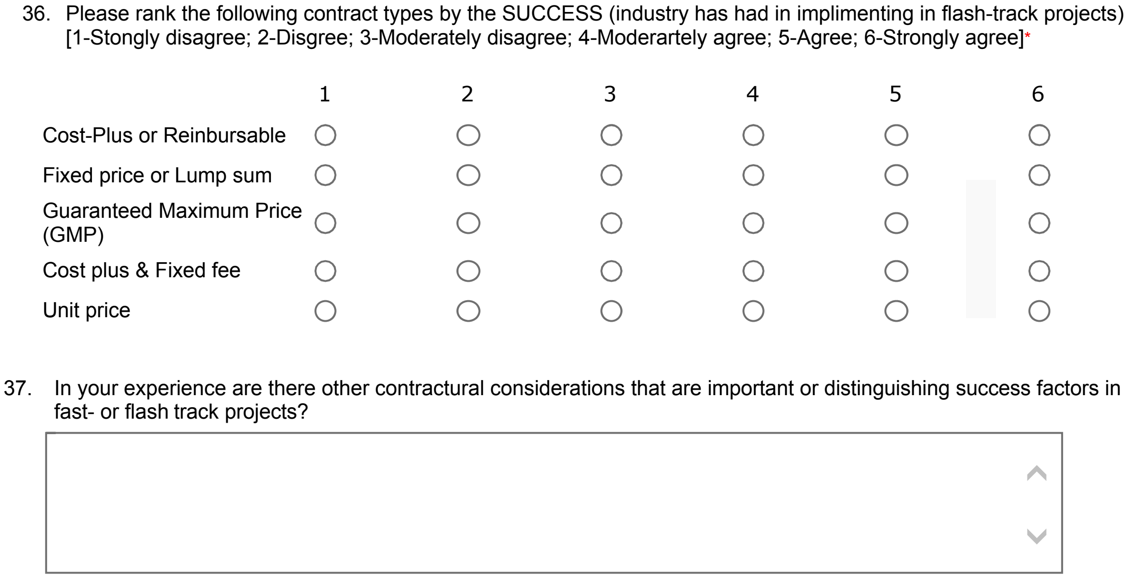
	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

34. Please rank the following contract types by IMPORTANCE (to successful flash-tracking) [1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

	1	2	3	4	5	6
Cost-Plus or Reinbursable	○	○	○	○	○	○
Fixed price or Lump sum	○	○	○	○	○	○
Guaranteed Maximum Price (GMP)	○	○	○	○	○	○
Cost plus & Fixed fee	○	○	○	○	○	○
Unit price	○	○	○	○	○	○

35. Please rank the following contract types by their UNIQUENESS (to flash-tracking) [1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

	1	2	3	4	5	6
Cost-Plus or Reinbursable	○	○	○	○	○	○
Fixed price or Lump sum	○	○	○	○	○	○
Guaranteed Maximum Price (GMP)	○	○	○	○	○	○
Cost plus & Fixed fee	○	○	○	○	○	○
Unit price	○	○	○	○	○	○



36. Please rank the following contract types by the SUCCESS (industry has had in implimenting in flash-track projects) [1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

	1	2	3	4	5	6
Cost-Plus or Reinbursable	○	○	○	○	○	○
Fixed price or Lump sum	○	○	○	○	○	○
Guaranteed Maximum Price (GMP)	○	○	○	○	○	○
Cost plus & Fixed fee	○	○	○	○	○	○
Unit price	○	○	○	○	○	○

37. In your experience are there other contractural considerations that are important or distinguishing success factors in fast- or flash track projects?

Part II of IX, Delivery Method Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?
2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?
3. How SUCCESSFUL has the construction industry been in implementing this practice?

39. Selecting team members and staff based on their fast track experience or qualifications*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

40. Focusing procurement decisions on construction priorities*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

41. Making timely selection and award contracts to subcontractors*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

42. Selecting the best value contractor*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

43. Selecting preferred or alliance contractors*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

44. Seeking a higher levels of self performance by prime contractors*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

45. Staffing with personnel with strong leadership capabilities*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

46. Please rank the following delivery methods by IMPORTANCE (to successful flash-tracking) [1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

	1	2	3	4	5	6
Design-Build or Engineer-Procure-Construct (EPC)	○	○	○	○	○	○
Integrated Project Delivery (IPD)	○	○	○	○	○	○
Design-Bid-Build	○	○	○	○	○	○
Construction Management	○	○	○	○	○	○

47. Please rank the following delivery methods by their UNIQUENESS (to flash-tracking) [1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

	1	2	3	4	5	6
Design-Build or Engineer-Procure-Construct (EPC)	○	○	○	○	○	○
Integrated Project Delivery (IPD)	○	○	○	○	○	○
Design-Bid-Build	○	○	○	○	○	○
Construction Management	○	○	○	○	○	○

48. Please rank the following delivery methods by the SUCCESS (industry has had in implimenting in flash-track projects) [1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

	1	2	3	4	5	6
Design-Build or Engineer-Procure-Construct (EPC)	○	○	○	○	○	○
Integrated Project Delivery (IPD)	○	○	○	○	○	○
Design-Bid-Build	○	○	○	○	○	○
Construction Management	○	○	○	○	○	○

49. In your experience are there other delivery method considerations that are important or distinguishing success factors in fast- or flash track projects?

Part III of IX, Organizational considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?

2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?

3. How SUCCESSFUL has the construction industry been in implementing this practice?

51. Engagement of operations & maintenance personnel in the development and design process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

52. Establishing a fully integrated project team including design, construction, specialty contractors, commissioning and operations personnel*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

53. Involving contractors, trades and vendors in the design phase*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

54. Using team building and partnering practices*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

55. Creating executive alignment amongst the contracted parties*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

56. Delegating authority to project level (maximize decision-making authority to the project level)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○

57. Empowering the project team (each organization led by an empowered leader)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

58. Having an owner with sufficient depth of resources and strength of organization*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

59. Staffing with experienced personnel with a high-level of technical competence*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

60. Staffing with "self-starters"*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

61. Selecting personnel with a "can do" attitude and willingness to tackle challenging tasks*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

62. Having an engaged and empowered Owner's Engineer (Owner's representative)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

63. Staffing with multi-skilled personnel*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

64. In your experience are there other organizational considerations that are important or distinguishing success factors in fast- or flash track projects?

Part IV of IX, Cultural Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?

2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?

3. How SUCCESSFUL has the construction industry been in implementing this practice?

66. Maintaining a strong customer focus (obligation to mitgate the client's cost and produce value)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

67. Accepting a new paradigm or mindset differing from that of traditional practices*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

68. Having a single empowered project champion*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

69. Having an active, involved and fully committed owner*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

70. Establishing flexible project teams that avoid rigid hierarchy*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

71. Maintaining a "no blame culture" and mutually supportive environment*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

72. Having open communication and transparency*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

73. Establishing a fully intergrated design team*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

74. Staffing with cooperative and collaborative personnel*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

75. Having an open minded team*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

76. Making collaborative decisions*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

77. Maintaining the commitments to common project goals*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

78. Establishing and maintaining trust within the project team*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

79. Maintaining positive, construcutive working relationships with a goal that parties would welcome the opportunity to work together in the future *

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

80. In your experience are there other cultural considerations that are important or distinguishing success factors in fast- or flash track projects?

Part V of IX, Planning Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?
2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?
3. How SUCCESSFUL has the construction industry been in implementing this practice?

82. Emphasizing coordination planning during the design process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

83. Performing exhaustive front end planning*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

84. Identifying and procuring long lead time items*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

85. Employing production philosophies for a continuous and relaible work flow*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

86. Developing look-ahead schedules that are highly focused on material and resource availability*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

87. Monitoring and driving corrective actions through the project controls process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

88. Employing the latest available planning, scheduling and project control tools*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

89. Monitoring and adapting to changing circumstances*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

90. Increasing resource levels for project control*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

91. Creating schedule-driven contingency plans (weather, equipment breakdowns, spare parts, etc....) *

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

92. Providing enough resources to critical path items*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

93. Developing an effective labor management plan*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

94. Employing Just-in-time deliveries *

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

95. Employing Pull scheduling and Last Planner system*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

96. In your experience are there other planning considerations that are important or distinguishing success factors in fast- or flash track projects?

Part VI of IX, Design Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?
2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?
3. How SUCCESSFUL has the construction industry been in implementing this practice?

98. Employing conservative designs to avoid design holds*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

99. Using standard repeatable designs and fewer design details*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

100. Stream-lining the design review process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

101. Encouraging increased levels of prefabrication, modularization*

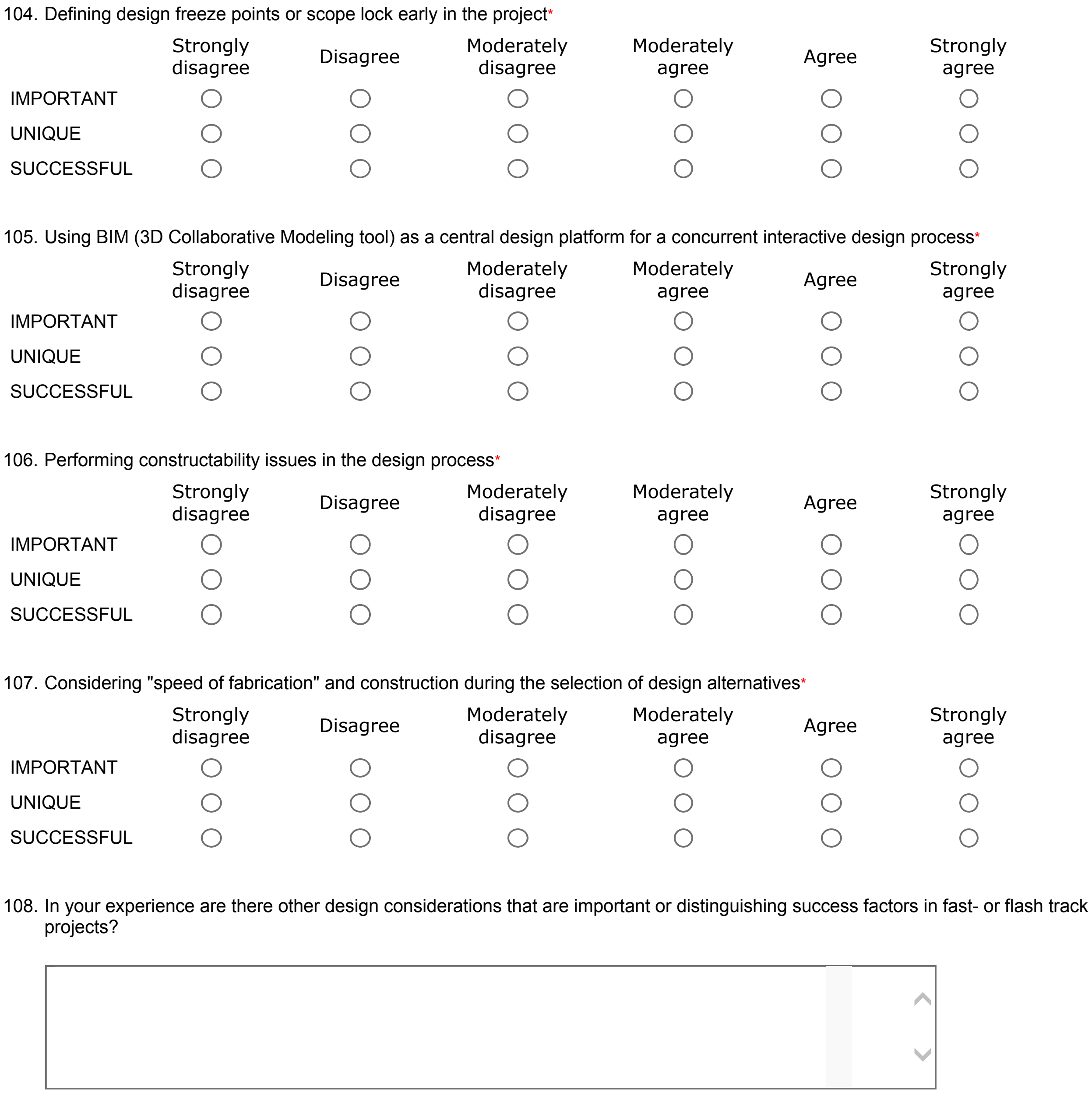
	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

102. Extensive use of physical mock ups*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

103. Establishing design criteria and standards at an early stage*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○



104. Defining design freeze points or scope lock early in the project*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

105. Using BIM (3D Collaborative Modeling tool) as a central design platform for a concurrent interactive design process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

106. Performing constructability issues in the design process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

107. Considering "speed of fabrication" and construction during the selection of design alternatives*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

108. In your experience are there other design considerations that are important or distinguishing success factors in fast- or flash track projects?

Part VII of IX, Execution Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?

2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?

3. How SUCCESSFUL has the construction industry been in implementing this practice?

110. Processing of change orders in a timely manner*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

111. Timely payments to contractors, subcontractors and suppliers*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

112. Co-location of project team (owner, designer, builder, and/or key vendors)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

113. Employing the latest, compatible software platforms*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

114. Employing BIM (3D Collaborative modeling) as a means for information sharing, visualization and coordination of the trades*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

115. Prioritizing design sequences/options to best support construction/ manufacturing schedules*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

116. Making timely and well informed decisions*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

117. Conducting timely and decision-focused progress and planning meetings*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

118. Simplifying approval procedures*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

119. Dedicating full-time personnel to the project*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

120. Settling public grievances in a timely manner*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

121. Employing Lean Construction practices*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

122. Improving work processes continually (continuous process improvements)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

123. Seeking provisional regulatory approvals*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

124. Selecting appropriate construction methods*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

125. Providing sufficient staging areas and site control*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

126. Minimizing hand-offs*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

127. Using well established project management processes*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

128. Securing contractor input to detailed design, estimates and schedules*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

129. Eliminating redundancy and duplication of support recources *

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

130. Eliminating redundancy and duplication of staff*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

131. Maintaining a commitment that safety will not be compromized in pursuit of schedule*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

132. Maintaining a commitment that quality will not be compromized in pursuit of schedule*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

133. In your experience are there other execution practices that are important or distinguishing success factors in fast- or flash track projects?

Part VIII of IX, Innovation Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?
2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?
3. How SUCCESSFUL has the construction industry been in implementing this practice?

135. **Employing innovative construction methods***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

136. **Employing innovative products***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

137. Employing innovative procurement practices*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

138. Seeking out suppliers and specialty contractors as a source for time saving innovations*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

139. We'd welcome any thoughts on innovative practices that may have been important or distinguishing success factors in your fast- or flash track project experience?

Part VIII of IX, Innovation Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?
2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?
3. How SUCCESSFUL has the construction industry been in implementing this practice?

135. **Employing innovative construction methods***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

136. **Employing innovative products***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

137. Employing innovative procurement practices*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

138. Seeking out suppliers and specialty contractors as a source for time saving innovations*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

139. We'd welcome any thoughts on innovative practices that may have been important or distinguishing success factors in your fast- or flash track project experience?

Part IX of IX, Risk Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. How IMPORTANT is this concept or method to successful implementation of a flash-track project?

2. How UNIQUE is this practice to Flash tracking (as opposed to being a typical best practice implemented in any non-Fast track project)?

3. How SUCCESSFUL has the construction industry been in implementing this practice?

141. Executing liability waivers among key project participants*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

142. Mitigating impacts of changes and design errors & omissions (effective reviews, timely identification, prompt actions)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

143. Employing a continual risk management process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

144. Assigning risks to the parties best able to control those risks*

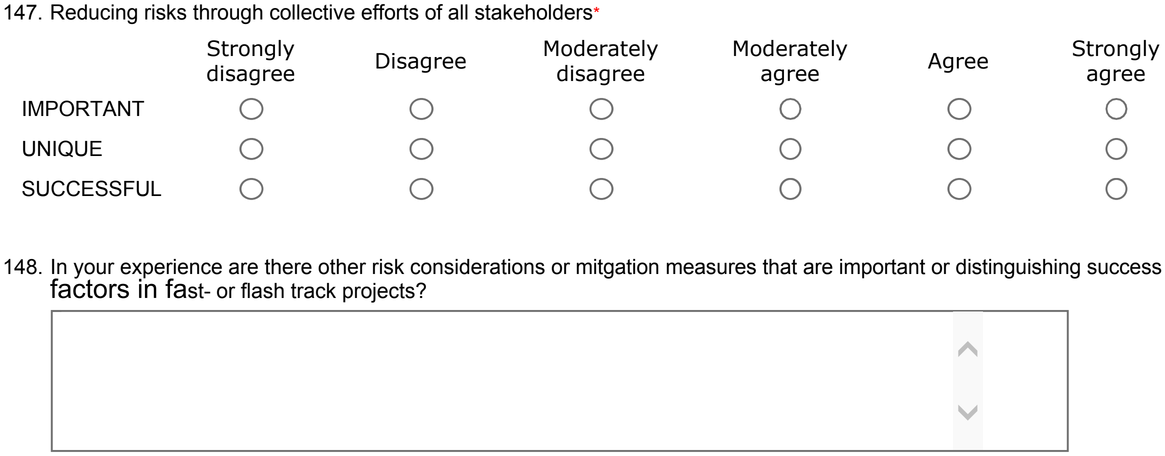
	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

145. Recognizing and managing the additional fast track risks*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○

146. Capping contractor's down-side risk*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○



147. Reducing risks through collective efforts of all stakeholders*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
IMPORTANT	○	○	○	○	○	○
UNIQUE	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

148. In your experience are there other risk considerations or mitgation measures that are important or distinguishing success factors in fast- or flash track projects?

Note: The survey software collectively numbers the demographic questions, points of relvancy (as phrased within the questions) and curiously skips a number at each category page. To arrive at the 118 points of relevancy in the Beta version of the survey:

Number of questions posted on this copy:	148
Less, 16 recorded as demographic questions	(10)
Less, numbering skips between the nine categories	(8)
Less, open ended questions in each of the nine catgories	(9)
Add, embedded points of relvancy for each contract type (multiple contract types in three questions)	3
Points of Relevancy:	**118**

Reseach Team 311: Beta test resuts, Round 0
Importance Mode= 5, SD ≤ 1 or Importance Mode= 6, SD < 2
Complete results

Importance scores (filtered)

									Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	I≥5	U>4	I & U	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
1	**Creating project-specific mutually equitable contracts**	5.800	6	OK	OK	OK	**6**	**0.400**	0%	0%	0%	0%	20%	80%	100%
2	**Explicitly designating the project as being "fast track"**	5.300	6	OK	OK	OK	**6**	**1.005**	0%	0%	10%	10%	20%	60%	80%
3	**Setting clear; specific scoping requirements**	5.700	6	OK	OK	OK	**6**	**0.640**	0%	0%	0%	10%	10%	80%	90%
4	**Establishing performance-based specifications**	4.600	5	-	OK	-	**5**	**1.114**	0%	10%	10%	0%	70%	10%	80%
5	**Tying performance incentives and rewards to project goals**	4.800	5	OK	OK	OK	**5**	**0.400**	0%	0%	0%	20%	80%	0%	80%
6	Including cancellation fees in all procurement contracts	4.400	4	-	OK	-	**4**	**0.800**	0%	0%	10%	50%	30%	10%	40%
7	**Having equitable shared risks and rewards**	5.400	5	OK	OK	OK	**5**	**0.490**	0%	0%	0%	0%	60%	40%	100%
8	**Aligning project participants' interests through contract**	5.300	5	OK	OK	OK	**5**	**0.458**	0%	0%	0%	0%	70%	30%	100%
9	**Establishing early completion bonuses**	5.100	5	OK	OK	OK	**5**	**0.539**	0%	0%	0%	10%	70%	20%	90%
10	Including an incentive bonus for no claims	4.200	4	-	OK	-	**4**	**0.748**	0%	0%	20%	40%	40%	0%	40%
11	**Employing performance incentives to promote a high performance culture**	4.800	5	OK	OK	OK	**5**	**0.400**	0%	0%	0%	20%	80%	0%	80%
12	**Establishing contract strategies specifically tailored to the project condition**	5.500	5.5	OK	OK	OK	**6**	**0.500**	0%	0%	0%	0%	50%	50%	100%
13	Employing Design Assist contracts	3.800	3	-	OK	-	**3**	**0.980**	0%	10%	30%	30%	30%	0%	30%
14	**Executing Single-source or no-bid contracts**	3.800	4	-	OK	-	**5**	**1.166**	0%	20%	20%	20%	40%	0%	40%
15	**Establishing clear change management procedures**	5.700	6	OK	<4		**6**	**0.458**	0%	0%	0%	0%	30%	70%	100%
16	**Establishing an effective claims resolution process**	5.200	5	OK	OK	OK	**6**	**0.748**	0%	0%	0%	20%	40%	40%	80%
17	**Funding early critical efforts**	5.500	6	OK	OK	OK	**6**	**0.671**	0%	0%	0%	10%	30%	60%	90%
18	**Please rank the following contract types by IMPORTANCE (to successful flash-tracking)**			OK	OK	OK									
18.1	**- Cost Plus or Reinbursible**	4.400	4.5	OK	<4		**5**	**0.917**	0%	0%	20%	30%	40%	10%	50%
18.2	- Fixed Price or Lump Sum	3.400	3.5	-	<4		**2**	**1.625**	10%	30%	10%	30%	0%	20%	20%
18.3	- Guaranteed Maximum Price	3.200	2.5	-	<4		**2**	**1.327**	0%	50%	10%	10%	30%	0%	30%
18.4	**- Cost Plus & Fixed Fee**	5.000	5	OK	OK	OK	**5**	**0.775**	0%	0%	0%	30%	40%	30%	70%
18.5	- Unit Price	3.300	2.5	-	<4		**2**	**1.676**	10%	40%	10%	0%	30%	10%	40%
19	**Selecting team members and staff based on their fast track experience or qualifications**	3.300	5	OK	OK	OK	**5**	**0.497**	0%	0%	0%	0%	56%	44%	100%
20	**Focusing procurement decisions on construction priorities**	5.556	6	OK	<4		**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
21	**Making timely selection and award contracts to subcontractors**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
22	**Selecting the best value contractor**	4.778	5	OK	OK	OK	**5**	**0.916**	0%	0%	11%	22%	44%	22%	67%
23	**Selecting preferred or alliance contractors**	5.111	5	OK	OK	OK	**6**	**0.875**	0%	0%	0%	33%	22%	44%	67%
24	Seeking a higher levels of self performance by prime contractors	4.444	5	-	OK	-	**5**	**1.423**	0%	22%	0%	11%	44%	22%	67%
25	**Staffing with personnel with strong leadership capabilities**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
26	Please rank the following delivery methods by IMPORTANCE (to successful flash-tracking)			OK	OK	OK									
26.1	- Design Build or EPC	5.111	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
26.2	- Integrated Project Delivery	4.667	5	-	OK	-	**5**	**1.054**	11%	11%	0%	11%	67%	11%	78%
26.3	- Design Bid Build	2.778	2	-	<4		**2**	**1.397**	11%	44%	22%	11%	0%	11%	11%
26.4	- Construction Management	3.000	3	-	<4		**3**	**0.943**	0%	33%	44%	11%	11%	0%	11%
27	**Engagement of operations & maintenance personnel in the development and design process**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
28	**Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
29	**Involving contractors; trades and vendors in the design phase**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
30	**Using team building and partnering practices**	5.111	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
31	**Creating executive alignment amongst the contracted parties**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
32	**Delegating authority to project level (maximize decision-making authority to the project level)**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
33	**Empowering the project team (each organization led by an empowered leader)**	5.333	5	OK	OK	OK	**5**	**0.471**	0%	0%	0%	0%	67%	33%	100%
34	**Having an owner with sufficient depth of resources and strength of organization**	4.778	5	OK	OK	OK	**5**	**0.629**	0%	0%	0%	33%	56%	11%	67%
35	Staffing with experienced personnel with a high-level of technical competence	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%

Reseach Team 311: Beta test resuts, Round 0
Importance Mode= 5, SD ≤ 1 or Importance Mode= 6, SD < 2 Items
Complete results

Importance scores (filtered)

									Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	I≥5	U>4	I & U	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
36	Staffing with self-starters	4.667	5	-	<4		**6**	**1.333**	0%	11%	11%	11%	33%	33%	67%
37	**Selecting personnel with a can do attitude and willingness to tackle challenging tasks**	5.000	5	OK	OK	OK	**5**	**0.667**	0%	0%	0%	22%	56%	22%	78%
38	**Having an engaged and empowered Owner's Engineer (Owner's representative)**	5.111	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
39	**Staffing with multi-skilled personnel**	4.889	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	22%	67%	11%	78%
40	Maintaining a strong customer focus (obligation to mitgate the client's cost and produce value)	4.889	5	OK	<4		**5**	**0.567**	0%	0%	0%	22%	67%	11%	78%
41	**Accepting a new paradigm or mindset differing from that of traditional practices**	5.111	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
42	Having a single empowered project champion	4.556	5	-	<4		**5**	**1.066**	0%	0%	22%	22%	33%	22%	56%
43	**Having an active; involved and fully committed owner**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
44	**Establishing flexible project teams that avoid rigid hierarchy**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
45	**Maintaining a no blame culture and mutually supportive environment**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
46	**Having open communication and transparency**	5.111	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
47	Establishing a fully intergrated design team	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
48	**Staffing with cooperative and collaborative personnel**	5.111	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
49	**Having an open minded team**	5.222	5	OK	OK	OK	**6**	**0.786**	0%	0%	0%	22%	33%	44%	78%
50	Making collaborative decisions	4.667	4	-	OK	-	**4**	**0.816**	0%	0%	0%	56%	22%	22%	44%
51	Maintaining the commitments to common project goals	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
52	Establishing and maintaining trust within the project team	5.444	6	OK	<4		**6**	**0.685**	11%	0%	0%	11%	33%	56%	89%
53	Maintaining positive; construcutive working relationships with a goal that parties would	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
54	**Emphasizing coordination planning during the design process**	5.222	5	OK	OK	OK	**5**	**0.629**	0%	0%	0%	11%	56%	33%	89%
55	**Performing exhaustive front end planning**	4.889	5	OK	OK	OK	**5**	**0.314**	0%	0%	0%	11%	89%	0%	89%
56	**Identifying and procuring long lead time items**	5.778	6	OK	OK	OK	**6**	**0.416**	0%	0%	0%	0%	22%	78%	100%
57	Employing production philosophies for a continuous and relaible work flow	5.111	5	OK	<4		**6**	**0.994**	0%	0%	11%	11%	33%	44%	78%
58	Developing look-ahead schedules that are highly focused on material and resource availability	5.667	6	OK	<4		**6**	**0.471**	0%	0%	0%	0%	33%	67%	100%
59	**Monitoring and driving corrective actions through the project controls process**	4.889	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	22%	67%	11%	78%
60	Employing the latest available planning; scheduling and project control tools	4.444	5	-	OK	-	**5**	**1.165**	0%	11%	11%	11%	56%	11%	67%
61	Monitoring and adapting to changing circumstances	5.222	5	OK	<4		**6**	**0.786**	0%	0%	0%	22%	33%	44%	78%
62	**Increasing resource levels for project control**	4.222	4	OK	OK	OK	**5**	**0.786**	0%	0%	22%	33%	44%	0%	44%
63	Creating schedule-driven contingency plans (weather; equipment breakdowns; spare parts;	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
64	**Providing enough resources to critical path items**	4.889	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	33%	44%	22%	67%
65	Developing an effective labor management plan	5.000	5	OK	<4		**5**	**0.471**	0%	0%	0%	11%	78%	11%	89%
66	Employing Just-in-time deliveries	3.889	4	-	<4		**3**	**0.875**	0%	0%	44%	22%	33%	0%	33%
67	Employing Pull scheduling and Last Planner system	4.667	5	-	OK	-	**4**	**0.667**	0%	0%	0%	44%	44%	11%	56%
68	**Employing conservative designs to avoid design holds**	4.889	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	33%	44%	22%	67%
69	**Using standard repeatable designs and fewer design details**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
70	**Stream-lining the design review process**	5.111	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
71	Encouraging increased levels of prefabrication; modularization	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
72	Extensive use of physical mock ups	3.556	3	-	<4		**3**	**1.165**	0%	11%	56%	11%	11%	11%	22%
73	Establishing design criteria and standards at an early stage	5.222	5	OK	<4		**5**	**0.629**	0%	0%	0%	11%	56%	33%	89%
74	Defining design freeze points or scope lock early in the project	5.556	6	OK	<4		**6**	**0.685**	0%	0%	0%	11%	22%	67%	89%
75	Using BIM (3D Collaborative Modeling tool) as a central design platform for a concurrent	4.667	5	OK	<4		**5**	**0.943**	0%	0%	11%	33%	33%	22%	56%
76	Performing constructability issues in the design process	5.667	6	OK	<4		**6**	**0.667**	0%	0%	0%	11%	11%	78%	89%
77	**Considering speed of fabrication and construction during the selection of design alternatives**	5.333	6	OK	OK	OK	**6**	**0.816**	0%	0%	0%	22%	22%	56%	78%
78	Processing of change orders in a timely manner	5.000	5	OK	<4		**5**	**0.471**	0%	0%	0%	11%	78%	11%	89%
79	Timely payments to contractors; subcontractors and suppliers	4.889	5	OK	<4		**5**	**0.737**	0%	0%	0%	33%	44%	22%	67%
80	**Co-location of project team (owner; designer; builder; and/or key vendors)**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
81	Employing the latest; compatible software platforms	4.111	4	OK	<4		**5**	**0.994**	0%	11%	11%	33%	44%	0%	44%
82	**Employing BIM (3D Collaborative modeling) as a means for information sharing; visualization**	4.222	4	-	<4		**4**	**0.629**	0%	0%	11%	56%	33%	0%	33%

Reseach Team 311: Beta test resuts, Round 0
Importance Mode= 5, SD ≤ 1 or Importance Mode= 6, SD < 2 It
Complete Results

Importance scores (filtered)

									Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	I≥5	U>4	I & U	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
83	Prioritizing design sequences/options to best support construction/manufacturing schedules	5.333	5	OK	OK	OK	**5**	**0.471**	0%	0%	0%	0%	67%	33%	100%
84	Making timely and well informed decisions	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
85	Conducting timely and decision-focused progress and planning meetings	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
86	**Simplifying approval procedures**	5.444	6	OK	OK	OK	**6**	**0.685**	0%	0%	0%	11%	33%	56%	89%
87	**Dedicating full-time personnel to the project**	5.333	6	OK	OK	OK	**6**	**0.816**	0%	0%	0%	22%	22%	56%	78%
88	Settling public grievances in a timely manner	5.000	5	OK	<4		**5**	**0.816**	0%	0%	0%	33%	33%	33%	67%
89	**Employing Lean Construction practices**	4.111	4	-	OK	-	**5**	**1.197**	0%	11%	22%	22%	33%	11%	44%
90	Improving work processes continually (continuous process improvements)	3.556	4	-	<4		**4**	**1.571**	11%	22%	11%	22%	22%	11%	33%
91	**Seeking provisional regulatory approvals**	5.111	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
92	**Selecting appropriate construction methods**	5.222	5	OK	OK	OK	**5**	**0.629**	0%	0%	0%	11%	56%	33%	89%
93	Providing sufficient staging areas and site control	5.111	5	OK	<4		**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
94	**Minimizing hand-offs**	5.000	5	OK	OK	OK	**5**	**0.667**	0%	0%	0%	22%	56%	22%	78%
95	Using well established project management processes	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
96	Securing contractor input to detailed design; estimates and schedules	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
97	Eliminating redundancy and duplication of support recources	5.000	5	OK	<4		**5**	**0.816**	0%	0%	11%	0%	67%	22%	89%
98	Eliminating redundancy and duplication of staff	4.444	4	-	<4		**4**	**0.831**	0%	0%	11%	44%	33%	11%	44%
99	Maintaining a commitment that safety will not be compromized in pursuit of schedule	5.667	6	OK	<4		**6**	**0.471**	0%	0%	0%	0%	33%	67%	100%
100	Maintaining a commitment that quality will not be compromized in pursuit of schedule	5.222	5	OK	<4		**6**	**0.786**	0%	0%	0%	22%	33%	44%	78%
101	**Employing innovative construction methods**	5.000	5	OK	OK	OK	**5**	**0.943**	0%	0%	11%	11%	44%	33%	78%
102	Employing innovative products	4.444	5	OK	<4		**5**	**0.956**	0%	0%	22%	22%	44%	11%	56%
103	**Employing innovative procurement practices**	5.000	5	OK	OK	OK	**5**	**0.816**	0%	0%	11%	0%	67%	22%	89%
104	**Seeking out suppliers and specialty contractors as a source for time saving innovations**	5.222	5	OK	OK	OK	**5**	**0.629**	0%	0%	0%	11%	56%	33%	89%
105	**Executing liability waivers among key project participants**	4.333	5	OK	OK	OK	**5**	**0.816**	0%	0%	22%	22%	56%	0%	56%
106	Mitigating impacts of changes and design errors & omissions (effective reviews; timely	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
107	Employing a continual risk management process	5.333	5	OK	<4		**5**	**0.471**	0%	0%	0%	0%	67%	33%	100%
108	Assigning risks to the parties best able to control those risks	5.556	6	OK	<4		**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
109	**Recognizing and managing the additional fast track risks**	5.222	6	OK	OK	OK	**6**	**1.030**	0%	0%	11%	11%	22%	56%	78%
110	**Capping contractor's down-side risk**	4.667	5	OK	OK	OK	**5**	**0.943**	0%	0%	11%	33%	33%	22%	56%
111	**Reducing risks through collective efforts of all stakeholders**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%

Items highlighted in green have been accepted (mode ≥5 and SD ≤ 1 or mode=6 and SD <2)
Standard deviations > 1 are highlighted in red, those <1 are in blue
Percentages in orange are the most commonly chosen responses (>25%)

Reseach Team 311: Beta test results, Round 0

Unique Mode= 5, SD < 1 or Unique Mode= 6, SD < 2

							Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	Accept	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
1	Creating project-specific mutually equitable contracts	4.400	4	OK	**4**	**0.800**	0%	0%	0%	80%	0%	20%	20%
2	Explicitly designating the project as being "fast track"	5.200	6	OK	**6**	**1.077**	0%	0%	10%	20%	10%	60%	70%
3	Setting clear; specific scoping requirements	3.400	3.5	OK	**4**	**0.663**	0%	10%	40%	50%	0%	0%	0%
4	Establishing performance-based specifications	3.600	4	OK	**4**	**0.917**	0%	20%	10%	60%	10%	0%	10%
5	Tying performance incentives and rewards to project goals	3.500	4	OK	**4**	**0.806**	0%	20%	10%	70%	0%	0%	0%
6	Including cancellation fees in all procurement contracts	3.100	3.5	OK	**4**	**0.943**	0%	40%	10%	50%	0%	0%	0%
7	Having equitable shared risks and rewards	4.200	4	OK	**4**	**1.077**	0%	10%	10%	40%	30%	10%	40%
8	Aligning project participants' interests through contract	4.200	4	OK	**4**	**0.872**	0%	0%	20%	50%	20%	10%	30%
9	Establishing early completion bonuses	3.600	4	OK	**4**	**1.020**	0%	20%	20%	40%	20%	0%	20%
10	Including an incentive bonus for no claims	3.700	4	OK	**4**	**0.640**	0%	0%	40%	50%	10%	0%	10%
11	Employing performance incentives to promote a high performance culture	4.000	4	OK	**4**	**0.775**	0%	10%	0%	70%	20%	0%	20%
12	Establishing contract strategies specifically tailored to the project condition	4.500	4.5	OK	**5**	**1.025**	0%	0%	20%	30%	30%	20%	50%
13	Employing Design Assist contracts	3.600	4	OK	**4**	**0.800**	0%	10%	30%	50%	10%	0%	10%
14	Executing Single-source or no-bid contracts	3.800	4	OK	**5**	**1.166**	0%	20%	20%	20%	40%	0%	40%
15	Establishing clear change management procedures	3.700	3.5	-	**2**	**1.487**	0%	30%	20%	20%	10%	20%	30%
16	Establishing an effective claims resolution process	3.900	4	OK	**4**	**1.375**	0%	20%	20%	30%	10%	20%	30%
17	Funding early critical efforts	4.500	5	OK	**6**	**1.565**	0%	20%	10%	10%	20%	40%	60%
18	Please rank the following contract types by their UNIQUENESS (to flash-tracking)			-									
18.1	- Cost Plus or Reinbursible	3.000	3	-	**2**	**1.183**	10%	30%	20%	30%	10%	0%	10%
18.2	- Fixed Price or Lump Sum	2.900	2.5	-	**2**	**1.446**	20%	30%	10%	20%	20%	0%	20%
18.3	- Guarateed Maximum Price	3.000	2.5	-	**2**	**1.342**	10%	40%	10%	20%	20%	0%	20%
18.4	- Cost Plus & Fixed Fee	3.300	3.5	OK	**4**	**1.345**	10%	20%	20%	40%	0%	10%	10%
18.5	- Unit Price	2.500	2	-	**2**	**1.118**	10%	60%	10%	10%	10%	0%	10%
19	Selecting team members and staff based on their fast track experience or qualifications	4.778	5	OK	**5**	**1.133**	0%	11%	0%	11%	56%	22%	78%
20	Focusing procurement decisions on construction priorities	4.000	5	-	**2**	**1.633**	0%	33%	11%	0%	33%	22%	56%
21	Making timely selection and award contracts to subcontractors	4.000	4	OK	**5**	**1.333**	0%	22%	11%	22%	33%	11%	44%
22	Selecting the best value contractor	4.000	4	OK	**4**	**1.414**	0%	22%	11%	33%	11%	22%	33%
23	Selecting preferred or alliance contractors	4.667	5	OK	**4**	**0.943**	0%	0%	11%	33%	33%	22%	56%
24	Seeking a higher levels of self performance by prime contractors	3.444	4	OK	**4**	**1.165**	0%	33%	11%	33%	22%	0%	22%
25	Staffing with personnel with strong leadership capabilities	3.778	4	OK	**4**	**1.030**	0%	11%	22%	56%	0%	11%	11%
26	Please rank the following delivery methods by their UNIQUENESS (to flash-tracking)			-									
26.1	- Design Build or EPC	3.778	4	OK	**5**	**1.397**	11%	11%	11%	22%	44%	0%	44%
26.2	- Integrated Project Delivery	4.000	4	OK	**5**	**1.333**	0%	22%	11%	22%	33%	11%	44%
26.3	- Design Bid Build	2.778	2	-	**2**	**1.030**	0%	56%	22%	11%	11%	0%	11%
26.4	- Construction Management	2.556	2	-	**2**	**0.956**	11%	44%	22%	22%	0%	0%	0%
27	Engagement of operations & maintenance personnel in the development and design process	3.333	4	OK	**4**	**1.054**	0%	33%	11%	44%	11%	0%	11%
28	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	4.444	5	OK	**5**	**1.257**	0%	11%	11%	22%	33%	22%	56%
29	Involving contractors; trades and vendors in the design phase	4.222	4	OK	**4**	**1.030**	0%	11%	0%	56%	22%	11%	33%

Reseach Team 311: Beta test results, Round 0

Unique Mode= 5, SD < 1 or Unique Mode= 6, SD < 2

Delphi Beta Test – Questionnaire and Results

							Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	Accept	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
30	Using team building and partnering practices	3.556	4	OK	**4**	**1.066**	0%	22%	22%	33%	22%	0%	22%
31	Creating executive alignment amongst the contracted parties	4.111	4	OK	**4**	**0.875**	0%	0%	22%	56%	11%	11%	22%
32	Delegating authority to project level (maximize decision-making authority to the project level)	4.556	4	OK	**4**	**0.956**	0%	0%	11%	44%	22%	22%	44%
33	Empowering the project team (each organization led by an empowered leader)	4.444	4	OK	**4**	**1.165**	0%	11%	0%	44%	22%	22%	44%
34	Having an owner with sufficient depth of resources and strength of organization	4.000	4	OK	**4**	**1.054**	0%	11%	11%	56%	11%	11%	22%
35	Staffing with experienced personnel with a high-level of technical competence	3.667	4	-	**2**	**1.414**	0%	33%	11%	22%	22%	11%	33%
36	Staffing with self-starters	3.222	3	-	**3**	**0.916**	0%	22%	44%	22%	11%	0%	11%
37	Selecting personnel with a can do attitude and willingness to tackle challenging tasks	3.889	4	OK	**4**	**1.523**	0%	33%	0%	33%	11%	22%	33%
38	Having an engaged and empowered Owner's Engineer (Owner's representative)	3.556	4	OK	**4**	**1.066**	0%	22%	22%	33%	22%	0%	22%
39	Staffing with multi-skilled personnel	3.778	4	OK	**5**	**1.227**	0%	22%	22%	11%	44%	0%	44%
40	Maintaining a strong customer focus (obligation to mitgate the client's cost and produce value)	3.667	4	-	**3**	**0.667**	0%	0%	44%	44%	11%	0%	11%
41	Accepting a new paradigm or mindset differing from that of traditional practices	4.667	5	OK	**5**	**0.943**	0%	0%	11%	33%	33%	22%	56%
42	Having a single empowered project champion	3.778	4	-	**3**	**0.786**	0%	0%	44%	33%	22%	0%	22%
43	Having an active; involved and fully committed owner	3.667	4	OK	**4**	**1.247**	0%	22%	22%	33%	11%	11%	22%
44	Establishing flexible project teams that avoid rigid hierarchy	4.667	4	OK	**4**	**1.054**	0%	0%	11%	44%	11%	33%	44%
45	Maintaining a no blame culture and mutually supportive environment	4.444	4	OK	**4**	**0.956**	0%	0%	11%	56%	11%	22%	33%
46	Having open communication and transparency	4.111	4	OK	**4**	**1.100**	0%	0%	33%	44%	0%	22%	22%
47	Establishing a fully intergrated design team	3.667	4	-	**2**	**1.633**	0%	44%	0%	22%	11%	22%	33%
48	Staffing with cooperative and collaborative personnel	4.111	4	OK	**5**	**1.449**	0%	22%	11%	22%	22%	22%	44%
49	Having an open minded team	4.222	4	OK	**6**	**1.315**	0%	11%	22%	22%	22%	22%	44%
50	Making collaborative decisions	3.111	3	OK	**4**	**0.875**	0%	33%	22%	44%	0%	0%	0%
51	Maintaining the commitments to common project goals	3.222	3	-	**2**	**1.227**	0%	44%	11%	22%	22%	0%	22%
52	Establishing and maintaining trust within the project team	3.556	3	-	**3**	**1.257**	0%	22%	33%	22%	11%	11%	22%
53	Maintaining positive; construcutive working relationships with a goal that parties would	3.556	3	-	**3**	**1.257**	0%	22%	33%	22%	11%	11%	22%
54	Emphasizing coordination planning during the design process	3.667	4	OK	**5**	**1.491**	11%	11%	22%	22%	22%	11%	33%
55	Performing exhaustive front end planning	3.889	5	OK	**5**	**1.370**	11%	0%	33%	0%	56%	0%	56%
56	Identifying and procuring long lead time items	3.889	5	OK	**5**	**1.792**	11%	22%	11%	0%	33%	22%	56%
57	Employing production philosophies for a continuous and relaible work flow	4.111	4	-	**3**	**1.370**	0%	11%	33%	11%	22%	22%	44%
58	Developing look-ahead schedules that are highly focused on material and resource availability	3.556	3	-	**2**	**1.707**	11%	22%	22%	11%	11%	22%	33%
59	Monitoring and driving corrective actions through the project controls process	3.222	4	OK	**4**	**1.227**	11%	22%	11%	44%	11%	0%	11%
60	Employing the latest available planning; scheduling and project control tools	3.222	4	OK	**4**	**1.227**	11%	22%	11%	44%	11%	0%	11%
61	Monitoring and adapting to changing circumstances	3.556	3	-	**3**	**1.707**	11%	22%	22%	11%	11%	22%	33%
62	Increasing resource levels for project control	3.444	4	OK	**4**	**0.956**	0%	22%	22%	44%	11%	0%	11%
63	Creating schedule-driven contingency plans (weather; equipment breakdowns; spare parts;	3.333	3	-	**2**	**1.155**	0%	33%	22%	22%	22%	0%	22%
64	Providing enough resources to critical path items	3.556	4	OK	**4**	**1.066**	0%	22%	22%	33%	22%	0%	22%
65	Developing an effective labor management plan	3.222	3	-	**2**	**1.030**	0%	33%	22%	33%	11%	0%	11%
66	Employing Just-in-time deliveries	3.222	3	-	**2**	**1.133**	0%	33%	33%	11%	22%	0%	22%
67	Employing Pull scheduling and Last Planner system	4.222	4	OK	**4**	**1.133**	0%	11%	11%	33%	33%	11%	44%
68	Employing conservative designs to avoid design holds	4.333	5	OK	**5**	**1.155**	0%	11%	11%	22%	44%	11%	56%
69	Using standard repeatable designs and fewer design details	4.444	5	OK	**5**	**1.343**	0%	11%	22%	0%	44%	22%	67%

Reseach Team 311: Beta test results, Round 0

Unique Mode= 5, SD < 1 or Unique Mode= 6, SD < 2

							Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	Accept	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
70	Stream-lining the design review process	4.333	5	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
71	Encouraging increased levels of prefabrication; modularization	3.889	4	-	**2**	**1.449**	0%	22%	22%	22%	11%	22%	33%
72	Extensive use of physical mock ups	3.667	3	-	**3**	**1.155**	0%	11%	44%	22%	11%	11%	22%
73	Establishing design criteria and standards at an early stage	3.667	3	-	**2**	**1.563**	0%	33%	22%	11%	11%	22%	33%
74	Defining design freeze points or scope lock early in the project	3.889	3	-	**3**	**1.523**	0%	22%	33%	0%	22%	22%	44%
75	Using BIM (3D Collaborative Modeling tool) as a central design platform for a concurrent	3.778	4	-	**3**	**1.133**	0%	11%	33%	33%	11%	11%	22%
76	Performing constructability issues in the design process	3.222	3	-	**2**	**1.227**	0%	33%	33%	22%	0%	11%	11%
77	Considering speed of fabrication and construction during the selection of design alternatives	4.222	5	OK	**6**	**1.618**	0%	22%	22%	0%	22%	33%	56%
78	Processing of change orders in a timely manner	3.111	2	-	**2**	**1.370**	0%	56%	0%	33%	0%	11%	11%
79	Timely payments to contractors; subcontractors and suppliers	2.667	2	-	**2**	**1.054**	11%	44%	11%	33%	0%	0%	0%
80	Co-location of project team (owner; designer; builder; and/or key vendors)	4.333	4	OK	**4**	**1.247**	0%	11%	11%	33%	22%	22%	44%
81	Employing the latest; compatible software platforms	3.000	3	-	**3**	**0.816**	0%	33%	33%	33%	0%	0%	0%
82	Employing BIM (3D Collaborative modeling) as a means for information sharing; visualization	3.444	3	-	**3**	**1.066**	0%	22%	33%	22%	22%	0%	22%
83	Prioritizing design sequences/options to best support construction/manufacturing schedules	4.222	4	OK	**4**	**1.397**	0%	22%	0%	33%	22%	22%	44%
84	Making timely and well informed decisions	3.556	4	-	**2**	**1.499**	0%	44%	0%	22%	22%	11%	33%
85	Conducting timely and decision-focused progress and planning meetings	3.222	3	-	**2**	**1.315**	0%	44%	11%	33%	0%	11%	11%
86	Simplifying approval procedures	4.667	4	OK	**4**	**1.054**	0%	0%	11%	44%	11%	33%	44%
87	Dedicating full-time personnel to the project	3.556	4	OK	**5**	**1.571**	11%	22%	11%	22%	22%	11%	33%
88	Settling public grievances in a timely manner	3.000	3	-	**3**	**1.054**	0%	44%	22%	22%	11%	0%	11%
89	Employing Lean Construction practices	3.556	3	OK	**5**	**1.343**	0%	33%	22%	0%	44%	0%	44%
90	Improving work processes continually (continuous process improvements)	3.000	3	-	**3**	**0.943**	0%	44%	11%	44%	0%	0%	0%
91	Seeking provisional regulatory approvals	4.111	4	OK	**5**	**1.286**	0%	22%	0%	33%	33%	11%	44%
92	Selecting appropriate construction methods	3.667	4	OK	**6**	**1.700**	11%	22%	11%	22%	11%	22%	33%
93	Providing sufficient staging areas and site control	3.556	4	-	**2**	**1.571**	0%	44%	0%	33%	0%	22%	22%
94	Minimizing hand-offs	4.000	4	OK	**4**	**1.247**	0%	22%	0%	44%	22%	11%	33%
95	Using well established project management processes	2.667	2	-	**2**	**1.054**	11%	44%	11%	33%	0%	0%	0%
96	Securing contractor input to detailed design; estimates and schedules	3.667	4	-	**2**	**1.414**	0%	33%	11%	22%	22%	11%	33%
97	Eliminating redundancy and duplication of support recources	3.111	3	-	**2**	**1.100**	0%	44%	11%	33%	11%	0%	11%
98	Eliminating redundancy and duplication of staff	3.000	3	-	**2**	**0.943**	0%	44%	11%	44%	0%	0%	0%
99	Maintaining a commitment that safety will not be compromized in pursuit of schedule	2.889	2	-	**2**	**1.663**	22%	33%	11%	11%	11%	11%	22%
100	Maintaining a commitment that quality will not be compromized in pursuit of schedule	3.444	3	-	**2**	**1.343**	0%	33%	22%	22%	11%	11%	22%
101	Employing innovative construction methods	4.000	4	OK	**5**	**1.054**	0%	11%	22%	22%	44%	0%	44%
102	Employing innovative products	3.333	3	-	**3**	**1.054**	0%	22%	44%	11%	22%	0%	22%
103	Employing innovative procurement practices	4.111	4	OK	**5**	**1.286**	0%	22%	0%	33%	33%	11%	44%
104	Seeking out suppliers and specialty contractors as a source for time saving innovations	4.222	5	OK	**5**	**1.030**	0%	11%	11%	22%	56%	0%	56%
105	Executing liability waivers among key project participants	4.111	4	OK	**4**	**0.875**	0%	11%	0%	56%	33%	0%	33%
106	Mitigating impacts of changes and design errors & omissions (effective reviews; timely identification; prompt actions)	3.333	3	-	**2**	**1.414**	0%	44%	11%	22%	11%	11%	22%
107	Employing a continual risk management process	3.444	4	-	**2**	**1.165**	0%	33%	11%	33%	22%	0%	22%
108	Assigning risks to the parties best able to control those risks	3.667	4	-	**2**	**1.563**	0%	44%	0%	11%	33%	11%	44%
109	Recognizing and managing the additional fast track risks	5.222	5	OK	**6**	**0.786**	0%	0%	0%	22%	33%	44%	78%

Reseach Team 311: Beta test results, Round 0

Unique Mode= 5, SD < 1 or Unique Mode= 6, SD < 2

							Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	Accept	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
110	Capping contractor's down-side risk	3.667	4	OK	**4**	**1.054**	0%	22%	11%	44%	22%	0%	22%
111	Reducing risks through collective efforts of all stakeholders	3.889	4	OK	**4**	**0.875**	0%	11%	11%	56%	22%	0%	22%

Reseach Team 311: Beta test resuts, Round 0

Importance Mode= 5, SD ≤ 1 or Importance Mode= 6, SD < 2

Items Resolved to be included in Round 1 of the the Delphi Process

Importance scores (filtered)

									Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	I≥5	U>4	I & U	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
1	**Creating project-specific mutually equitable contracts**	5.800	6	OK	OK	OK	**6**	**0.400**	0%	0%	0%	0%	20%	80%	100%
2	**Explicitly designating the project as being "fast track"**	5.300	6	OK	OK	OK	**6**	**1.005**	0%	0%	10%	10%	20%	60%	80%
3	**Setting clear; specific scoping requirements**	5.700	6	OK	OK	OK	**6**	**0.640**	0%	0%	0%	10%	10%	80%	90%
4	**Establishing performance-based specifications**	4.600	5	-	OK	-	**5**	**1.114**	0%	10%	10%	0%	70%	10%	80%
5	**Tying performance incentives and rewards to project goals**	4.800	5	OK	OK	OK	**5**	**0.400**	0%	0%	0%	20%	80%	0%	80%
7	**Having equitable shared risks and rewards**	5.400	5	OK	OK	OK	**5**	**0.490**	0%	0%	0%	0%	60%	40%	100%
8	**Aligning project participants' interests through contract**	5.300	5	OK	OK	OK	**5**	**0.458**	0%	0%	0%	0%	70%	30%	100%
9	**Establishing early completion bonuses**	5.100	5	OK	OK	OK	**5**	**0.539**	0%	0%	0%	10%	70%	20%	90%
11	**Employing performance incentives to promote a high performance culture**	4.800	5	OK	OK	OK	**5**	**0.400**	0%	0%	0%	20%	80%	0%	80%
12	**Establishing contract strategies specifically tailored to the project condition**	5.500	5.5	OK	OK	OK	**6**	**0.500**	0%	0%	0%	0%	50%	50%	100%
14	**Executing Single-source or no-bid contracts**	3.800	4	-	OK	-	**5**	**1.166**	0%	20%	20%	20%	40%	0%	40%
15	**Establishing clear change management procedures**	5.700	6	OK	<4		**6**	**0.458**	0%	0%	0%	0%	30%	70%	100%
16	**Establishing an effective claims resolution process**	5.200	5	OK	OK	OK	**6**	**0.748**	0%	0%	0%	20%	40%	40%	80%
17	**Funding early critical efforts**	5.500	6	OK	OK	OK	**6**	**0.671**	0%	0%	0%	10%	30%	60%	90%
18	**Please rank the following contract types by IMPORTANCE (to successful flash-tracking)**			OK	OK	OK									
18.1	**- Cost Plus or Reinbursible**	4.400	4.5	OK	<4		**5**	**0.917**	0%	0%	20%	30%	40%	10%	50%
18.4	**- Cost Plus & Fixed Fee**	5.000	5	OK	OK	OK	**5**	**0.775**	0%	0%	0%	30%	40%	30%	70%
19	**Selecting team members and staff based on their fast track experience or qualifications**	3.300	5	OK	OK	OK	**5**	**0.497**	0%	0%	0%	0%	56%	44%	100%
20	**Focusing procurement decisions on construction priorities**	5.556	6	OK	<4		**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
21	**Making timely selection and award contracts to subcontractors**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
22	**Selecting the best value contractor**	4.778	5	OK	OK	OK	**5**	**0.916**	0%	0%	11%	22%	44%	22%	67%
23	**Selecting preferred or alliance contractors**	5.111	5	OK	OK	OK	**6**	**0.875**	0%	0%	0%	33%	22%	44%	67%
25	**Staffing with personnel with strong leadership capabilities**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
26.2	- Integrated Project Delivery	4.667	5	-	OK	-	**5**	**1.054**	11%	11%	0%	11%	67%	11%	78%
27	**Engagement of operations & maintenance personnel in the development and design process**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
28	**Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
29	**Involving contractors; trades and vendors in the design phase**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
30	**Using team building and partnering practices**	5.111	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
31	**Creating executive alignment amongst the contracted parties**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
32	**Delegating authority to project level (maximize decision-making authority to the project level)**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
33	**Empowering the project team (each organization led by an empowered leader)**	5.333	5	OK	OK	OK	**5**	**0.471**	0%	0%	0%	0%	67%	33%	100%
34	**Having an owner with sufficient depth of resources and strength of organization**	4.778	5	OK	OK	OK	**5**	**0.629**	0%	0%	0%	33%	56%	11%	67%
37	**Selecting personnel with a can do attitude and willingness to tackle challenging tasks**	5.000	5	OK	OK	OK	**5**	**0.667**	0%	0%	0%	22%	56%	22%	78%
38	**Having an engaged and empowered Owner's Engineer (Owner's representative)**	5.111	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
39	**Staffing with multi-skilled personnel**	4.889	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	22%	67%	11%	78%
41	**Accepting a new paradigm or mindset differing from that of traditional practices**	5.111	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
43	**Having an active; involved and fully committed owner**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
44	**Establishing flexible project teams that avoid rigid hierarchy**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
45	**Maintaining a no blame culture and mutually supportive environment**	5.556	6	OK	OK	OK	**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%
46	**Having open communication and transparency**	5.111	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
48	**Staffing with cooperative and collaborative personnel**	5.111	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
49	**Having an open minded team**	5.222	5	OK	OK	OK	**6**	**0.786**	0%	0%	0%	22%	33%	44%	78%
54	**Emphasizing coordination planning during the design process**	5.222	5	OK	OK	OK	**5**	**0.629**	0%	0%	0%	11%	56%	33%	89%
55	**Performing exhaustive front end planning**	4.889	5	OK	OK	OK	**5**	**0.314**	0%	0%	0%	11%	89%	0%	89%
56	**Identifying and procuring long lead time items**	5.778	6	OK	OK	OK	**6**	**0.416**	0%	0%	0%	0%	22%	78%	100%

Reseach Team 311: Beta test resuts, Round 0

Importance Mode= 5, SD ≤ 1 or Importance Mode= 6, SD < 2

Items Resolved to be included in Round 1 of the the Delphi Process

Importance scores (filtered)

									Strongly Disagree	Disagree	Moderately Disagree	Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	I≥5	U>4	I & U	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
59	**Monitoring and driving corrective actions through the project controls process**	4.889	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	22%	67%	11%	78%
62	**Increasing resource levels for project control**	4.222	4	OK	OK	OK	**5**	**0.786**	0%	0%	22%	33%	44%	0%	44%
64	**Providing enough resources to critical path items**	4.889	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	33%	44%	22%	67%
68	**Employing conservative designs to avoid design holds**	4.889	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	33%	44%	22%	67%
69	**Using standard repeatable designs and fewer design details**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
70	**Stream-lining the design review process**	5.111	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
77	**Considering speed of fabrication and construction during the selection of design alternatives**	5.333	6	OK	OK	OK	**6**	**0.816**	0%	0%	0%	22%	22%	56%	78%
80	**Co-location of project team (owner; designer; builder; and/or key vendors)**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
82	**Employing BIM (3D Collaborative modeling) as a means for information sharing; visualization**	4.222	4	-	<4		**4**	**0.629**	0%	0%	11%	56%	33%	0%	33%
86	**Simplifying approval procedures**	5.444	6	OK	OK	OK	**6**	**0.685**	0%	0%	0%	11%	33%	56%	89%
87	**Dedicating full-time personnel to the project**	5.333	6	OK	OK	OK	**6**	**0.816**	0%	0%	0%	22%	22%	56%	78%
89	**Employing Lean Construction practices**	4.111	4	-	OK	-	**5**	**1.197**	0%	11%	22%	22%	33%	11%	44%
91	**Seeking provisional regulatory approvals**	5.111	5	OK	OK	OK	**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
92	**Selecting appropriate construction methods**	5.222	5	OK	OK	OK	**5**	**0.629**	0%	0%	0%	11%	56%	33%	89%
94	**Minimizing hand-offs**	5.000	5	OK	OK	OK	**5**	**0.667**	0%	0%	0%	22%	56%	22%	78%
101	**Employing innovative construction methods**	5.000	5	OK	OK	OK	**5**	**0.943**	0%	0%	11%	11%	44%	33%	78%
103	**Employing innovative procurement practices**	5.000	5	OK	OK	OK	**5**	**0.816**	0%	0%	11%	0%	67%	22%	89%
104	**Seeking out suppliers and specialty contractors as a source for time saving innovations**	5.222	5	OK	OK	OK	**5**	**0.629**	0%	0%	0%	11%	56%	33%	89%
105	**Executing liability waivers among key project participants**	4.333	5	OK	OK	OK	**5**	**0.816**	0%	0%	22%	22%	56%	0%	56%
109	**Recognizing and managing the additional fast track risks**	5.222	6	OK	OK	OK	**6**	**1.030**	0%	0%	11%	11%	22%	56%	78%
110	**Capping contractor's down-side risk**	4.667	5	OK	OK	OK	**5**	**0.943**	0%	0%	11%	33%	33%	22%	56%
111	**Reducing risks through collective efforts of all stakeholders**	5.333	5	OK	OK	OK	**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%

Items highlighted in green have been accepted (mode ≥5 and SD ≤ 1 or mode=6 and SD <2)
Standard deviations > 1 are highlighted in red, those <1 are in blue
Percentages in orange are the most commonly chosen responses (>25%)

Reseach Team 311: Beta test resuts, Round 0
Importance Mode= 5, SD ≤ 1 or Importance Mode= 6, SD < 2 Items
Resolved to not be included in Round 1 of the the Delphi Process

Delphi Beta Test – Questionnaire and Results

Importance scores (filtered)

Issue #	Question	Mean	Median	I≥5	U>4	I & U	Mode	Standard Deviation	Strongly Moderately Disagree	Disagree	Moderately Disagree	Agree	Agree	Strongly Agree	
									1	2	3	4	5	6	Agreement (agree + strongly agree)
6	Including cancellation fees in all procurement contracts	4.400	4	-	OK	-	**4**	**0.800**	0%	0%	10%	50%	30%	10%	40%
10	Including an incentive bonus for no claims	4.200	4	-	OK	-	**4**	**0.748**	0%	0%	20%	40%	40%	0%	40%
13	Employing Design Assist contracts	3.800	3	-	OK	-	**3**	**0.980**	0%	10%	30%	30%	30%	0%	30%
18	Please rank the following contract types by IMPORTANCE (to successful flash-tracking)														
18.2	- Fixed Price or Lump Sum	3.400	3.5	-	<4		**2**	**1.625**	10%	30%	10%	30%	0%	20%	20%
18.3	- Guaranteed Maximum Price	3.200	2.5	-	<4		**2**	**1.327**	0%	50%	10%	10%	30%	0%	30%
18.5	- Unit Price	3.300	2.5	-	<4		**2**	**1.676**	10%	40%	10%	0%	30%	10%	40%
24	Seeking a higher levels of self performance by prime contractors	4.444	5	-	OK	-	**5**	**1.423**	0%	22%	0%	11%	44%	22%	67%
26	Please rank the following delivery methods by IMPORTANCE (to successful flash-tracking)			OK	OK	OK									
26.1	- Design Build or EPC	5.111	5	OK	OK	OK	**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
26.3	- Design Bid Build	2.778	2	-	<4		**2**	**1.397**	11%	44%	22%	11%	0%	11%	11%
26.4	- Construction Management	3.000	3	-	<4		**3**	**0.943**	0%	33%	44%	11%	11%	0%	11%
35	Staffing with experienced personnel with a high-level of technical competence	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
36	Staffing with self-starters	4.667	5	-	<4		**6**	**1.333**	0%	11%	11%	11%	33%	33%	67%
40	Maintaining a strong customer focus (obligation to mitgate the client's cost and produce value)	4.889	5	OK	<4		**5**	**0.567**	0%	0%	0%	22%	67%	11%	78%
42	Having a single empowered project champion	4.556	5	-	<4		**5**	**1.066**	0%	0%	22%	22%	33%	22%	56%
47	Establishing a fully intergrated design team	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
50	Making collaborative decisions	4.667	4	-	OK	-	**4**	**0.816**	0%	0%	0%	56%	22%	22%	44%
51	Maintaining the commitments to common project goals	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
52	Establishing and maintaining trust within the project team	5.444	6	OK	<4		**6**	**0.685**	11%	0%	0%	11%	33%	56%	89%
53	Maintaining positive; construcutive working relationships with a goal that parties would	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
57	Employing production philosophies for a continuous and relaible work flow	5.111	5	OK	<4		**6**	**0.994**	0%	0%	11%	11%	33%	44%	78%
58	Developing look-ahead schedules that are highly focused on material and resource availability	5.667	6	OK	<4		**6**	**0.471**	0%	0%	0%	0%	33%	67%	100%
60	Employing the latest available planning; scheduling and project control tools	4.444	5	-	OK	-	**5**	**1.165**	0%	11%	11%	11%	56%	11%	67%
61	Monitoring and adapting to changing circumstances	5.222	5	OK	<4		**6**	**0.786**	0%	0%	0%	22%	33%	44%	78%
63	Creating schedule-driven contingency plans (weather; equipment breakdowns; spare parts;	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
65	Developing an effective labor management plan	5.000	5	OK	<4		**5**	**0.471**	0%	0%	0%	11%	78%	11%	89%
66	Employing Just-in-time deliveries	3.889	4	-	<4		**3**	**0.875**	0%	0%	44%	22%	33%	0%	33%
67	Employing Pull scheduling and Last Planner system	4.667	5	-	OK	-	**4**	**0.667**	0%	0%	0%	44%	44%	11%	56%
71	Encouraging increased levels of prefabrication; modularization	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
72	Extensive use of physical mock ups	3.556	3	-	<4		**3**	**1.165**	0%	11%	56%	11%	11%	11%	22%
73	Establishing design criteria and standards at an early stage	5.222	5	OK	<4		**5**	**0.629**	0%	0%	0%	11%	56%	33%	89%
74	Defining design freeze points or scope lock early in the project	5.556	6	OK	<4		**6**	**0.685**	0%	0%	0%	11%	22%	67%	89%
75	Using BIM (3D Collaborative Modeling tool) as a central design platform for a concurrent	4.667	5	OK	<4		**5**	**0.943**	0%	0%	11%	33%	33%	22%	56%
76	Performing constructability issues in the design process	5.667	6	OK	<4		**6**	**0.667**	0%	0%	0%	11%	11%	78%	89%
78	Processing of change orders in a timely manner	5.000	5	OK	<4		**5**	**0.471**	0%	0%	0%	11%	78%	11%	89%
79	Timely payments to contractors; subcontractors and suppliers	4.889	5	OK	<4		**5**	**0.737**	0%	0%	0%	33%	44%	22%	67%
81	Employing the latest; compatible software platforms	4.111	4	OK	<4		**5**	**0.994**	0%	11%	11%	33%	44%	0%	44%
83	Prioritizing design sequences/options to best support construction/manufacturing schedules	5.333	5	OK	OK	OK	**5**	**0.471**	0%	0%	0%	0%	67%	33%	100%
84	Making timely and well informed decisions	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
85	Conducting timely and decision-focused progress and planning meetings	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%
88	Settling public grievances in a timely manner	5.000	5	OK	<4		**5**	**0.816**	0%	0%	0%	33%	33%	33%	67%
90	Improving work processes continually (continuous process improvements)	3.556	4	-	<4		**4**	**1.571**	11%	22%	11%	22%	22%	11%	33%
93	Providing sufficient staging areas and site control	5.111	5	OK	<4		**5**	**0.567**	0%	0%	0%	11%	67%	22%	89%
95	Using well established project management processes	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
96	Securing contractor input to detailed design; estimates and schedules	5.333	5	OK	<4		**6**	**0.667**	0%	0%	0%	11%	44%	44%	89%

Reseach Team 311: Beta test resuts, Round 0
Importance Mode= 5, SD ≤ 1 or Importance Mode= 6, SD < 2 Items
Resolved to <u>not</u> be included in Round 1 of the the Delphi Process

Delphi Beta Test – Questionnaire and Results

Importance scores (filtered)

									Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	I≥5	U>4	I & U	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
97	Eliminating redundancy and duplication of support recources	5.000	5	OK	<4		**5**	**0.816**	0%	0%	11%	0%	67%	22%	89%
98	Eliminating redundancy and duplication of staff	4.444	4	-	<4		**4**	**0.831**	0%	0%	11%	44%	33%	11%	44%
99	Maintaining a commitment that safety will not be compromized in pursuit of schedule	5.667	6	OK	<4		**6**	**0.471**	0%	0%	0%	0%	33%	67%	100%
100	Maintaining a commitment that quality will not be compromized in pursuit of schedule	5.222	5	OK	<4		**6**	**0.786**	0%	0%	0%	22%	33%	44%	78%
102	Employing innovative products	4.444	5	OK	<4		**5**	**0.956**	0%	0%	22%	22%	44%	11%	56%
106	Mitigating impacts of changes and design errors & omissions (effective reviews; timely	5.111	5	OK	<4		**5**	**0.737**	0%	0%	0%	22%	44%	33%	78%
107	Employing a continual risk management process	5.333	5	OK	<4		**5**	**0.471**	0%	0%	0%	0%	67%	33%	100%
108	Assigning risks to the parties best able to control those risks	5.556	6	OK	<4		**6**	**0.497**	0%	0%	0%	0%	44%	56%	100%

Items highlighted in green have been accepted (mode ≥5 and SD ≤1 or mode=6 and SD <2)
Standard deviations > 1 are highlighted in red, those <1 are in blue
Percentages in orange are the most commonly chosen responses (>25%)

APPENDIX I

Delphi Round 1 – Questionnaire, Responses and Oracle Comments

In the first of three rounds of the Delphi study, fast track subject matter experts or oracles were asked to score 66 practices. The following pages show the questionnaire, results, and comments:

A message from the Construction Industry Institute

The purpose of centralizing data collection through use of CII server-based software is to establish a centralized database to support CII research, benchmarking, and other CII committees working to support CII's mission. The centralized database should provide for more secure data collection and storage, and facilitates the sharing of data among authorized teams and committees while reducing the data collection burden on CII member companies.

All data provided for any CII survey in support of benchmarking and research activities by participating organizations are considered "company confidential." The data have been provided by participating companies with the assurance that individual company data will not be communicated in any form to any party other than CII authorized academic researchers and designated CII staff members. Any data or analyses based on these data that are shared with others or published will represent summaries of data from multiple organizations participating in the survey which have been aggregated in a way that will preclude identification of proprietary data and the specific performance of individual organizations.

Survey Purpose

"Successful Delivery of Flash-Track Projects" is a Construction Industry Institute (CII) funded study to better understand how to delivery faster Fast-Track (Flash-Track) through investigating and identifying distinguishing approaches, innovative delivery methods and barriers to faster, more effective project delivery.

Whereas, fast-track has been defined as a time-driven project requiring some degree of concurrency between Engineering, Procurement and Construction - flash-tracking requires a heightened degree of concurrency; relational contracting methods and exceptional execution.

We anticipate that a more heavily overlapped work-process will require the adoption of innovative design, management, and construction tools and techniques markedly different from traditional construction practices. We also expect that the re-engineered work-processes will better define fast-track project risks, enhance team integration and quality of relationships; contributing to increased predictability and Stakeholders' satisfaction for Owners, Designers and Contractors.

Results from this survey will serve as a central element in our efforts to identify critical organizational, scoping, contractual, and planning issues to significantly enhance the likelihood of success in the delivery of Flash Track projects. These efforts will ultimately lead to the development of an implementation resource that will define a project's readiness for flash-tracking and a guide of how to successfully deliver cost effective, quality, faster, fast-track or flash track projects.

Respondent Characteristics

Experience, please enter your approximate number of years of professional experience in any of project life cycle phases for each of the following:

1. Heavy Industry*
Includes chemical manufacturing, cogeneration, environmental remediation, gas distribution, metals refining/processing, mining, natural gas processing, oil exploration/production, oil refining, oil sands, power generation, and pulp and paper.

2. Light Industrial*
Includes automotive manufacturing, consumer products manufacturing, food and beverage, microelectronics manufacturing, office products manufacturing, pharmaceutical manufacturing, pharmaceutical labs and clean room

3. Infrastructure*
Includes airport, electrical distribution, flood control, highway, marine facilities, navigation, pipeline, rail, tunneling, water/wastewater, telecom and wide area network

4. Buildings*
Includes non-industrial facilities, such as a communications center, courthouse, dormitory, hotel, large apartment complex, embassy, office building, hospital, laboratory, maintenance facilities, movie theatre, parking garage, physical fitness center, prison, restaurant, nightclub, retail building, school or warehouse.

5. Project leadership roles (please provide a short description or listing)*

6. Fast- or flash-track experience (please describe or list)*

7. Project life-cycle experience (please check those which you have had experience)*

☐ Development
☐ Design
☐ Construction
☐ Start-up/Commissioning
☐ Operations

9. Prior experience in relational contracting (please check those which you have had experience).*

☐ Design-Build
☐ Engineer-Procure-Construct (EPC)
☐ Integrated project teams
☐ Integrated Project Delivery (IPD) contracts

10. Please advise on your prior experience with 3D Collaborative Modeling Tools (i.e, BIM, SmartPlant, etc..)*

☐ 3D Collaborative Modeling Tools for visualization
☐ 3D Collaborative Modeling Tools for coordination
☐ 3D Collaborative Modeling Tools for constructability
☐ 3D Collaborative Modeling Toolsfor Fabrication & Installation
☐ No experience with 3D Collaborative Modeling Tools

11. Do you have any experience with Lean Construction practices?*

-- Please Select -- ⌄

Flash Track, Delphi Panel -- Round 1

Glossary of Terms

The following terms which are used in the survey are offered as a reference for your review or future reference as you share your thoughts on the delivery of enhanced or faster, fast-track project deliveries. These definitions are either rooted in other Construction Industry Institute resources or defined by this study's research team.

Alignment: The condition where appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives.

Building Information Modelling (BIM): A digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition. Software that enables 3D modelling and information management is the technical core of BIM.

Concurrent Engineering: A systematic approach to the integrated, concurrent design of a project, including construction, maintenance and operations. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal including quality, cost, schedule and user requirements"

Constructability: The optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives.

Delivery Method: A structured approach used to organize a project team so as to manage the delivery of a project.

Design Assist contract: A procurement method by which, prior to completion of design, a consulting construction contract is award where a contractor provides design assistance, constructability reviews, budget and/or schedule services to the architect or engineer of record.

Design-Build: An integrated delivery process which combines architectural and engineering design services with construction performance under one contract agreement.

Fast Track: A time-driven project which by necessity requires some degree of concurrency between Engineering, Procurement and Construction.

Flash Track: A time-driven project which by necessity requires a heightened degree of concurrency between Engineering, Procurement and Construction; relational contracting methods and exceptional execution.

Front End Planning (FEP): The essential process of developing sufficient strategic information with which owners can address risk and make decisions to commit resources in order to maximize the potential for a successful project. FEP is often perceived as synonymous with front-end engineering design, front end loading, pre-project planning, feasibility analysis, programming and conceptual planning.

Integrated Project Delivery: A collaborative alliance of people, systems, business structures and practices into a process that harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.

Just-in-Time: An execution strategy employed to increase efficiency and decrease waste by receiving materials or equipment only as they are needed in the construction process, thereby reducing inventory costs or realizing other benefits.

Last Planner: A collaborative, commitment-based planning system that integrates should-can-will-did planning (pull planning, look-ahead planning with constraint analysis, weekly, etc…).

Lean Construction: A combination of original research and practical development in design and construction with an adaption of lean manufacturing principles and practices (i.e., Toyota Management System) to the end-to-end design and construction process. Lean construction is concerned with the alignment and holistic pursuit of concurrent and continuous improvements in all dimensions of the built and natural environment: design, construction, activation, maintenance, salvaging and recycling

Partnering: A long-term commitment between two or more organizations as in an alliance or it may be applied to a shorter period of time such as the duration of a project. The purpose of partnering is to achieve specific business objectives by maximizing the effectiveness of each participant's resources.

Pull Scheduling: A Lean technique for scheduling where real-time feedback from construction and off-site fabrication / manufacturing activities are provided to so process steps can be re-sequenced opportunistically. In "pulling" the required information and resources through the supply chain, pull-driven scheduling reduces uncertainties and improves work-plan reliability.

Successful: A common understanding to deliver a project that fulfills project goals, such as function, time, cost, quality & safety, and also meets stakeholders' expectations such that they welcome future opportunity to work together.

Team Building: A project-focused process that builds and develops shared goals, interdependence, trust and commitment, and accountability among team members and that seeks to improve team members' problem-solving skills

Flash Track, Delphi Panel – Round 1

Instructions

The practices listed in the following pages have been identified from published documents, focus group discussions and case-study interviews as prevailing concepts or methods required for the successful execution of faster fast-track or flash-track projects. In this survey, we are seeking to assess the essentiality of each practice for the success of flash-track projects and the industry's success in implementing each practice. In addition, we would like to further identify any other important flash-track practices.

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?

2. How SUCCESSFUL has the industry been in implementing this concept or practice?

The questions have been grouped into the following categories:

I. Contract Considerations (16 questions)
II. Delivery Method Considerations (6 questions)
III. Organizational Considerations (11 questions)
IV. Cultural Considerations (7 questions)
V. Planning Considerations (6 questions)
VI. Design Considerations (4 questions)
VII. Execution Considerations (8 questions)
VIII. Innovation Considerations (3 questions)
IX. Risk Considerations (4 questions)

Please answer each question. The survey will allow you to offer comments on each question. At the end of each section and the survey, you will have the opportunity to offer comments and additional items which were not included, but you believe are important or distinguishing characteristics of successful flash-track projects.

You can either complete the survey in one sitting or incrementally. If you close the survey before completing it, you can return to the e-mailed link, click the survey link and you will be forwarded to the first uncompleted page and be allowed to finish the survey. Once the survey is completed you will not have the ability to update your answers In test runs of this survey, it took respondents about 30 minutes to complete.

Please note that the survey software does not function correctly in Google Chrome; as a result we suggest the use of Internet Explorer or Firefox.

We look forward to seeing your responses and input.

Part I of IX, Contract Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?
2. How SUCCESSFUL has the industry been in implementing this concept or practice?

17. Creating project-specific mutually equitable contracts*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

18. Explicitly designating the project as being "fast track"*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

19. Setting clear, specific scoping requirements*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

20. Establishing performanced based specifications*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

21. Tying performance incentives and rewards to project goals*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

22. Having equitable shared risks and rewards*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

23. Aligning project participants' interests through contract*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

24. Establishing early completion bonuses*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

25. Employing performance incentives to promote a high performance culture*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

26. Establishing contract strategies specifically tailored to the project condition*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

27. Executing single-source or no-bid contracts*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

28. Establishing clear change management procedures*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

29. Establishing an effective claims resolution process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

30. Funding early critical efforts*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

31. Please rank the following contract types by how absolutely ESSENTIAL they are (to flash-tracking)
[1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

32. Please rank the following contract types by the SUCCESS (industry has had in implimenting in flash-track projects)
[1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

	1	2	3	4	5	6
Cost-Plus or Reinbursable	○	○	○	○	○	○
Cost plus & Fixed fee	○	○	○	○	○	○
Integrated Project Delivery (e.g., tri-party agreements)	○	○	○	○	○	○

33. In your experience are there other contractual considerations that are absolutely essential for the success of flash track projects?

Part II of IX, Delivery Method Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?

2. How SUCCESSFUL has the industry been in implementing this concept or practice?

35. Selecting team members and staff based on their fast track experience or qualifications*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

36. Focusing procurement decisions on construction priorities*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

37. Making timely selection and award contracts to subcontractors*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

38. Selecting the best value contractor*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

39. Selecting preferred or alliance contractors*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

40. Staffing with personnel with strong leadership capabilities*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

41. In your experience are there other delivery method considerations that are absolutely essential for the success of flash track projects?

Part III of IX, Organizational considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?

2. How SUCCESSFUL has the industry been in implementing this concept or practice?

43. Engagement of operations & maintenance personnel in the development and design process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

44. Establishing a fully integrated project team including design, construction, specialty contractors, commissioning and operations personnel*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

45. Involving contractors, trades and vendors in the design phase*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

46. Using team building and partnering practices*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

47. Creating executive alignment amongst the contracted parties*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

48. Delegating authority to project level (maximize decision-making authority to the project level)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

49. Empowering the project team (each organization led by an empowered leader)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

50. Having an owner with sufficient depth of resources and strength of organization*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

51. Selecting personnel with a "can do" attitude and willingness to tackle challenging tasks*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

52. Having an engaged and empowered Owner's Engineer (Owner's representative)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

53. Staffing with multi-skilled personnel*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

54. In your experience are there other organizational considerations that are absolutely essential for the success of flash track projects?

Part IV of IX, Cultural Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?

2. How SUCCESSFUL has the industry been in implementing this concept or practice?

56. Accepting a new paradigm or mindset differing from that of traditional practices*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

57. Having an active, involved and fully committed owner*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

58. Establishing flexible project teams that avoid rigid hierarchy*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

59. Maintaining a "no blame culture" and mutually supportive environment*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

60. Having open communication and transparency*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

61. Staffing with cooperative and collaborative personnel*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

62. Having an open minded team*

	Strongly disagree	Disagree	Mod disagree	Mod agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

63. In your experience are there other cultural considerations that are absolutely essential for the success of flash track projects?

Part V of IX, Planning Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?
2. How SUCCESSFUL has the industry been in implementing this concept or practice?

65. Emphasizing coordination planning during the design process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

66. Performing exhaustive front end planning*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

67. Identifying and procuring long lead time items*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

68. Monitoring and driving corrective actions through the project controls process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

69. Increasing resource levels for project control*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

70. Providing enough resources to critical path items*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

71. In your experience are there other planning considerations that are absolutely essential for the success of flash track projects?

Part VI of IX, Design Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?

2. How SUCCESSFUL has the industry been in implementing this concept or practice?

73. Employing conservative designs to avoid design holds*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

74. Using standard repeatable designs and fewer design details*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

75. Stream-lining the design review process*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

76. Considering "speed of fabrication" and construction during the selection of design alternatives*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

77. In your experience are there other design considerations that are absolutely essential for the success of flash track projects?

Part VII of IX, Execution Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?

2. How SUCCESSFUL has the industry been in implementing this concept or practice?

79. Co-location of project team (owner, designer, builder, and/or key vendors)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

80. Highly integrated 3-D modelling with all major users updating a common database*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

81. Simplifying approval procedures*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

82. Dedicating full-time personnel to the project*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTAIL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

83. Employing Lean Construction practices (e.g., continuous improvement)*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

84. Seeking provisional regulatory approvals*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

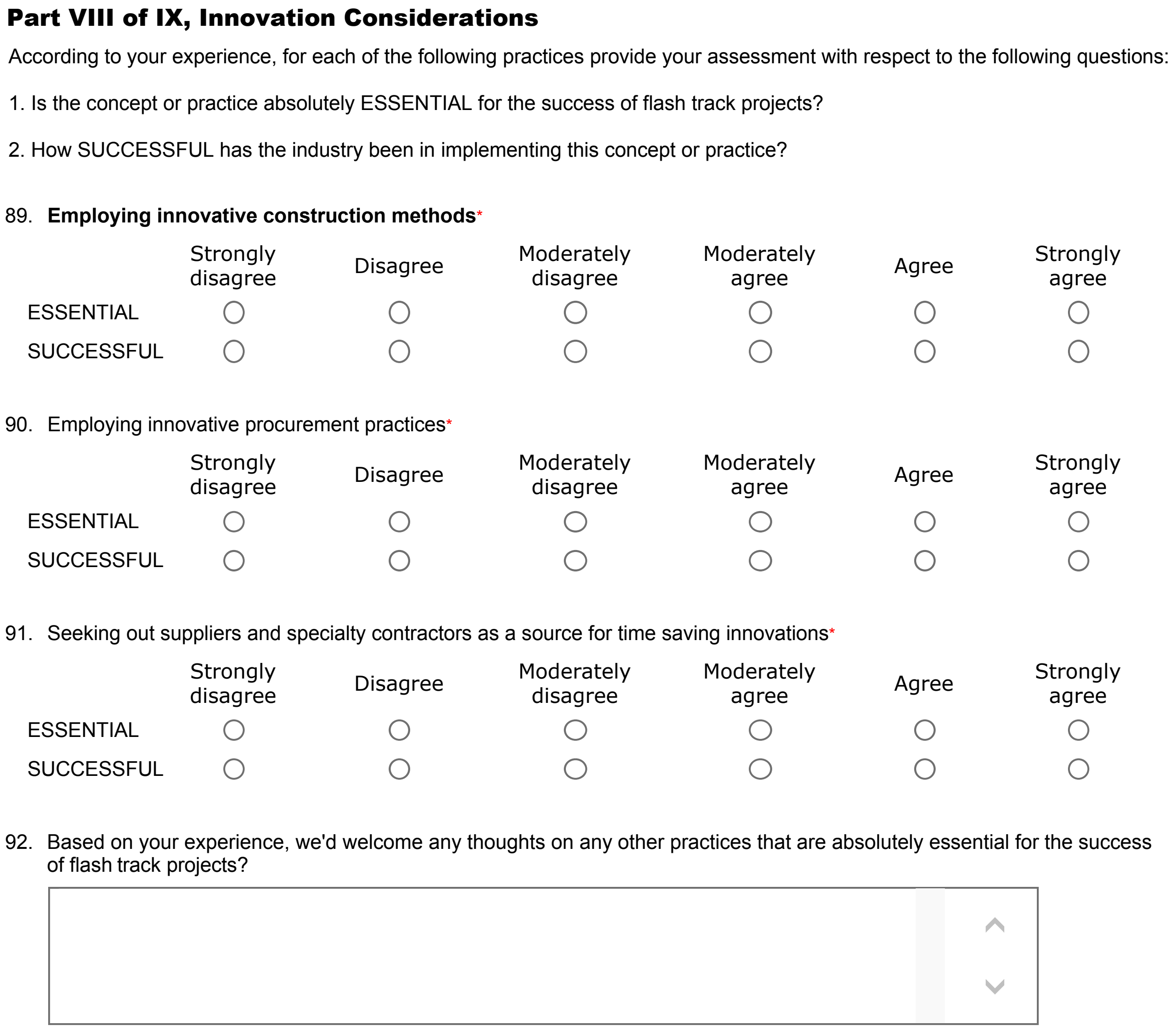
85. Selecting appropriate construction methods*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

86. Minimizing hand-offs*

	Str. Disagree	Disagree	Mod. Disagree	Mod. Agree	Agree	Str. Agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

87. In your experience are there other execution practices that are absolutely essential for the success of flash track projects?



Part VIII of IX, Innovation Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?

2. How SUCCESSFUL has the industry been in implementing this concept or practice?

89. **Employing innovative construction methods***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

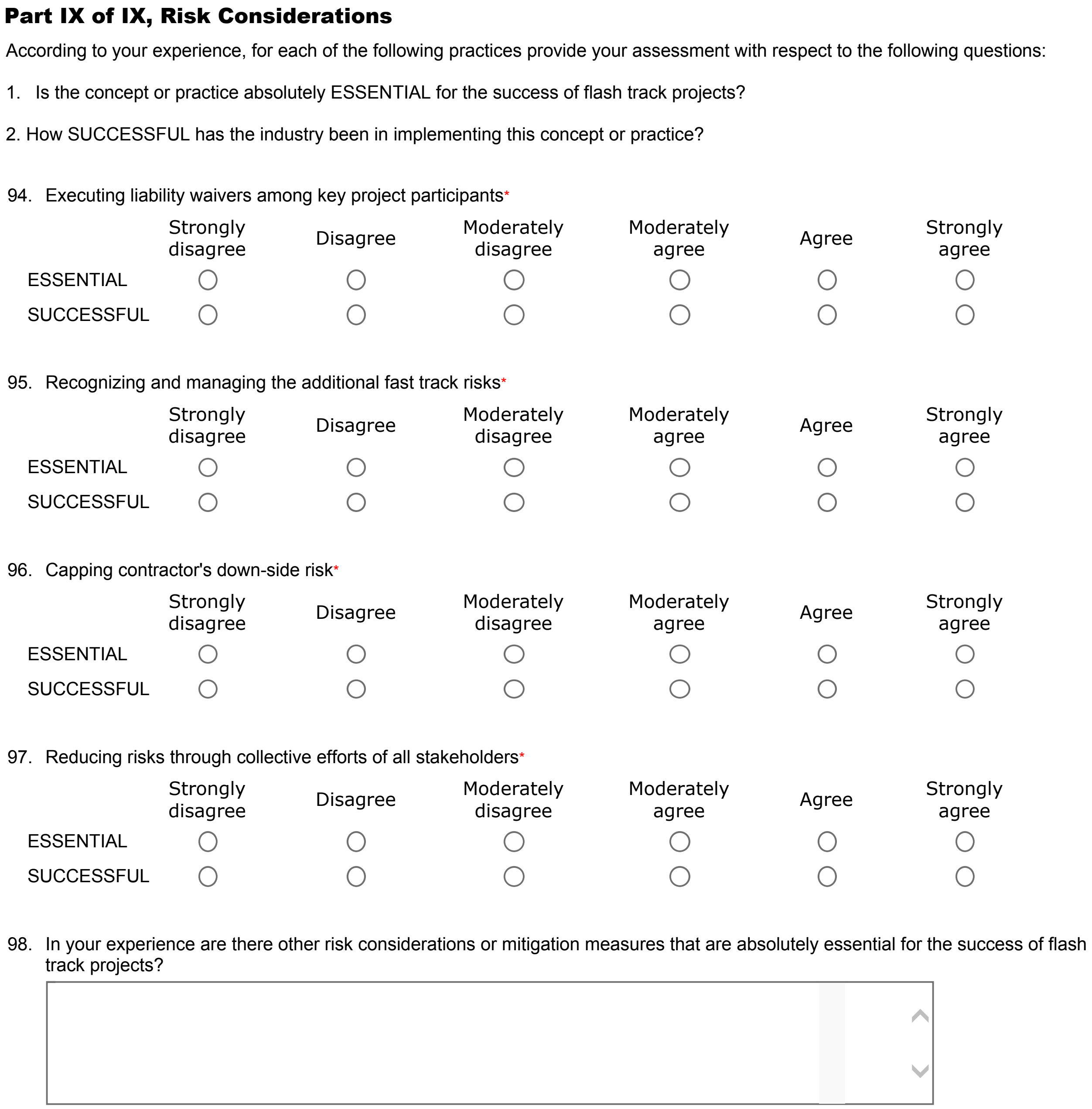
90. Employing innovative procurement practices*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

91. Seeking out suppliers and specialty contractors as a source for time saving innovations*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

92. Based on your experience, we'd welcome any thoughts on any other practices that are absolutely essential for the success of flash track projects?



Part IX of IX, Risk Considerations

According to your experience, for each of the following practices provide your assessment with respect to the following questions:

1. Is the concept or practice absolutely ESSENTIAL for the success of flash track projects?

2. How SUCCESSFUL has the industry been in implementing this concept or practice?

94. Executing liability waivers among key project participants*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

95. Recognizing and managing the additional fast track risks*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

96. Capping contractor's down-side risk*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

97. Reducing risks through collective efforts of all stakeholders*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○
SUCCESSFUL	○	○	○	○	○	○

98. In your experience are there other risk considerations or mitigation measures that are absolutely essential for the success of flash track projects?

CII RT-311 Successful Delivery of Flash Track- Delphi Survey Round 1 Numerical Result (Essential)

Response summary:
A total of 75 candidates were invited to participate in the Delphi process
Sixty-four (64) of these returned a consent form and were sent the first round of the survey
Fifty-five (55) of these completed the Round 1 survey
Round 1 participation rate 55/64 = 85.9%

						Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
Consensus of on whether item is ESSENTIAL for fast track (mode=5 and SD ≤ 1 or mode=6 and SD ≤ 2)												
1	Identifying and procuring long lead time items	5.618	6	6	0.522	0%	0%	0%	2%	35%	64%	98%
2	Setting clear; specific scoping requirements	5.518	6	6	0.534	0%	0%	0%	2%	45%	54%	98%
3	Dedicating full-time personnel to the project	5.426	6	6	0.656	0%	0%	0%	9%	39%	52%	91%
4	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	5.382	5	6	0.726	0%	2%	0%	4%	47%	47%	95%
5	Focusing procurement decisions on construction priorities	5.375	6	6	0.814	0%	2%	2%	5%	39%	52%	91%
6	Engagement of operations & maintenance personnel in the development and design process	5.073	5	6	1.093	0%	5%	2%	18%	29%	45%	75%
7	Co-location of project team (owner; designer; builder; and/or key vendors)	4.944	5	6	1.112	0%	2%	13%	15%	30%	41%	70%
8	Establishing clear change management procedures	5.339	5	5	0.689	0%	0%	2%	7%	46%	45%	91%
9	Funding early critical efforts	5.357	5	5	0.718	0%	2%	0%	4%	50%	45%	95%
10	Establishing an effective claims resolution process	4.714	5	5	0.773	0%	0%	5%	32%	48%	14%	63%
11	Aligning project participants' interests through contract	4.732	5	5	0.834	0%	2%	7%	20%	59%	13%	71%
12	Establishing contract strategies specifically tailored to the project condition	4.946	5	5	0.895	0%	2%	4%	21%	45%	29%	73%
13	Establishing performance-based specifications	4.518	5	5	0.926	0%	4%	9%	30%	46%	11%	57%
14	Selecting team members and staff based on their fast track experience or qualifications	4.875	5	5	0.709	0%	0%	2%	27%	54%	18%	71%
15	Making timely selection and award contracts to subcontractors	5.339	5	5	0.689	0%	0%	2%	7%	46%	45%	91%
16	Staffing with personnel with strong leadership capabilities	5.375	5	5	0.584	0%	0%	0%	5%	52%	43%	95%
17	Involving contractors; trades and vendors in the design phase	5.000	5	5	0.874	0%	4%	0%	16%	53%	27%	80%
18	Using team building and partnering practices	4.618	5	5	1.000	0%	7%	2%	27%	49%	15%	64%
19	Creating executive alignment amongst the contracted parties	5.218	5	5	0.594	0%	0%	0%	9%	60%	31%	91%
20	Delegating authority to project level (maximize decision-making authority to the project level)	5.200	5	5	0.644	0%	0%	2%	7%	60%	31%	91%
21	Empowering the project team (each organization led by an empowered leader)	5.236	5	5	0.602	0%	0%	0%	9%	58%	33%	91%
22	Having an owner with sufficient depth of resources and strength of organization	4.927	5	5	0.912	0%	2%	5%	18%	47%	27%	75%
23	Selecting personnel with a can do attitude and willingness to tackle challenging tasks	5.291	5	5	0.652	0%	0%	2%	5%	55%	38%	93%

CII RT-311 Successful Delivery of Flash Track- Delphi Survey Round 1 Numerical Result (Essential)

Response summary:

A total of 75 candidates were invited to participate in the Delphi process
Sixty-four (64) of these returned a consent form and were sent the first round of the survey
Fifty-five (55) of these completed the Round 1 survey
Round 1 participation rate 55/64 = 85.9%

						Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
24	Having an engaged and empowered Owner's Engineer (Owner's representative)	5.127	5	5	0.916	0%	0%	9%	9%	42%	40%	82%
25	Staffing with multi-skilled personnel	4.564	5	5	0.681	0%	0%	4%	44%	45%	7%	53%
26	Accepting a new paradigm or mindset differing from that of traditional practices	4.582	5	5	0.928	0%	2%	13%	24%	49%	13%	62%
27	Having an active; involved and fully committed owner	5.291	5	5	0.705	0%	0%	4%	4%	53%	40%	93%
28	Establishing flexible project teams that avoid rigid hierarchy	4.600	5	5	0.926	0%	2%	11%	27%	45%	15%	60%
29	Maintaining a no blame culture and mutually supportive environment	4.927	5	5	0.970	0%	4%	5%	13%	51%	27%	78%
30	Having open communication and transparency	5.345	5	5	0.547	0%	0%	0%	4%	58%	38%	96%
31	Staffing with cooperative and collaborative personnel	5.255	5	5	0.512	0%	0%	0%	4%	67%	29%	96%
32	Having an open minded team	5.073	5	5	0.567	0%	0%	2%	7%	73%	18%	91%
33	Providing enough resources to critical path items	5.236	5	5	0.631	0%	0%	2%	5%	60%	33%	93%
34	Emphasizing coordination planning during the design process	5.291	5	5	0.493	0%	0%	0%	2%	67%	31%	98%
35	Performing exhaustive front end planning	4.382	5	5	0.924	0%	7%	9%	22%	62%	0%	62%
36	Monitoring and driving corrective actions through the project controls process	5.018	5	5	0.674	0%	0%	0%	22%	55%	24%	78%
37	Considering speed of fabrication and construction during the selection of design alternatives	5.036	5	5	0.687	0%	0%	4%	11%	64%	22%	85%
38	Highly integrated 3-D modelling with all major users updating a common database	4.630	5	5	0.929	0%	4%	6%	30%	46%	15%	61%
39	Simplifying approval procedures	4.889	5	5	0.629	0%	0%	2%	20%	65%	13%	78%
40	Selecting appropriate construction methods	5.111	5	5	0.629	0%	0%	2%	9%	65%	24%	89%
41	Minimizing hand-offs	4.889	5	5	0.831	0%	0%	7%	19%	52%	22%	74%
42	Employing innovative construction methods	4.481	5	5	0.897	0%	4%	7%	35%	44%	9%	54%
43	Employing innovative procurement practices	4.704	5	5	0.915	0%	2%	7%	28%	44%	19%	63%
44	Seeking out suppliers and specialty contractors as a source for time saving innovations	4.778	5	5	0.809	0%	0%	7%	24%	52%	17%	69%
45	Recognizing and managing the additional fast track risks	5.241	5	5	0.575	0%	0%	0%	7%	61%	31%	93%
46	Reducing risks through collective efforts of all stakeholders	5.000	5	5	0.770	0%	0%	4%	19%	52%	26%	78%

CII RT-311 Successful Delivery of Flash Track- Delphi Survey Round 1 Numerical Result (Essential)

Response summary:
A total of 75 candidates were invited to participate in the Delphi process
Sixty-four (64) of these returned a consent form and were sent the first round of the survey
Fifty-five (55) of these completed the Round 1 survey
Round 1 participation rate 55/64 = 85.9%

						Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	**Mode**	**Standard Deviation**	1	2	3	4	5	6	Agreement (agree + strongly agree)
Mode score > 5 but consensus of whether issue is ESSENTAIL to fast track was not reached												
47	Having equitable shared risks and rewards	4.607	5	5	1.097	0%	7%	9%	18%	48%	18%	66%
48	Please rank the following contract types by how absolutely ESSENTIAL they are (to flash-tracking)											
48.1	- Cost Plus or Reimbursable	4.536	5	5	1.210	2%	9%	2%	30%	36%	21%	57%
48.2	- Cost Plus & Fixed Fee	4.309	5	5	1.204	0%	13%	9%	27%	36%	15%	51%
48.3	- Integrated Project Delivery (e.g., tri-party agreement)	4.130	4	5	1.203	2%	9%	19%	24%	37%	9%	46%
49	Executing Single-source or no-bid contracts	4.107	4	5	1.359	2%	14%	18%	20%	30%	16%	46%
50	Employing conservative designs to avoid design holds	4.255	4	5	1.031	0.000	0.055	0.200	0.255	0.418	0.073	49%
51	Capping contractor's down-side risk	4.463	5	5	1.031	0%	6%	9%	33%	37%	15%	52%
52	Stream-lining the design review process	4.782	5	5	1.039	0.000	0.036	0.091	0.182	0.436	0.255	69%
53	Explicitly designating the project as being "fast track"	4.714	5	5	1.047	0%	5%	7%	20%	46%	21%	68%
54	Seeking provisional regulatory approvals	4.815	5	5	1.073	0.000	0.037	0.093	0.185	0.389	0.296	69%
55	Employing Lean Construction practices	4.259	4	5	1.075	2%	4%	17%	31%	37%	9%	46%
56	Using standard repeatable designs and fewer design details	4.400	5	5	1.089	0.000	0.091	0.073	0.309	0.400	0.127	53%
57	Creating project-specific mutually equitable contracts	4.893	5	5	1.113	4%	2%	4%	11%	54%	27%	80%
58	Employing performance incentives to promote a high performance culture	4.143	4	5	1.125	0.018	0.089	0.125	0.339	0.357	0.071	43%
59	Selecting preferred or alliance contractors	4.607	5	5	1.277	2%	7%	9%	21%	32%	29%	61%
Mode score < 4												
60	Increasing resource levels for project control	4.436	4	4	0.869	0%	0%	15%	38%	36%	11%	47%
61	Tying performance incentives and rewards to project goals	4.286	4	4	0.901	0%	5%	9%	43%	38%	5%	43%
62	Establishing early completion bonuses	3.982	4	4	0.973	2%	7%	13%	52%	23%	4%	27%
63	Executing liability waivers among key project participants	3.796	4	4	1.112	4%	13%	13%	41%	30%	0%	30%
64	Selecting the best value contractor	4.321	4	4	1.182	2%	4%	20%	29%	29%	18%	46%

Open ended questions (see attached comments sheet)

🟨 Illustrates mode

Items where Delphi experts concur that item is ESSENTIAL for flash track 🟩 46/66 69.7%

Signifies SD > 1 🟥
Signifies SD < 1 🟦

CII RT-311 Successful Delivery of Flash Track- Delphi Survey Round 1 Numerical Result (Success)

Issue #	Question	Mean	Median	Mode	Standard Deviation	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	Agreement (agree + strongly agree)
						1	2	3	4	5	6	
1	Identifying and procuring long lead time items	4.600	5	5	0.926	0%	4%	5%	33%	44%	15%	58%
2	Setting clear; specific scoping requirements	4.143	4	4	1.093	0%	11%	13%	38%	30%	9%	39%
3	Dedicating full-time personnel to the project	4.315	4	4	0.997	0%	7%	7%	41%	35%	9%	44%
4	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	3.745	4	4	1.163	5%	11%	16%	40%	25%	2%	27%
5	Focusing procurement decisions on construction priorities	4.000	4	4	1.282	2%	16%	13%	30%	29%	11%	39%
6	Engagement of operations & maintenance personnel in the development and design process	3.636	4	5	1.326	7%	13%	27%	18%	31%	4%	35%
7	Co-location of project team (owner; designer; builder; and/or key vendors)	3.870	4	4	1.072	0%	11%	24%	39%	19%	7%	26%
8	Establishing clear change management procedures	4.304	4	5	1.016	0%	4%	20%	30%	36%	11%	46%
9	Funding early critical efforts	4.071	4	5	1.361	5%	14%	5%	27%	39%	9%	48%
10	Establishing an effective claims resolution process	3.857	4	4	0.908	0%	2%	25%	38%	30%	5%	36%
11	Aligning project participants' interests through contract	3.821	4	4	0.889	0%	11%	18%	50%	21%	0%	21%
12	Establishing contract strategies specifically tailored to the project condition	4.036	4	4	0.906	0%	5%	20%	45%	27%	4%	30%
13	Establishing performance-based specifications	3.804	4	4	0.854	2%	5%	21%	54%	18%	0%	18%
14	Selecting team members and staff based on their fast track experience or qualifications	4.196	4	4	1.025	0%	11%	7%	39%	38%	5%	43%
15	Making timely selection and award contracts to subcontractors	4.179	4	5	1.037	0%	7%	18%	32%	36%	7%	43%
16	Staffing with personnel with strong leadership capabilities	4.196	4	4	0.895	0%	2%	21%	38%	34%	5%	39%
17	Involving contractors; trades and vendors in the design phase	3.618	4	4	1.136	5%	11%	25%	33%	25%	0%	25%
18	Using team building and partnering practices	3.745	4	4	0.919	0%	11%	25%	42%	22%	0%	22%
19	Creating executive alignment amongst the contracted parties	3.945	4	4	0.923	0%	5%	25%	42%	24%	4%	27%
20	Delegating authority to project level (maximize decision-making authority to the project level)	3.836	4	4	1.040	4%	7%	16%	51%	18%	4%	22%
21	Empowering the project team (each organization led by an empowered leader)	3.855	4	4	1.052	2%	9%	24%	35%	29%	2%	31%
22	Having an owner with sufficient depth of resources and strength of organization	3.564	4	3	1.156	5%	11%	31%	29%	22%	2%	24%
23	Selecting personnel with a can do attitude and willingness to tackle challenging tasks	4.291	4	4	0.947	2%	4%	5%	49%	33%	7%	40%
24	Having an engaged and empowered Owner's Engineer (Owner's representative)	3.909	4	4	0.996	4%	2%	24%	45%	22%	4%	25%
25	Staffing with multi-skilled personnel	3.800	4	4	0.724	0%	4%	27%	55%	15%	0%	15%
26	Accepting a new paradigm or mindset differing from that of traditional practices	3.400	3	4	0.886	2%	13%	38%	38%	9%	0%	9%
27	Having an active; involved and fully committed owner	3.945	4	4	1.017	2%	5%	24%	38%	27%	4%	31%
28	Establishing flexible project teams that avoid rigid hierarchy	3.673	4	4	0.916	0%	15%	20%	49%	16%	0%	16%
29	Maintaining a no blame culture and mutually supportive environment	3.455	4	4	1.125	4%	18%	27%	33%	16%	2%	18%
30	Having open communication and transparency	3.764	4	4	0.972	0%	11%	27%	38%	22%	2%	24%
31	Staffing with cooperative and collaborative personnel	4.018	4	4	0.981	2%	5%	18%	40%	33%	2%	35%
32	Having an open minded team	3.982	4	4	0.774	0%	2%	25%	45%	27%	0%	27%
33	Providing enough resources to critical path items	4.091	4	4	1.014	4%	0%	20%	42%	29%	5%	35%
34	Emphasizing coordination planning during the design process	4.182	4	4	0.876	0%	2%	20%	42%	31%	5%	36%
35	Performing exhaustive front end planning	3.582	4	4	1.021	2%	15%	27%	36%	20%	0%	20%
36	Monitoring and driving corrective actions through the project controls process	3.891	4	4	0.908	0%	7%	22%	49%	18%	4%	25%
37	Considering speed of fabrication and construction during the selection of design alternatives	3.891	4	4	0.908	0%	7%	24%	44%	24%	2%	25%

CII RT-311 Successful Delivery of Flash Track- Delphi Survey Round 1 Numerical Result (Success)

						Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	Mode	Standard Deviation	1	2	3	4	5	6	Agreement (agree + strongly agree)
38	Highly integrated 3-D modelling with all major users updating a common database	3.759	4	4	1.137	6%	6%	26%	37%	22%	4%	26%
39	Simplifying approval procedures	3.685	4	4	1.068	4%	11%	20%	44%	19%	2%	20%
40	Selecting appropriate construction methods	4.241	4	4	0.792	0%	4%	9%	48%	37%	2%	39%
41	Minimizing hand-offs	3.981	4	4	0.805	0%	2%	28%	41%	30%	0%	30%
42	Employing innovative construction methods	3.685	4	4	0.919	2%	6%	33%	43%	15%	2%	17%
43	Employing innovative procurement practices	3.630	4	4	1.191	7%	9%	22%	37%	22%	2%	24%
44	Seeking out suppliers and specialty contractors as a source for time saving innovations	3.741	4	4	0.886	0%	9%	28%	43%	20%	0%	20%
45	Recognizing and managing the additional fast track risks	3.741	4	3	1.109	2%	11%	30%	30%	24%	4%	28%
46	Reducing risks through collective efforts of all stakeholders	3.537	4	4	0.937	0%	17%	28%	41%	15%	0%	15%
47	Having equitable shared risks and rewards	3.589	4	4	1.130	2%	20%	21%	34%	21%	2%	23%
48	Please rank the following contract types by the SUCCESS (industry has had in implimenting in flash-track projects)											0%
48.1	- Cost Plus or Reinbursible	4.327	5	5	1.161	0%	11%	11%	25%	40%	13%	53%
48.2	- Cost Plus & Fixed Fee	4.091	4	4	1.049	0%	7%	22%	33%	31%	7%	38%
48.3	- Integrated Project Delivery (e.g., tri-party agreement)	3.574	4	3	1.082	2%	15%	33%	24%	26%	0%	26%
49	Executing Single-source or no-bid contracts	3.429	3	3	1.193	5%	18%	29%	27%	20%	2%	21%
50	Employing conservative designs to avoid design holds	3.891	4	3	0.985	0%	5%	36%	24%	33%	2%	35%
51	Capping contractor's down-side risk	3.333	3	3	0.962	2%	19%	35%	33%	11%	0%	11%
52	Stream-lining the design review process	3.491	4	4	1.025	0%	22%	25%	35%	18%	0%	18%
53	Explicitly designating the project as being "fast track"	4.125	4	4	0.908	0%	2%	25%	38%	30%	5%	36%
54	Seeking provisional regulatory approvals	3.685	4	4	1.015	2%	13%	20%	46%	17%	2%	19%
55	Employing Lean Construction practices	3.407	3	4	1.028	4%	15%	33%	33%	15%	0%	15%
56	Using standard repeatable designs and fewer design details	3.545	4	4	0.969	0%	18%	25%	40%	16%	0%	16%
57	Creating project-specific mutually equitable contracts	3.554	4	4	0.981	4%	9%	30%	45%	11%	0%	11%
58	Employing performance incentives to promote a high performance culture	3.375	3	4	1.028	2%	21%	29%	34%	14%	0%	14%
59	Selecting preferred or alliance contractors	4.000	4	5	1.102	2%	11%	16%	30%	39%	2%	41%
60	Increasing resource levels for project control	3.491	4	4	0.912	5%	4%	36%	45%	9%	0%	9%
61	Tying performance incentives and rewards to project goals	3.446	4	4	1.016	0%	23%	25%	36%	16%	0%	16%
62	Establishing early completion bonuses	3.589	4	4	0.959	2%	13%	27%	43%	16%	0%	16%
63	Executing liability waivers among key project participants	3.241	3	3	1.035	2%	26%	31%	28%	13%	0%	13%
64	Selecting the best value contractor	3.661	4	4	1.005	2%	11%	29%	39%	18%	2%	20%

Open ended questions (see attached comments sheet)

CII RT-311 Successful Delivery of Flash Track

Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
1	*Setting clear; specific scoping requirements*		
	5	2	Client definition of scope requirements tend not to have the detail required. Causing delays and cost issues.
	6	4	All to often, scope left open to interpretation or thought to be understood lead to disagreements and claims.
	6	5	People are much more likely to meet your expectations, when they know what they are. Specificity and clarity are extremely important.
	6	3	Scope must be clear and not change
	6	5	Especially with EPC projects the greater the definition of scope, the less ambiguity the team has in completing the work efforts.
	6	3	Recycle on scope kills fast-track projects
	6	3	Two keys to success include well defined scope and a proactive change management process. CIIs PDRI and change management are included in our work processes. We have not been diligent in implementing on a consisten basis.
	6	4	Early alignment on scope is essential for expediting project schedule, with tight protocols to limit subsequent changes to only essential items.
	6	5	Setting the clear scoping requirements is essential. What is more inportant is not changing the scope once established.
	6	4	Concurrent Engineering methods, e.g. as defined by Don Clausing are very helpful to improve CII's Setting Business Priorities, & Classes of Plant Quality VIP workshops.
	6	5	you can
	6	5	Definition is essential to keep team focussed and to stay on track.
	6	2	Scope drives cost and schedule...has to be firm early early early
	6	3	This is essential but no one takes the time to clearly scope the project and projects are generally so complex you can
	6	4	need to maintain scope, minimize change - hard to do
	6	4	Clear specific scope requirements is the foundational alignment requirement of parties executing the flash track project.
	6	6	Clear, well written statements of work containing well written, stable requirements are an essential ingredient to project success in any setting, not limited to fast/flash track.
	5	5	The project scoping is essential but can sometimes lead to doing business as usual. Making sure the scope is a functional scope rather than an only path method can lead to innovations in the design process.
	6	6	Defining clear commercial and technical deliverables are a huge component of defining scope.
2	*Establishing performance-based specifications*		

CII RT-311 Successful Delivery of Flash Track

Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
3	*Aligning project participants' interests through contract*		
	6	4	Understanding each parties expectations,concerns and goals is ,in my opinion, a critical component of project success.
	4	2	We tend to rely far too much on contract and insufficiently address the foundation for increasing trust. Innovation cannot be contracted. To improve EPC requires profound innovation, only available through mature trust.
	5	4	hard to do as participants do have different underlying interests / needs; need to understadn them going before signing
	6	4	Nothing aligns interests more than when it's put in writing and agreed to in a binding contract.
	6	5	It is essential, but most owners I have had experience with are not sophisticated enough to do this.
4	*Establishing contract strategies specifically tailored to the project condition*		
	6	6	Participation by the team in the development of the contract strategies is important when trying to implement fast track performance
	6	4	A must.
	6	5	a best practice used is the preparation of a contract quilt
	6	2	My experience with owners is that one size fits all when it comes to writing agreements.
5	*Establishing clear change management procedures*		
	6	6	Clear agreed to procedures are required to maintain a fast track project.
	6	6	Change management needs to be controlled and all personnel on the team needs to understand the procedures to keep the project moving on the fast track.
	6	5	Clear change management procedures are essential in flash track projects to avoid schedule delays and misunderstandings in time of the essence flash track projects.
	6	6	Change management is an inevitable part of any project, and should be embraced from the get-go. Having the approval process, cost structures, etc agreed to up front will speed up the inevitable.
	6	5	Owners still feel they have the right to negotiate change orders even when the terms are clearly established.
	6	3	See my note aove - CII has a good process but it is not followed by many in the industry.
	6	4	Changes must be minimized in order to maintain schedule.
	6	3	Everyone says that clear change management is vitally essential but it is rarely successfully executed
	6	3	requires discipline and determination

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Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	6	If it is truely Flash Track there can be NO changes
	6	4	Establishing and executing are two different things..
	6	6	The participants need to understand from day one how changes are going to be managed and everyone understands and executes accordingly.
	6	4	Without strong procedures, contractual issues will overwhelm execution.
	6	4	need to have a clear system with back-pressure on changes
	3	3	You should always expect change and if the project is fast track you don
	6	4	yes, need spoc for changes as well as criteria for accepting a change - hurdle rates, operability, safety
	6	3	Change control is critical, but the discipline it requires to be practiced effectively is often missing from the project culture and/or individual manager's training/habits.
	6	3	Management procedures should detail roles and responsibilities of management processes as well as their deliverables. Owners at best devise detailed project controls and submittals requirements.
6	*Establishing an effective claims resolution process*		
	4	4	It is more important to try and settle all changes without going to the claims resolution process. When settled at the lowest level on the project all projects become successful because you are not deluting resources to handle claims.
	5	4	Typically dispute resolution takes a back seat to assuring the fast track schedule is achieved this is often financially to the detriment of the contractor.
	6	3	Claims management is often mired in obtuse legal posturing and legal maneuvering rather than true claim resolution
	6	4	This is a key element, necessary to prevent work stoppage.
	3	5	To improve EPC, you don't just do business, you build relationships. When the going gets tough, you look to how to sustain the relationship. Reliance on contract spells an end to the relationship.
	6	5	necessary - spell out in contract
	5	4	Most owners and contractors on large EPC negotiate settlements without the need of lawyers and claims.
7	*In the event that you either strongly agree or strongly disagree your comments would be greatly appreciated. Please feel free to add any other comments.*		
	6	5	Can't be waiting for funding on a fast track project - too many other things to execute quickly
	6	5	Early critical path efforts need to proceed with undue delay using early funding, instead of waiting for full contractual agreement.
	6	6	Fundamental requirement for fast track and flash track projects.

CII RT-311 Successful Delivery of Flash Track

Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	5	Early funding ensures no disruption during project execution
	6	4	FEL stage funding is well established but not universally. Early involvement of subs and suppliers, essential to flash track will require funding until trust in mutual benefit is established. 3 to 5 years.
	6	4	Owners typically say they want early Construction Involvement for input but few want to fund it sufficiently for a successful Precon effort.
	6	4	Absolutely required plus all constraints on types of spending (engineering, equipment, construction, permitting) must be removed.
	5	5	need money for long lead items and support design work
8	*Reducing risks through collective efforts of all stakeholders*		
	6	4	sound planning at the beginning. Well defined and integrated contracts clearly allocating scope and responsibilities.Frequent meetings highlighting issues and proposed resolutions
	6	4	Collective stakeholder engagement in risk identification and mitigation is key to project success, even more so in fast track projects.
	5	4	Owners still try to stick the contractor with as much as they are willing to take.
	6	4	Risk represents a distraction. If it is maanged, the project can be the focus.
	4	4	need to define early and reach alignment
9	*Selecting team members and staff based on their fast track experience or qualifications*		
	6	5	Getting the right people is critical to the sucess of the project
	5	4	Experience,qualifications and performance history.
	5	5	Selecting team members with fast track experience is very helpful, but having fast track project processes in place can be more beneficial.
	6	5	It is especially successful if the team members have worked with each other in similar roles on previous projects.
	6	5	Experienced team members can hit the ground running
	5	4	Ok to have a mix of team members with and without fast track experience.
	6	4	Participants have to know and be familiar with fast-track concepts and practices
	6	5	I would have different answers for fast track experience and qualifications. I feel strongly about qualifications. One key to success is a qualified dedicated team.
	5	2	There is great value is in consistent teams during and between projects. Experience in EPC certainly helps.
	5	4	Availability of Flash Track capable/experienced resources that can be dedicated for the duration of a project is random.
	6	2	Someone has to know what steps can/can

CII RT-311 Successful Delivery of Flash Track

Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	4	5	helpful but not nesessary if the team members are already good
	4	4	Experienced personnel will quickly adapt to the specifics of fast tracking.
10	*Focusing procurement decisions on construction priorities*		
	6	6	This is a no-brainer. It has to be done. You schedule backwards taking into account equipment lead-times, etc...
	6	4	Construction is the ultimate completion of a project. (I have included testing/startup and commissioning in my definition of construction here).
	6	5	Equipment and material deliveries need to support the construction execution strategy - just in time so as not to double-handle.
	6	5	Must have the equipment available to meet the construction schedule
	6	2	This has been a major gap area in my experience.
	6	4	successful fast-track procurement is essential for success
	6	6	Very important item.
	6	4	Construction should drive engineering and procurement
	6	4	this is part of the pull system
	6	4	Difficulty of execution of Procurement is critical to Flash-Thorough understanding of of Flash by the entire team is required.
	6	4	required...i will always assume all the schedule float is consumed in definition/design/procurement...stakeholders have to align that Start of Construction date is more sacred than End of Construction or Start of Production -- EoC/SoP focus is too late
	6	5	need to sequence procurement with construction need
	6	5	Buy ahead to secure equipment to be shipped ahead of required period or planned to arrive just in time to lift /set in place.
11	*Making timely selection and award contracts to subcontractors*		
	6	6	Again, equipment lead times are one of the main drivers for schedule. The sooner you can award the sooner you can construct.
	6	5	Critical to design completion to support construction.
	6	5	This is not always successful as the subcontractor scope may not be fully determined at the time the contract needs to be awarded (if subcontractor work efforts are substantial across the duration of the schedule).
	5	4	Identifying all subcontract needs early ensures the subcontractors are ready to go
	6	4	delay before award often cannot be made up during fabrication or increases costs
	6	5	Schedule prequalifications based on WBS and schedule engineering deliverables to support scope defintion for Bid packages.

CII RT-311 Successful Delivery of Flash Track

Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	6	need to maintain schedule
	6	5	must do
	6	2	Owner
12	*Staffing with personnel with strong leadership capabilities*		
	4	4	Again, depends. You want good leaders, but there needs to be a good mix of players. Too many cooks in the kitchen can lead to problems.
	5	5	Sometimes strong leadership capabilities correlates to strong personalities. Teamwork is the goal.
	6	5	Leadership drives the decision making and schedule
	6	5	The project manager must be able to not only lead his/her project team but also successfully interact with other stakeholders.
	6	6	This one falls into the duh category.
	5	4	Again, leadership in our industry leaves a great deal to be desired. A profound redefinition is in order.
	6	5	Great opportunity for successful project..
	6	6	you need the right modivator
	6	3	Leadership is the only difference. The workers are the same regardless of the contractor on large jobs.
	6	5	it's a people driven business.
	6	3	Nothing great ever happens without one person deciding to do it.
	6	3	The problem here is that the experienced industry leaders are retiring and the next level is not nearly as experienced
	6	4	many projects fail in this area, need someone to make descisons - a slow decision can be as bad as a wrong decision
	6	6	This is a critical component to success!
	6	2	Leadership is definitely different than management. Ask anybody who was ever an officer in the military. Unfortunately, there isn
13	*Employing innovative procurement practices*		
14	*Highly integrated 3-D modelling with all major users updating a common database*		
	6	6	This helps greatly with space management, reducing interferences, constructability and operability reviews.
	4	5	depends on size and complexity of the project

CII RT-311 Successful Delivery of Flash Track

Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	2	3	Contractors should work in the systems they are most efficient and familiar with. Integration needs to occur on a regular planned basis (preferably after normal work hours.)
	6	5	The challenge/opportunity for improvement with 3-D models is at the discipline and company interfaces.
	6	4	Only restrictions are Owner funding Cost.. Most all companies now have the capabilities.
	4	1	seen lots of 3D modeling -- doesn't seem to work well across multiple suppliers
	4	3	For 3-D modeling only the designer should be updating the information - having the contractor or owner do it also slows the process and results in errors
	6	4	excellent for design reviews, mto, procurement of bulks
15	*Involving contractors; trades and vendors in the design phase*		
	6	5	Ditto above
	6	5	Early constructability input
	5	4	This is the highest return constructability phase and is essential to have construction smarts provide input. I don
	6	2	Relational Competitive Partnering Principles must be understood, bought into and performed by executives of the Client, EPC and lean supply chain subs and suppliers.
	5	3	vendors can solve many issues and prevent expensive, time-consuming over-engineering
	6	4	build in their specific knowledge into the design will speed construciton
	6	1	Vendors (OEMs) must be involved early. Usually their equipment defines the process. Contractors can provide some constructability input with respect to specs and testing very early on.
	5	3	Not all - focus should be on the critical ones
16	*Seeking out suppliers and specialty contractors as a source for time saving innovations*		
	5	4	Only if it doesn
	6	4	Using a suppliers ideas and resources during a proposal evaluation can bring new ideas at low - no cost
	3	3	We spend more time getting inovative contractors qualified in order to use them
	6	4	Prequalified and Partnering of Vendors for specific materials and services for a pre determined unit cost or rate that has a life cycle and then re bid to ensure best value, can save valuable time and money. Instead of having to bid out every project,
	5	3	special firms and equipment are worth the money
	6	5	getting material onsite to feed installation is critical

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Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	3	Specialties many times are overlooked because the traditional players are the ones usually involved up front.
17	*Engagement of operations & maintenance personnel in the development and design process*		
	2	2	Drivers are not conductive to fast track projects.
	6	5	need thier buy in up front or the project has a higher probability of failure
	2	2	Although I like to get the O&M people involved in the development/design process to get their buy-in and to reduce disagreements at turn-over, their interests are non necessarily schedule driven and they want the moon.
	6	6	The earlier you get the involvement the better the outcome
	6	5	Factoring their experience and knowledge into a design process cannot help but lead to a good project.
	5	2	Operations and maintenance personnel resource constraints lead to minimal participation from them on capital projects.
	6	6	Early involvement of key (skilled, experienced,...) stakeholders adds significantly to the effectiveness of a project.
	6	5	Flash-track projects need decisions made quickly. Having these resources on the team aids this requirement.
	5	4	O&M personnel must be empowered to make quick decisions, unlike many O&M people- the right ones need to be picked
	6	5	Absolutely critical to have their early input and no change
	4	4	Ops and maintenance invovlement can negatively impact cost and schedule. Perhaps they can have some invovlement during the development process and be invovled in GA and P&ID reviews. After that I beleive they need to stay away from the project until COD.
	6	5	Especially important in pulp & paper industry
	6	5	operations and maintenance have to get involved from the start of the project for overall success
	3	4	to much opportunity for input will delay the completion date. No input could result in a unwanted final product. Need to find a balanced approach
	6	4	On a large project, you must backfill the positions, dedicate them to the project team or the team will proceed without the necessary input because they will be sucked back into production critical activities.
	6	4	Grass Root Facilities typically dont allow for Maintenance and Operations involvement unless the owner is committed to a vertical startup and budgeted for a considerable increase of wants/needs from Operations and Maintenance. But IWS input is valuable..
	5	3	better to make changes earlier rather than later
	6	4	need to involve customer to make correct decisions

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Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	3	real involvement and time made available for ops -- designate and co-locate with designers
	6	4	ops can block decisions but can also facialitate design and construction, they have info we need
	6	2	Operations need time to digest changes to existing operations and sometimes communications to operations by engineering is not effective. Operators not used to reading drawings need more visual tools.
18	*Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel*		
	6	5	The better the integration and communications,the better the project results.
	6	3	Extremely important to have a fully integrated project team to gain early alignment with all stakeholders, to facilitate timely decisions and avoid schedule delays due to changing project requirements.
	6	4	key word: team
	6	5	Need all areas represented on the project team and pulling in the same direction
	6	4	Sometimes, each group needs to be reminded that they are to be working for the betterment of the project and not their organization.
	6	2	To do so requires profoundly increased level of trust in mutual benefit, usually only achievable with expectations and trust in benefit in and beyond a single project.
	6	4	Fully Integrated & Collaborative teams are rare for projects due to Owners lack of budgeting or buy in.. Theyb talk it but choke on cost and committment.
	6	4	best practice for type of project, definitely facilitates start-up
	6	1	Unless the owner is mature enough to understand these phase relationships well, this doesn
19	*Using team building and partnering practices*		
	6	5	This is one of the most important items. Everyone needs to feel that their contributions are needed for the project to be successful and that no one is sucessful unless we all are successful
	6	5	The theme is consistant, good interaction SHOULD = good results
	5	4	Unfortunately, formal team building efforts have become somewhat obsolete. They have been replaced with soft skill approaches.
	5	4	If there is engagment and some vulnerability from all invovled than this has extreme benefits. Willingness to really participte is needed.
	2	2	team building sounds wonderful but I doubt that it adds anything to the eventual success of the project
	2	4	Traditional team building and partnering efforts are of marginal benefit. Relational Competitive Partnering is far different.
	5	5	everyone needs to work together and be in harmony

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Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	4	4	not a fan of it; can help understand each others drivers but need ongoing TB to be effective; one shot does not help much
	6	4	Needs to be a priority with executive sponsorship from all parties to be effective.
20	*Delegating authority to project level (maximize decision-making authority to the project level)*		
	6	4	Agree but there must be some level of oversight.When a critical decision is made, it should be fed forward.
	6	6	Having the proper amount of leadership, experience, and knowledge in the executors of the work is imperative. Trying to manage this from the boardroom is a recipe for disaster.
	6	3	delegation of authority is the most important element-also you have to have experience people to give this authority to.
	6	4	Must have authority at the decision making level or decisions take too long
	6	4	The various leads - proj mgr, project engineer, site manager all need to be empowered.
	6	4	Without this there will not be timley decision making, which is critical
	5	4	still need to stay within corp guidelines
	6	4	Delegation of authority to the project level is key to providing timely decisions.
	6	3	If the roles and responsibiltities are set right; alignment and team building complete, then day to day operating decisions with the authorized paramaters must be allowed.
	6	4	Too many layers of decision making or need to get too many involved is a hinderance
21	*Empowering the project team (each organization led by an empowered leader)*		
	6	5	Back to Leadership Technical leader + Project Engr. Contact and overall Leader= Project Manager Constuction Leader Const. Mgr
	6	4	Without this there will not be timley decision making, which is critical
	5	3	Keeping the project from being stuck in a rut of indecision is very important.
22	*Having an owner with sufficient depth of resources and strength of organization*		
	6	4	Important to ensure full understanding of contract/changes and the fair and equitable handling of those
	6	4	Owners are often resource limited - many are new hires who will not feel empowered until they understand the new Owner culture.
	6	4	So many times we as contractors take on the Owner
	5	4	Where client organization gaps exist one option is to fill them with subtended qualified EPC personnel
	6	5	always good to have unless a turn key project

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	1	In my experience, this is the root of all failed EPC projects. When an ower decides to give project management to an operations manager as an ad hoc assignment; the results are always disastrous.
23	*Selecting personnel with a can do attitude and willingness to tackle challenging tasks*		
	6	5	Cannot afford participants who are negative when facing a challenging issue
	6	6	Back to my lack of focus/support on your contract questions, this is more something that I would look for that spending weeks with the lawyers trying to get a 'good' contract.
	6	5	Need personnel with energy to handle the workload, challenges, and expectations
	4	4	The problem is not the workers, given a chance, they will do it with gusto. The problem is the exeutives who don
	6	4	always a good choice if it exists
	6	4	Attitude and setting a team attitude are crucial.
24	*Having an engaged and empowered Owner's Engineer (Owner's representative)*		
	3	3	Depends on their agenda. A lot of times the OE can act adversarial towards the EPC contractor and slow things down.
	6	6	An independent engineer is not essential if owners engineering staff is adequate in size and capability
	6	4	Need to have an owner rep that is capable.
	6	5	Again, Owner resources are often limited.
	4	3	Provides location experience and guidance to the contractors
	5	3	An OE without alterior motives absolutely needs to be engaged and invovled. As long as they understand their role. They can help the project immensely with the right attitude.
	6	5	EPCs control much and can improve much with or without an willing client. There is no excuse for them not proceeding to do what is clearly under their control. A willing and knowledgable owner
	6	4	Without engagement, there will not be success
	6	4	required for on the spot decision making
	6	2	The Owner rep needs to be involved and empowerd to make timely decisions
	6	1	Engineer
	6	1	If the OE has the project in focus instead of their chargeable hours
25	*Staffing with multi-skilled personnel*		
	6	3	Crosstraining and empowerment of engineering disciplines and trades adds considerable flexibility to the team. This is normally stage 3 or 4 of a lean implementation.

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Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	5	3	The leadership needs to possess multi-skills but the support staff can be specific in the skills they bring
26	*Accepting a new paradigm or mindset differing from that of traditional practices*		
	6	4	moving from fast to flash track will require innovative thinking and some new and different concepts
	2	2	I think that if you deviate to much from standard practices and procedures you will waste a lot of time developing them.
	6	3	This is tough for executives, like learning their role in the safety paradigm shift 2 decades ago.
	6	4	needed but people are hard to change - what worked before will work again, change is hard
	3	3	There is plenty of room for improvement within the current/traditional paradigm
27	*Having an active; involved and fully committed owner*		
	6	4	Agree but involvement must last throughout the project
	6	6	You need an owner rep that is skilled and can make decisions.
	6	4	Owner resources are often limited.
	6	5	Owner
	6	5	Another key element
	6	3	Client Executives and personnel must learn new ropes to even know what to ask for.
	6	4	Most Owners are Production or Process types that dont have the knowledge to understand totally the EPC alignment and sequential responsibiliites.
	6	1	The owner wants safety, quality, cost and schedule met, but usually doesn
28	*Establishing flexible project teams that avoid rigid hierarchy*		
	6	5	Everyone pitching in to ensure the work goes well
	4	4	Not typically the issue. Willingness to listen to new paradigm principles and making the effort to figure out how to apply them to improve their standards and behavior is paramount.
	3	3	One of the worse things I
29	*Maintaining a no blame culture and mutually supportive environment*		
	6	6	Sometimes difficult to keep out of the construction world.
	5	4	This has especially improved in the HSSE arena.
	5	4	Need to make sure people are still held accountable.
	5	5	Team
	5	5	Understand the concept, but no blame does not mean no responsibity

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	2	4	Standards that clearly define expectations and visual, transparent systems that make it blatently obvious to management what is happening, near real time, leaving anything less that excellence no place to hide is paramont. Accountability is important.
	6	4	Falicy in system, even LPD gets down to Root Cause and that typically is Identifying the Person that failed even tho a repair is made to the syetem or process..
	6	4	depending on project location or owner, this can be hard to do
	6	3	When one person makes a mistake; the team has made a mistake and the resources are usually available to come up with a good fix.
30	*Having open communication and transparency*		
31	*Staffing with cooperative and collaborative personnel*		
	4	4	This is a you create it item, with demonstrative executive leadership. 90% or more will get on board once the executives are there and expect it.
	6	4	Engineering and Construction Mind Sets --- Sometimes Hard to get past personalities and egos.
32	*Having an open minded team*		
	6	2	Clients in EPC are going to have to learn and become lean themselves and say to EPC executives, somebody is going to figure out how to do this, and when they do, were going to hire them. Until that happens, with rare exceptions, it is all smoke.
	6	4	Constructability is a great tool to identify opportunities, but hard to find teams that are open to Change..
33	*Creating executive alignment amongst the contracted parties*		
	6	4	Goes back to good leadership ---- Right to the top.
	6	5	Executive alignment and committment is needed to assure appropriate resources are engaged to meet the project objectives.
	6	6	Having a routine executive sponsors meeting ensures alignment within the organizations
	6	3	Essential but I do not think this is a standard.Need to develop this more so it happens regularly.
	6	2	This is THE challenge. The usual state of affairs is that Executives have arrived, already know and will not listen to learn what is new, different and of profound benefit to everyone. Pride is the issue.
	5	5	work still happens at the site however, executive alignmnet can help with resourcing
	6	4	When execs get together timely and review progress and discuss issues; resolutions usually follow.
34	*Emphasizing coordination planning during the design process*		
	5	3	Engineering and Construction have different drivers. Budgets need to be aligned to make this work.

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	6	This needs to happen early and continue through the project duration.
	6	4	no brainer
	6	5	Construction-driven engineering and procurement is essential to support flash track projects.
	4	4	Ephasis is a lame term. Protocols, Early Extraction of Need, Alignment, etc. etc. are much better. See chapter 2 Patty & Denton
35	*Performing exhaustive front end planning*		
	5	5	The plan (Project Controls: schedule, procurement plan, staffing plan, etc...) should be developed early. As I said before, procure long lead items ASAP, then engineering has to be executed well to support the construction schedule.
	3	3	Need to have a fast track process that allows for front end loading sequentially with the activities
	5	5	every aspect should be reviewed thoroughly with all organizations and disciplines invloved.
	5	4	Front end planning is critical to eliminating late changes
	2	4	Many EPCs /Client teams are very good at performing FEL using CII and IPA recommendations and measures. How to improve FEL well beyond best practice using lean, SixSigma, Theory of Constrains, Concurrent eng
	5	4	Few projects/owners will fund the appropriate Construction Front end support resources, timing of engineering is not aligned to sequence of staffing
	5	4	Without a plan there will not be success. No spec, no check.
	5	4	get it right to facilitate detailed engineering, identify long lead items
36	*Identifying and procuring long lead time items*		
	6	6	This is essential. Has to happen!
	6	5	ensuring some slack is obviously essential. knowing all items is critical.
	6	5	Long lead time procurement strategies are an essential component to your project execution plan.
	6	5	Depends on Owner cashflow capabilities and limitations.
	6	6	Typicall do this well and is absolutely critical
	6	5	Procurement and Construction often have a different definition of required on site
	6	4	Early engagement of long lead suppliers in a target costing, mutual benefit, long term lean procurement can help. See Chapt 5
	6	4	Design to support critcal/long lead deliveries, and Procurement support that understands the importance- lack of communications or involvement by Procurement up front.
	6	4	You can't use it if you don't have it

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	4	Otherwise drawings hold things up
	6	5	cannot fast pace w/o it
37	*Monitoring and driving corrective actions through the project controls process*		
	5	5	Yes, you have to stay on top of things to see if anything is veering from the path. Correct the path ASAP.
	6	4	early id of issues and implementation of corrective actions including work arounds is critical.
	6	4	Best Practice Project Controls are not controls at all. They are visual accounting. They lack foundation elements to actually control anything. No production unit, no defined action limits, poor measures at the source, late, low transparancy, etc.etc.
	6	4	Project Controls early involvement is critical for Cost estimating and Schedule alignment to WBS and Execuiton Planning by Construction.
	6	4	If you don't solve problems, you will not move forward
	5	3	Using prescpritive processes or templates is proactive; project controls are reactive.
38	*Providing enough resources to critical path items*		
	6	5	I have consistantly emphasized the need for good communications among all project organizations
	6	4	Communications is the key and transparency ensures problems are surfaced early so actions can be taken
	5	3	So many tiems it is the Ownber VS. the contractor as opposed the the Owner AND the contractor
	6	4	Needed, but doesn't always work.
	6	2	Many organizations are full of cordial hypocrisy. Trust is low, Transparancy Marginal. Doing the right thing is a lot of work. If we get along just fine without all that work, it takes rare birds to successfully lead the effort.
	6	4	Been on a few of these projects and they are super.. But rare.. due to Relational type Contract restrictions.. Lump Sum, T&M, Etc
	6	4	WIthout this delays will occur
	6	4	team building can help
	6	5	who could disagree with the critical need to provide enough resources. Believe the word capable should be used with enough since the solution is not in #s alone.
	6	4	Project success largely depends on executing critical path items in a timely manner.
	6	6	Typically do this well and absolutely critical
	6	5	There needs to be a planning group defining work as outlined in # 7

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	3	3	Critical path is only useful for long range planning and resource leveling. Task level planning and execution control is necessary to actually control design, P & C.
	6	4	If you don't manage the critical path, you will not meet the schedule
	6	4	more overlap / interface of work activity requires more oversight
39	*Considering speed of fabrication and construction during the selection of design alternatives*		
	4	3	lack of details have hurt construction. Causing others to complete the design details which are required. Having one group responsible would speed up the process.
	6	5	whenever you can improve fabrication and construction times through design options, there is a net benefit to the overall schedule.
	2	2	Ned to make sure that designs are complete to avoid field rework
	5	5	This is where alliance fabricators are beneficial.
	6	5	Standardization should yield significant schedule/cost benefits . caution Re: fewer design details vs. construction/supplier needs.
	6	4	See #3 response... this adds extended review/approval/fabrication time to the cycle. especially of Standard Details like Pipe Racks/Supports, & Misc Steel, & Stairs, etc
	3	3	These are 2 separate issues, the first a worthy pursuit. Optimization of design detail is to provide just what is needed, just in time, to who needs it.
	6	4	need to do this as equipment / steel needed faster
	6	4	We are getting better at this..
	6	5	as much a possible
40	*Recognizing and managing the additional fast track risks*		
	5	5	Develop a risk register early in the process; think about mitigation measures early on for the identified risks.
	6	6	All risks need to be identified especially those that are because it is fast track. Mitigation plans are more important to make sure that risks can be mitigated quickly.
	5	5	Hopefully there is no stone unturned and all risks are identified and covered through contact scope, responsibilities and accountabilities. What is additional ?
	6	5	Identifying and managing additional fast track risks are key to project success. There are different risk factors and risk mitigation techniques associated with fast track projects compared to cost driven projects.
	5	3	Unfortunately the risks are identified at the start of the project and rarely evaluated or updated after compilation.

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	5	Projects by nature are risky propositions; being proactive by identifying and mitgating risk early is key
	6	4	Plan for success- but dont underestimate Contingency needs for worse case..
	6	5	need to know up front the plan to fast track so budgetting, personnel assignments, project plan, schedule, etc. can be made and aligned
	6	3	Need effective changement process and an empowered owner project maanger who can make decisions and not change later
41	*Co-location of project team (owner; designer; builder; and/or key vendors)*		
	2	5	ideal but almost always impossible or impractical
	5	5	Design is usually most efficient at the engineering firm. So the watchout here is that you can slow detailed design by requiring the engineering firm to be somewhere other than their home office.
	4	4	Co-location may not always be the most effective approach; members need to be where they can work most effectively
	6	4	essential team members need to be on-site in order to quickly resolve problems
	5	4	Helpful but not absolutely essential.
	6	4	Done on a few projects... Highly recommended on Complex Projects that are Flash Track for faster collaboration and decision making
	6	3	hard to do...modern collaboration technologies can help emulate co-location
	6	5	facilitates reviews and speeds answers to queries
	6	4	This must include engineering leads when MEP construction is in progress.
42	*Simplifying approval procedures*		
	4	4	Again, this can be a catch 22. This may come back to bite you!
	5	5	don
	4	4	Not just simplifying them, but making them flow, pull flow where possible
	6	4	Empowerment of appropriate Decision Makers and refined # of approvals
	5	4	to the best possible
43	*Dedicating full-time personnel to the project*		
	5	5	ae required by schedule- great if cost of idle time is not an issue
	6	6	You don't need 'tourist,' who periodically walk by the project. You need people who eat, sleep, and breathe the project 24x7, who are committed to its success.
	6	6	Typically do this well and absolutely critical

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	4	3	Depends on the skill set and size of the project. At project spinup in early FEL is the most important time for the largest number of people to be dedicated to build what they know into the plan and design to avoid back loops
	6	4	Again, all the right thoughts, just needs appropriate funding by a client and dedicated team of resources that understand the value.
	6	5	If the job doesn't justify full time people, it is not large enough to qualify for this survey
	5	4	impossible to do completely...a few key roles pending size of project is essential
	6	4	need continuity and consistency through out project
	6	4	Dedicating full time personnel to the project reflects commitment to the successful execution of the project.
44	*Selecting appropriate construction methods*		
	6	6	??? Don't you always need to utilize appropriate construction methods!
	6	5	Construction Plan review critical to project success
	5	2	Lame question
	6	5	modularization, for example, will speed up field work
	5	3	Depends on what you mean by provisional. Caution proceeding to far without approval certainty.
45	*Minimizing hand-offs*		
	3	3	Not sure what you mean here???
	4	4	Need to be able to freeze the design with minimal adjustments
	6	5	scopes must be well defined and contracts clear as to responsibilities and limitations on subcontracting -require pre-approval-
	4	4	Handoffs done well are not an issue. Having a person/firm try to execute part of the project that is outside their core competancy is a watchout.
	6	4	Risks increase in all aspects of the project with the greater number of hand-offs.
	6	5	Streamlining processes speeds delivery
	3	3	Lame question
	6	4	We dont always do a great job of Passing the Baton thru the process of Design to Construction and the between activities that get overlooked.. Like when does this need to go to Procurement, Project Controls alignment with Construction Execution/WBS.
	4	4	not sure what is meant here. if means less owner involvement, not a good idea

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
46	*Employing innovative construction methods*		
	4	4	As long as they are safe and make sense.
	4	3	Innovative is good but you goal is to get going faster. Fast track already has differences and introducing innovative may take the focus off the fast track.
	4	4	Depends on the project
	5	4	Must be proven and safe
	3	3	Lame question, of course if they will help.
	6	4	Sometimes innovative means & methods can require design changes although Cost Savings Support the change, but hard for Engineering to accept having to redesign..
	3	3	get lots of attention...typically burned more design time and money for the showy execution
	3	3	Construction Innovation is not a driver for fast tract - it's proven methods
	5	4	need to ensure the team has knowledge of how to employ them, if training is needed time can be lost

Mode score ≥ 5 but consensus of whether issue is ESSENTAIL to fast track was not reached			
47	*Having equitable shared risks and rewards*		
	2	*2*	*The owner takes on more risk on flash track projects.*
	5	*4*	*Ultimately, the client has the burden of the risk.*
	2	*3*	*As we know - an Owner will the plant or facility for a lifetime to generate revenue and profit. A contractor has a one time opportunity to generate profict during execution. The risks and reward should be gradusted based on this.*
	6	*5*	*if the risks / rewards are not shared equally, the motivation needed will not be consistant.*
	5	*3*	*Clearly distributed ownership of outcome, based on what the respective entities can actually control and plan to huddle up quickly to address circumstance that arize that were not planned for are important.*
	6	*4*	*Easier to do in an alliance type contracting environment.*
	6	*2*	*The risk should be primarily with the entity that stands to gain the most from the project long term. Generally the contracts that define the risk are the same as for normal projects - except for a few cases.*
	6	*5*	*necessary*

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	2	*3*	*In heavy industrial construction i have rarely seen performance rewards - sharing or acknowledging risks is critical*
	6	*6*	*Too many owners want to dump their responsibilities onto a contractor. When engineering is deficient; force the contractor to fill the gap via change order. When owner doesn*
	6	*2*	*Equality of skin in the game a must. Customer base has been poor at accepting their share of risk.*
	6	*2*	*Equality of skin in the game a must. Customer base has been poor at accepting their share of risk.*
48	*Please rank the following contract types by how absolutely ESSENTIAL they are (to flash-tracking)*		
	Please rank the following contract types by the SUCCESS (industry has had in implimenting in flash-track projects)		
	48.1		*- Cost Plus or Reinbursible*
	48.2		*- Cost Plus & Fixed Fee*
	48.3		*- Integrated project Delivery (e.g., tri-party agreement)*
49	*Executing Single-source or no-bid contracts*		
	1	*1*	*These are harder to negotiate a fair price and may take longer. Like bidding to 3 preferred contractors to know your expectations*
	5	*5*	*In many cases this can knock weeks off the pro*
	6	*6*	*Especially with respect to use of Alliance fabricators and commodity suppliers.*
	6	*5*	*Single source allows early engagement critical to fast-track projects success*
	2	*3*	*Usually, long term there should be 2 or 3 relational competitive partners developed and deployed for just about everything.*
	2	*3*	*Single source source should be based on someone proving they are so good helping the team reduce cost in and beyond what they supply and so dependable, that there is no point going to someone else.*
	6	*5*	*This would depend on previous experience of CM/Sub relationships and trusted values for cost of execution.*
	6	*2*	*This can save significant time.*
	6	*3*	*This is a key element of a successful fast track project - it should be awarded on a qualifications basis - not competitively bid*
	6	*5*	*this will help a fast track project - eliminate bidding cycle / time*
	3	*3*	*This sounds like a good idea, but it typically doesn*
	2	*2*	*single-source may be only marginally better than multiple-bid contracting*
	6	*3*	*only method i*

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Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	2	*4*	*Sole source is not necessarily a key strategy for fast/flash track success. Competition works just as well.*
	6	*5*	*When labor markets are tight or skills are in demand, this is a very effective way to successfully contract.*
50	*Employing conservative designs to avoid design holds*		
	5	*2*	*Engineering tends to release with holds to fast track designs which causes cost and schedule issues with construction.*
	5	*5*	*With caution vs. costs.*
	4	*3*	*This needs to be done on a case by case basis.*
	6	*5*	*Especially important in the concrete (foundation) and structural steel areas.*
	6	*4*	*may need to over design if vendor data not on time*
51	*Capping contractor's down-side risk*		
	3	*3*	*If you down-side risk to contractor than owner will be taking on more of the risk. Tough to negotiate and mitigate.*
	6	*4*	*This is a difficult issue to control. Contract language is always an issue as is the potential for impasse leading to possible work interruption.The solution=strong contract between two well estab. co's with a well defined sect. on risk exposure/*
	5	*4*	*That is not the best question. If the project cannot be designed and constructed such that all participants make money, then it should not proceed past the stage gate where that is discovered.*
	3	*3*	*not sure of benefit here*
52	*Stream-lining the design review process*		
	2	*2*	*Ensuring everyone's buy in through the design review process is critical - just need to expedite the process*
	4	*4*	*This can be a catch 22. A lack of adequate review can lead to problems in the field, due to engineering mistakes, that can significantly increase cost and schedule.*
	5	*5*	*Need to have over the shoulder reviews*
	4	*5*	*need good definition of base design review process vs. streamlined KISS*
	5	*5*	*Having all stakeholders input, regardless of their ability to do so, can slow things down. This has to be managed.*
	6	*5*	*Quick turnaround on drawing reviews is critical to meeting schedule*
	6	*2*	*Design review needs to happen often and in real-time*
	2	*2*	*That is generic, what do you mean by that?*

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	*4*	*Too many redetailing & reviews of sufficient design details by Engineer.. Specs require submittals of Shop drawings by Fabricator that are not that different from the design details.*
	5	*4*	*WIthout timely reviews, work stops*
	6	*4*	*everyone sees the design / comments a one time*
53	*Explicitly designating the project as being "fast track"*		
	6	*5*	*Need everyone to be on board and have upper management support*
	5	*5*	*The project needs to be identified as fast track to align project participants to implement fast track project processes.*
	2	*3*	*Explicit designation as fast track isn't nearly as important as establishing the critical schedule dates, and constantly reenforcing their importance.*
	4	*4*	*Owner organizations are reluctant to designate a project as fast track - they typically want to get the best of both worlds - a project that is budget conscious while meeting or beating schedule.*
	6	*5*	*Communicating a project is fast-track aligns the team toward schedule goals*
	6	*4*	*Fast track projects are pretty obvious, but if not obvious it is essenmtila to make sure the contractor understands the risk*
	6	*4*	*all parties MUST know from the beginning that the project is fast track*
	6	*4*	*necesary to gain alignment on priorities*
	6	*6*	*The pitfall here is that every project becomes Fast Track and therefore the process becomes the norm vs the exception*
	4	*3*	*EPC is customarily fast track. What we call it is not so important as how we work together to accomplish it.*
	6	*4*	*Customers and suppliers need to align to what the term means and implies regarding funding, decision-making, change-management, and have commitment that schedule, not scope or cost, will be the lead topic and visibly tracked/gapped versus the target timel*
	6	*5*	*It is essential that all team members (and their supervisors) as well as the consultants and contractors be made aware of the urgency of the project and need to commit, up-front, the resources needed to accomplish the goals of the project.*
	4	*3*	*Projects get designated fast track only a fraction of the time - to me it doesn*
	6	*6*	*Naming the activity is essential to alerting the team and related stakeholders, including senior management, of the importance and urgency in attacking the project in a different way!*
	3	*4*	*The contract requirements (e.g. constructability participation), schedule and deliverables are self explanitory*
54	*Seeking provisional regulatory approvals*		

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	5	how can this not be essential
	5	5	Depends greatly on the local authority.
	6	4	Regulatory approvals can be a major hang-up in achieving fast-track project goals
	6	5	need to know what is required and timing for approvals to incorporate into the plan
	6	4	Timely regulatory approval is a must for a successful project
	6	2	Depends on what you mean by provisional. Caution proceeding to far without approval certainty.
55	Employing Lean Construction practices		
	6	2	That is a lame question. All the stuff in this inquiry is lean practice in the broad sense. Six Sigma would claim it as well as Theory of Constraints, etc.
	6	4	Been around a long time like a lot of other practices like Constructability, Last Planner/Reverse Phase Planning, etc .. Tools are there, just need to use them..
	6	4	You will repeat the past if you don't learn from it
	1	2	These principals will slow the project - they may be a key that the client wants - but it does not help speed up the project
	5	4	good concept but too many new ideas late can stall the work with new learnings
56	Using standard repeatable designs and fewer design details		
57	Creating project-specific mutually equitable contracts		
	3	3	I have seen this concept utilized, but the relationships typically break down, and the vendors tend to exploit the non-competitive nature of these agreements.
	6	2	Contracts need to be robust to cover all the dynamics of the fast track. Not many contract managers understand the concept of fast track and are not set up to get the contracts out to support this type of contracting.
	6	4	Any contract which is explicit and equitable is essential to smooth and effective project performance.
	5	2	Contracts must support the need to drive the speed of deliverables to get to construction.
	5	4	The management team needs to focus on getting the project completed and not spending more time in protecting their position against the contract. A mutually equitable contract assumes a level of trust between the parties facilitates greater collaboration
	6	3	aligned incentives are critical

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	*3*	*Unfair contract terms - even if executed by both parties -will always result in owner/contractor acrimony and distrust*
	6	*4*	*The success varies according to the culture of the organizations joining forces. Sometimes this is a mariage made in heaven and other times a disaster.*
	1	*1*	*The use of existing contracts has facilitated a quicker start, readily available resources, understanding of owner requirements, etc*
	6	*2*	*Mutual benefit is essential in the contract, but more essential in protocols not written but adhered to share benefits. Trust must be developed over time, that if I share something that saves the project team cost, bottom line benefit will be shared.*
	6	*4*	*Without equitable contracts, energy will be wasted on contractual issues rather then project issues.*
	3	*3*	*My company has been very successful in the use of alliance type (not project-specific) contracts.*
	6	*5*	*contracts need a win-win concept for projects to be successful - eliminate barriers*
	4	*3*	*In the aerospace industry, the farther your company is down the supplier food chain, the less equitable the partnering contracts tend to be.*
	6	*1*	*Engineering contracts are usually commodity based (estimated mhrs x rate); Procurement (OEMs) bid hard dollar; construction either bid hard dollar or partner type agreements.*
58	*Employing performance incentives to promote a high performance culture*		
	1	*1*	*Contracts can have all the performance incentives but you have no control over the workers in the field.*
	5	*3*	*My ratingRe: success- not used enough at performance team levels. They don*
	5	*4*	*Operational performance normally more important than early completion.*
	5	*3*	*Mutual success is required to go long term, beyond one project. Convoluted expectations must be resolved into enginering and business criteria. Incentives can be helpful if bottom line and long term.*
	6	*5*	*Project doesnt benefit to finish on/ahead of schedule if rework is required to meet quality requirements.*
	6	*4*	*I can go with incentives providing 90% of the money gets to the craft*
	5	*5*	*A culture does not result from one time contract incentives. If the culture exists, the incentives are nice, but not necessary.*
	2	*2*	*Not really effective*
59	*Selecting preferred or alliance contractors*		

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	4	*4*	*Again, depends. If good working relationships have been developed, this can be a good thing. But what is their current backlog? What team are you going to get?*
	6	*5*	*working with those you have had prior experience and success with can prove to be invaluable*
	6	*5*	*Preferred or alliance partners with a proven track record of high performance on flash track projects are essential for executing flash track projects successfully with a high success rate.*
	6	*5*	*Relationships and experience with a contractor speeds team building and organization*
	4	*4*	*Advanced clients have milked about all they are going to get out of preferred or allianced contracting. Lean Relational Competitive Partnering is different, only elements remain useful from the traditional systems.*
	6	5	*Prior Experience and Relationship Contracting is better than the unknowns.*
	6	*5*	*Without an alliance, there is not enouigh shared risk to drive the best decisions for every challenge*
	6	*4*	*Mutual commitment to current and future work is powerful partnering tool and eliminates many pressure points.*
	5	*5*	*may help if they already are familiar with your people, processes, standards*
	6	*5*	*It works when labor is tight or skillsets are critical. However, that alone doesn*
Mode score < 4			
60	*Increasing resource levels for project control*		
	3	*3*	*I don't know if this will help. The project controls team will need to engage the discipline leads to provide input and updates to the scheduling.*
	3	*3*	*Resources are not the issue. Project controls are not doing what will control work process.*
61	*Tying performance incentives and rewards to project goals*		
	3	*2*	*Determining which party will assume which risk is important and needs to be researched to determine the best approach.*
	2	*2*	*Getting the incentives and rewards lined out in the contracts is time consuming and may defeat the purpose of the fast track.*
	2	*3*	*Incentives and rewards are a distraction to fast-track projects*
	5	*3*	*No harm no foul is tough to get agreement. If you and no prejudice or no harm/no foul situation the incentives and gaols are not lined up. Incentives and rewards are needed - jsut don*
	5	*2*	*Incentives are important, especially bottom line ones and when Lean means and methods are taught to the team so that they know how to do something different.*

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	6	*5*	*A Dog in the Hunt so to speak.. Monetary incentives and penalties linked to success or failure to deliver usually succeeds.*
	3	*3*	*this could go either way between moderately agree and disagree. i don*
	5	*3*	*Incentives are nice but we price the work to make money already - what is important is to not lose money on these projects.*
	4	*3*	*not a real fan of incentives - added burden to administer - make initial contracts fair and equitable*
	5	*4*	*These can work, but industry can do more to implement them effectively.*
	6	*5*	*The incentives are typical: LDs, Schedule bonus/penalty, HSE stats, QC stats. Maybe shared savings in constructability program.*
62	*Establishing early completion bonuses*		
	2	*2*	*Not really effective.*
	3	*3*	*what are you sacrificing to get early completion in the quality?*
	5	*4*	*Early bonuses create the incentive to get the job done---the concern at any cost .Care must be used to ensure quality.*
	4	*4*	*Need to be very careful that early completion incentives do not result in unintended consequences in project quality/performance.*
	5	*4*	*Not to the extend that either safety or quality is compromised*
	4	*3*	*One key is balance. Lean enable improving both cost and schedule simultaneously. Big problems have occured when cost got out of hand on so called schedule driven projects. Early completion alone may be harsh.*
	1	*2*	*Early completion bonuses suggest that the project had slack time. Flash track means faster then it has ever been done, with no slack.*
	4	*3*	*This is the icing on the cake and great if you get it but the base contract / arrangement must be sound*
	3	*3*	*again, not a fan of bonuses*
63	*Executing liability waivers among key project participants*		
	3	*3*	*No hammer can reduce effectiveness of schedule expediting.*
	1	*3*	*In today*
	5	*5*	*Limiting liability risks is key to almost all who participate in a major project*
	2	*2*	*Better to have pre-negotiated terms and conditions*
	2	*4*	*Overreliance on contracts will not produce the necessary trust in intent and competency that is necessary. How we behave of mutual benefit to others is far more important.*
	5	*4*	*More of the Collaborative Partnering concepts- Shared Risk and Reward*
	5	*5*	*still need certain basics to protect the parties*

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
64	*Selecting the best value contractor*		
	4	*4*	*Depends on your definition of value. If you mean low-cost, then no this is not necessarily a good idea. If you mean a contractor who executes well and provides a good bang for the buck (good value) then yes.*
	5	*4*	*definition and implementation of value must be carefully and uniformly applied.*
	5	*4*	*Best Value is a pretty broad term.*
	4	*5*	*Need to better define best value. By the nature of a Flash Track project schedule has a higher priority than cost.*
	6	*2*	*Profound improvement will require a profound expansion of what constitutes value.*
	6	*4*	*Due diligence to prequal or past experience for verification to execute Flash to meet Quality, Schedule and Cost & Safety parameters.*
	4	*4*	*best value may not always mean fastest; if prpoirty is speed, may need to spend more money for that type of contractor*
	6	*2*	*Owners need to appreciate on larger EPC projects that contractors add value (vs. being commodities). Good GCs need to market themselves accordingly.*

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Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
65	*In your experience are there other contractural considerations that are important or distinguishing success factors in fast- or flash track projects?*		
	Target Price with cost saving splits.		
	standardization of key equipment and specifications.		
	What is essential is to have buy in by all involved parties and all involved parties push that done to all levels. A high degree of trust has to be developed and a detailed plan has to be implemented but it has to be a plan that is re-validated/re-adjusted on a regular basis.		
	It seems that most considerations have been considered.Regardless of how essential a concept is, the quality & execution of the contract will determine it's success.Therefore answers reflect my experience over time.		
	Frankly, I don't put much weight in the contract. I put much more weight in my relationship with the contracted. If I have a solid relationship with the contractor, that will enable my success. And you can't word a contract well enough, to get good support from a contractor who doesn't have your best interest at heart.		
	Assuming you are able to self perform many construction activities this enables you to control the pace of the project, so self perform is an aspect to be considered..		
	Prior negotiated terms and conditions (master service agreements) to eliminate the lawyers		
	Open book concept		
	Lump Sum or Guaranteed max cost (To be negotiated at approximately 30 percent Engineering) Open book approach until 30 percent Engineering point.		
	It is absolutely essential that all parties know and fully understand from the very beginning of the project that the primary and fundamental objective is to get to the successful completion of the project as quickly and efficiently as possible.		
	Contracts must be equitable and a win / win for all parties involved		
	Absolutely. You haven't even addressed target costing or the foundation role of trust. Womack and Jones sort of missed that part. But Shingijutsu did not. The improvements EPC needs are primarily people issues. Pride among executives that we already know and are doing everything practical is the great disrupter.		
	Depending on the contract strategy, Contracts for Flash Track should incorporate project specific T&C's, deliverables and risk and reward guidelines. Clear definition of Completion & Acceptance criteria has to be spelled out, and not just referred to or use boiler plate guidelines from Ghost Projects.		
	Target price where losses and gains are shared in an open book arangement		
	A long term trusting partnership between the owner and contractor is essential. It will not suceed when deep relationships do not exist.		
	T&M rate agreements if related work is needed and/or for change management items.Night, weekend design/construction support needs assumptions and plans.Contingency plans/pricing if critical performance milestones, (e.g., successful equipment VAT), alignment to pay for parallel options for any critical unit op that has risk of failing Acceptance Testing.		
	There needs to be limitations of liabilities so you don't have to go slow worring about errors and ommissions		
	ensuring the project team understands what is in the contract		
	design build		

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
			Cost plus with a fix fee generally gives the best results. Other incentative add ons can be attractive to expedite certain milestone activities or craft labor bonus to complete the critical components on time or ahead of schedule.
			No particular contract type lends itself to fast track success. Other tools such as visual PM, teambuilding, and contract incentives are more effective methods to use.
			Owner's MUST understand their role in the project (unless they are awarded an EPC contract). They must have the managerial and technical expertise necessary to function as the de facto EPC if they plan to award direct contracts for E, P, C (or any combination requiring more than one contractor). This means understanding the importance of engineering being more than a commodity; understanding that foreign OEM's don't always understand N. American requirements and they must understand that failure to assign risks to the party best suited to manage that risk is only a recipe for failure. This means owners must know how to write appropriate contracts for each party, identify the commercial and technical deliverables and understand the consequences of each stakeholder not meeting their obligations.
			No one contracting method is essential for all of the contractual agrrements. The right one for each designated aspect is more important thn having one for all.
66			*In your experience are there other delivery method considerations that are important or distinguishing success factors in fast- or flash track projects?*
			The main factor in reducing schedule length is getting the calcs and specs done for the long lead items ASAP. This will require the engineering to be front loaded some.
			Already covered compositely in some of above: Early establishment of a coordinated fast(flash) track schedule planinvolving Engineering Design/Construction/Owner/major suppliers-contractors requiring participation/comments/agreement.Revisit periodically and when needed to resolve unforeseen issues.
			Insuring Engineering has agreed to the project phlosophy
			These questions are applicable to any 'well done' project. Choosing best value, having personnel with strong leadership,... are all valuable to any job. I don't know that I provided much, with my answers this section....
			Teamwork is essential to the sucessful execution of flash track projects. However it is important to also understand who the ultimate decision-maker is.
			Consider multiple contractors, ie: multiple discipline packages of work
			Selecting project team memebers based on their ability to work together as one team and not exclusively based on their availability for assignment.
			I think all qestions covered this
			Select EPC contractor early so they become part of the overall project team.
			Set achievable goals
			schedule knowledge and adhearence
			See Lean Supply Chain Development , Cooper & SlagmulderThese methods and their application by Shingijutsu have been summarized and related to FEL & EPC in The End of Project Overruns Patty & Denton
			Owner leadership behavior and reaction to bad news...transparent/authentic two-way communication/decision-making expectations need to be maintained. Problems, cost impacts, and options need to flow freely and quickly or teams will bury themselves for too long until it's too late to fix.

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	NA		
	Solid Change management systemScope management		
	In addtion to strong management leaders, the selection of specialize labor teams (crews that are familar with each other skill) are good way to reinforce and improve work flow and focus the overall project workforce. Working in safe conditions improves crews attention to working productive and safely.		
	Visual PM via metrics that are current and prominent to all project participants, to keep everyone aligned and in the know as to where the project stands.		
	I like a hybrid agreement with a contractor where an assumed set of quantities is used for estimating. Based on those quantities, a schedule and time dependent costs (Const Equip, GCs, Management & Supervision) can be established. I like to award a fixed contract based on the above. During the design phase, the parties work together to meet or underrun the design quantities. Based on designed quantities vs. estimated quantities, there is an adjustment. As long as the designed quantities do not exceed estimated by some factor, the fixed costs remain intact. This provides some topside protection to the owner while providing incentives to the contractor.		
	Picking the right fit for the scope that is to be delivered		
67	*In your experience are there other organizational considerations that are important or distinguishing success factors in fast- or flash track projects?*		
	I believe that flash track projects would be better executed by companies that can do both engineering and construction (and have good project controls (scheduling) processes). This will facilitate better and expedited coordination with aligned interest.		
	A competitive group of individuals, with the proper skills and experience, aligned to the project goals is the key to success. Thus, this are, organization, is the critical piece in my mind. I can write the contracts on the back of a napkin, if need be. A team like this won't let that get in the way of success.		
	No		
	I have noticed true Owners (say a utility) are much more structured and incentivized to properly address the questions you have asked thus far. However, when the Owner is really the developer,a whole differnt dynamic and model come into play. Many items a developer will flip a project only after a few months and this ends up in a real battle. Also, developers have no real sense of long term ownership. You should consider this developer mentality as you develop the process		
	All questions above coveerd the subject		
	Depending on the financing structure but alignment with the banking entity or lender's engineer could be essential.		
	definition of success to both teams a common good if you will		
	Yes,many leadership, trust and carrer path and even longview organizational investment/funding issues. See End of Project Overruns, Patty & Denton, Primer, Chapters 10 & 11.		
	Pre committed staffing to project from womb to tomb is typical, but rarely ever sustained thru out the project due to secondary and priority shifts from within the organizations.. Another project overlapping.		

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	A skilled Launch organization within the operations is model delivering great results for us. Treating the design input/design review/construction turnover/IQ/OQ/commissioning/qualification/validation/training and overall integration into operations is really another Technology unto itself, equal to Engineering, Construction, and Operations. Dedicating some partial operations resources for a one-off startup doesn't deliver anything, especially on a fast-track job.		
	Conduct monthly exectuive leadership meetings with PRIORITY contractors to ensure alignment		
	Available funding		
	Need well defined roles and responsibilities across all partners in the project.		
	Less cooks in the kitchen and having a good handle on change management is important		
68	*In your experience are there other planning considerations that are important or distinguishing success factors in fast- or flash track projects?*		
	Project needs to be construction driven, not engineering driven in order to be successful .		
	No comment.		
	No		
	More resources and cost should be dedicated to FEL on projects, especially Fast Track.		
	a base line schedule lock down to measure to and one that everyone agrees to at the start of the project		
	A process which clearly defines the package of work (about 500 hrs), by discipline which includes materials, test plans, s/c support, controls, SHES,etc. We must do everything we can to have front line supervision on the front line		
	Push and Pull flow control, including the push-pull interface, critical chain, Pugh Matrix, Alignment of criteria breakdown with work breakdown, cost and schedule and team break down structures. Target costing with confirmations at stage gates and shared savings, etc.etc.		
	taking the time to develop a detail schedule with logic ties.		
	External and internal interfaces -- either within a plant or with local agencies -- maintaining production/construction activities require as much attention as the other base scope blocks of a project		
	No		
	Available funding so schedule is not delayed		
	Using a template process for EPC projects is more proactive than relying on project controls. Project controls, by it's nature is feedback to provide corrective actions. Templating the project at the beginning provides a medium for all parties to interlock their outputs to others' inputs. It provides gates for reviewing at key milestones. A template provides transparency, communicates expectations and shows impacts of stakeholders not meeting their deliverables.		
	Plan the work and work the plan but don't stagnate the work by overdoing it.		
69	*In your experience are there other cultural considerations that are important or distinguishing success factors in fast- or flash track projects?*		
	Quick reaction to and resolution of personal interaction issues.		
	The right people - skills, attitude, etc are THE key to success.		

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
	The Team concept approach always is the best approach		
	Having a collaborative approach to the decision making and contractural language which allows benefit to all involved when a project is successful.		
	the understanding of in the project is sucessful everyone wins its about the project not individuals or the contractor or owner you cannot have a win loose situation		
	There is, but the items listed are a good start.		
	Conductiong periodic partnering sessions with all stakeholders (Owner, Designers, Contractor, subcontractors, etc...)		
	People need to understand that we all come from different walks of life and experience. Some people will like each other; others will not. However, personality clashes must be identified and resolved.		
	Mutual goals		
70	*In your experience are there other design considerations that are important or distinguishing success factors in fast- or flash track projects?*		
	Consider modularization and offsite fabrication as appropriate		
	Not getting too sidetracked with study items is a key as well. The enemy of good is better -- don't get too distracted with making things better, when good is good enough.		
	Contructability input from discipline specialists throughout the design process.		
	constructability		
	Yes, many design for assembly (Boothroyd),and design for field assembly (Chap 8,9 Patty & Denton), Design for rapid setup (Shingo), Design for Factory production (Hoop & Spearman), Statistical Process control applied to engineering organizations (Deming)issues are paramount. Balance between often conflicting ideals is key.		
	use performance specifications where appropriate		
	preventing over-design and inter-discipline cascading changes -- co-location isn't even enough -- collaborative tools with frequent in-process customer quick review can speed up design. The other major consideration is working up front to bundle the discipline packages in a way that construction can efficiently bid them.		
	Standardize definitions and criteria used to achieve specific revisions. There should be definitions for each discipline as to what information is required to meet Rev A status. Same for Rev B, Rev C, IFC, IFD, IFM, etc. In the modern world of 3D engineering; % complete is misleading. Ensure the design deliverables are broken down using the same WBS as procurement and construction. It is more important that the engineer work on the information needed first than stream lining the review process.		
	Keep iterations to a minimum.		
71	*In your experience are there other execution practices that are important or distinguishing success factors in fast- or flash track projects?*		
	frequent project review meetings		
	Having the proper communication systems (daily meetings, conference calls, etc) is importatnt to enabling a fast and efficient project execution.		
	Development of project specific execution plans are very essential.		

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Item	Essential score (Mode)	Success score (Mode)	Commments offered
			Yes, See previously mentioned literature, especially Chap 8 & 9, Patty & Denton
			minimize number of separate orgs interfacing...don't be fooled by hidden divisions within single companies, though...those can be worse than two different firms
			Minimize decision iterations
72			*Based on your experience, we'd welcome any thoughts on innovative practices that are absolutely essential for the success of flash track projects?*
			For innovative procurement practices, early procurement to get a place in the cue can help to reduce impact from long lead items.
			Suppose 3 covers this but where possible seek out multi-discipline modularization ideas
			Using OEM's versus 2nd or 3rd tier distributors can help shave time from the process, when this is an option.
			Modularize everything that is practical. Reduce on site labor as much as possible.
			agressiveness
			A budget is a must, but, full authority for the project manager to use liberal Undefined, Contingency, and Maintaining Production allowances would streamline project execution. If on every project I was given a Stretch Goal, Estimated Total Cost (including standard risk funds), then an unpublished Potential Estimated Cost and a schedule...I would hit the schedule everytime and the be between the Stretch Goal and ETC 90% of the time. As it is...the organizational angst and review processes to beg and justify seeking the final funds up to the ETC cause endless rework, scope choices, re-design, and team frustration to where we rarely deliver schedule but always deliver ETC and project teams feel like over-wrought failures.
			Time is money, but there is a breakover point where less time is a lot more money. Need to carefully define the balancing point. If the project driver truely is schedule, must have an ample budget to achieve success.
			optimiizing the procurement process and removing non productive ativities and authorizations,
			Predictable is far more important that innovative when it comes to fast or flash track.
73			*In your experience are there other risk considerations or mitgation measures that are important or distinguishing success factors in fast- or flash track projects?*
			All projects are full of risk. Every player has to be willing to take on risk. The key is to balance the risk. Everybody has to win or nobody wins. If one player loses, everybody loses. So, the key is for everybody to be a winner. Every player may have a different definition of winning but nonetheless, they all have to be winners in their terms.
			I don't think that you can manage the Owner's risk much, through contracts or caps. For example, in the consumer products industry where I work, a million dollar project will produce tens of millions of dollars of product a year. No participant in the project (EPC firm, equipment supplier, etc) can shoulder multiples of their PO in risk on every job they work.
			When issues arise have the decision making team with authority in place for quick resolutions.
			understanding what drives the process on each side of the table if there were more communication of front there would be better out comes for both parties
			see previous comments on final funding procedures...I realize this may be company-specific...I realize this aspect of a project doesn't cause the entire team angst, but, typically the key people on a project can get so consumed with funding processes we don't get to manage the scope/schedule/design elements with the same rigor...and schedules slide and design quality suffers

CII RT-311 Successful Delivery of Flash Track

Delphi Survey Round 1 Oracle comments

Item	Essential score (Mode)	Success score (Mode)	Commments offered
	Risk should be apportioned to the party best suited to manage/mitigate the risk. As stated earlier, owners tend to dump all their sins on the contractor during the heat of construction.As a person that has 30+ years with a global EPC and 7+ years as an owner's rep on large cap programs; I have yet to see an owner organization that is fully mature enough to take on the EPC obligations that they take on. Risk allocation is a key issue.		

APPENDIX J

Delphi Round 2 – Questionnaire, Responses and Oracle Comments

In the second of three rounds of the Delphi study, fast track subject matter experts or oracles were asked to consider the results and comments offered in the first round and to reconsider the 20 practices on which they did not reach consensus in the first round. The following pages show the questionnaire, results, and comments:

Flash Track, Delphi Panel -- Round 2

Page 1

A message from the Construction Industry Institute

The purpose of centralizing data collection through use of CII server-based software is to establish a centralized database to support CII research, benchmarking, and other CII committees working to support CII's mission. The centralized database should provide for more secure data collection and storage, and facilitates the sharing of data among authorized teams and committees while reducing the data collection burden on CII member companies.

All data provided for any CII survey in support of benchmarking and research activities by participating organizations are considered "company confidential." The data have been provided by participating companies with the assurance that individual company data will not be communicated in any form to any party other than CII authorized academic researchers and designated CII staff members. Any data or analyses based on these data that are shared with others or published will represent summaries of data from multiple organizations participating in the survey which have been aggregated in a way that will preclude identification of proprietary data and the specific performance of individual organizations.

Survey Purpose

"Successful Delivery of Flash-Track Projects" is a Construction Industry Institute (CII) funded study to better understand how to delivery faster Fast-Track (Flash-Track) through investigating and identifying distinguishing approaches, innovative delivery methods and barriers to faster, more effective project delivery.

Whereas, fast-track has been defined as a time-driven project requiring some degree of concurrency between Engineering, Procurement and Construction - flash-tracking requires a heightened degree of concurrency; relational contracting methods and exceptional execution.

We anticipate that a more heavily overlapped work-process will require the adoption of innovative design, management, and construction tools and techniques markedly different from traditional construction practices. We also expect that the re-engineered work-processes will better define fast-track project risks, enhance team integration and quality of relationships; contributing to increased predictability and Stakeholders' satisfaction for Owners, Designers and Contractors.

Results from this survey will serve as a central element in our efforts to identify critical organizational, scoping, contractual, and planning issues to significantly enhance the likelihood of success in the delivery of Flash Track projects. These efforts will ultimately lead to the development of an implementation resource that will define a project's readiness for flash-tracking and a guide of how to successfully deliver cost effective, quality, faster, fast-track or flash track projects.

Round 2 - Instructions

Thank you for your participation on the first round of this Construction Industry Institute (CII) funded study regarding *Successful Delivery of Flash Track Projects*. The first round survey was a great success. We had a participation level of near 90%, which included several interesting comments. We were able to reach consensus on 46 of the original 66 issues.

In this second round, we again offer the 20 items which consensus was not reached, along with the comments offered by either you or one of the other Delphi experts. Four (4) new issues have been added, based on the comments offered. We have also included a few new definitions in the glossary of terms to facilitate the process.

It would be greatly appreciated if you would review these comments and offer a new assessment whether the cited issue is absolutely ESSENTIAL for the success of flash track projects.

The practices listed in the following pages have been identified from published documents, focus group discussions, case-study interviews or Delphi experts as prevailing concepts or methods required for the successful execution of faster fast-track or flash-track projects. Again, we welcome any comments that you may wish to share.

Please answer each question. The survey will allow you to offer comments on each question. At the end of each section and the survey, you will have the opportunity to offer comments and additional items which were not included, but you believe are essential characteristics of successful flash-track projects.

You can either complete the survey in one sitting or incrementally. If you close the survey before completing it, you can return to the e-mailed link, click the survey link and you will be forwarded to the first uncompleted page and be allowed to finish the survey. Once the survey is completed you will not have the ability to update your answers. In test runs of this survey, it took respondents about 30 minutes to complete.

Please note that the survey software does not function correctly in Google Chrome; as a result we suggest the use of Internet Explorer or Firefox. Finally, when you complete the survey, hit the "done" radio button at the base of the last page.

We look forward to seeing your responses and input.

Flash Track, Delphi Panel -- Round 1

Glossary of Terms

The following terms which are used in the survey are offered as a reference for your review or future reference as you share your thoughts on the delivery of enhanced or faster, fast-track project deliveries. These definitions are either rooted in other Construction Industry Institute resources or defined by this study's research team.

Alignment: The condition where appropriate project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives.

Building Information Modelling (BIM): A digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition. Software that enables 3D modelling and information management is the technical core of BIM.

Concurrent Engineering: A systematic approach to the integrated, concurrent design of a project, including construction, maintenance and operations. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal including quality, cost, schedule and user requirements"

Constructability: The optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives.

Delivery Method: A structured approach used to organize a project team so as to manage the delivery of a project.

Design Assist contract: A procurement method by which, prior to completion of design, a consulting construction contract is award where a contractor provides design assistance, constructability reviews, budget and/or schedule services to the architect or engineer of record.

Design-Build: An integrated delivery process which combines architectural and engineering design services with construction performance under one contract agreement.

Fast Track: A time-driven project which by necessity requires some degree of concurrency between Engineering, Procurement and Construction.

Flash Track: A time-driven project which by necessity requires a heightened degree of concurrency between Engineering, Procurement and Construction; relational contracting methods and exceptional execution.

Front End Planning (FEP): The essential process of developing sufficient strategic information with which owners can address risk and make decisions to commit resources in order to maximize the potential for a successful project. FEP is often perceived as synonymous with front-end engineering design, front end loading, pre-project planning, feasibility analysis, programming and conceptual planning.

Integrated Project Delivery: A collaborative alliance of people, systems, business structures and practices into a process that harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.

Just-in-Time: An execution strategy employed to increase efficiency and decrease waste by receiving materials or equipment only as they are needed in the construction process, thereby reducing inventory costs or realizing other benefits.

Last Planner: A collaborative, commitment-based planning system that integrates should-can-will-did planning (pull planning, look-ahead planning with constraint analysis, weekly, etc…).

Lean Construction: A combination of original research and practical development in design and construction with an adaption of lean manufacturing principles and practices (i.e., Toyota Management System) to the end-to-end design and construction process. Lean construction is concerned with the alignment and holistic pursuit of concurrent and continuous improvements in all dimensions of the built and natural environment: design, construction, activation, maintenance, salvaging and recycling

Partnering: A long-term commitment between two or more organizations as in an alliance or it may be applied to a shorter period of time such as the duration of a project. The purpose of partnering is to achieve specific business objectives by maximizing the effectiveness of each participant's resources.

Pull Scheduling: A Lean technique for scheduling where real-time feedback from construction and off-site fabrication / manufacturing activities are provided to so process steps can be re-sequenced opportunistically. In "pulling" the required information and resources through the supply chain, pull-driven scheduling reduces uncertainties and improves work-plan reliability.

Successful: A common understanding to deliver a project that fulfills project goals, such as function, time, cost, quality & safety, and also meets stakeholders' expectations such that they welcome future opportunity to work together.

Team Building: A project-focused process that builds and develops shared goals, interdependence, trust and commitment, and accountability among team members and that seeks to improve team members' problem-solving skills

Flash Track, Delphi Panel-Round 2

Twenty (20) ISSUES did not reach consensus and four (4) new items were identified by the Delphi experts in Round 1 of the Delphi study. We request your further consideration and assessment whether the cited issue is ESSENTIAL for the success of flash track projects in light of the feedback offered in Round 1.

Creating project-specific mutually equitable contracts*

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	○	○	○	○	○	○

Please consider the following comments in regard to: *Creating project-specific mutually equitable contracts*

The use of existing contracts has facilitated a quicker start, readily available resources, understanding of owner requirements, etc

I have seen this concept utilized, but the relationships typically break down, and the vendors tend to exploit the non-competitive nature of these agreements

My company has been very successful in the use of alliance type (not project-specific) contracts

In the aerospace industry, the farther your company is down the supplier food chain, the less equitable the partnering contracts tend to be

The management team needs to focus on getting the project completed and not spending more time in protecting their position against the contract. A mutually equitable contract assumes a level of trust between the parties facilitates greater collaboration

As decisions are made during the design/build all participants need to feel they are an equitable partner for quality input throughout the project.

Contracts need to be robust to cover all the dynamics of the fast track Not many contract managers understand the concept of fast track and are not set up to get the contracts out to support this type of contracting

Any contract which is explicit and equitable is essential to smooth and effective project performance

Contracts must support the need to drive the speed of deliverables to get to construction
aligned incentives are critical

Unfair contract terms - even if executed by both parties -will always result in owner/contractor acrimony and distrust

The success varies according to the culture of the organizations joining forces.

Sometimes this is a mariage made in heaven and other times a disaster

Mutual benefit is essential in the contract, but more essential in protocols not written but adhered to share benefits Trust must be developed over time, that if I share something that saves the project team cost, bottom line benefit will be shared

Without equitable contracts, energy will be wasted on contractual issues rather then project issues

The contract is the key to a successful outcome
contracts need a win-win concept for projects to be successful - eliminate barriers

Engineering contracts are usually commodity based (estimated mhrs x rate); Procurement (OEMs) bid hard dollar; construction either bid hard dollar or partner type agreements

2 **Explicitly designating the project as being "fast track"**

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL						

Please consider the following comments in regard to: ***Explicitly designating the project as being "fast track"***

The contract requirements (e g constructability participation), schedule and deliverables are self explanitory

EPC is customarily fast track What we call it is not so important as how we work together to accomplish it

Projects get designated fast track only a fraction of the time - to me it doesn
The pitfall here is that every project becomes Fast Track and therefore the process becomes the norm vs the exception

Customers and suppliers need to align to what the term means and implies regarding funding, decision-making, change-management, and have commitment that schedule, not scope or cost, will be the lead topic and visibly tracked/gapped versus the taraet timel

It is essential that all team members (and their supervisors) as well as the consultants and contractors be made aware of the urgency of the project and need to commit, up-front, the resources needed to accomplish the goals of the project.

Naming the activity is essential to alerting the team and related stakeholders, including senior management, of the importance and urgency in attacking the project in a different way!

3 **Tying performance incentives and rewards to project goals***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐			

Please consider the following comments in regard to: ***Tying performance incentives and rewards to project goals***

Getting the incentives and rewards lined out in the contracts is time consuming and may defeat the purpose of the fast track

Incentives and rewards are a distraction to fast-track projects
Determining which party will assume which risk is important and needs to be researched to determine the best approach

this could go either way between moderately agree and disagree i don

not a real fan of incentives - added burden to administer - make initial contracts fair and equitable

No harm no foul is tough to get agreement. If you and no prejudice or no harm/no foul situation the incentives and gaols are not lined up. Incentives and rewards are needed - jsut don

Incentives are important, especially bottom line ones and when Lean means and methods are taught to the team so that they know how to do something different.

Incentives are nice but we price the work to make money already - what is important is to not lose money on these projects

These can work, but industry can do more to implement them effectively

A Dog in the Hunt so to speak Monetary incentives and penalties linked to success or failure to deliver usually succeeds

The incentives are typical: LDs, Schedule bonus/penalty, HSE stats, QC stats Maybe shared savings in constructability program

4 **Having equitable shared risks and rewards***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐	☐		

Please consider the following comments in regard to: ***Having equitable shared risks and rewards***

The owner takes on more risk on flash track projects

As we know - an Owner will the plant or facility for a lifetime to generate revenue and profit A contractor has a one time opportunity to generate profict during execution. The risks and reward should be gradusted based on this.

In heavy industrial construction i have rarely seen performance rewards - sharing or acknowledging risks is critical

Ultimately, the client has the burden of the risk.

Clearly distributed ownership of outcome, based on what the respective entities can actually control and plan to huddle up quickly to address circumstance that arize that were not planned for are important.

if the risks / rewards are not shared equally, the motivation needed will not be consistant.

Easier to do in an alliance type contracting environment

The risk should be primarily with the entity that stands to gain the most from the project long term Generally the contracts that define the risk are the same as for normal projects - except for a few cases.

necessary

Too many owners want to dump their responsibilities onto a contractor When engineering is deficient; force the contractor to fill the gap via change order. When owner doesn
Equality of skin in the game a must. Customer base has been poor at accepting their share of risk

5 **Establishing early completion bonuses***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL						

Please consider the following comments in regard to: *Establishing early completion bonuses*

Early completion bonuses suggest that the project had slack time Flash track means faster then it has ever been done, with no slack

Not really effective

what are you sacrificing to get early completion in the quality?

again, not a fan of bonuses

Need to be very careful that early completion incentives do not result in unintended consequences in project quality/performance

One key is balance. Lean enable improving both cost and schedule simultaneously Big problems have occured when cost got out of hand on so called schedule driven projects.

Early completion alone may be harsh.

This is the icing on the cake and great if you get it but the base contract / arrangement must be sound

Early bonuses create the incentive to get the job done---the concern at any cost Care must be used to ensure quality

Not to the extend that either safety or quality is compromised

✓ 6 **Employing performance incentives to promote a high performance culture***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐	☐		☐

Please consider the following comments in regard to: *Employing performance incentives to promote a high performance culture*

Contracts can have all the performance incentives but you have no control over the workers in the field

Not really effective

My ratingRe: success- not used enough at performance team levels They don

Operational performance normally more important than early completion

Mutual success is required to go long term, beyond one project. Convoluted expectations must be resolved into enginering and business criteria. Incentives can be helpful if bottom line and long term.

A culture does not result from one time contract incentives If the culture exists, the incentives are nice, but not necessary

Project doesnt benefit to finish on/ahead of schedule if rework is required to meet quality requirements

I can go with incentives providing 90% of the money gets to the craft

7 **Executing single-source or no-bid contracts***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐			

Please consider the following comments in regard to: *Executing single-source or no-bid contracts*

These are harder to negotiate a fair price and may take longer Like bidding to 3 preferred contractors to know your expectations

single-source may be only marginally better than multiple-bid contracting

Sole source is not necessarily a key strategy for fast/flash track success Competition works just as well

Usually, long term there should be 2 or 3 relational competitive partners developed and deployed for just about everything

This sounds like a good idea, but it typically doesn

In many cases this can knock weeks off the pro

only method i

When labor markets are tight or skills are in demand, this is a very effective way to successfully contract

Especially with respect to use of Alliance fabricators and commodity suppliers

Single source allows early engagement critical to fast-track projects success

This would depend on previous experience of CM/Sub relationships and trusted values for cost of execution

This can save significant time

This is a key element of a successful fast track project - it should be awarded on a qualifications basis - not competitively bid

this will help a fast track project - eliminate bidding cycle / time

8 **Please rank the following contract types or requirements by how absolutely ESSENTIAL they are (to flash-tracking)**
[1-Stongly disagree; 2-Disgree; 3-Moderately disagree; 4-Moderartely agree; 5-Agree; 6-Strongly agree]*

	1	2	3	5	6
Cost-Plus or Reinbursable			☐	☐	☐
Cost plus & Fixed fee			☐	☐	☐
Integrated Project Delivery (e g , tri-party agreements)			☐	☐	☐
Target Price/Value with shared cost savings (1)			☐	☐	☐
Open Book (1)			☐	☐	☐
Time & Material rate agreements (1)			☐	☐	☐

(1) additional items suggested by Delphi panel

Flash Track, Delphi Panel-Round 2

Delphi experts offered the following additional comments on *contractual considerations that are absolutely essential for the success of flash track projects:*

Open book concept

Target Price with cost saving splits

Absolutely. You haven't even addressed target costing or the foundation role of trust. Womack and Jones sort of missed that part. But Shingijutsu did not. The improvements EPC needs are primarily people issues. Pride among executives that we already know and are doing everything practical is the great disrupter.

Target price where losses and gains are shared in an open book arangement

T&M rate agreements if related work is needed and/or for change management items Night, weekend design/construction support needs assumptions and plans Contingency plans/pricing if critical performance milestones, (e g , successful equipment VAT), alignment to pay for parallel options for any critical unit op that has risk of failing Acceptance Testing

design build

Lump Sum or Guaranteed max cost (To be negotiated at approximately 30 percent Engineering) Open book approach until 30 percent Engineering point.

standardization of key equipment and specifications

What is essential is to have buy in by all involved parties and all involved parties push that done to all levels A high degree of trust has to be developed and a detailed plan has to be implemented but it has to be a plan that is re-validated/re-adjusted on a regular basis

It seems that most considerations have been considered Regardless of how essential a concept is, the quality & execution of the contract will determine it's success Therefore answers reflect my experience over time

Frankly, I don't put much weight in the contract. I put much more weight in my relationship with the contracted If I have a solid relationship with the contractor, that will enable my success And you can't word a contract well enough, to get good support from a contractor who doesn't have your best interest at heart.

Assuming you are able to self perform many construction activities this enables you to control the pace of the project, so self perform is an aspect to be considered
Prior negotiated terms and conditions (master service agreements) to eliminate the lawyers
It is absolutely essential that all parties know and fully understand from the very beginning of the project that the primary and fundamental objective is to get to the successful completion of the project as quickly and efficiently as possible

Contracts must be equitable and a win / win for all parties involved
Depending on the contract strategy, Contracts for Flash Track should incorporate project specific T&C's, deliverables and risk and reward guidelines Clear definition of

Completion & Acceptance criteria has to be spelled out, and not just referred to or use boiler plate guidelines from Ghost Projects

A long term trusting partnership between the owner and contractor is essential It will not suceed when deep relationships do not exist.

There needs to be limitations of liabilities so you don't have to go slow worring about errors and ommissions

ensuring the project team understands what is in the contract

Cost plus with a fix fee generally gives the best results Other incentative add ons can be attractive to expedite certain milestone activities or craft labor bonus to complete the critical components on time or ahead of schedule

No particular contract type lends itself to fast track success Other tools such as visual PM, teambuilding, and contract incentives are more effective methods to use

Owner's MUST understand their role in the project (unless they are awarded an EPC contract) They must have the managerial and technical expertise necessary to function as the de facto EPC if they plan to award direct contracts for E, P, C (or any combination requiring more than one contractor) This means understanding the importance of engineering being more than a commodity; understanding that foreign OEM's don't always understand N American requirements and they must understand that failure to assign risks to the party best suited to manage that risk is only a recipe for failure This means owners must know how to write appropriate contracts for each party, identify the commercial and technical deliverables and understand the consequences of each stakeholder not meeting their obligations

No one contracting method is essential for all of the contractual agrrements. The right one for each designated aspect is more important thn having one for all

Additional comments contractual considerations are welcomed.

9 **Selecting the best value contractor***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐			☐

Please consider the following comments in regard to: Selecting the best value contractor

Depends on your definition of value If you mean low-cost, then no this is not necessarily a good idea If you mean a contractor who executes well and provides a good bang for the buck (good value) then yes

Need to better define best value By the nature of a Flash Track project schedule has a higher priority than cost.

best value may not always mean fastest; if prpoirty is speed, may need to spend more money for that type of contractor

definition and implementation of value must be carefully and uniformly applied

Best Value is a pretty broad term

Profound improvement will require a profound expansion of what constitutes value.

Due diligence to prequal or past experience for verification to execute Flash to meet Quality, Schedule and Cost & Safety parameters

Owners need to appreciate on larger EPC projects that contractors add value (vs being commodities). Good GCs need to market themselves accordingly.

10 **Selecting preferred or alliance contractors***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐		☐	☐

Please consider the following comments in regard to: *Selecting preferred or alliance contractors*

Again, depends If good working relationships have been developed, this can be a good thing But what is their current backlog? What team are you going to get?

working with those you have had prior experience and success with can prove to be invaluable

Preferred or alliance partners with a proven track record of high performance on flash track projects are essential for executing flash track projects successfully with a high success rate.

Relationships and experience with a contractor speeds team building and organization

Advanced clients have milked about all they are going to get out of preferred or allianced contracting Lean Relational Competitive Partnering is different, only elements remain useful from the traditional systems

Prior Experience and Relationship Contracting is better than the unknowns

Without an alliance, there is not enouigh shared risk to drive the best decisions for every challenge

Mutual commitment to current and future work is powerful partnering tool and eliminates many pressure points

may help if they already are familiar with your people, processes, standards

It works when labor is tight or skillsets are critical However, that alone doesn

Delphi experts offered the following additional comments on *delivery method considerations that are absolutely essential for the success of flash track projects*

The main factor in reducing schedule length is getting the calcs and specs done for the long lead items ASAP. This will require the engineering to be front loaded some

Already covered compositely in some of above: Early establishment of a coordinated fast(flash) track schedule plan involving Engineering Design/Construction/Owner/major suppliers-contractors requiring participation/comments/agreement. Revisit periodically and when needed to resolve unforeseen issues

Engineering Design/Construction/Owner/major suppliers-contractors requiring participation/comments/agreement. Revisit periodically and when needed to resolve unforeseen issues

Insuring Engineering has agreed to the project phlosophy

These questions are applicable to any 'well done' project. Choosing best value, having personnel with strong leadership,. are all valuable to any job I don't know that I provided much, with my answers this section

Teamwork is essential to the sucessful execution of flash track projects However it is important to also understand who the ultimate decision-maker is

Consider multiple contractors, ie: multiple discipline packages of work
Selecting project team memebers based on their ability to work together as one team and not exclusively based on their availability for assignment.

Select EPC contractor early so they become part of the overall project team

Set achievable goals

schedule knowledge and adhearence

See Lean Supply Chain Development , Cooper & Slagmulder. These methods and their application by Shingijutsu have been summarized and related to FEL & EPC in The End of Project Overruns Patty & Denton

Owner leadership behavior and reaction to bad news transparent/authentic two-way communication/decision-making expectations need to be maintained Problems, cost impacts, and options need to flow freely and quickly or teams will bury themselves for too long until it's too late to fix

Solid Change management system Scope management

In addtion to strong management leaders, the selection of specialize labor teams (crews that are familar with each other skill) are good way to reinforce and improve work flow and focus the overall project workforce Working in safe conditions improves crews attention to working productive and safely

Visual PM via metrics that are current and prominent to all project participants, to keep everyone aligned and in the know as to where the project stands.

I like a hybrid agreement with a contractor where an assumed set of quantities is used for estimating Based on those quantities, a schedule and time dependent costs (Const Equip, GCs, Management & Supervision) can be established I like to award a fixed contract based on the above During the design phase, the parties work together to meet or underrun the design quantities Based on designed quantities vs estimated quantities, there is an adjustment. As long as the designed quantities do not exceed estimated by some factor, the fixed costs remain intact. This provides some topside protection to the owner while providing incentives to the contractor.

Picking the right fit for the scope that is to be delivered

Additional comments on delivery method considerations are welcomed.

11 **Increasing resource levels for project control***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐			☐

Please consider the following comments in regard to: *Increasing resource levels for project control*

I don't know if this will help The project controls team will need to engage the discipline leads to provide input and updates to the scheduling

Resources are not the issue Project controls are not doing what will control work process.

Delphi experts offered the following additional comments on *planning considerations that are absolutely essential for the success of flash track projects*

In your experience are there other planning considerations that are absolutely essential for the success of flash track projects?

Project needs to be construction driven, not engineering driven in order to be successful

More resources and cost should be dedicated to FEL on projects, especially Fast Track
a base line schedule lock down to measure to and one that everyone agrees to at the start of the project

A process which clearly defines the package of work (about 500 hrs), by discipline which includes materials, test plans, s/c support, controls, SHES,etc. We must do everything we can to have front line supervision on the front line

Push and Pull flow control, including the push-pull interface, critical chain, Pugh

Matrix, Alignment of criteria breakdown with work breakdown, cost and schedule and team break down structures Target costing with confirmations at stage gates and shared savings, etc etc.

taking the time to develop a detail schedule with logic ties

External and internal interfaces -- either within a plant or with local agencies -- maintaining production/construction activities require as much attention as the other base scope blocks of a project

Available funding so schedule is not delayed

Using a template process for EPC projects is more proactive than relying on project controls. Project controls, by it's nature is feedback to provide corrective actions

Templating the project at the beginning provides a medium for all parties to interlock their outputs to others' inputs It provides gates for reviewing at key milestones. A template provides transparency, communicates expectations and shows impacts of stakeholders not meeting their deliverables

Plan the work and work the plan but don't stagnate the work by overdoing it.

Additional comments on planning considerations are welcomed.

12 **Employing conservative designs to avoid design holds***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL						

Please consider the following comments in regard to: ***Employing conservative designs to avoid design holds***

Engineering tends to release with holds to fast track designs which causes cost and schedule issues with construction

This needs to be done on a case by case basis.

Especially important in the concrete (foundation) and structural steel areas
may need to over design if vendor data not on time

13 **Using standard repeatable designs and fewer design details***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐	☐	☐	☐

Please consider the following comments in regard to: ***Using standard repeatable designs and fewer design details***

Ned to make sure that designs are complete to avoid field rework

These are 2 separate issues, the first a worthy pursuit. Optimization of design detail is to provide just what is needed, just in time, to who needs it.
lack of details have hurt construction Causing others to complete the design details which are required. Having one group responsible would speed up the process.

Standardization should yield significant schedule/cost benefits caution Re: fewer design details vs construction/supplier needs.

We are getting better at this

as much a possible

14 **Stream-lining the design review process***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐	☐		

Please consider the following comments in regard to: *Stream-lining the design review process*

In the event that you either strongly agree or strongly disagree your comments would be greatly appreciated Please feel free to add any other comments "

Ensuring everyone's buy in through the design review process is critical - just need to expedite the process

That is generic, what do you mean by that?

This can be a catch 22 A lack of adequate review can lead to problems in the field, due to engineering mistakes, that can significantly increase cost and schedule
need good definition of base design review process vs streamlined KISS

Need to have over the shoulder reviews

Having all stakeholders input, regardless of their ability to do so, can slow things down This has to be managed

Without timely reviews, work stops

Quick turnaround on drawing reviews is critical to meeting schedule

Design review needs to happen often and in real-time

Too many redetailing & reviews of sufficient design details by Engineer. Specs require submittals of Shop drawings by Fabricator that are not that different from the design details

everyone sees the design / comments a one time

15 **Employing Lean Construction practices (e.g., continuous improvement)***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐		☐	☐	☐	☐

Please consider the following comments in regard to: *Employing Lean Construction practices (e.g., continuous improvement)*

These principals will slow the project - they may be a key that the client wants - but it does not help speed up the project

good concept but too many new ideas late can stall the work with new learnings

That is a lame question. All the stuff in this inquiry is lean practice in the broad sense Six Sigma would claim it as well as Theory of Constraints, etc.
Been around a long time like a lot of other practices like Constructability, Last Planner/Reverse Phase Planning, etc . Tools are there, just need to use them..

You will repeat the past if you don't learn from it

16 **Seeking provisional regulatory approvals***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐	☐	☐	☐

Please consider the following comments in regard to: *Seeking provisional regulatory approvals*

Depends greatly on the local authority.

how can this not be essential

Regulatory approvals can be a major hang-up in achieving fast-track project goals
need to know what is required and timing for approvals to incorporate into the plan

Timely regulatory approval is a must for a successful project

Depends on what you mean by provisional Caution proceeding to far without approval certainty.

17 ***Frequent project review meetings (1)****

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐	☐	☐	☐

(1) additional items suggested by Delphi panel

Delphi experts offered the following additional comments on *execution considerations that are absolutely essential for the success of flash track projects*

frequent project review meetings

Having the proper communication systems (daily meetings, conference calls, etc) is importatnt to enabling a fast and efficient project execution

Development of project specific execution plans are very essential

Yes, See previously mentioned literature, especially Chap 8 & 9, Patty & Denton
minimize number of separate orgs interfacing don't be fooled by hidden divisions within single companies, though those can be worse than two different firms

Minimize decision iterations

Additional comments on execution practices are welcomed.

Please consider the following comments in regard to: ***Other innovative practices that are absolutely essential for the success of flash track projects***

For innovative procurement practices, early procurement to get a place in the cue can help to reduce impact from long lead items

where possible seek out multi-discipline modularization ideas

Using OEM's versus 2nd or 3rd tier distributors can help shave time from the process, when this is an option

Modularize everything that is practical Reduce on site labor as much as possible
agressiveness

A budget is a must, but, full authority for the project manager to use liberal Undefined,

Contingency, and Maintaining Production allowances would streamline project execution If on every project I was given a Stretch Goal, Estimated Total Cost (including standard risk funds), then an unpublished Potential Estimated Cost and a schedule .I would
hit the schedule everytime and the be
review processes to beg and justify se
team frustration to where we rarely del
organizational angst and
choices, re-design, and
over-wrought failures.

Time is money, but there is a breakover point where less time is a lot more money. Need to carefully define the balancing point. If the project driver truely is schedule, must have an ample budget to achieve success.
optimiizing the procurement process and removing non productive ativities and authorizations,

Predictable is far more important that innovative when it comes to fast or flash track

Additional comments on innovative practices are welcomed.

18. **Executing liability waivers among key project participants***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL	☐	☐	☐			

Please consider the following comments in regard to: ***Executing liability waivers among key project participants***

In today

Better to have pre-negotiated terms and conditions

Overreliance on contracts will not produce the necessary trust in intent and competency that is necessary. How we behave of mutual benefit to others is far more important.

No hammer can reduce effectiveness of schedule expediting

Limiting liability risks is key to almost all who participate in a major project

More of the Collaborative Partnering concepts- Shared Risk and Reward
still need certain basics to protect the parties

19 **Capping contractor's down-side risk***

	Strongly disagree	Disagree	Moderately disagree	Moderately agree	Agree	Strongly agree
ESSENTIAL						

Please consider the following comments in regard to: *Capping contractor's down-side risk*

If you down-side risk to contractor than owner will be taking on more of the risk Tough to negotiate and mitigate

not sure of benefit here

That is not the best question If the project cannot be designed and constructed such that all participants make money, then it should not proceed past the stage gate where that is discovered

This is a difficult issue to control Contract language is always an issue as is the potential for impasse leading to possible work interruption The solution

Delphi experts offered the following additional comments on *risk considerations or mitigation measures that are absolutely essential for the success of flash track projects*

n risk. The key is to balance the risk. Everybody has to win or
for everybody to be a winner. Every player may have a different
in their terms.

nsumer products
articipant in the project

When issues arise have the decision making team with authority in place for quick resolutions.

understanding what drives the process on each side of the table if there were more communication of front there would be better out comes for both parties

see previous comments on final funding procedures I realize this may be company-specific .I realize this aspect of a project doesn't cause the entire team angst, but, typically the key people on a project can get so consumed with funding processes we don't get to manage the scope/schedule/design elements with the same rigor...and schedules slide and design quality suffers

best suited to
construction.A
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te th
has
at is

owners tend to dump all their
EPC and 7+ years as an owner's
take on the EPC obligations that

Additional comments on risk considerations or mitigation measuresare welcomed.

Four new items denoted with (1):

\# 17 Frequent project review meetings

\#8 Target Price/Value with shared cost savings
Open Book
Time & Material rate agreements

Note: #8 includes three issues that had been included in Round 1
(18 + (3-1) =20 issues where consensus was not reached in Round 1)

CII RT-311 Successful Delivery of Flash Track- Delphi Survey Round 2 Numerical Result

Response summary:
47 of the 55 oracles who responded to Round 1 , completed Round 2
2 additional individuals submitted consent forms; neither participated in Round 2
Total number of consent forms received = 64
Round 2 participation rate 47/64 = 73%

						Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree	
Issue #	Question	Mean	Median	Mode	Standard Deviation	1	2	3	4	5	6	Agreement (agree + strongly agree)
Consensus of on whether item is ESSENTIAL for fast track (mode=5 and SD ≤ 1 or mode=6 and SD ≤ 2)												
1	Frequent project review meetings	4.91	5	5	0.846	0.0%	2.2%	0.0%	21.7%	52.2%	23.9%	76.1%
2	Employing conservative designs to avoid design holds	4.23	4	5	0.994	0.0%	6.4%	14.9%	34.0%	38.3%	6.4%	44.7%
Mode score ≥ 5 but consensus of whether issue is ESSENTIAL to fast track was not reached:												
3	Stream-lining the design review process	4.49	5	5	1.008	0.0%	4.3%	12.8%	25.5%	44.7%	12.8%	57.4%
4	Having equitable shared risks and rewards	4.26	4	5	1.081	0.0%	10.6%	8.5%	34.0%	38.3%	8.5%	46.8%
5	Selecting the best value contractor	4.49	5	5	1.089	0.0%	4.4%	11.1%	28.9%	35.6%	20.0%	55.6%
6	Seeking provisional regulatory approvals	4.51	5	5	1.089	0.0%	6.4%	10.6%	25.5%	40.4%	17.0%	57.4%
7	Selecting preferred or alliance contractors	4.57	5	5	1.144	0.0%	8.5%	6.4%	25.5%	38.3%	21.3%	59.6%
8	Creating project-specific mutually equitable contracts	4.34	5	5	1.259	2.1%	10.6%	6.4%	29.8%	34.0%	17.0%	51.1%
Mode scores ≤ 4												
9	Rankings of contract types or requirements by how absolutely ESSENTIAL they are (to flash-tracking)											
9.1	- Cost Plus & Fixed Fee	4.00	4	5	1.238	2.1%	10.6%	21.3%	27.7%	27.7%	10.6%	38.3%
9.2	- Open Book	3.81	4	4	1.160	2.2%	10.9%	26.1%	30.4%	23.9%	6.5%	30.4%
9.3	- Target Price/Value with shared cost savings	3.79	4	4	1.202	6.5%	8.7%	15.2%	41.3%	23.9%	4.3%	28.3%
9.3	- Time & Material rate agreements	3.91	4	4	1.252	6.5%	4.3%	21.7%	32.6%	26.1%	8.7%	34.8%
9.5	- Cost Plus or Reimbursable	4.15	4	4	1.321	2.2%	17.4%	21.7%	32.6%	13.0%	8.7%	21.7%
9.6	- Integrated Project Delivery (e.g., tri-party agreement)	3.46	4	2	1.228	2.2%	28.3%	17.4%	28.3%	21.7%	2.2%	23.9%
10	Employing performance incentives to promote a high performance culture	3.55	3	3	1.145	0.0%	20.0%	28.9%	33.3%	8.9%	8.9%	17.8%
11	Capping contractor's down-side risk	3.94	4	3	1.210	4.4%	2.2%	31.1%	26.7%	24.4%	11.1%	35.6%
12	Using standard repeatable designs and fewer design details	4.23	4	4	0.904	0.0%	4.3%	12.8%	44.7%	31.9%	6.4%	38.3%
13	Increasing resource levels for project control	4.17	4	4	0.996	0.0%	4.3%	17.4%	43.5%	23.9%	10.9%	34.8%
14	Executing liability waivers among key project participants	3.57	4	4	1.087	4.3%	12.8%	25.5%	36.2%	21.3%	0.0%	21.3%
15	Employing Lean Construction practices (e.g., continuous improvement)	3.51	4	4	1.146	0.0%	26.1%	21.7%	28.3%	21.7%	2.2%	23.9%
16	Tying performance incentives and rewards to project goals	3.85	4	4	1.167	0.0%	17.4%	15.2%	39.1%	19.6%	8.7%	28.3%
17	Establishing early completion bonuses	3.62	4	4	1.213	2.3%	18.2%	22.7%	34.1%	13.6%	9.1%	22.7%
18	Executing single-source or no-bid contracts	3.98	4	4	1.280	2.1%	17.0%	8.5%	36.2%	25.5%	10.6%	36.2%
19	Explicitly designating the project as being "fast track"	4.13	4	4	1.453	2.2%	21.7%	0.0%	32.6%	21.7%	21.7%	43.5%

Open Ended Questions (see comment sheets)

Items where Delphi experts concur that item is essential for flash track 🟩

Signifies SD ≥ 1 🟥

Signifies SD < 1 🟦

🟨 Illustrates mode

CII RT311 Successful Delivery of Flash Track Delphi Survey R2 Oracle Comments

Consensus of on whether item is ESSENTIAL for fast track
(mode=5 and SD ≤ 1 or mode=6 and SD ≤ 2)

Item	Essential score (Mode)	Commments offered
1	Frequent project review meetings	
	6	On all of our projects, we employ a plan-of-the-day meeting. That's a short meeting at the start of every work day with all disciplines present so everyone knows what's happening and where there are bottlenecks/problems that need to be solved.
	6	keeping all stakeholders current is essential
	6	Also essential to document agreements and Action items from project review meetings.
	6	Last Planner, used properly can help identify issues/status readily, no matter what phase you are in(Design thru startup)
	6	Keeps all facets moving in the same direction. A Must
	6	Without timely issues resolution, the project will not be fast track.
	6	Being fast tracked it is a must. First 60 days should be setup in a format similiar to a war room.
	5	Development of project specific execution plans are very essential
	5	Define Frequent ? Interactive meetings which integrate and disseminate the activities of all disciplines and keeps all aware of status is a + to the proj.The freq. would be project specific and freq/partic. would be related to point in schedule.
	5	Decisions need to be made quickly in a fast track.
	5	Depending on the nature of the project, this can be done regularly for various phases.
	5	Weekly. Period.
	5	Effective Meetings should be quick and simple....decisions made...next
	5	either actual or virtual co-location practices are essential
	4	Key is the owner and contractors working hand in hand to progress the project, does not always mean meetings are needed.
	4	No more or less meetings than are required. I've attended many ineffective meetings; so more isn't always better.
	4	I would say that finding a balance between frequent and customary is more important. Too many reviews/meetings will slow the project and divert team attention away from daily management/execution of taks to preparing Powerpoint charts and other material.
2	*Employing conservative designs to avoid design holds*	
	6	If time is of the essense, then material quantities (which are often used to judge project success) need to take a back seat to speed of completion
	6	cookie cutter saves significant time and often/should utilize constructability best practices
	6	Error on the side of knowns when planning for shut downs

CII RT311 Successful Delivery of Flash Track Delphi Survey R2 Oracle Comments

	5	Review in detail to keep from over designing critical schedule items.
	5	Where deemed to be cost effective and facilitating to construction needs and resulting in schedule benefits.
	5	Not only conservative designs but standardizing equipment and specs help to minimize the risks of the owners
	5	Sometime you just need to make things happen to get on with the project.
	5	I say employee flexible designs to avoid holds. Then, have engineering folks on the site to readily approve implementation changes.
	5	Don't always have to time to get details so design needs to be robust enough allow flexibility in execution.
	5	This is a time vs. money issue. If I have little itme, then conservative designs would be more effective. Each project must determine which is more important. I've worked on both sides of this and have had succes with both.
	5	This is a MUST for the Civil/Structural arena - to allow foundations to be installed early.
	4	Each situation in the project may require a different answer.
	4	This can be expensive. Need to monitor on project by project basis and on each discipline within the project.
	4	For a given Work Package (Engineering, Procurement, and Construction), inputs that are lacking should be included in the Plan
	4	If the project is truely a fast track then it has to work under a conservative design approach. Caution must be placed on this and must be closely monitored and controlled as it is being rolled
	3	Conservative does not feel like the right term. Employing proven technologies, doing what you know works, eliminating uncertainty in the design, etc., all feel like a better description.
	3	This can increase construction costs significantly
	2	who defines what conservative means? Usually this drives increased costs.
	2	Consertative designs could be a component or accepting rework another, etc

Round 2 comments

Mode score ≥ 5 but consensus of whether issue is ESSENTIAL to fast track was not reached:

3	*Stream-lining the design review process*	
	3	Timely reviews are critical, not necessarily stream-lining the review process. Must meet or beat review periods required by the schedule.
	3	A schedule conscious review of significant items/designs involving Engrg/supplier/Owner (as applicable)/constructor can eliminate delays.
	3	Streamlining reviews generally means taking shortcuts. Big mistake. Perform reviews more efficienlty, but do not cut corners.
	3	streamlining is an overused word in my opinion. if it shortems the design schedule but increases the construction schedule or cost then nothing has been gained.

CII RT311 Successful Delivery of Flash Track Delphi Survey R2 Oracle Comments

	4	If basic engineering was done correctly and approved; and equipment/bulk specs are agreed upon early, design reviews should be more about confirmation. Again; the owner has to have the discipline to stick with early decisions (aka Frozen information)
	4	Expedite the process _Touch it to see the intent is in place don't mull over the same calculation for days getting same result.
	4	The Flash-Track team should be an experienced high-functioning Core Group. Design Reviews should be implemented as the work progresses.
	5	need to have empowered reviewers who can make decisions on the spot without going back to get input from others
	5	Reviews are not eliminated but more over the shoulder reviews are performed and getting everyone to do quicker reviews, between owners and designers
	5	Make sure you have constructability reviews with the design review process.
	5	A lot of time is wasted in design review if not done efficiently. Bring multiple parties together to reivew concurrently
	5	Understanding of requirements up front reduces the need for the review process. Having established standards or specifications streamlines the process as well.
	5	The review/approve process and getting fast/knowledgeable review is as important as the Design Process...almost needs to be treated as a discipline itself...perhaps to the point of designating a
	6	why expedite the design process only to have the review process move through channels at a snail's pace
	6	As long as a quality review is completed, streamlinging the process and estabilishing short drawing review intervals can be very helpful.
	6	All good and confirms my previous comment.
	6	Cut owner review time to 5 working days. Actually, the owner needs to be present at the engineering office continuously to expedite decisions as well as approvals.
	6	Must be communicated way up front in the planning stages of the project.
4	*Having equitable shared risks and rewards*	
	2	Fast Track - owner assumes more risks. It may be minimized by standardizing equpment, piping, valves, etc.
	2	The owner will have to take on a majority of the risk for a Fast Track job.
	3	Fair contract is important so agree on shared risks. The reward should be a job well done and future work.
	4	each partner must take on the risks that they can control and risks/rewards need to be compatible.
	4	Helps keep everyone in the game. However, requires a committee which slows a fast track
	4	equitable shared probably needs more definition
	4	Yes share a percentage of the project vavlue on both risk and rewards.
	4	Yes if EPC is built up from a Consortium or JV type contract with aumber providers.
	4	Customer should have some risk to ensure good vendor pricing and vendor must carry risk to ensure project budgets and schedules are met. Vendors must have skin in the game.
	5	It is true that the client owns most risk. Still important that contractor sees his risks as reasonable and rewards are commensurate with the risk he perceives.This can be partially offset with rewards.
	5	Agree that the risks need to be equitable but proportionate. As noted below - perhaps creating tiers and majority of the first tier should be contractor

CII RT311 Successful Delivery of Flash Track Delphi Survey R2 Oracle Comments

	5	Project risks are recognized in the cost. Increased risk equates to increased cost to cover exposure.
	5	Owners reps need to avoid always telling their senior mgmt that the contractor is at fault.
	6	An incentive based contract has both positive and negative based incentives. It has to be a shared risk. The owner
	6	This starts with the allocation of responsibilities among the stakeholders. Owners drive the bus; unfortunately, they don
	6	The owner should really assume the risk on fast track projects as they get the project benefits sooner and long term
5	*Selecting the best value contractor*	
	2	Lowest price does not equal best quality
	2	Too broad a term to define well
	3	Not to define the question better.
	3	flash track work typically is open heart surgery to an existing production facility. A known entity is more valuable to meeting planned start up dates.
	3	if speed is the priority, may need to sacrifice on cost
	4	Hard to define what constitutes the best value
	4	This generally delivers the best results.
	4	If best value means lowest cost, then i disagree. Working relationship and work history are more important to fast-track than cost.
	5	Low bidder does not equal fast track !!
	5	value can only be based on cost +/- a factored value based on performance history (therein the difficulty). Still some value must be given to those who have demonstrated good/outstanding performance
	5	schedule is a big part of best value
	5	Best Value is essential because it allows factors other than cost to drive the contractor selection. This is important since Flash Track implies that schedule achievement and agile management is
	5	If Best is the best based on past records of the their ability to excute their scope at minimum_(first) Project on time as scheduled or revised by customer. (second) Estimated correctly and made good on their project cost.
	6	For me, best value is best overall evaluated contractor. The best value contractor may be the highest cost contractor.
	6	This presumes the owner properly defines best value. That means they have enough proj mgt maturity not to be shopping for a contractor the same way as purchasing commodities.
	6	Certainly essential, but need to better define best value in alignment with the specific project goals.
	6	Must be in the areas of safety and quality. These drive the proper results.
6	*Seeking provisional regulatory approvals*	
	3	Number 1 requirement to get ahead once enough documents are available. However Jumping ahead without final permit can cost you design changes that was fitting the provisional outline. Final permit mat cause a R&D development new vendors , etc.

	3	ould be construed as bribery which opens up potential legal problems to all.
	4	Only if possible.
	5	As required to mitigate schedule issues only
	5	Depends on what you mean by provisional. Caution proceeding to far without approval certainty
	5	I have not seen provisional approval. If it can be used effectively, then I can see how it would be helpful.
	5	Prevents surprises or rework in execution.
	5	Good enough to proceed with early design phases but not the fully detailed design work.
	5	No reason to start the project until all Regulatory Approvals have been received.
	5	similar approach to LEAN principles need to be employed with local authorities...make them and pay them to be part of the team early
	6	once again how can this not be essential (danger in the word provisional) must have high,high confidence in timely final approvals.
	6	Pre meetings with the Local authorities to get concensus on their buy in to Flash Track and their part in it, as well as their availability and ability to comply.. Mostly we create problems ourselves
	6	Assuming this refers to Federal permits; this is essential for the project to even start - regardless of whether it is fast track. Need further definition of term.
	6	All regulatory approvals should be worked early and often, the sooner the team engages with regulators, the better!
	6	Early start is always a good thing.
	6	Obvious
7	*Selecting preferred or alliance contractors*	
	2	Depends - does the alliance contractor have the proper skills and experience for the specific projecct.
	2	Do not like alliance contracts. I would only use them in a squeeze. Much prefer to bid work if
	2	This is not ESSENTIAl. They may be considered as a player, but you have to look at the entire Flash Track project and the contractor before deciding.
	4	This can streamline both the contracting and on-boarding process for the contractor.
	4	Watch this one_ May do great work for area that are the Preferred,but not necessary at the new project area. Also they may lack the skill and experience on the new work scope. Use the best overall contractor suited for the project..
	4	developing relationships with high performing contractors drives consistency
	5	Assuming supplier availability is compatible with project needs,prior history and experience can yield significant benefits as can shared responsibilities and risk.
	5	This typically will speed up the process.
	5	Knowledge of how a client does business and what is expected is essential.
	5	Can minimize risk in terms of cost and schedule
	5	Needs to have the A team as part of the execution teamversus just selecting the contractor without discussing personnel.

CII RT311 Successful Delivery of Flash Track Delphi Survey R2 Oracle Comments

	5	Alliance contracts must be re-bid periodically to ensure best contract is always in place.
	6	you know who you are working with from past experience so you can be more comfortable moving forward rapidly
	6	I define an alliance relationship as using another company as an extension of your own. This can certainly improve the outcome on fast/flash track projects.
	6	Established history and ongoing working relaionship fit well for fast-track projects
	6	An alliance contractor has much more to loose if the project does not go well
8	*Creating project-specific mutually equitable contracts*	
	1	It is important to have a contract where both parties have the potential to win. I will always contend if one party loses, both parties lose.
	2	Specialty contractors may be at a disadvantaged over the larger contractors. All contracts may not be the same type of contract.
	2	One and done, yes, but having an MSA in place saves time when you if younhave already agreed to the T's and C's. You can always negotiate specific terms and add as an Exhibit.
	3	The project work is apparently critical therefore equitable terms in a contract allows all parties to give all their attention to performing the work.
	3	I have seen flash track projects work without a project specific mutually equitable contract, especially if the scope is not not too complex or unique
	4	Contracts need to be balanced with risk placed where it is best controlled.
	4	Bring to the table your company offer(s) of Excuteion expereince and design and /or contruction. As the EPC group decides on scope-break it becomes perentage of the contract basis and cash flow. The equitable part can be in the cost submitted by each.
	4	I agree that the contract is very important but it does not have to be project specific rather it can be an ongoing partnering agreement
	4	Mutually equitable contracts protect enterprise risk and higher costs for flash track projects, however T&Cs don't necassarily have to be project specific if a master services agreement can be put in place ahead of time
	5	Project specificity is critical to clarity and scope definition. Project specific agreements drive this and if done well by definition create equitable balance
	5	Flash track projects require a different approach and mutually equitable contracts will alllow for out of the box approach.
	5	The contract is the basis for all business but it must be fair and equitable for all.
	5	Without mutually equitable contracts both owner and contractor are not incented to support each other toward a flash track solution
	5	This would be an ideal situation.
	5	The contract scope of supply and work must be clear
	5	Mutually equitable contracts can take several forms, but the key to success is that they are in fact mutually equitable.
	6	a detailed contract iding reponsibilities is essential. It is crucial that it not be limiting regarding unnecessary approvals before action

	6	Specific contracts go a long way to eliminating confusion and wasted time in assuming terms are in place
	6	It is essential the team is focused on the project, not commercial items.
	6	Of course project complexity is a key in deciding the magnitude of contracts contents.
Mode scores ≤ 4		
Item	Essential score	Commments offered
9	*Rankings of contract types or requirements by how absolutely ESSENTIAL they are (to flash-tracking)*	
	Ave	
	4.19	- Cost Plus & Fixed Fee
	4.06	- Open Book
	3.26	- Target Price/Value with shared cost savings
	3.94	- Time & Material rate agreements
	4.03	- Cost Plus or Reimbursable
	4.09	- Integrated Project Delivery (e.g., tri-party agreement)
10	*Employing performance incentives to promote a high performance culture*	
	2	Fast track is not the place to try and promote a high performance culture. Not every project will be fast track.
	3	Not a fan of incentives.
	3	A culture presumes that the company will high perform without incentives on every project. You don
	3	Performance matrics work short term. More of a disincentive long term.
	3	not necessary but extra dollars is always good
	3	Evaluating and selecting the right supplier for the specific project is more important than paying a performance incentive to drive high performance
	4	Incentives passed to team can be motivating. Must use care not to demotivate those not included.
	5	Developing project culture is work. If the p[roper processes are employed and considered in pricing, it can be done on a project. It has to start early and time (which equates to money) must be invested
	5	incentives need to be shared thru out the owner and contractor teams, down to the lowest levels
	5	I agree with distribution to the craft but hard to do as employees for various trades are usually not here from begin to end and often move on to another Company, so the shared profit often winds up in the Company/Managers pockets..
	6	Incentives for safety, environmental impact, etc are important to improve the culture of the project execution. Sharing that incentive with the craft is equally as important.
	6	This can only strengthen the contract language, but must be careful to not overly do the performance requirements.
11	*Capping contractor's down-side risk*	
	3	owner really needs to take the risk in Flash Track
	3	Fair and equitable contract language should address this concern.

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	3	depends on how much scope is know when establishing contract.
	4	Obviously Contractors risk must be capped to ensure reasonable exposure and owner must share some exposure. Must be negotiated in contract.
	4	Better contractors have risk profiles: once you exceed it, they decline the work. This is more of a go/no go decision than something that can improve project performance.
	4	Not sure how you define the cap
	6	As noted in the incentives section - need to cap up side and down side. Contractor has one shot and Owner has a plant
12	*Using standard repeatable designs and fewer design details*	
	2	I have never been on a project where you could use cookie cutter designs. There are always conditions specific to locations where designs are required to meet soil conditions, or sizemic requirements.
	3	The standard design can work but you will need the details for others to supply or erect what the design intent which is not reflected on the drawings without details.
	3	This can be rather expensive and not necessarily justified for the alleged time gain.
	3	To separate issues. Standard repeartable designs - yes. Fewer design details - no.
	4	Having an approved set of design standards is important, especially if the engineering contractor is familiar with them. Standard designs for certain installations can be helpful. Fewer design details would need to be used with caution.
	4	as long as owner understands the cost and schedule implications this can fast track a project
	4	Re-phrased: Leverage past design details...evolve into new Standards, reference these details on
	4	Agree with standard repeatable designs but not less detail
	4	Depends on project complexity
	5	Standardized repeatable design is best.. Some of the time its in the specs that call for extended/duplicated details by both the Engineer and then the Fabricator, which rips into the
	5	Ok to reduce details only if previously addressed in standard designs.
	5	especially if engg firm separate from construction it is typically over and under engineered
	6	Employing repeat designs,where applicable should save cost/schedule. Details must be sufficient to allow a constructor/supplier proceed with minimal questions.
	6	Replication and standardization offers fewer opportunities for errors and ommissions as well as the time to establish fundamentals or base scope.
	6	Standards are always preferable. Just don't spend to much time trying to get round pegs in square holes.
13	*Increasing resource levels for project control*	
	2	Project controls are reactive - not proactive. Well defined, communicated processes are proactive. Processes that are graphically depicted on a template are proactive.
	3	increase from what ? Assign what is necessary to do what is required.
	3	the leaders from owner and contractor have to have the knowledge of where the project is without waiting for project controls to report

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	3	Having the right resources is important, but not necessarily increasing them.
	3	You need the right persons for the team. Adding additional resources is not always the correct answer.
	3	Depends on the length of the project. Does Flash Track also mean short duration? The longer the duration, the more valuable project control resources will be.
	3	This could go either way.
	4	A accurate schedule reflecting true needs in the field is key to driving engineering and procurement deliverables priorities.
	4	You need experienced people to ensure the work gets done right. stretching personnel too thin causes fatigue and stress and creates mistakes.
	4	You must know where you are on cost and schedule, however the project must be driven by construction.
	4	Sometimes this is helpful sometimes it causes confusion. It is more a question of looking at the correct things versus looking at too many things or the same things in multiple ways.
	4	Dependent on size and complexity of project.
	4	It may not take extra resources but rather accepting some rework and risk
	4	You must understand the level of project montioring and control it requires. Just staffing up to create and issue pretty charts is not the answer.
	4	only if project controls are technically cabable of understanding issues and have mindset to remove any controls barriers quickly, while maintaining compliance, of course
	5	Increased controls are definitely required to assert the outcome.
	5	I dont think PCs are dedicated to and understand the projects from the beginning to understand the project development, always seem to be playing catchup
	5	Project controls must be foreard looking. Simply reproting adds little value. Engineering and construfiton must work together. Placing one above the other discourages team work and draws lines in the sand. Fast track projets must be a team work effort
	5	Especially important if not lump sum contracting.
	5	The plan defines the path to success. If a strong planning/control process is not in place, the result will not be as predictable.
	6	Project control shoulod be staffed at a level which can keep management informed and current on project status. This is key to decision making on fast tract projects,
	6	Project planning & control is a critical set of functions for project success over the project life cycle. Lack of skill in cost estimating, scheduling, managing risk, and configuration control are key root causes for project cost growth and schedule sli
14	*Executing liability waivers among key project participants*	
	1	Someone has to manage the risk
	2	Too vague...some liabilities can not be waived by law.
	3	The risks along with the appropriate liability for those risks need to be appropriately allocated.
	3	Having pre-negotiated terms and conditions is the key.

	3	This could go either way to help success or failure.
	4	Helps define the amount of risk to be expected.
	5	Just plain important to have negotiated liability limits.
	5	yes a must
	5	needs to be part of MOAs, POs, Supplemental Agreements during FEP process...part of vetting vendors
15	*Employing Lean Construction practices (e.g., continuous improvement)*	
	2	The process does not support Fast Track Projects very well ,
	2	Lean construction in my opinion is a fad. I prefer other CII techniques for productivity improvements. In the fast track world; I'm not even sure what the relevance of Lean is.
	2	all processes implemented with the team in flash track projects are LEAN!
	2	No matter a fast tracked or normal tracked project, you must learn lessons. do not past it up
	3	I doubt there will be time to review and incorporate these practices on the current job. Good for the next fast track job.
	3	Fast track projects must rely on proven methods. Inventing while building will cause delay.
	3	LEAN is too broad of a concept to conclude it would improve overall schedule. A philosophical concept. Need to evaluate detailed planks to determine its impact on the project
	3	Lean construction practices should be part the of Day 1 Plan. Continuous Improvement implemented w/ the next project
	4	Practices should be implemented from the start of the project. Eliminate Re-do's
	4	keep pace with technology and new,proven practices---can't try new(untried) in critical aspects of a project unless there is a timely,cost effective fall back available as an option
	4	personnally not familiar with lean construction techniques
	5	We should always look for better ways and products.
	5	Should be reviewed and considered early in the project.
	5	Lean practices will help at the start of a project, or if it gets into trouble, by identifying process steps/requirements that arent' adding value.
	5	Applying lessons learned from previous projects or early phases can keep the project on track.
	5	continuous improvement practices should be evaluated after each project and incorporated during the next project. Flash track typically does not have the time to incorporate during
16	*Tying performance incentives and rewards to project goals*	
	2	Incentives really don't do much for me.
	2	too many uncontrollable variables can prevent the incentive and ends up breaking down relationship
	3	Not a big fan of incentives and rewards. These can become distracting and not helpful in achieving project goals.

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	3	This is generally something that makes the Owner feel good but not essential for a successful project. It seems that Owner's sometimes apply heavy handed L/D's that could be less severe
	3	Can often lead to unintended consequences.
	3	To me the incentive is getting to work on the project and receive the fee that goes with it - incentives are nice but it's more about teamwork and being considered for the next project.
	4	The key is that any incentives and or LD's must drive the appropriate behavior to support
	4	If incentives pass down to discipline leaders they can stimulate improved interactive support and improve success potential when inter-discipline work arounds are facilitated.
	4	too much emphasis on incentives that can be complicated can distract from moving fast
	4	This is icing on the cake. Contracting with incentives requires early and quick alignment as well as easily defined objectives.
	4	Incentives can get in the way of performance. Inherently creates an advisarial situation at the end of the project.
	4	What really needs to be done is a strong team building and a team with a good attitude.
	4	The only effective incentive would be ONE for the entire team at the completion of the project
	5	Incentives around KPIs that can be objectively measured can be very effective. They must be substantial enough to drive behavior. Token incentives are a waste of time and subjective KPIs result in result animosity if not easily agreed upon.
	5	I thnik incentives are important - and they ahve to go both ways i.e. between Owner and Contractor. Fortunately or unfortunately, incentives have become the motivator - and I include schedule and performance LD
	5	This keeps the petal to the metal.
	5	Incentives for early completion should be included in the contract if LD's are included.
	5	Incentives work wherever people have the ability and desire to increase their reward.
	6	Contracts need to be incentive based. It sets the tone and gives the contractor a goal. However, I do agree, incentives can cost the contactor money.
	6	These must be thought out carefully to truely envoke a win win in project success.
17	*Establishing early completion bonuses*	
	2	Contractor is bidding a fast track and accounting for the risks (contingency). Why reward him again for completing on-time?
	3	Flash Track implies an already tight schedule, however if there is increased value in an earlier finish date, the contractor(while ensuring quality) should share in the wind fall
	3	Again, not a big fan of incentive contracts. Distracting and not always easy to administer.
	3	Concern about project quality.

	3	Again sounds like a transactional one off project with partners assembled for just this project
	3	Competitive execution plans for flash track projects rarely carry excessive schedule float. The owner gauges success on predictive start up planning. Compensation for added value of the best speed to market execution plan is preferred
	4	Again, incentives don't really help much.
	4	On Flash track projects early completion is usually very unlikely.
	4	Assuming engineers and suppliers meet their deadlines and the contract doesn
	4	OK if the improved schedule date is really say two months ahead of the Contract date. Plan to make all of the safety milestones as well and its a good incentative for all involved.
	4	Early completion bonus seems unrealistic for fast track projects. Professional services pricing based on expected perfromance
	4	This can work as long as the level of quality is well defined and adhered to during the execution.
	4	Depends on the magnituted of the project
	5	Early completion is a great objective as long as the burden of cost to achieve is not on the contractor. If the project is scheduled and priceded in a way to achieve this (second shift, pre-
	5	Incentive for creative execution strategies.
	6	Also essential that the owner support this concept and supports the contractor in getting bonuses
	6	Nothing wrong with setting up Milestone incentives to encurage schedule, quality, and safety, but they must be tied to each other keep each other equally incheck.
	6	As an owner, I need the contractor focused on the end. I do understand it can be a negative for the contractor in that he may spend more money making the bonus than the bonus is worth.
18	*Executing single-source or no-bid contracts*	
	2	Many lost opportunities with this.
	2	Having a stable of a select few highly qualified and known suppliers drives competition and consistency
	2	Rarely used in my mind. Should be carefully vetted before considering.
	3	Single source or no-bid contracts take too long to negotiate a fair price. Easier to go with best value
	3	No bid contracts have their place. If the scope is small, it can be OK to sole source work. Large projects need to be bid to validate price and to keep everybody honest with the bids.
	4	Can be helpful depending upon the situation.
	4	With familiar parties who have worked together in the past, the commercial negotiation can save time.
	4	If we're talking about alliance type contracts, I agree. If we're talking about project specific single-source or no-bid, I disagree.

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	4	Make hopefully a short list of the long lead items then market price the industry then pursue best deal with the one that can closest meet specification. Everthing else 3 bids.
	4	Best approach if few first tier contractors to choose from.
	4	If existing supplier staffs the project with the A Team then the better this strategy can work. THis startegy needs to address the people who will be placed on the project to be successful.
	4	On an as needed basis. Find the right ones.
	4	only works with alliance contractor wanting future work and willing to be open book
	5	When doing this there needs to be performance KPIs established so the supplier is incentivized to perform
	5	Particularly with those previously used.Most times will result in a shorter procurement-design-delivery-installment cycle
	5	Sole sourse contracts saves between 4 to 6 weeks because you eliminate the bidding time necessary to put bid packages together receive evaluate and award contracts.
	5	Agree if Alliance Agreements are in place with Labor rates/unit rates and markups..
	5	Depends on the market and supply of skillsets. In a tight labor market, the owner is going to pay anyways; they might as well negotiate with a proven performer. In other markets, getting competitive pricing is a good idea.
	5	Often the case when specific process technologies are required, so less time devoted to develpment and investigation
	6	this is part of the strategy for making quick decisions. Relationships from past projects are also a key to making this successful
	6	Alliances are important for continuity of work product and spped quailty work can be deleviered.
	6	Should choose the right partner and then negotiate the project details
	6	this works well with long established alliance partners - allows early constructability input
19	*Explicitly designating the project as being "fast track"*	
	1	The key is mutually understanding of the schedule requirements. Designating the project as fast track does nothing to gain that mutal understanding.
	2	Contractually designating a project as fast track opens the door for stakeholders to modify consistent and best practices and processes. This might be done under the guise of fast track but
	2	This is typically self explanatory
	2	Most projects I deal with are usually considered fast tract.
	2	We cannot overlook quality and safety due to the designation of a project.
	2	Most projects that I have been associated with start late and are not able to extend the finish date. This does not mean we need to designate them as fast track. I think fast track is over used.
	2	The Agreement docs (terms, conditions, schedule, budget, etc.) say it all - or at least they should say it all.

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	2	I don't think the title matters as much as agreeing to the agressive timelines, risk posture and approach to getting decisions made quickly
	3	Incorporating schedules, phasing expectations, mob/demob requirements, work hours, site availability drives the execution plan
	4	Project will have a schedule down to the discipline level. This will evidence Fast Track . An explicit lead in will not hurt.
	4	what you call it is not as important as a deep understanding of schedule and schedule drivers
	4	It is important that all are aligned on schedule being the primary driver. Using the term fast track is optional, but everyone needs to behave as if it is.
	5	Projects may become fast track during the process but won't be set up as fast track . To me a fast track project is one that construction starts between 30-60% of the design is complete, not at the 95% design complete.
	5	Establishes tone and expectations of project execution.
	5	If not identified that every component is needed earlier than what most Engineering and OEM groups have loaded as the default baseline. They can keep their hours just require design earlier by months and some cases a year.
	5	Fast track designation implies added urgency above the general projet types.
	5	Senior management must be completely supportive of the team
	6	All players need to understand this when it comes to budgets and decision marking process.
	6	You must call it fast-track so everyone understands that it is fast-track.
	6	This needs to be repeated over and over for all to hear. Key also is that upper management of the owner must support this concept, meaning that at times, a bit more money needs to be spent to achieve Fast Track.
	6	Must have sponsor and all stakeholders buy prior to beginning a fast track project. I consider a fast track project to be rare. Some may say it is an EPC, not true in my mind the EPC is setup to change through the final design stages.
	6	it is key that all team members understand the project is fast track and has the support of management
	6	This is most importantly used to manage-upward to insure owner/decision-makers understand the cost/timing implications for them to really do fast track .
Open Ended Questions		
21	*Additional comments on contractual considerations are welcomed.*	
	No one contracting method is essential. Must use a combination based on project requirements, time of execution, knowledge of contractors, etc.	
	Perfer Lump Sum work if the scope is clearly defined. Cost Plus is good when the scope is not defined which is most likely on fast track project.	
	Focus is on implementing scope as quickly as possible. Cost plus a fixed fee allows for fewer distractions on micro-managing details.	
	Members involved in a Flash Track project should be naturally motivated by self accomplishment, and not by monetary incentives	
	Execute 30% engineering LUMP SUM, then execute Detailed Design, Procurement, & Construction LUMP SUM	

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22	*Additional comments on delivery method considerations are welcomed.*
	Best value selection applies to all projects. Low price awards should never be considered as the only driver for contractor or equipment selection
	Mostly all good points..
	Time is the key. You need to get time on your side. When it is not, you do things you would not ordinarily do. Those things usually add risk to the job. You need to be able to quickly evaluate the risk before you make the
	The best scenario is to have stakeholders that have worked with each other before, competent at what they do, aligned with the project objectives and goals and are engaged early in the project life cycle.There is more
	Having a well developed plan to hit the ground running. Engineering must be done efficiently and long lead procurments in place early.
	Owner needs competent contractor that they can depend on leading sucess with the right resources and tools to accomplish what they cannot.
	Ship Largest fabricated component that will fit on the highway, water or air routes to project. Sometimes the end location is the bottle neck and new routes developed. This will be different on many pieces of equipment and standard bulk material items. Consider special transport when limit of loads required. If you have say 200 loads from one fabricator then effort may get lost in all of the tranportation methods.
	Most of the above looks spot on.
	The owners and contractors personnel staffing are key to the success of the fast track project.
	Settle on scope direction from feasibility studies. Select all technologies for unit operations. Establish existing conditions. Complete scope definition through 30% egineering. Execute lump sum EPC base lined from 30% egineering completion.
	Scope must be nailed down prior to project beginning.
	Focused effort in the FEP stage to minimize number of firms within the EPC process is most important...not all EPC firms are truly EPC and can have interface issues within a single firm.
23	*Additional comments on organizational considerations are welcomed.*
	The composition of a project team that has successfully worked together in the past, if available, is a +.
	Need to decision making persons who can make fast decisions in a timely fashion. Nothing stops a flash track project then someone who takes forever to make even the simplest decisions affecting construction. Processes and procedures need to match the fast track method.
	We use to call them Team Buildings, onsite Ok but offsite is better, and mind clearing agendas and exercises work well..
	All major parties in any project need to try and become a uniform team based on trust. It is sometimes hard to do but if it happens, everybody pushes in the same direction most of the time. This really improves the project's ability to be successful.
	Organization considerations should include the allocation of risk previously mentioned.The scope of work matrix should assign responsibilities based on each stakeholder's capabilities.Each stakeholder needs to be accountable for their complete, correct and timely deliverables.Decisions need to be taken and held firm.A classic example of where this goes wrong is when the owner's engineer falls behind and the owner demands the contractor make up the engineering deficiency. The owner is only fooling himself if he thinks the outcome will be good.

	The design of the virtual project team organizational structure can be critical to project success, to ensure that all teaming contractors and/or the joint venture is aligned with the project work. The following are good project team organization design principles that should be used:A written OBS dictionary should be developed to describe the key Roles, Responsibilities, Authorities and Accountabilities (RRAAs) assigned to each functional box and/or staff position.Clearly written RRAAs should be defined for each functional box and/or staff position. This helps to eliminate any potential duplication or overlap between the functions and serves as a key educational or team training document.In general the OBS should mirror the WBS. This is reflected in the org structure template in Figure 3.2 by the assignment of WBS element numbers to specific functional boxes. A Responsibility Assignment Matrix, which documents the assignment of OBS elements to the work elements can also be developed for more complicated Projects.Both the OBS and WBS element definitions should differentiate between boxes on the team org chart which perform ongoing continuous functions (i.e. Project planning and control or Project integration) and those which produce and deliver the space flight hardware or software 'system' and its subsystems and/or elements. For large or complex systems, the product-delivery boxes can also be further defined using a PBS.The team should be organized in a way that balances the managerial span of decision making and control at each level. This avoids potential bottlenecks in data flow and decision making at any one functional box. For example, a large Project may establish multiple deputy positions at key levels, such as assigning separate DPMs for flight hardware and ground operations.The Project org chart should identify independent TA reporting flows as dashed lines flowing up and out of the Project. At a minimum, an Engineering TA and a Safety and Mission Assurance TA line of independent reporting should be shown for the typical GRC space flight Project. The template shown in Figure 3.2 also shows a technical DLE reporting relationship typical of GRC's approach to Engineering TA for SFS Projects. Other TAs may apply to certain Projects to meet unique customer requirements.In addition to TAs other important external stakeholder relationships should be explicitly shown. This serves to both identify the point of entry into the Project team and/or box with primary responsibility to manage the organizational interface and to emphasize to all viewers that the Project team recognizes the importance of managing external relationships. These could include key customers, other government agencies or universities, a SRB advising the Project, commercial partners. or prime and subcontractors involved with the Project.In general the virtual Project team organization should be simple and leanly staffed as required to get the job done. Positions should NOT be created with an individual in mind, but rather with the needed functions and position requirements in mind. Only then should the recruiting and selection of candidates to fill the functional positions be undertaken.
	Strong organization skills are required with project management to push project forward. Full service, engineer, construct and commission organization.
	Capital aquisition request process that incorporates elements of front-end planning is imparative to successful fast track projects.
	Constructability Planning is a key group at the bidding and design phases. They should have a key position in the daily organization chart but remain in position to question and resolve any changes to the base-line plan whether Senior Managemen, Ebgineering or Procurement. Even a good improvement an item delivery may change storage location and how the installation sequence could be impacted.
	I disagree with the first statement that flash track projects would be better executed by companies that can do both engineering and construction (and have good project controls (scheduling) processes). This will facilitate better and expedited coordination with aligned interest. There are a lot of engineering firms that team well with construction firms to make flash track successful. The key, I believe, is in the attitude of the players from both outfits.

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	Ability of team leaders (Owner and contractors) to managem up and down their hierarchial chains ill elp the success of the project.
	EPC execution with at least one design stake holder participating in the field during construction
	Must have strong leadership and constant monitoring of team dynamics. Msut act quick to keep team strong. The three C's; communicate. communicate, communicate.
24	*Additional comments on planning considerations are welcomed.*
	Plan for success not for failure
	Focusing on the critical path activities is important. Also, focusing early on areas outside the direct control of the project team are critical, such as regulatory permitting, easements, funding strategies, etc.
	All good points, PCs need to be involved in the beginning, and the PM determines the level of control and how he wants to see it tracked and controlled.
	Planning and scheduling are two different things to me. Planning is determining the details for successful execution. Scheduling is executing the details. Both are a continuous effort during the execution of any project. Planning continuously changes based on the dynamics of the project. Consequently, scheduling continously changes because the plan continously changes.
	Using experienced people and EPC templates are the foundation of good planning. Not very many project invent a new wheel. Most are variations on previously seen projects. I get it that all projects are unique, but there are many similarities - otherwise CII wouldn't need to exist.The knowledge already exists how to obtain good results on projects. Experienced people know these best practices.If you think about it; projects that go wrong are usually because people not skilled at projects are making the decisions.
	PP&C functions include cost estimating, resource planning/tracking, scheduling, risk management, and configuration/data management. Having crackerjack people performing these functions is critical to project
	A better road map and steering from project controls is a good thing
	Concept evaluations need to be completed prior to commencement.
	Project should Construction driven with importantance on the sequence of deliveries.Also the Construction Turnover Packages (CTO)to Commissioning in a sequence of how Commissioning plans to perform the installed equipment systems. This will keep the project aligned earlier to meet dates in the project schedule.
	Evaluating project risks and potential remediation actions early can help the fast track projects
	The Project Planner/Scheduler must be a 100% dedicated resource to the project. Will need to implement Out of the Box processes
	Hour by hour shut down planning and phasing schedules should be developed during FEP
	This is the phase of a project that can make it be successful or make it be a failure. Spending the proper amount time in up front planning is crucial. You must nail down the scope along with the roles and
25	*Additional comments on cultural considerations are welcomed.*
	having a true team with shared vision and goals is essential to project success
	Learning how to work together quickly is a key. People are all different and successful projects can have a good blend. It's understanding the differences and learning how to work together that is key. Teams that have worked together previously are also helpful.
	Clear lines of communication are essential to the success of fast track.

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	In management, it will happen.. that's why we have managers, they are the leaders, eventually there will be a clash, but good Professionals know how to work thru this..
	Companies that have high performance, much like individuals, are self driven. You cannot take a lackluster contractor and make them high performance with incentives.High performance comes as the result of investing in high performance people, having processes and infrastructure to support the people; and
	Cultural factors can make or break a project. Care should be taken by senior management of all parties, client, contractors, and external stakeholders, to think through how their respective organizational cultures will interact and either complement or clash with each other. Putting appropriate incentives, recognition, and rewards in place can help promote the desired teaming behavior over the life of the project.
	Client's project execution culture is important to successful fast-track projects.
	OK as is.
	Uts about the people on the project
	Iron out indecision and changes during FEP and prior to EPC kick off
	Team members must have the proper KSA's in the role they play on the joint project team.
26	*Additional comments on design considerations are welcomed.*
	Consider modularization and offsite fabrication where it helps.
	Too many times we try to build the best possible plant when all that is necessary is a good plant that meets all of the design objectives.
	I think more frequent online design reviews using todays technology is not being optimized.. Participants would be more available if travel was not required to attend, eating up valuable productivity time and
	Have as much assembly as possbile completed in the shop before it is shipped to the site. Less work on site more work (with better quality) in the shop allows more work to be completed in a shorter time frame.
	Standardizing terminology, performance based engineering documents (i.e. the docs have the necessary information to be labeled IFC or they don't!), agreeing upon information flow or work flows, a good WBS,
	Constructability. Drive to decisions
	Repeating successful previous or similar designs can minimize overall time.
	Constructability during FEP
	Joint project team follows the established design process.
27	*Additional comments on execution practices are welcomed.*
	I am a proponent of Modularization and offsite fab. where it can help with labor & cost.
	Communications is critical to fast track projects. As long as the frequency is reasonable, this can be helpful to keep all aligned. Having periodic senior level sponsorship meetings can also be critical to ensure alignment and proper resources.
	Need good execution plans that have minor revisions to the plans. Having frequent pre-construct meetings to address key install methods is essential to prevent re-work.
	Use less customized specifications and more off-the-shelf applications assuming the product meets the needs and life cycle requirements.
	A good WBS, work package planning, productivity planning, scheduling and discipline work flows (processes) are always positive execution practices.

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	Visual project management is critical. Use everything from online management dashboards to posters/signs on site to keep ALL project personnel informed about the project, from senior management on down to rank and file laborers.
	Frequent communication and the use of collaborative tools are useful.
	You will need to add the meetings to the project schedule and they will require adjustment as the design, purchasing, Construction and Commissioning phases heat up.
	Communication plans (internally & externally), project specific safety plan, & client stakeholders involved early during FEP
	Daily communications and if needed shiftly communications on where execution is and where it must be adjusted for project success.
28	*Additional comments on innovative practices are welcomed.*
	Fast track is not where you want to put new ideas into place. You have designed it to get it consructive faster. That is not to say that construction shouldn't be engaged earlier to do over the shoulder constructability reviews to make sure that when it goes to the field it can be constructive safely and faster
	As stated before, the tools and practices are there... we just need to use them..
	I don't know that innovative practices should be tested on a fast track project. If time is critical; you need the predictability of proven practices.
	Investigate breaking larger components into smaller ones. Reduces complexity and time. Also, a parallel versus serial execution is essential.
	Plan is based on Fast Track /Flash projects then you can discuss innovative ideas but Only used if looking for ie a work-around for a missed delivery - design was incorrect - foundation did pass inspection and the erector need other work fronts that will not two-block the original sedudule activity.
	Working from the start=up backwards will help identify what needs to de done to fast track a project. Having construction say the design was early and perfect and all equipment is on site would be a star to a great fast
	do not give up all the project tools just to get a project completed unless it is affecting personal safety.
29	*Additional comments on risk considerations or mitigation measuresare welcomed.*
	All being Honest the last comment above is the fairest analogy I have seen..
	Same as previously stated. Allocate risks to the party best suited to manage and mitigate it.
	Defining probability of risk can help focus efforts; avoids too much time and attention on low probability areas.
	You must list risks and understand impacts

APPENDIX K

Relative Index Ranking of Essential Practices Defined in Delphi Round 1 and 2

The results of Delphi Rounds 1 and 2 were compiled based on a weighted average, as discussed in Chapter 2 (Methodology). Results of the top ten rankings are reported in Chapter 6 (Results).

The following pages show the rank ordering of the 47 practices identified in the Delphi study.

CII RT-311 Successful Delivery of Flash Track - Delphi Survey Round 1 and 2 (Relative Index)

Issue #	Issue	Median	Mode	Standard Deviation	Relative Index	RI Rank
36	Identifying and procuring long lead time items	6	6	0.522	0.936	1
1	Setting clear; specific scoping requirements	6	6	0.534	0.920	2
43	Dedicating full-time personnel to the project	6	6	0.656	0.904	3
18	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	5	6	0.726	0.897	4
10	Focusing procurement decisions on construction priorities	6	6	0.814	0.896	5
12	Staffing with personnel with strong leadership capabilities	5	5	0.584	0.896	6
7	Funding early critical efforts	5	5	0.718	0.893	7
30	Having open communication and transparency	5	5	0.547	0.891	8
5	Establishing clear change management procedures	5	5	0.689	0.890	9
11	Making timely selection and award contracts to subcontractors	5	5	0.689	0.890	10
23	Selecting personnel with a can do attitude and willingness to tackle challenging tasks	5	5	0.652	0.882	11
27	Having an active; involved and fully committed owner	5	5	0.705	0.882	12
34	Emphasizing coordination planning during the design process	5	5	0.493	0.882	13
31	Staffing with cooperative and collaborative personnel	5	5	0.512	0.876	14
40	Recognizing and managing the additional fast track risks	5	5	0.575	0.873	15
21	Empowering the project team (each organization led by an empowered leader)	5	5	0.602	0.873	16
38	Providing enough resources to critical path items	5	5	0.631	0.873	17
33	Creating executive alignment amongst the contracted parties	5	5	0.594	0.870	18
20	Delegating authority to project level (maximize decision-making authority to the project level)	5	5	0.644	0.867	19
24	Having an engaged and empowered Owner's Engineer (Owner's representative)	5	5	0.916	0.855	20
44	Selecting appropriate construction methods	5	5	0.629	0.852	21
32	Having an open minded team	5	5	0.567	0.845	22
17	Engagement of operations & maintenance personnel in the development and design process	5	6	1.093	0.845	23
39	Considering speed of fabrication and construction during the selection of design alternatives	5	5	0.687	0.839	24
37	Monitoring and driving corrective actions through the project controls process	5	5	0.674	0.836	25
15	Involving contractors; trades and vendors in the design phase	5	1	0.846	0.833	26
8	Reducing risks through collective efforts of all stakeholders	5	5	0.874	0.833	27
47	Frequent project review meetings	5	5	0.770	0.826	28
4	Establishing contract strategies specifically tailored to the project condition	5	5	0.895	0.824	29
41	Co-location of project team (owner; designer; builder; and/or key	5	6	1.112	0.824	30
22	Having an owner with sufficient depth of resources and strength of organization	5	5	0.912	0.821	31
29	Maintaining a no blame culture and mutually supportive environment	5	5	0.970	0.821	32
42	Simplifying approval procedures	5	5	0.629	0.815	33

Issue #	Issue	Median	Mode	Standard Deviation	Relative Index	RI Rank
45	Minimizing hand-offs	5	5	0.831	0.815	34
9	Selecting team members and staff based on their fast track experience or qualifications	5	5	0.709	0.813	35
16	Seeking out suppliers and specialty contractors as a source for time saving innovations	5	5	0.809	0.796	36
3	Aligning project participants' interests through contract	5	5	0.834	0.789	37
6	Establishing an effective claims resolution process	5	5	0.773	0.786	38
13	Employing innovative procurement practices	5	5	0.915	0.784	39
14	Highly integrated 3-D modelling with all major users updating a common database	5	5	0.929	0.772	40
19	Using team building and partnering practices	5	5	1.000	0.770	41
28	Establishing flexible project teams that avoid rigid hierarchy	5	5	0.926	0.767	42
26	Accepting a new paradigm or mindset differing from that of traditional	5	5	0.928	0.764	43
25	Staffing with multi-skilled personnel	5	5	0.681	0.761	44
2	Establishing performance-based specifications	5	5	0.926	0.753	45
46	Employing innovative construction methods	5	5	0.897	0.747	46
35	Performing exhaustive front end planning	5	5	0.924	0.730	47

APPENDIX L

Delphi Round 3

– Questionnaire, Responses and Oracle Comments

In the third and final round of the Delphi study, fast track subject matter experts or oracles were asked to select their top ten choices from the 47 practices identified in the first two rounds of the process. The following pages show the questionnaire, results, and comments:

A message from the Construction Industry Institute

The purpose of centralizing data collection through use of CII server-based software is to establish a centralized database to support CII research, benchmarking, and other CII committees working to support CII's mission. The centralized database should provide for more secure data collection and storage, and facilitates the sharing of data among authorized teams and committees while reducing the data collection burden on CII member companies.

All data provided for any CII survey in support of benchmarking and research activities by participating organizations are considered "company confidential." The data have been provided by participating companies with the assurance that individual company data will not be communicated in any form to any party other than CII authorized academic researchers and designated CII staff members. Any data or analyses based on these data that are shared with others or published will represent summaries of data from multiple organizations participating in the survey which have been aggregated in a way that will preclude identification of proprietary data and the specific performance of individual organizations.

Survey Purpose

"Successful Delivery of Flash-Track Projects" is a Construction Industry Institute (CII) funded study to better understand how to delivery faster Fast-Track (Flash-Track) through investigating and identifying distinguishing approaches, innovative delivery methods and barriers to faster, more effective project delivery.

Whereas, fast-track has been defined as a time-driven project requiring some degree of concurrency between Engineering, Procurement and Construction - flash-tracking requires a heightened degree of concurrency; relational contracting methods and exceptional execution.

We anticipate that a more heavily overlapped work-process will require the adoption of innovative design, management, and construction tools and techniques markedly different from traditional construction practices. We also expect that the re-engineered work-processes will better define fast-track project risks, enhance team integration and quality of relationships; contributing to increased predictability and Stakeholders' satisfaction for Owners, Designers and Contractors.
Results from this survey will serve as a central element in our efforts to identify critical organizational, scoping, contractual, and planning issues to significantly enhance the likelihood of success in the delivery of Flash Track projects. These efforts will ultimately lead to the development of an implementation resource that will define a project's readiness for flash-tracking and a guide of how to successfully deliver cost effective, quality, faster, fast-track or flash track projects.

Instructions for Round 3

Thank you for your participation on the first two rounds of this Construction Industry Institute (CII) funded study regarding *Successful Delivery of Flash Track Projects*. A summary of the results based on your generous input are shown on the next page.

In this final round, we are seeking your perspective on prioritizing the issues collected in the first two rounds.

At the end of this survey we welcome any further comments on what you find to be the most essential issues to consider when undertaking a flash-track project, as well as any comments on how the flash track process can be more predictable and faster.

You can either complete the survey in one sitting or incrementally. If you close the survey before completing it, you can return to the e-mailed link, click the survey link and you will be forwarded to the first uncompleted page and be allowed to finish the survey. Once the survey is completed you will not have the ability to update your answers. In test runs of this final survey, it took respondents about 15-20 minutes to complete.

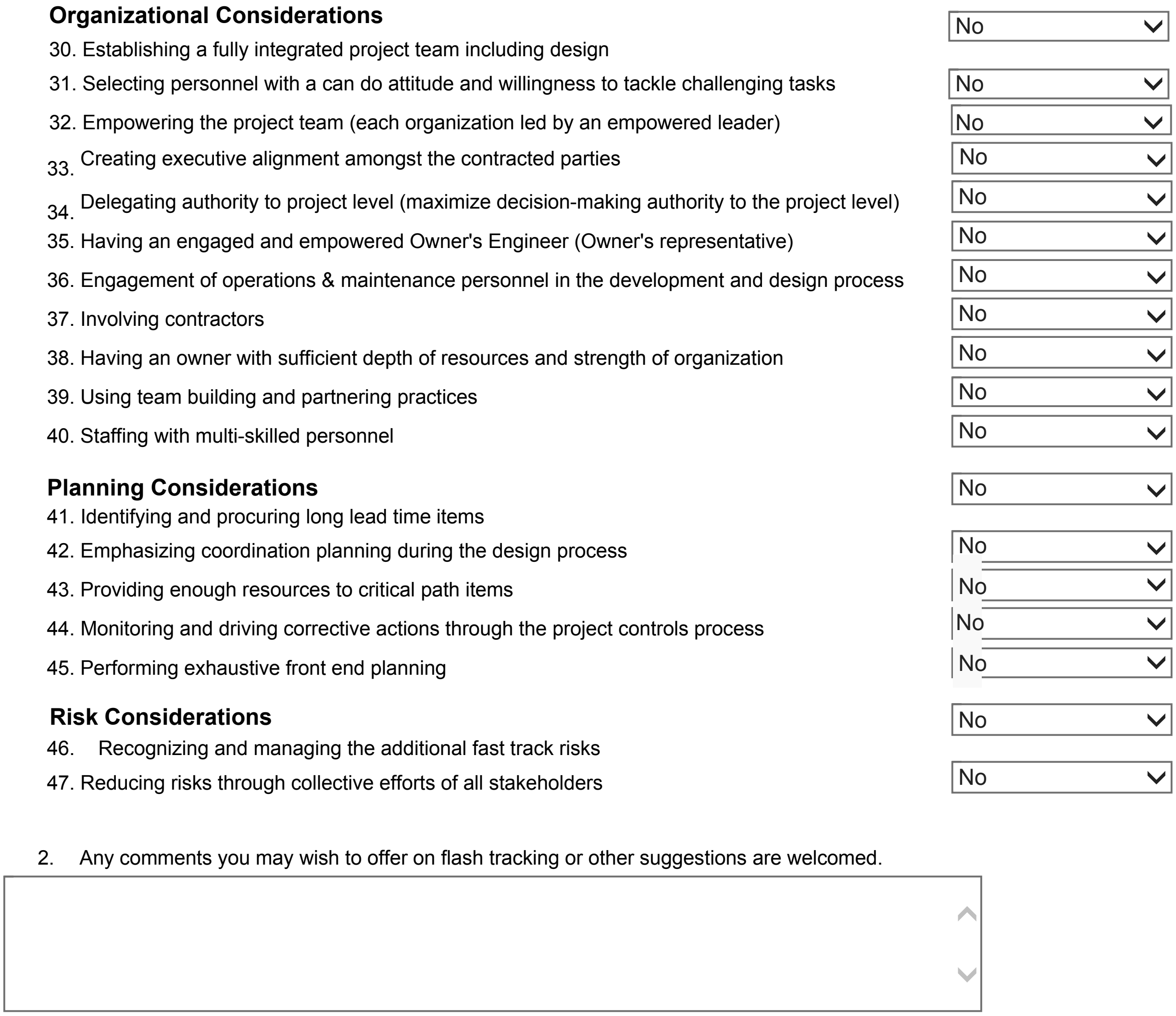
Please note that the survey software does not function correctly in Google Chrome; as a result we suggest the use of Internet Explorer or Firefox. Finally, when you complete the survey, hit the "done" radio button at the base of the last page.

Thank you for your time in effort in contributing to this effort. We look forward to seeing your responses.

Thanks to your efforts we attained an outstanding participation level. Eighty seven percent of the nominated experts (55/63) participated in the first round of the survey with eighty five percent of those participants (47/55) completing the second round. In the first round expert panelist reached consensus that 46 of 66 issues were ESSENTIAL for successful flash-tracking and offered four new items for consideration. In the second round, where the Round 1 comments were shared, expert panelists did not reach consensus on any of the remaining original items. One of the four added items "Frequent project review meetings" reached consensus. The Successful Delivery of Flash Track Delphi process has generated 47 ESSENTIAL issues, as well as almost 1,000 comments that will be of great value.

Please select the top ten issues you consider as being most ESSENTIAL for a successful flash-track project

	Top-ten issues for a successful flash-track
Contract Considerations	
1. Setting clear, specific scoping requirements	No ⌄
2. Funding early critical efforts	No ⌄
3. Establishing clear change management procedures	No
4. Establishing contract strategies specifically tailored to the project condition	No ⌄
5. Aligning project participants' interests through contract	No ⌄
6. Establishing an effective claims resolution process	No ⌄
7. Establishing performance-based specifications	No ⌄
Cultural Considerations	
8. Having open communication and transparency	No ⌄
9. Having an active	No ⌄
10. Staffing with cooperative and collaborative personnel	No ⌄
11. Having an open minded team	No ⌄
12. Maintaining a no blame culture and mutually supportive environment	No ⌄
13. Establishing flexible project teams that avoid rigid hierarchy	No ⌄
14. Accepting a new paradigm or mindset differing from that of traditional practices	No ⌄
Design Considerations	
15. Considering speed of fabrication and construction during the selection of design alternatives	No ⌄
16. Highly integrated 3-D modelling with all major users updating a common database	No ⌄
Delivery Method Considerations	
17. Focusing procurement decisions on construction priorities	No ⌄
18. Staffing with personnel with strong leadership capabilities	No ⌄
19. Making timely selection and award contracts to subcontractors	No ⌄
20. Selecting team members and staff based on their fast track experience or qualifications	No ⌄
Execution Considerations	
21. Dedicating full-time personnel to the project	No ⌄
22. Selecting appropriate construction methods	No ⌄
23. Co-location of project team (owner	No ⌄
24. Minimizing hand-offs	No ⌄
25. Frequent project review meetings	No ⌄
26. Simplifying approval procedures	No ⌄
Innovation Considerations	
27. Seeking out suppliers and specialty contractors as a source for time saving innovations	No ⌄
28. Employing innovative procurement practices	No ⌄
29. Employing innovative construction methods	No ⌄



Organizational Considerations	
30. Establishing a fully integrated project team including design	No
31. Selecting personnel with a can do attitude and willingness to tackle challenging tasks	No
32. Empowering the project team (each organization led by an empowered leader)	No
33. Creating executive alignment amongst the contracted parties	No
34. Delegating authority to project level (maximize decision-making authority to the project level)	No
35. Having an engaged and empowered Owner's Engineer (Owner's representative)	No
36. Engagement of operations & maintenance personnel in the development and design process	No
37. Involving contractors	No
38. Having an owner with sufficient depth of resources and strength of organization	No
39. Using team building and partnering practices	No
40. Staffing with multi-skilled personnel	No
Planning Considerations	
41. Identifying and procuring long lead time items	No
42. Emphasizing coordination planning during the design process	No
43. Providing enough resources to critical path items	No
44. Monitoring and driving corrective actions through the project controls process	No
45. Performing exhaustive front end planning	No
Risk Considerations	
46. Recognizing and managing the additional fast track risks	No
47. Reducing risks through collective efforts of all stakeholders	No

2. Any comments you may wish to offer on flash tracking or other suggestions are welcomed.

CII RT-311 Successful Delivery of Flash Track
- Delphi Survey Round 3 Numerical Result (T-denotes tie)

Response summary:
52 of the 64 oracles (81%) who submitted consent forms responded to the Round 3 survey

Issue #	Issue	# Oracles who selected this item as a Top-10	% of total responses	Round 3 rank
1	Setting clear; specific scoping requirements	42	81%	1
18	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations	31	60%	2
43	Dedicating full-time personnel to the project	27	52%	3
10	Focusing procurement decisions on construction priorities	24	46%	4
30	Having open communication and transparency	23	44%	5
7	Funding early critical efforts	22	42%	T6
36	Identifying and procuring long lead time items	22	42%	T6
11	Making timely selection and award contracts to subcontractors	22	42%	T6
9	Selecting team members and staff based on their fast track experience or qualifications	20	38%	9
40	Recognizing and managing the additional fast track risks	19	37%	10
35	Performing exhaustive front end planning	18	35%	11
39	Considering speed of fabrication and construction during the selection of design alternatives	17	33%	12
23	Selecting personnel with a “can do” attitude and willingness to tackle challenging tasks	16	31%	T13
31	Staffing with cooperative and collaborative personnel	16	31%	T13
38	Providing enough resources to critical path items	15	29%	15
20	Delegating authority to project level (maximize decision-making authority to the project level)	14	27%	T16
47	Frequent project review meetings	14	27%	T16
12	Staffing with personnel with strong leadership capabilities	14	27%	T16
41	Co-location of project team (owner; designer; builder; and/or key vendors)	12	23%	T19
5	Establishing clear change management procedures	12	23%	T19
4	Establishing contract strategies specifically tailored to the project condition	12	23%	T19
24	Having an engaged and empowered Owner's Engineer (Owner's representative)	12	23%	T19
21	Empowering the project team (each organization led by an empowered leader)	11	21%	23
14	Highly integrated 3-D modelling with all major users updating a common database	10	19%	T24
15	Involving contractors; trades and vendors in the design phase	10	19%	T24
29	Maintaining a no blame culture and mutually supportive environment	10	19%	T24
26	Accepting a new paradigm or mindset differing from that of traditional practices	9	17%	T27

Issue #	Issue	# Oracles who selected this item as a Top-10	% of total responses	Round 3 rank
34	Emphasizing coordination planning during the design process	9	17%	T27
42	Simplifying approval procedures	9	17%	T27
19	Using team building and partnering practices	9	17%	T27
33	Creating executive alignment amongst the contracted parties	8	15%	T31
17	Engagement of operations & maintenance personnel in the development and design process	8	15%	T31
8	Reducing risks through collective efforts of all stakeholders	8	15%	T31
44	Selecting appropriate construction methods	8	15%	T31
28	Establishing flexible project teams that avoid rigid hierarchy	6	12%	T35
45	Minimizing hand-offs	6	12%	T35
37	Monitoring and driving corrective actions through the project controls process	6	12%	T35
16	Seeking out suppliers and specialty contractors as a source for time saving innovations	6	12%	T35
46	Employing innovative construction methods	5	10%	T39
13	Employing innovative procurement practices	5	10%	T39
32	Having an open minded team	4	8%	41
3	Aligning project participants' interests through contract	3	6%	T42
2	Establishing performance-based specifications	3	6%	T42
22	Having an owner with sufficient depth of resources and strength of organization	3	6%	T42
25	Staffing with multi-skilled personnel	3	6%	T42
6	Establishing an effective claims resolution process	2	4%	46
27	Having an active; involved and fully committed owner	1	2%	47

CII RT-311 Successful Delivery of Flash Track
Delphi Survey Round 3 Oracle Comments

No. Comments

1 Creating a winning Flash-Track project takes the correct team with a innovative/collaborative effort. Everyone must work together tirelessly to meet the goal. Most of all, the owner has to by in 100% to the concept, with no finger pointing or slow decision making processes.

2 Tough to decide on just 10. I could do this exercise 10 times and come up with 10 different Top 10s depending on how I am thinking about the total project process from cradle to grave. There would be common issues chosen in all my Top 10s but many of issues could come in or out of the Top 10s just by how I am thinking about the execution at that time or the issues I have dealt with on my last project. It is important to understand any project can be executed successfully in multiple ways. There is typically no one successfull way to execute a project. All good leaders need to understand their executing team(s) may not be executing a project the exact way you would. So, you must determine if their execution can meet the same objective(s). If so, the good leader will let the executing team follow the path they have chosen. This provides for much better training and experience for the team(s). They must learn from their own mistakes and from the experiences of their leadership but not solely on the experiences of their leadership.

3 Having the materials available before you start.

4 There is a lot of commonality and overlap among these considerations. I think it comes down to interpretation of the specifics to differentiate. I found myself wanting to combine a majority of the similar items from all 47 to get a solid 10 Considerations, and leaving only a few that would carry less weight in the mix.. Anyone that has done Fast and Flash Track can see the associations..

5 Having the materials available before you start.

6 Management committment is a desiding success factor.

7 Understanding the differences (permitting/design/construction capabilities) in countries is a key to better understanding what fast tracking means to you project

8 in my opinion, people make the project. select the team based on ability to work together in harmony, technical capability in their respective discipline is a given. if it turns out that someone does not fit in, replace them immediately. cooperation is essential.

9 It's all about the team and simple processes to allow them to move fast

10 Without a skilled empowered team a project of this type can not succeed.

11 In my experience (process/industrial projects), unless the owner awards and EPC contract, the owner is the de facto EPC contractor.Owner's typically do not spend money up front on constructability. They typically do not make the necessary engineering decisions early enough; they change their minds; they do not get the ops and maint personnel involved (sometimes because they're not hired yet).Schedule compression requires timely decisions resulting in frozen information. It requires the major stakeholders be involved at the onset.Contracts, team building, empowerment, etc. are all nice; but it's decisions and information that keep the project moving.

12 Each of the Construction Turnover packages milestone dates to be submitted the Commissioning Manager are critical to each of the process systems being completed in a proper sequence check-out that support the complete project start-up. Duration of the Commissioning activities for each system will back stop the project schedule to identify activities the duration of the construction, procurement and design phases. Also project specific could include Numbers 3,6,19,21,27,36,38, 44 just as easily a Top 10 choice.

APPENDIX M

AHP Software, Instructions and Questionnaire

Appendix M provides a narrative of a series of Excel workbooks (which were developed to build the AHP questionnaire), compute and compile the results, a copy of the AHP questionnaire's instructions and the AHP questionnaire.

The analysis was performed using established guidelines offered by Saaty (2004, 2006, and 2012) and MS Excel functions. The template for three Excel worksheets had been developed at Virginia Tech as part of an earlier research effort (Horsey, S. et al. 2014).

AHP Software

The AHP analysis was completed using three Excel workbooks to 1) construct a pair-wise comparison questionnaire, 2) collect and analyze the pair-wise comparisons, and 3) consolidate the individual responses in an aggregated format. These workbooks were based on a template developed by Virginia Tech as part of an earlier research effort (Horsey, S. et al. 2014).

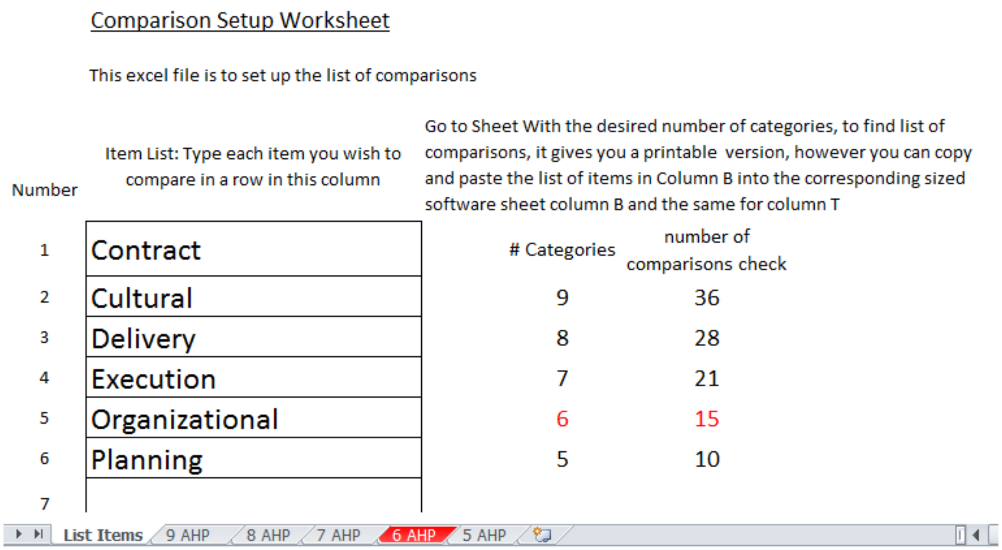
M.1 AHP Decision Matrix

The first step in an AHP is to create a decision matrix in which judgments can be entered in response to the question "How much more important is one criterion than another at the top of the matrix?" The resulting decision matrix, showing the pairwise comparisons, is a square reciprocal matrix with diagonals representing the comparison of a practice to itself; n(n-1)/2 comparisons are needed if n is the number of criteria being compared (Satty 2006).). In the matrix, a_{ij} is always the reciprocal of a_{ji} as illustrated in Figure M.1 below. The values along the diagonal represent the comparison of a practice to itself and are by default set equal to one.

Goal	A	B	C	…	n
A	1	a_{12}	a_{13}	…	a_{1n}
B	$1/a_{12}$	1	a_{23}	…	a_{2n}
C	$1/a_{13}$	$1/a_{23}$	1	…	a_{3n}
⋮	⋮	⋮	⋮	⋮	⋮
I	$1/a_{1n}$	$1/a_{2n}$	$1/a_{3n}$	…	1

Figure M.1, AHP Decision Matrix

The comparison set-up workbook (first workbook), illustrated in Figures M.2 and M.3, was designed to set up the comparisons of the practices within each category as well as the comparisons between the categories. It used a call function from the list of practices on a given sheet to create the pairwise comparison questionnaire and analysis workbook.



Comparison Setup Worksheet

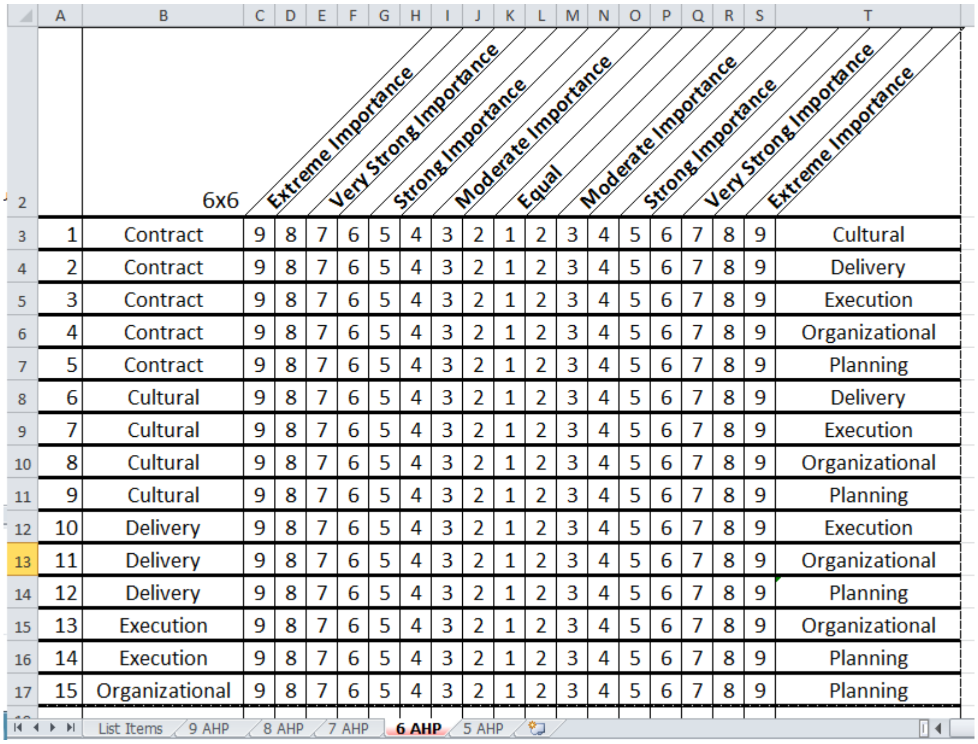
This excel file is to set up the list of comparisons

Go to Sheet With the desired number of categories, to find list of comparisons, it gives you a printable version, however you can copy and paste the list of items in Column B into the corresponding sized software sheet column B and the same for column T

Number	Item List: Type each item you wish to compare in a row in this column
1	Contract
2	Cultural
3	Delivery
4	Execution
5	Organizational
6	Planning
7	

# Categories	number of comparisons check
9	36
8	28
7	21
6	15
5	10

Figure M.2 – Comparison set-up workbook input page (example)

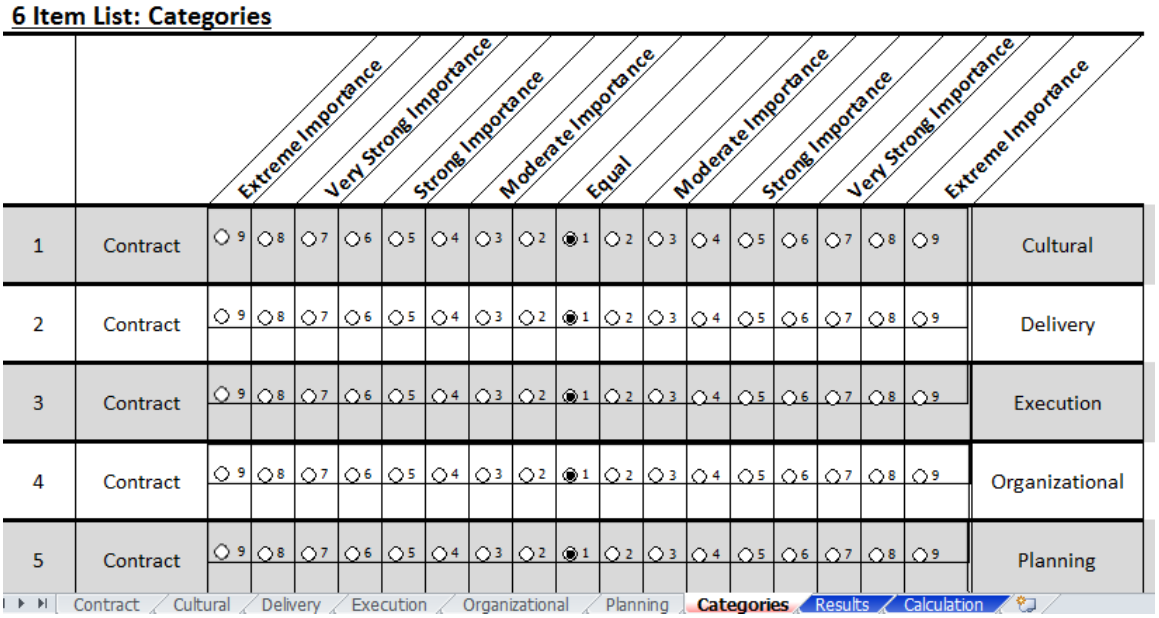


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
2		6x6	Extreme Importance		Very Strong Importance		Strong Importance		Moderate Importance		Equal		Moderate Importance		Strong Importance		Very Strong Importance		Extreme Importance	
3	1	Contract	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Cultural
4	2	Contract	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Delivery
5	3	Contract	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Execution
6	4	Contract	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Organizational
7	5	Contract	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Planning
8	6	Cultural	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Delivery
9	7	Cultural	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Execution
10	8	Cultural	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Organizational
11	9	Cultural	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Planning
12	10	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Execution
13	11	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Organizational
14	12	Delivery	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Planning
15	13	Execution	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Organizational
16	14	Execution	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Planning
17	15	Organizational	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Planning

Figure M.3 – Comparison set-up workbook output

M.2 Input, Multiplier Matrix, and Weightings

The input and computation workbook (second workbook) incorporates the information from the first workbook, and serves as the collection media for users' input on the six categories and the category pairwise comparison. Hidden worksheets on that workbook translate the users' input, in matrix format, to facilitate the subsequent analysis (Figure M.4).



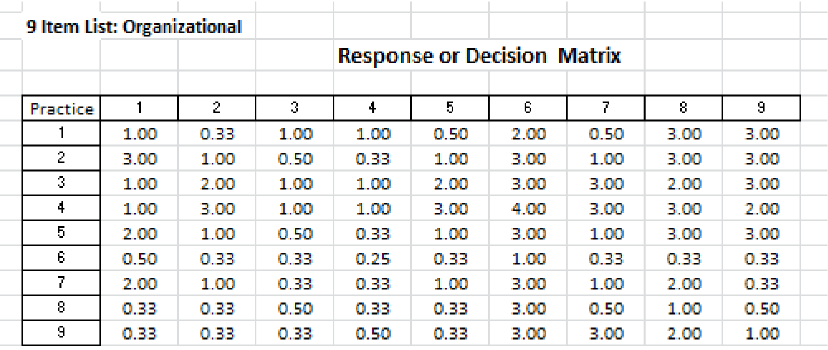
6 Item List: Categories

		Extreme Importance		Very Strong Importance		Strong Importance		Moderate Importance		Equal		Moderate Importance		Strong Importance		Very Strong Importance		Extreme Importance	
1	Contract	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Cultural
2	Contract	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Delivery
3	Contract	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Execution
4	Contract	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Organizational
5	Contract	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Planning

Figure M.4 – AHP Software – Survey participant input page (example)
Tabs shown in blue are hidden from the survey participants

Survey participants' comparison scores were based on criteria in the AHP instructions.

In calculating the resulting weightings, the comparisons between the pairs of issues are organized into a decision matrix (Figure M-5) that, through a process of matrix multiplications and other operations, is translated into comparative weights for each participant.



9 Item List: Organizational

Response or Decision Matrix

Practice	1	2	3	4	5	6	7	8	9
1	1.00	0.33	1.00	1.00	0.50	2.00	0.50	3.00	3.00
2	3.00	1.00	0.50	0.33	1.00	3.00	1.00	3.00	3.00
3	1.00	2.00	1.00	1.00	2.00	3.00	3.00	2.00	3.00
4	1.00	3.00	1.00	1.00	3.00	4.00	3.00	3.00	2.00
5	2.00	1.00	0.50	0.33	1.00	3.00	1.00	3.00	3.00
6	0.50	0.33	0.33	0.25	0.33	1.00	0.33	0.33	0.33
7	2.00	1.00	0.33	0.33	1.00	3.00	1.00	2.00	0.33
8	0.33	0.33	0.50	0.33	0.33	3.00	0.50	1.00	0.50
9	0.33	0.33	0.33	0.50	0.33	3.00	3.00	2.00	1.00

Figure M.5, Sample AHP Decision Matrix

To define the dominance of one alternative over another, the decision matrix is raised to a large power—in the case of this research, the 10th power—forming a super matrix (Saaty 2004, Saaty 2006). After the super matrix is formed, its principal eigenvector is calculated and normalized. This normalized eigenvector gives a complete set of the relative weights of the attributes or practices of the entities (Figure I-6).

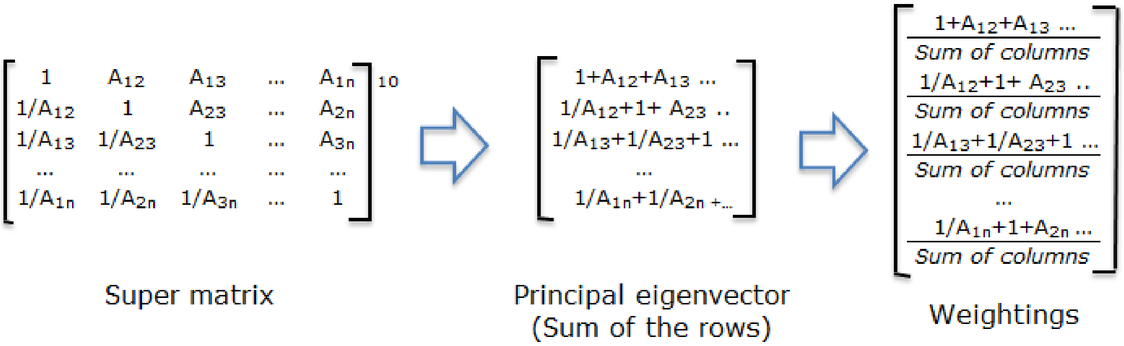
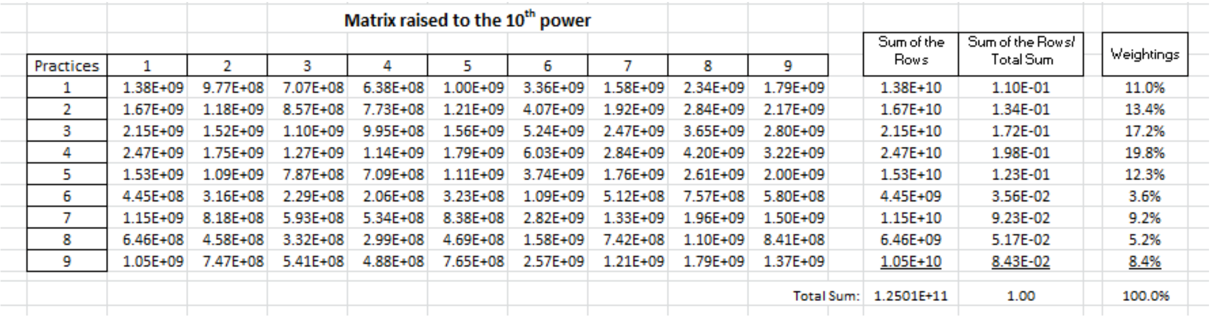


Figure I-6 – Super matrix, Principal Eigenvector and Weightings (self-created)

The AHP software computes the supermatrixusing the MS Excel MMULT function, which calculates the cross product of two matrices; the MMULT function was nested to achieve 10 multiplications of the matrix. Sample worksheet calculations for the supermatrix and weightings are shown in Figure M.7.



Matrix raised to the 10^{th} power

Practices	1	2	3	4	5	6	7	8	9	Sum of the Rows	Sum of the Rows/ Total Sum	Weightings
1	1.38E+09	9.77E+08	7.07E+08	6.38E+08	1.00E+09	3.36E+09	1.58E+09	2.34E+09	1.79E+09	1.38E+10	1.10E-01	11.0%
2	1.67E+09	1.18E+09	8.57E+08	7.73E+08	1.21E+09	4.07E+09	1.92E+09	2.84E+09	2.17E+09	1.67E+10	1.34E-01	13.4%
3	2.15E+09	1.52E+09	1.10E+09	9.95E+08	1.56E+09	5.24E+09	2.47E+09	3.65E+09	2.80E+09	2.15E+10	1.72E-01	17.2%
4	2.47E+09	1.75E+09	1.27E+09	1.14E+09	1.79E+09	6.03E+09	2.84E+09	4.20E+09	3.22E+09	2.47E+10	1.98E-01	19.8%
5	1.53E+09	1.09E+09	7.87E+08	7.09E+08	1.11E+09	3.74E+09	1.76E+09	2.61E+09	2.00E+09	1.53E+10	1.23E-01	12.3%
6	4.45E+08	3.16E+08	2.29E+08	2.06E+08	3.23E+08	1.09E+09	5.12E+08	7.57E+08	5.80E+08	4.45E+09	3.56E-02	3.6%
7	1.15E+09	8.18E+08	5.93E+08	5.34E+08	8.38E+08	2.82E+09	1.33E+09	1.96E+09	1.50E+09	1.15E+10	9.23E-02	9.2%
8	6.46E+08	4.58E+08	3.32E+08	2.99E+08	4.69E+08	1.58E+09	7.42E+08	1.10E+09	8.41E+08	6.46E+09	5.17E-02	5.2%
9	1.05E+09	7.47E+08	5.41E+08	4.88E+08	7.65E+08	2.57E+09	1.21E+09	1.79E+09	1.37E+09	1.05E+10	8.43E-02	8.4%
									Total Sum:	1.2501E+11	1.00	100.0%

Figure M.7, Sample Multiplier Matrix and Weightings

M.3 Consistency Index

If a decision support theory is to be trustworthy, there must be consistency in the representation of judgments (Saaty 1990). The AHP process includes a Consistency Ratio (CR) check to measure how consistent the assigned scores are relative to a purely random selection. If a CR is much in excess of 0.1, the judgments are considered untrustworthy because the responses offered are internally inconsistent and may reflect random selection. In the event that an RT 311 industry expert's evaluation fell beyond a CR of 0.1, a re-assessment was required. The consistency equations (Saaty 2006) employed are shown in Eqs. M.1 and M.2 below.

Consistency Index: $$\mathrm{CI} = (\lambda_{\max}-n)/(n-1) \qquad \text{(Eq.M.1)}$$

$\lambda_{\max}$ – the average value of the eigenvalues of the matrix
n – matrix size

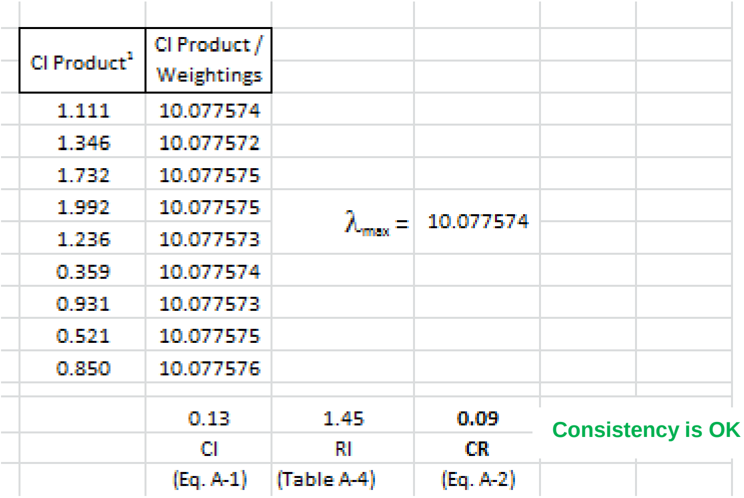
Consistency Ratio: $$\mathrm{CR} = \mathrm{CI}/\mathrm{RI} \qquad \text{(Eq. M.2)}$$

The Random Index (RI) is a randomly generated receptacle matrix from the 9-point scale, as defined by Saaty (1980, 2006) shown below in Table M.1.

Table M.1, Random Index Values

Size	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

$\lambda_{\max}$ was calculated by taking the cross product of the decision matrix and the vector that represents the sum of the rows. The values of the resulting vector were then divided by the weightings for each issue. The average of the numbers in this matrix was calculated and represented as λ_{max} in the consistency index equation (Eq. M.1), which was then used to calculate the consistency ratio (Eq. M.2). A sample worksheet calculation for the consistency ratio is shown in Figure M.8.



CI Product^1	CI Product / Weightings			
1.111	10.077574			
1.346	10.077572			
1.732	10.077575			
1.992	10.077575	λ_{max} =	10.077574	
1.236	10.077573			
0.359	10.077574			
0.931	10.077573			
0.521	10.077575			
0.850	10.077576			
	0.13	1.45	0.09	Consistency is OK
	CI	RI	CR	
	(Eq. A-1)	(Table A-4)	(Eq. A-2)	

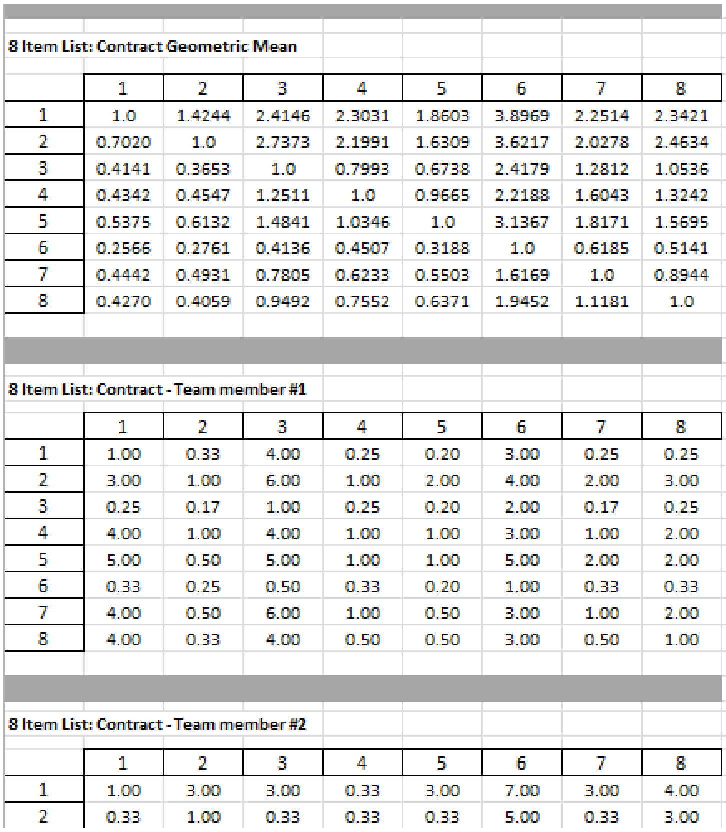
1 - [Decision Matrix] x [Weightings]

Figure M.8, Sample Worksheet Calculation for Consistency Ratio

M.4 Aggregation of Multiple Users

AHP can be used successfully with a group (Saaty 2012). The geometric mean has been used as a measure of central tendency when compiling individual responses (Saaty 2004). The geometric mean indicates the central tendency of a set of numbers based on the product of their values. In mathematical terms, the geometric mean is defined as the n^{th} root of the product of n numbers (i.e., for a set of numbers $\{x_i\}_{i=1}^{N}$, the geometric mean is defined as $(\prod_{i=1}^{N} x_{\mathrm{i}})^{1/N}$). One of the recommended methods of employing the geometric mean in the AHO is to combine the matrices containing the original responses by calculating the geometric mean of each cell (e.g., for element (a,a) of geometric mean matrix R calculated from response matrices M_1 through M_n, $\mathrm{R}_{(a,a)} = (\prod_{i=1}^{n} M_{i(a,a)})^{1/n}$) and then calculating the weightings of the resulting matrix using the formula described for the individual matrices (Saaty 2004). As with the individual matrices, the sum of the matrix's elements is 100%.

This method of aggregating results from multiple users was employed in the Geometric Mean of Multiple Inputs workbook (third workbook). This workbook incorporates the information from the users' input and computation workbook (second workbook) to calculate the geometric mean matrix, employing the MS Excel GEOMEAN function. After calculating the geometric mean, the resulting mean decision matrix undergoes the same process described above for the individual inputs to calculate the weightings. A sample worksheet for the entry of 15 user inputs for the geometric mean calculation is shown in Figure M.9.



8 Item List: Contract Geometric Mean

	1	2	3	4	5	6	7	8
1	1.0	1.4244	2.4146	2.3031	1.8603	3.8969	2.2514	2.3421
2	0.7020	1.0	2.7373	2.1991	1.6309	3.6217	2.0278	2.4634
3	0.4141	0.3653	1.0	0.7993	0.6738	2.4179	1.2812	1.0536
4	0.4342	0.4547	1.2511	1.0	0.9665	2.2188	1.6043	1.3242
5	0.5375	0.6132	1.4841	1.0346	1.0	3.1367	1.8171	1.5695
6	0.2566	0.2761	0.4136	0.4507	0.3188	1.0	0.6185	0.5141
7	0.4442	0.4931	0.7805	0.6233	0.5503	1.6169	1.0	0.8944
8	0.4270	0.4059	0.9492	0.7552	0.6371	1.9452	1.1181	1.0

8 Item List: Contract - Team member #1

	1	2	3	4	5	6	7	8
1	1.00	0.33	4.00	0.25	0.20	3.00	0.25	0.25
2	3.00	1.00	6.00	1.00	2.00	4.00	2.00	3.00
3	0.25	0.17	1.00	0.25	0.20	2.00	0.17	0.25
4	4.00	1.00	4.00	1.00	1.00	3.00	1.00	2.00
5	5.00	0.50	5.00	1.00	1.00	5.00	2.00	2.00
6	0.33	0.25	0.50	0.33	0.20	1.00	0.33	0.33
7	4.00	0.50	6.00	1.00	0.50	3.00	1.00	2.00
8	4.00	0.33	4.00	0.50	0.50	3.00	0.50	1.00

8 Item List: Contract - Team member #2

	1	2	3	4	5	6	7	8
1	1.00	3.00	3.00	0.33	3.00	7.00	3.00	4.00
2	0.33	1.00	0.33	0.33	0.33	5.00	0.33	3.00

Figure M.9, Sample Worksheet for Calculation of the Geometric Mean

Subsequent to formal training session on the background, purpose, and execution of the AHP (Nashville, TN on 3/14/14) industry members of RT 311 were given further instructions along with an initial iteration of the pairwise comparison questionnaire. That instruction was given on 4/17/14.

The following pages include a copy of the message sent to each industry member, along with instructions for completing the pairwise comparisons.

Industry members of RT 311were invited to call with any questions and were asked to respond in approximately one month.

AHP Instructions

Transmitted to each member of RT 311, 4/17/14and 5/21/14

Dear RT 311 Colleagues:

Further to our meeting in Nashville, it is time to perform the Analytic Hierarchy Process (AHP) to find the relative importance of the Flash Track practices within each category and also to find the relative importance of the Categories themselves. The AHP process has a rigorous mathematical foundation; but is easy to use without a discussion of its underlying mathematical theory.

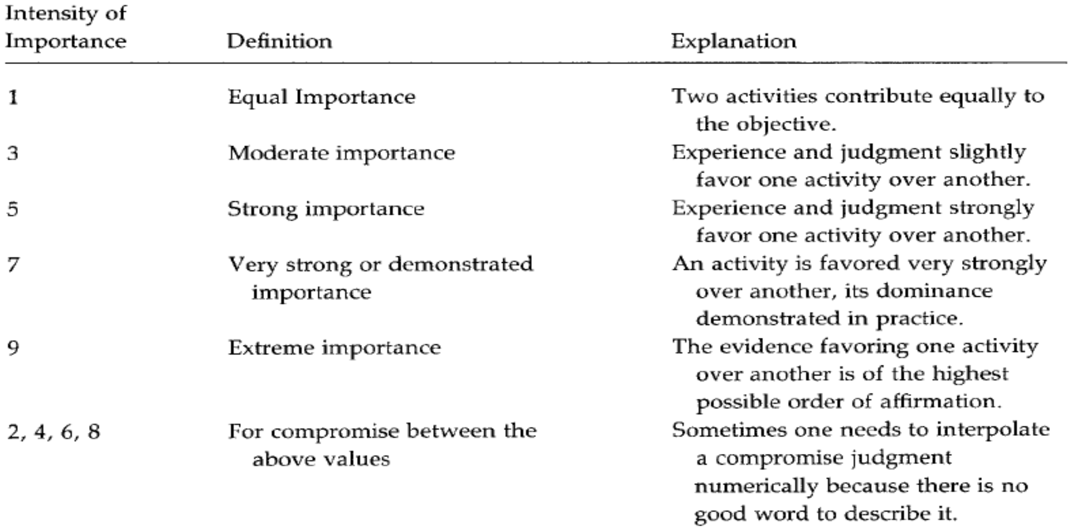
We have developed a computer program to facilitate your task. As discussed in Nashville, AHP works by performing pair-wise comparisons. From the user's perspective, AHP is a two-step process: 1) making a pairwise comparison and 2) checking for consistency.

So, these are the instructions of how to do it:

1) When you open the spreadsheet, you will be looking at the Flash Track practices for the Contract Category. This spreadsheet uses macros, so if prompted to enable macros please do so.
2) Use the +/- zoom sliding bar on the lower right corner of your monitor to adjust the spreadsheet to fit your screen, making sure that you can read the Issues on both left and right columns.

Making a pairwise comparison

3) For each pair-wise Issue comparison, click the point in the scale that best describes the relative importance between the two issues at hand. Please consider the following explanation of the scoring scale.



Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective.
3	Moderate importance	Experience and judgment slightly favor one activity over another.
5	Strong importance	Experience and judgment strongly favor one activity over another.
7	Very strong or demonstrated importance	An activity is favored very strongly over another, its dominance demonstrated in practice.
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation.
2, 4, 6, 8	For compromise between the above values	Sometimes one needs to interpolate a compromise judgment numerically because there is no good word to describe it.

4) Scroll down to complete all pair-wise Issue comparisons within each Category.

5) Save the file (Ctrl-S). You can also save partially completed set of comparisons to finish later. Please append the term “completed” to the file name you received.

6) Go to the next Category by choosing the next sheet and repeat steps 3-6 for all 9 Categories. Then go to the Categories sheet to also rank them.

Checking for consistency

7) After you’ve completed each Category, you can view your results by selecting the “Results” sheet. Once here, you’ll see the comparative weights and a Consistency Ratio score of your responses. If the Consistency Ratio is > 0.1 (i.e., Red Box) then see item #8; if not, see item #9

8) If the Consistency Ratio is greater than 0.1, please revisit your responses within that category for any errant entries, which may have contributed to your consistency score. High Consistency Ratios can result when responses have inconsistent logic and/or numerical inconsistencies. To remedy, revise your responses accordingly. If you have any problems getting the Consistency Ratio to be ≤ 0.1, please call Bob Austin at: (646) 484-0263.

9) The Results sheet will show you the weights of each Issue within each Category. If you feel you want to go back to a Category and edit your responses, feel free to do it by repeating steps 3-6. Save the file (Ctrl-S).

In completing this effort, we will be able to better determine how the multiple issues are interrelated and affect the total problem of how to effectively deliver flash-track projects.

Thank you for your efforts in this critical element of our research.

8 Item List: Contract

		Extreme Importance		Very Strong Importance		Strong Importance		Moderate Importance		Equal		Moderate Importance		Strong Importance		Very Strong Importance		Extreme Importance	
1	Setting clear; specific scoping requirements	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Funding early critical efforts
2	Setting clear; specific scoping requirements	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing clear change management procedures
3	Setting clear; specific scoping requirements	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing contract strategies specifically tailored to the project condition
4	Setting clear; specific scoping requirements	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Aligning project participants' interests through contract
5	Setting clear; specific scoping requirements	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing an effective claims resolution process
6	Setting clear; specific scoping requirements	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing performance-based specifications
7	Setting clear; specific scoping requirements	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Reducing risks through collective efforts of all stakeholders
8	Funding early critical efforts	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing clear change management procedures
9	Funding early critical efforts	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing contract strategies specifically tailored to the project condition
10	Funding early critical efforts	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Aligning project participants' interests through contract
11	Funding early critical efforts	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing an effective claims resolution process
12	Funding early critical efforts	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing performance-based specifications
13	Funding early critical efforts	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Reducing risks through collective efforts of all stakeholders
14	Establishing clear change management procedures	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing contract strategies specifically tailored to the project condition

15	Establishing clear change management procedures	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Aligning project participants' interests through contract
16	Establishing clear change management procedures	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing an effective claims resolution process
17	Establishing clear change management procedures	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing performance-based specifications
18	Establishing clear change management procedures	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Reducing risks through collective efforts of all stakeholders
19	Establishing contract strategies specifically tailored to the project condition	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Aligning project participants' interests through contract
20	Establishing contract strategies specifically tailored to the project condition	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing an effective claims resolution process
21	Establishing contract strategies specifically tailored to the project condition	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing performance-based specifications
22	Establishing contract strategies specifically tailored to the project condition	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Reducing risks through collective efforts of all stakeholders
23	Aligning project participants' interests through contract	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing an effective claims resolution process
24	Aligning project participants' interests through contract	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing performance-based specifications
25	Aligning project participants' interests through contract	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Reducing risks through collective efforts of all stakeholders
26	Establishing an effective claims resolution process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing performance-based specifications
27	Establishing an effective claims resolution process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Reducing risks through collective efforts of all stakeholders
28	Establishing performance-based specifications	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Reducing risks through collective efforts of all stakeholders

8 Item List: Delivery

		Extreme Importance		Very Strong Importance		Strong Importance		Moderate Importance		Equal		Moderate Importance		Strong Importance		Very Strong Importance		Extreme Importance	
1	Focusing procurement decisions on construction priorities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with personnel with strong leadership capabilities
2	Focusing procurement decisions on construction priorities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Making timely selection and award contracts to subcontractors
3	Focusing procurement decisions on construction priorities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Selecting team members and staff based on their fast track experience or qualifications
4	Focusing procurement decisions on construction priorities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Highly integrated 3-D modelling with all major users updating a common database
5	Focusing procurement decisions on construction priorities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Seeking out suppliers and specialty contractors as a source for time saving innovations
6	Focusing procurement decisions on construction priorities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative procurement practices
7	Focusing procurement decisions on construction priorities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Involving contractors; trades and vendors in the design phase
8	Staffing with personnel with strong leadership capabilities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Making timely selection and award contracts to subcontractors
9	Staffing with personnel with strong leadership capabilities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Selecting team members and staff based on their fast track experience or qualifications
10	Staffing with personnel with strong leadership capabilities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Highly integrated 3-D modelling with all major users updating a common database
11	Staffing with personnel with strong leadership capabilities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Seeking out suppliers and specialty contractors as a source for time saving innovations
12	Staffing with personnel with strong leadership capabilities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative procurement practices
13	Staffing with personnel with strong leadership capabilities	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Involving contractors; trades and vendors in the design phase
14	Making timely selection and award contracts to subcontractors	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Selecting team members and staff based on their fast track experience or qualifications

15	Making timely selection and award contracts to subcontractors	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Highly integrated 3-D modelling with all major users updating a common database
16	Making timely selection and award contracts to subcontractors	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Seeking out suppliers and specialty contractors as a source for time saving innovations
17	Making timely selection and award contracts to subcontractors	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative procurement practices
18	Making timely selection and award contracts to subcontractors	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Involving contractors; trades and vendors in the design phase
19	Selecting team members and staff based on their fast track experience or qualifications	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Highly integrated 3-D modelling with all major users updating a common database
20	Selecting team members and staff based on their fast track experience or qualifications	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Seeking out suppliers and specialty contractors as a source for time saving innovations
21	Selecting team members and staff based on their fast track experience or qualifications	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative procurement practices
22	Selecting team members and staff based on their fast track experience or qualifications	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Involving contractors; trades and vendors in the design phase
23	Highly integrated 3-D modelling with all major users updating a common database	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Seeking out suppliers and specialty contractors as a source for time saving innovations
24	Highly integrated 3-D modelling with all major users updating a common database	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative procurement practices
25	Highly integrated 3-D modelling with all major users updating a common database	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Involving contractors; trades and vendors in the design phase
26	Seeking out suppliers and specialty contractors as a source for time saving innovations	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative procurement practices
27	Seeking out suppliers and specialty contractors as a source for time saving innovations	○ 9	○ 8	○ 7	○ 6	○ 5	● 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Involving contractors; trades and vendors in the design phase
28	Employing innovative procurement practices	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Involving contractors; trades and vendors in the design phase

9 Item List: Organizational

		Extreme Importance		Very Strong Importance		Strong Importance		Moderate Importance		Equal		Moderate Importance		Strong Importance		Very Strong Importance		Extreme Importance	
1	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Selecting personnel with a "can do" attitude and willingness to tackle challenging tasks
2	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Empowering the project team (each organization led by an empowered leader)
3	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Delegating authority to project level (maximize decision-making authority to the project level)
4	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	● 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an engaged and empowered Owner's Engineer (Owner's representative)
5	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Engagement of operations & maintenance personnel in the development and design process
6	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	● 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an owner with sufficient depth of resources and strength of organization
7	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Using team building and partnering practices
8	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with multi-skilled personnel
9	Selecting personnel with a "can do" attitude and willingness to tackle challenging tasks	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	● 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Empowering the project team (each organization led by an empowered leader)
10	Selecting personnel with a "can do" attitude and willingness to tackle challenging tasks	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Delegating authority to project level (maximize decision-making authority to the project level)
11	Selecting personnel with a "can do" attitude and willingness to tackle challenging tasks	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an engaged and empowered Owner's Engineer (Owner's representative)
12	Selecting personnel with a "can do" attitude and willingness to tackle challenging tasks	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Engagement of operations & maintenance personnel in the development and design process

13	Selecting personnel with a “can do” attitude and willingness to tackle challenging tasks	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an owner with sufficient depth of resources and strength of organization
14	Selecting personnel with a “can do” attitude and willingness to tackle challenging tasks	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Using team building and partnering practices
15	Selecting personnel with a “can do” attitude and willingness to tackle challenging tasks	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with multi-skilled personnel
16	Empowering the project team (each organization led by an empowered leader)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Delegating authority to project level (maximize decision-making authority to the project level)
17	Empowering the project team (each organization led by an empowered leader)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an engaged and empowered Owner's Engineer (Owner's representative)
18	Empowering the project team (each organization led by an empowered leader)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Engagement of operations & maintenance personnel in the development and design process
19	Empowering the project team (each organization led by an empowered leader)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an owner with sufficient depth of resources and strength of organization
20	Empowering the project team (each organization led by an empowered leader)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Using team building and partnering practices
21	Empowering the project team (each organization led by an empowered leader)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with multi-skilled personnel
22	Delegating authority to project level (maximize decision-making authority to the project level)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an engaged and empowered Owner's Engineer (Owner's representative)
23	Delegating authority to project level (maximize decision-making authority to the project level)	○ 9	○ 8	○ 7	○ 6	○ 5	● 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Engagement of operations & maintenance personnel in the development and design process
24	Delegating authority to project level (maximize decision-making authority to the project level)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an owner with sufficient depth of resources and strength of organization
25	Delegating authority to project level (maximize decision-making authority to the project level)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Using team building and partnering practices
26	Delegating authority to project level (maximize decision-making authority to the project level)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with multi-skilled personnel
27	Having an engaged and empowered Owner's Engineer (Owner's representative)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Engagement of operations & maintenance personnel in the development and design process
28	Having an engaged and empowered Owner's Engineer (Owner's representative)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an owner with sufficient depth of resources and strength of organization
29	Having an engaged and empowered Owner's Engineer (Owner's representative)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Using team building and partnering practices

30	Having an engaged and empowered Owner's Engineer (Owner's representative)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with multi-skilled personnel
31	Engagement of operations & maintenance personnel in the development and design process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an owner with sufficient depth of resources and strength of organization
32	Engagement of operations & maintenance personnel in the development and design process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Using team building and partnering practices
33	Engagement of operations & maintenance personnel in the development and design process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with multi-skilled personnel
34	Having an owner with sufficient depth of resources and strength of organization	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Using team building and partnering practices
35	Having an owner with sufficient depth of resources and strength of organization	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with multi-skilled personnel
36	Using team building and partnering practices	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	● 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with multi-skilled personnel

8 Item List: Cultural

		Extreme Importance		Very Strong Importance		Strong Importance		Moderate Importance		Equal		Moderate Importance		Strong Importance		Very Strong Importance		Extreme Importance	
1	Having open communication and transparency	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an active; involved and fully committed owner
2	Having open communication and transparency	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with cooperative and collaborative personnel
3	Having open communication and transparency	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an open minded team
4	Having open communication and transparency	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Maintaining a no blame culture and mutually supportive environment
5	Having open communication and transparency	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing flexible project teams that avoid rigid hierarchy
6	Having open communication and transparency	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Accepting a new paradigm or mindset differing from that of traditional practices
7	Having open communication and transparency	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Creating executive alignment amongst the contracted parties
8	Having an active; involved and fully committed owner	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Staffing with cooperative and collaborative personnel
9	Having an active; involved and fully committed owner	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an open minded team
10	Having an active; involved and fully committed owner	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Maintaining a no blame culture and mutually supportive environment
11	Having an active; involved and fully committed owner	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing flexible project teams that avoid rigid hierarchy
12	Having an active; involved and fully committed owner	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Accepting a new paradigm or mindset differing from that of traditional practices
13	Having an active; involved and fully committed owner	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Creating executive alignment amongst the contracted parties
14	Staffing with cooperative and collaborative personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Having an open minded team
15	Staffing with cooperative and collaborative personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Maintaining a no blame culture and mutually supportive environment

16	Staffing with cooperative and collaborative personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing flexible project teams that avoid rigid hierarchy
17	Staffing with cooperative and collaborative personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Accepting a new paradigm or mindset differing from that of traditional practices
18	Staffing with cooperative and collaborative personnel	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Creating executive alignment amongst the contracted parties
19	Having an open minded team	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Maintaining a no blame culture and mutually supportive environment
20	Having an open minded team	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing flexible project teams that avoid rigid hierarchy
21	Having an open minded team	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Accepting a new paradigm or mindset differing from that of traditional practices
22	Having an open minded team	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Creating executive alignment amongst the contracted parties
23	Maintaining a no blame culture and mutually supportive environment	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Establishing flexible project teams that avoid rigid hierarchy
24	Maintaining a no blame culture and mutually supportive environment	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Accepting a new paradigm or mindset differing from that of traditional practices
25	Maintaining a no blame culture and mutually supportive environment	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Creating executive alignment amongst the contracted parties
26	Establishing flexible project teams that avoid rigid hierarchy	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Accepting a new paradigm or mindset differing from that of traditional practices
27	Establishing flexible project teams that avoid rigid hierarchy	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Creating executive alignment amongst the contracted parties
28	Accepting a new paradigm or mindset differing from that of traditional practices	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Creating executive alignment amongst the contracted parties

7 Item List: Planning

		Extreme Importance		Very Strong Importance		Strong Importance		Moderate Importance		Equal		Moderate Importance		Strong Importance		Very Strong Importance		Extreme Importance	
1	Identifying and procuring long lead time items	○ 9	○ 8	○ 7	○ 6	○ 5	● 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Emphasizing coordination planning during the design process
2	Identifying and procuring long lead time items	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Providing enough resources to critical path items
3	Identifying and procuring long lead time items	○ 9	○ 8	○ 7	● 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Monitoring and driving corrective actions through the project controls process
4	Identifying and procuring long lead time items	○ 9	○ 8	○ 7	○ 6	○ 5	● 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Performing exhaustive front end planning
5	Identifying and procuring long lead time items	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Recognizing and managing the additional fast track risks
6	Identifying and procuring long lead time items	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	● 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Considering speed of fabrication and construction during the selection of design alternatives
7	Emphasizing coordination planning during the design process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Providing enough resources to critical path items
8	Emphasizing coordination planning during the design process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Monitoring and driving corrective actions through the project controls process
9	Emphasizing coordination planning during the design process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Performing exhaustive front end planning
10	Emphasizing coordination planning during the design process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Recognizing and managing the additional fast track risks
11	Emphasizing coordination planning during the design process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Considering speed of fabrication and construction during the selection of design alternatives
12	Providing enough resources to critical path items	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Monitoring and driving corrective actions through the project controls process
13	Providing enough resources to critical path items	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Performing exhaustive front end planning

14	Providing enough resources to critical path items	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Recognizing and managing the additional fast track risks
15	Providing enough resources to critical path items	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	● 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Considering speed of fabrication and construction during the selection of design alternatives
16	Monitoring and driving corrective actions through the project controls process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Performing exhaustive front end planning
17	Monitoring and driving corrective actions through the project controls process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Recognizing and managing the additional fast track risks
18	Monitoring and driving corrective actions through the project controls process	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	● 5	○ 6	○ 7	○ 8	○ 9	Considering speed of fabrication and construction during the selection of design alternatives
19	Performing exhaustive front end planning	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Recognizing and managing the additional fast track risks
20	Performing exhaustive front end planning	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	● 5	○ 6	○ 7	○ 8	○ 9	Considering speed of fabrication and construction during the selection of design alternatives
21	Recognizing and managing the additional fast track risks	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	● 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Considering speed of fabrication and construction during the selection of design alternatives

7 Item List: Execution

		Extreme Importance		Very Strong Importance		Strong Importance		Moderate Importance		Equal		Moderate Importance		Strong Importance		Very Strong Importance		Extreme Importance	
1	Dedicating full-time personnel to the project	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	● 4	○ 5	○ 6	○ 7	○ 8	○ 9	Selecting appropriate construction methods
2	Dedicating full-time personnel to the project	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Co-location of project team (owner; designer; builder; and/or key vendors)
3	Dedicating full-time personnel to the project	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	● 5	○ 6	○ 7	○ 8	○ 9	Minimizing hand-offs
4	Dedicating full-time personnel to the project	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Frequent project review meetings
5	Dedicating full-time personnel to the project	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	● 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative construction methods
6	Dedicating full-time personnel to the project	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	● 5	○ 6	○ 7	○ 8	○ 9	Simplifying approval procedures
7	Selecting appropriate construction methods	○ 9	○ 8	○ 7	○ 6	● 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Co-location of project team (owner; designer; builder; and/or key vendors)
8	Selecting appropriate construction methods	○ 9	○ 8	○ 7	○ 6	● 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Minimizing hand-offs
9	Selecting appropriate construction methods	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Frequent project review meetings
10	Selecting appropriate construction methods	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative construction methods
11	Selecting appropriate construction methods	○ 9	○ 8	○ 7	● 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Simplifying approval procedures
12	Co-location of project team (owner; designer; builder; and/or key vendors)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Minimizing hand-offs
13	Co-location of project team (owner; designer; builder; and/or key vendors)	○ 9	○ 8	○ 7	○ 6	○ 5	● 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Frequent project review meetings
14	Co-location of project team (owner; designer; builder; and/or key vendors)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative construction methods
15	Co-location of project team (owner; designer; builder; and/or key vendors)	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	● 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Simplifying approval procedures

16	Minimizing hand-offs	○ 9	○ 8	○ 7	○ 6	○ 5	● 4	○ 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Frequent project review meetings
17	Minimizing hand-offs	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	● 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative construction methods
18	Minimizing hand-offs	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	● 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Simplifying approval procedures
19	Frequent project review meetings	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	○ 2	○ 3	● 4	○ 5	○ 6	○ 7	○ 8	○ 9	Employing innovative construction methods
20	Frequent project review meetings	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1	● 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Simplifying approval procedures
21	Employing innovative construction methods	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	● 3	○ 2	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	Simplifying approval procedures

APPENDIX N

Analytic Hierarchy Process Results and Rankings

The results of the top ten rankings of the AHP are reported in Chapter 5 (Results). The following pages show the rank ordering of the 47 practices as evaluated with the AHP.

Issue #	Issue	Item Weight (A)	Cat.	Cat. Weight (B)	Product (A x B)	AHP Rank
44	Selecting appropriate construction methods	23.9%	Exec.	19.4%	4.6%	1
36	Identifying and procuring long lead time items	20.1%	Planning	22.2%	4.5%	2
38	Providing enough resources to critical path items	17.4%	Planning	22.2%	3.9%	3
40	Recognizing and managing the additional fast track risks	17.2%	Planning	22.2%	3.8%	4
43	Dedicating full-time personnel to the project	18.4%	Exec.	19.4%	3.6%	5
30	Having open communication and transparency	20.9%	Cultural	16.6%	3.5%	6
20	Delegating authority to project level (maximize decision-making authority to the project level)	19.9%	Org.	17.1%	3.4%	7
39	Considering speed of fabrication and construction during the selection of design alternatives	14.1%	Planning	22.2%	3.1%	8
42	Simplifying approval procedures	15.7%	Exec.	19.4%	3.1%	9
34	Emphasizing coordination planning during the design process	13.3%	Planning	22.2%	2.9%	10
12	Staffing with personnel with strong leadership capabilities	18.1%	Delivery	15.8%	2.9%	11
18	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and	16.7%	Org.	17.1%	2.8%	12
21	Empowering the project team (each Org. led by an empowered leader)	16.2%	Org.	17.1%	2.8%	13
10	Focusing procurement decisions on construction priorities	17.2%	Delivery	15.8%	2.7%	14
29	Maintaining a no blame culture and mutually supportive environment	15.9%	Cultural	16.6%	2.6%	15
45	Minimizing hand-offs	13.3%	Exec.	19.4%	2.6%	16
35	Performing exhaustive front end planning	11.1%	Planning	22.2%	2.5%	17
41	Co-location of project team (owner; designer; builder;	13.0%	Exec.	19.4%	2.5%	18
11	Making timely selection and award contracts to	15.4%	Delivery	15.8%	2.4%	19
15	Involving contractors; trades and vendors in the design phase	14.5%	Delivery	15.8%	2.3%	20
31	Staffing with cooperative and collaborative personnel	13.6%	Cultural	16.6%	2.3%	21
1	Setting clear; specific scoping requirements	23.0%	Contract	8.9%	2.0%	22
9	Selecting team members and staff based on their fast track experience or qualifications	11.8%	Delivery	15.8%	1.9%	23
16	Seeking out suppliers and specialty contractors as a source for time saving innovations	11.8%	Delivery	15.8%	1.9%	24
28	Establishing flexible project teams that avoid rigid hierarchy	11.5%	Cultural	16.6%	1.9%	25
7	Funding early critical efforts	20.6%	Contract	8.9%	1.8%	26
27	Having an active; involved and fully committed owner	10.5%	Cultural	16.6%	1.8%	27
33	Creating executive alignment amongst the contracted parties	10.9%	Cultural	16.6%	1.8%	28
46	Employing innovative construction methods	9.2%	Exec.	19.4%	1.8%	29
26	Accepting a new paradigm or mindset differing from that of traditional practices	9.4%	Cultural	16.6%	1.6%	30
17	Engagement of operations & maintenance personnel in the development and design process	9.2%	Org.	17.1%	1.6%	31
23	Selecting personnel with a can do attitude and willingness to tackle challenging tasks	9.0%	Org.	17.1%	1.5%	32
37	Monitoring and driving corrective actions through the project controls process	6.8%	Planning	22.2%	1.5%	33
22	Having an owner with sufficient depth of resources and strength of Org.	8.6%	Org.	17.1%	1.5%	34

24	Having an engaged and empowered Owner's Engineer (Owner's representative)	8.4%	Org.	17.1%	1.4%	35
47	Frequent project review meetings	6.5%	Exec.	19.4%	1.3%	36
3	Aligning project participants' interests through contract	13.5%	Contract	8.9%	1.2%	37
32	Having an open minded team	7.3%	Cultural	16.6%	1.2%	38
25	Staffing with multi-skilled personnel	6.4%	Org.	17.1%	1.1%	39
4	Establishing contract strategies specifically tailored to the project condition	11.4%	Contract	8.9%	1.0%	40
19	Using team building and partnering practices	5.8%	Org.	17.1%	1.0%	41
13	Employing innovative procurement practices	5.9%	Delivery	15.8%	0.9%	42
5	Establishing clear change management procedures	9.5%	Contract	8.9%	0.8%	43
8	Reducing risks through collective efforts of all stakeholders	8.9%	Contract	8.9%	0.8%	44
14	Highly integrated 3-D modelling with all major users updating a common database	5.4%	Delivery	15.8%	0.8%	45
2	Establishing performance-based specifications	8.2%	Contract	8.9%	0.7%	46
6	Establishing an effective claims resolution process	4.9%	Contract	8.9%	0.4%	47

APPENDIX O

Comparative Rankings of AHP, Relative Index and Round 3

The research employed three methods for ranking the 47 Flash Track practices: 1) the AHP (Appendix M and N), 2) the Relative Index (Appendix K), and 3) the top ten scoring in Delphi Round 3 (Appendix L).

The following pages offer a comparative perspective on the three rankings.

CII RT-311 Successful Delivery of Flash Track - Analytic Hierarchy Process, Results and Rankings

			Ranks			Comparative Differences		
Issue #	Issue	Category	AHP Rank	RI Rank	R3 Rank	AHP-RI	AHP-R3	RI-R3
44	Selecting appropriate construction methods	Exec.	1	21	T31	20	30	10
36	Identifying and procuring long lead time items	Planning	2	1	T6	1	4	5
38	Providing enough resources to critical path items	Planning	3	17	15	14	12	2
40	Recognizing and managing the additional fast track risks	Planning	4	15	10	11	6	5
43	Dedicating full-time personnel to the project	Exec.	5	3	3	2	2	0
30	Having open communication and transparency	Cultural	6	8	5	2	1	3
20	Delegating authority to project level (maximize decision-making authority to the project level)	Org.	7	19	T16	12	9	3
39	Considering speed of fabrication and construction during the selection of design alternatives	Planning	8	24	12	16	4	12
42	Simplifying approval procedures	Exec.	9	33	T27	24	18	6
34	Emphasizing coordination planning during the design process	Planning	10	13	T27	3	17	14
12	Staffing with personnel with strong leadership capabilities	Delivery	11	6	T16	5	5	10
18	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	Org.	12	4	2	8	10	2
21	Empowering the project team (each organization led by an empowered leader)	Org.	13	16	23	3	10	7
10	Focusing procurement decisions on construction priorities	Delivery	14	5	4	9	10	1
29	Maintaining a no blame culture and mutually supportive environment	Cultural	15	32	T24	17	9	8
45	Minimizing hand-offs	Exec.	16	34	T35	18	19	1
35	Performing exhaustive front end planning	Planning	17	47	11	30	6	36
41	Co-location of project team (owner; designer; builder; and/or key vendors)	Exec.	18	30	T19	12	1	11
11	Making timely selection and award contracts to	Delivery	19	10	T6	9	13	4
15	Involving contractors; trades and vendors in the design phase	Delivery	20	26	T24	6	4	2
31	Staffing with cooperative and collaborative personnel	Cultural	21	14	T13	7	8	1
1	Setting clear; specific scoping requirements	Contract	22	2	1	20	21	1
9	Selecting team members and staff based on their fast track experience or qualifications	Delivery	23	35	9	12	14	26
16	Seeking out suppliers and specialty contractors as a source for time saving innovations	Delivery	24	36	T35	12	11	1
28	Establishing flexible project teams that avoid rigid hierarchy	Cultural	25	42	T35	17	10	7
7	Funding early critical efforts	Contract	26	7	T6	19	20	1
27	Having an active; involved and fully committed owner	Cultural	27	12	47	15	20	35
33	Creating executive alignment amongst the contracted parties	Cultural	28	18	T31	10	3	13
46	Employing innovative construction methods	Exec.	29	46	T39	17	10	7
26	Accepting a new paradigm or mindset differing from that of traditional practices	Cultural	30	43	T27	13	3	16
17	Engagement of operations & maintenance personnel in the development and design process	Org.	31	45	T42	14	0	14
23	Selecting personnel with a can do attitude and willingness to tackle challenging tasks	Org.	32	6	T16	26	19	7

CII RT-311 Successful Delivery of Flash Track - Analytic Hierarchy Process, Results and Rankings

			Ranks			**Comparative Differences**		
Issue #	**Issue**	**Category**	**AHP Rank**	**RI Rank**	**R3 Rank**	AHP-RI	AHP-R3	RI-R3
37	Monitoring and driving corrective actions through the project controls process	Planning	33	21	T31	12	2	14
22	Having an owner with sufficient depth of resources and strength of organization	Org.	34	10	T6	24	8	32
24	Having an engaged and empowered Owner's Engineer (Owner's representative)	Org.	35	20	T19	15	16	1
47	Frequent project review meetings	Exec.	36	28	T16	8	20	12
3	Aligning project participants' interests through contract	Contract	37	37	T42	0	5	5
32	Having an open minded team	Cultural	38	22	41	16	3	19
25	Staffing with multi-skilled personnel	Org.	39	44	T42	5	3	2
4	Establishing contract strategies specifically tailored to the	Contract	40	29	T19	11	21	10
19	Using team building and partnering practices	Org.	41	41	T27	0	14	14
13	Employing innovative procurement practices	Delivery	42	39	T39	3	3	0
5	Establishing clear change management procedures	Contract	43	9	T19	34	24	10
8	Reducing risks through collective efforts of all stakeholders	Contract	44	27	T31	17	13	4
14	Highly integrated 3-D modelling with all major users updating a common database	Delivery	45	40	T24	5	21	16
2	Establishing performance-based specifications	Contract	46	45	T42	1	4	3
6	Establishing an effective claims resolution process	Contract	47	38	46	9	1	8

Average differences:
AHP and RI = 12.1
AHP and R3 = 11.5
RI and R3 = 8.2

APPENDIX P

Implementation, Barrier, Risks and Mitigation Worksheets (Sample)

After the data collection and analysis phase of the research, RT 311 undertook the tool development process. An integral element of that process was completing the Implementation, Barrier, Risk, and Mitigation worksheets for each of the 47 practices identified in the modified Delphi method study. These worksheets were completed in a series of small group discussions with the results shared at the periodic progress meetings. The review process included whole group discussions as well as alternate small group reviews.

A sample of one of the worksheets is included here. These worksheets were used as source documents for the development of the implementation measures and recommendations included in the Flash Track tool (Appendix R).

Team 4 - Cahill, Reynolds, Sullivan and Austin Date: 9-5-14

Date: 9-5-14

Discussed, review and updated at Kansas City Meeting - September 18-19, 2014

CII RT-311 Successful Delivery of Flash Track

Implementation, Barriers, Risk and Mitigation Worksheet (Sample)

Flash-track concept or practice

1 - Setting clear,specific scoping requirements

. *Category: Contractual*

Rankings	
RI Rank:	2
R3 Rank:	1
AHP Rank:	22

Mean scores (R1)	
Essential:	5.52
Success:	4.60

Innovative Implementation Strategies		Barriers		Potential Risks Incurred		Mitigation Measures	
1	Early involvement of a construction execution-strategy team	1-1	Insufficient information to make the proper selection of personnel and or organizations	1.1	Lack of participation by the appropriate personnel	1.1.1	Robust early staffing across all needed skill sets.
						1.1.2	Selecting team on the basis of favorable past experience, preferred contractors, and alliance partners, among other considerations.
						1.1.3	Adequate early funding
		1-2	Lack of funding	1.2	Selecting the wrong partner	1.2.1-2	Selection based on best value; Seasoned skilled partners
				1.3	Early partner fixed on its position (advocacy)	1.3.1	Selecting multi-skilled partners
		1-3	Limited technical owner resources	1.4	Inability to reach consensus. Revisiting past decisions (recycling decisions). Recycling of ideas as a result of overlapping stages; confusion and delay caused by options not being closed off at the end of each stage. Poor task management	1.4.1	Securing and maintaining an aligned team.
						1.4.2	Strong, focused task management
				1.5	Added up-front cost		
2	Setting hard milestones for top-level design documents, such as P&IDs, General Arrangement drawings, and design criteria	2-2-	Securing necessary end user requirements	2.1	Inadequate input	2.1.1	Early involvement of O&M personnel (#17), with recognition of the challenges of eliciting critical information. Invest effort in asking very specific questions.
						2.1.2	Performance requirements must be explicit and readily understandable. The team must relentlessly seek out hard data.
						2.1.3	Employ focus groups; conduct value improvement practice workshops. Rank needs.
						2.1.4	Emphasize use of CII's PDRI.
						2.1.5	Employing high-skilled input on required input and design sequencing (delete?)
		2-3	Fully understanding regulatory approvals / requirements	2.2	Evolving requirements.	2.2.1	Secure provisional regulatory approvals. Treat regulatory requirements as an additional customer need.
						2.2.2	Executive alignment (#33)
		2-4	Commercial and organizational restraints			2.2.3	Ensure that requirements of all stakeholders are addressed in the formation of the concept.
				2.3	Costs due to over design	2.3.1	Allocate sufficient funding for early engineering, as needed (#7).
						2.3.2	Develop an early understanding of business model requirements
3	Setting explicit performance requirements			3.1	Incompatible procurement practices and contract terms. Challenges of	3.1.1	Relational versus transactional contracts
						3.1.2	Equitable risk distribution, principle with the owner in a flash track environment
	Establishing performance-based specifications (#2)	3-2	Business model not yet fully developed. Starting the process too early	3.2	Translating to detailed design	3.2.1	Employ focus groups; conduct value improvement practice workshops. Rank needs.
						3.2.2	Allocate sufficient funding for early engineering, as needed.
						3.2.3	Early staffing across all needed skill sets
						3.2.4	Understand limitations of potential alternatives.
						3.2.5	Maintain focus on strategic business objectives.
				3.3	Scope creep	3.3.1	Evaluate the cost of schedule implications of alternatives.
				3.4	Rework, if performance requirements are not met		
				3.5	Performance requirements are too vague.		
4	Early development of construction-execution plan	4-1	Lack of construction specific in-house or available resources	4.1	Lack of continuity, change of key players/decision-makers	4.1.1	Organization's commitment to flash tracking
						4.1.2	Having an owner with sufficient depth of resources and strength of organization (#10)
		4-2	Failure to release the benefits of early construction planning	4.2	Wrong/inadequate personnel at the first cycle		
				4.3	Inadequate project understanding, leading to wrong decisions on what should drive the job	4.3.1	Funding early critical efforts (#7)
						4.3.2	Selecting a competent, quality contractor

Tiers

Tier I: (RI ∪ R3 ∪ AHP)	Identified as a Top-10 item in one or multiple rankings
Tier II: (47 items)-(RI ∪ R3∪AHP)	Not identified as a Top-10 in any of the rankings

Implementation, Barriers, Risk and Mitigation Worksheet (Sample)
CII RT-311 Successful Delivery of Flash Track
Original comments from: Team 4 - Cahill, Reynolds, Sullivan and Austin Date: 9-5-14

Reviewed by Team 3 - Marty, Larry and Mike
Updated 12-2-2014 following Washington DC meeting

10/31/14

Flash-track concept or practice
2 - Establishing performance-based specifications
. Category: Contractual

Rankings
RI Rank: 45
R3 Rank: T42 T- denotes "tie"
AHP Rank: 46
Tier: II

Mean scores (R1)
Essential: 4.52
Success: 3.80

Innovative Implementation strategies		Barriers		Potential risks incurred		Mitigation measures	
1	Repeated cycles of well-planned, well-executed discussions with key OEM personnel, contractors, and internal user groups in the scoping process	1-1	Reluctance to expose performance margins	1.1	Internal resistance	1.1.1	Prior early discussions with end-users on scope
		1-2	Concern with passing trade secrets, losing competitive advantage			1.1.2	Senior management buy -in
						1.1.3	Internal executive alignment/support (#33)
		1-3	Availability of key personnel with knowledge and/or authority	1.2	Early selection of OEM may steer solution from a more objective development of scope.	1.1.1	Engage in multiple rounds of concepts, OEM and contractors
						1.1.2	Sign MOU prior to entering contract negotiations
Comment/reference:				1.3	Lack of consistency in internal participation	1.3.1	Designate internal participants and substitutes. Internal agents have full authority to speak for the group and sell developed scope internally.
						1.3.2	Secure senior management buy-in and sponsorship in advance
				1.4	Lack of results	1.4.1	Plan meetings in advance, with agenda and all parties prepared, minutes with action items + follow-ups
						1.4.2	Understand that issues resolved will not be re-visited.
						1.4.3	Continually engage the right parties
						1.4.4	Hire/assign top-flight project manager with follow through
2	Increased use of performance specifications comprising short descriptions of inputs, required outputs, and reference to applicable industry standards.	2-1	Ability to estimate project adequately and set contract price	2.1	Insufficient scope	2.1.1	Adequate front end investigation, including discussion with OEMs, contractors, and others (#35)
		2-2	Differences in interpretation of detailed requirements			2.1.2	Engage proven suppliers and contractors.
	Comment/reference:	2-3	Inability to fairly allocate performance risks across owner, supplier, and erector			2.1.3	Prequalification process
						2.1.4	Draw from earlier projects (highlighting both what is and is not wanted).
		2-4	Ability to define project requirements clearly.			2.1.5	Fully, exhaustively draw from lessons learned.
		2-5	Contrary to normal practices			2.1.6	Recognize "red flags" (*clarification/example?)
		2-6	Satisfying internal stakeholders	2.2	Scope change after award	2.2.1	Firm scope locks (i.e., design freeze)
						2.2.2	Accelerated processing of changes
						2.2.3	Limited notices to proceed
						2.2.4	Having an owner with sufficient depth of resources and strength of organization (#22)
				2.3	Scope creep	2.2.1	See above.
						2.2.2	Address items beyond fundamental needs later (separate award).
				2.4	Excessive change orders during execution	2.2.1	Resolve potential issues with internal stakeholders early in the process
						2.2.2	Early focus on interface requirements
	Examples: reference to industry standards with input and required output defined					2.2.3	Prudent selection of components; project elements addressed under a performance specification
				2.5	Misaligned project objectives and failed project	2.2..1	See above.
3	Explore innovative procurement practices (#13), including the following: - Target value cost - Best value contracting - Performance warranties - Setting delivery date and project costs, soliciting best value			3.2	Limited responses and or non-responsive responses	3.2.1	Carefully craft RFP.
		7-1	Performance contracts not widely utilized across all industries			3.2.2	Illustrate prior successful use of the concept.
						3.2.3	Standing master service agreements (MSA) with pre-approved payment terms
4	Contracts that are consistent with effective flash track principles - Contracts must be simple. - Reasonable contracts and fair dealings - Equitable risk distribution	4-1	Excessive use and reliance on prescriptive contracts	4.1	Inconsistencies in execution, culture, and other project elements. Principles and procurement mechanisms	4.1.1	Establish clear change management procedures (#4).
						4.1.2	Reduce risks through collective efforts of all stakeholders (#8).
		4-2	Declining use of relational contracts			4.1.3	Have each contracting party develop succinct term sheets.
A need for contracts/work to be executed in a relational manner				4.2	Rigid adherence to loosely worded contract provisions, e.g., providing "maintenance access"	4.2.1	Establish an effective claims resolution process (#6).
						4.2.1	Have open communication and transparency (#30).
						4.2.2	Employ innovative procurement/construction methods, e.g., man lifts versus platforms (#13 /#46).
5	Solicit external expertise to define technical requirements and /or to validate the developed performance specification.	5-1	Finding objective individual with required knowledge base	5.1	Costs without benefits	5.1.1	Follow prudent selection process.
						5.1.2	Conduct prior early discussions with end users on scope

Tiers
Tier I: (RI ∪ R3 ∪ AHP) Identified as a top-10 item in one or multiple rankings
Tier II: (47 items)-(RI ∪ R3∪AHP) Not identified as a top-10 in any of the rankings

APPENDIX Q

Sample Report

The research results were used to construct an Excel-based Flash Track tool with which the representative of an organization could enter a readiness score on each of the 47 Flash Track practices. Based on the scores a user provides, the Flash Track Tool generates a report which shows the organization's readiness and a list of recommendations to guide the user through a process.

IR 311-2, Flash Track Readiness Tool

RT 311, Successful Delivery of Flash Track Projects
Flash Track Readiness Report

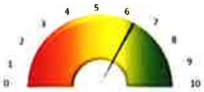
Project Name: *Sample Project*

Company: *Anywhere, USA*
Short description: *A quick turnaound project!*

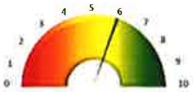
Completed By: *Joe Carroll, Project Manager; Susan Wright, Project Engineer*
William Starfire, Superintendent ; Prafulla Santa, Procurement
Nancy Alden, Facilitator

Overall Readiness: 6.0

Scoring Overview



Contractual Readiness: 6.7



Delivery Readiness: 6.1

Organizational Readiness: 6.7

Planning Readiness: 5.7

Execution Readiness: 4.8

Cultural Readiness: 6.5

(Click on "Category " icon to skip to that XXX recommendations)

Tier I Readiness: 6.4

The 18 practices found to be the most essential to successful management of flash track projects

Tier II Readiness: 5.5

The balance of practices identified as contributing to successful flash track projects

Contractual Considerations

	Practice	Self score
1	Setting clear, specific scoping requirements (Tier I)	8
2	Establishing performance-based specifications	3
3	Aligning project participants' interests through contract	6
4	Establishing contract strategies specifically tailored to project conditions	7
5	Establishing clear change management procedures (Tier I)	5
6	Establishing an effective claims resolution process	2
7	Funding early critical efforts (Tier I)	9
8	Reducing risks through the collective efforts of all stakeholders	6

To show incremental improvements (scores >6), check 'yes' on the Process Generator.

Critical Improvements and implementation measures	Issues scored as "not probable" or "somewhat improbable" in your self-assessment (scores of 0, 1, 2 or 3)
2	**Establish performance-based specifications.**
2.1	**Hold frequent discussions with original equipment manufacturers (OEM), contractors, and internal user groups, throughout the scoping process.**
	Empower key stakeholders to speak for their organizations.
	Assign strong, project-level leadership with senior management support. Avoid re-visiting of prior resolutions.
	Plan meetings in advance, with clear agendas and all parties prepared. Distribute meeting minutes with action items and follow-ups.
	Secure executive alignment. Obtain explicit commitments from key contractors and suppliers through memorandums of agreement (MOUs) or comparable instruments.
	Employ collaborative tools, such as joint objectives, co-location, joint IT-resources, team building, and dispute resolution.
	Recognize that early selection of OEMs may steer solutions from a more objective performance requirements.
2.2	**Prescribe performance requirements based on clear and concise descriptions of 1) input feeds, 2) required outputs, and 3) reference to applicable industry standards.**
	Adequate front-end investigation, including discussion with OEMs, contractors, and owner's stakeholders.
	Draw from lessons learned from earlier projects (highlighting both what is wanted and what is undesirable).
	Recognize "red flags" (e.g., unclear or ambiguous language, inadequate criteria for evaluating compliance, unverifiable quality requirements, and inadequate early funding).
	Solicit external expertise to define technical requirements and/or to validate the developed performance specifications.
	Engage proven suppliers and contractors. Pursue a pre-qualification process early on.
	Define firm scope locks (i.e., design freeze).
2.3	**Employ contracts that are consistent with flash track strategies.**
	Award relational contracts that are sufficiently flexible to address flash track requirements.
	Award contracts that facilitate problem-solving and empower dispute resolution at the project level.
	Award contracts that foster collaborative behavior, promote open communications, and reward teamwork.
	Include mechanisms that effectively address changes. Adopt clear change management procedures.
	Ensure that contracts are simple and committed to good faith and fair dealings.
2.4	**Consider alternative procurement practices.**
	Prequalify contractors through Master Service Agreements (MSA) with pre-approved payment terms.
	Select contractors on the basis of best value, focusing on competence, prior experience, and collaborative ability. Set weightings for important selection criteria, such as delivery date, availability of resources, and others.
	Incentivize early completion and project cost-savings measures.
	Foster long-term partnering in the procurement process.
	Incentivize collaboration and high performance on safety, quality, schedule, reliability, teamwork, and cost.
	Extend collaborative and performance incentives to sub-contractors.
7	**Fund early critical efforts (Tier I).**
7.1	**Obtain early release of an allowance for discretionary funds to the project leadership team.**
	Establish early release of funds as part of the front-end planning (FEP) client approval.
	Review scope, commitments, and expenditures regularly with executive sponsors.
	Recognize the ripple effect of late release of funding on down stream activities.
7.2	**Set a firm "scope lock" date.**
	Establish scope locks as part of FEP Kickoff.
	Use pull scheduling to keep the "scope lock" date as late as possible, to optimize opportunities to explore alternatives.
7.3	**Employ a "target value design" process in lieu of "value engineering."**
	Educate, advocate, and persuade executive sponsors on the benefits of the target value design process.
	Continued ...

Improvements and implementation measures	***Issues scored as "neutral" in your self- assessment (scores of 4, 5 or 6)***
3	**Align project participants' interests through contract.**
3.1	**Involve key project participants early.**
	Increase early funding to cover additional costs of early engagement of key stakeholders., including compensating contractors for their early involvement, as may be needed.
	Engage multiple suppliers and contractors (e.g., equipment suppliers, specialty contractors).
	Create a system for expediting the procurement phase: 1. Create a database with a list of qualified project players. 2. Develop RFQ and RFP templates. 3. Formulate robust evaluation criteria.
	Recognize potential for increased time and costs in the front end process.
3.2	**Select a project team, including key suppliers and contractors, with previous positive experience working together.**
	Establish the selection criteria, describing prior experience and team selection requirements, before receipt of bids.
	Recognize potential for increased bid costs from reduced competition.
3.3	**Conduct an alignment workshop.**
	Employ a skilled meeting leader or facilitator.
	Collectively define measures to promote a culture of open dialog, timely decision-making, issue resolution, and consensus building. Subsequently, capture these measures within the construction contract.
	Define the following deliverables for the end of the alignment workshop including a clear scope of work; an explicit Division of Responsibility (DOR); and agreements on interface schedules.
3.4	**Employ a "speed dating" selection technique among short-listed teams, based on demonstrated team synergy and compatibility.**
	Explain the objectives of the process, such as the following - securing early feedback on the project's flash track objectives - creating a better understanding of the contractor on the other side of the table - creating a better understanding of what is possible.
	Select a strong, competent project manager, along with his or her core team members, who have executed projects together.
	Explore the contractor's commitment to provide key personnel and resources to the flash track project, including access to top executives, as needed.
3.5	**Develop an equitable contract, with shared incentive provisions that are tied to team performance on shared goals and targets.**
	Avoid members with a risk-averse attitude. Get all members' buy-in to risk assignment.
	For subcontractors and vendors who join the project in a later phase, develop a subcontract agreement similar to the original contract between key players. This agreement should include similar shared values, goals, and targets. Develop the incentive and disincentive plan around their contributions to achieving those shared goals.
3.6	**Explore project labor agreements (PLAs) or other measures targeted to essential flash track requirements.**
	Commitment to a safe and heathy worksite.
	Aligning rewards to the achievement of project objectives.
	Promoting innovative, open, and effective employee relations. Relaxed trade jurisdiction provisions and skills-based compensation.
	Sliding scale incentive pay based on verifiable productivity measures.

5	**Establish clear change management procedures (Tier I).**
5.1	**Develop a project Change Notification Procedure (CNP).**
	Agree to develop a project CNP targeting expedited reviews, approvals, and the processing of any payments for meeting early project milestones.
	Reach early consensus and agreement on notification/submission requirements and cost estimating practices, specifically on labor and equipment rates, work hour calculations, miscellaneous and indirect costs, overhead, profit, subtrade quotes, and processing timelines.
	Consider measures such as simplifying the approval and processing process, negotiating a change order allowance, and making payment provisions for a percentage of estimated costs for disputed costs.
	Recognize the importance of timely payments. Understand that changes and rework are common on flash track projects.
5.2	**Delegate authority to the project team.**
	Empower the resident project manager with the authority to approve critical changes.
	Establish a clear project charter and alignment, affording the resident manager direct access to executive sponsors.
	Continued ...

Delivery Considerations

Delivery Readiness: 6.1

Tier I Delivery Readiness: 6.7

	Practice	Self score
9	Selecting team members and staff on the basis of their fast track experience or qualifications (Tier I)	7
10	Focusing procurement decisions on construction priorities (Tier I)	5
11	Selecting and awarding contracts to subcontractors in a timely manner (Tier I)	7
12	Staffing with personnel with strong leadership capabilities (Tier I)	8
13	Employing innovative procurement practices	4
14	Using highly integrated 3D modeling with all major users updating a common database	5
15	Involving contractors, trades, and vendors in the design phase	7
16	Seeking out suppliers and specialty contractors as sources of time-saving innovations	5

To show incremental improvements (scores >6), check 'yes' on the Process Generator.

Critical Improvements and implementation measures	Issues scored as "not probable" or "somewhat improbable" in your self-assessment (scores of 0, 1, 2 or 3)
13	**Employ innovative procurement practices.**
13.1	**Explore alternatives used successfully on other flash track efforts.**
	Employ procurement practices based on time certainty, speed of delivery, and ability to accommodate a flexible design.
	Execute work through established Master Service Agreements with preferred contractors and suppliers.
	Adopt policies of "relational competitive partnering" or take a long-term perspective on procurement practices where proven contractors are selected on the basis of their past performance and pricing.
	Ensure early engagements of contractors/consultants to define the scope of work more precisely. Consider employing a target value design process.
	Proceed under reimbursable contracts with succinct rate sheets. Consider Open Book procurement measures.
	Incentivize timely performance with early completion bonuses and similar measures.
	Avoid inequitable risk-shifting contract provisions, embracing shared risk or risk contingency concepts.
13.2	**Employ relational contract strategies.**
	Ensure prudent selection of contract partners. Team selection based on shared values and willingness to collaborate.
	Avoid changes to participation at the executive level (characterized as cancerous in an alliance), ensuring stable senior management representation.
	Maintain a one-on-one relationship among senior elements of the alliance parties.
	Promote consistency in spirit within the contract alliance.
	Employ alliance contracts with vendors. Demonstrate benefits of relational contracting, such as alliance and IPD contracts, to the owner.
	Recognize that poorly executed relational contracts, without mutual trust, are problematic.
13.3	**Offer incremental or progressive notices to proceed to major equipment suppliers and subcontractors.**
	Secure executive-level support and alignment among the contracted parties.
	Complete substantive risk assessments and cost-benefit analysis.
	Actively engage the owner's representative in the decision process.
	Use vendor-indicative pricing to establish the basis of pricing for memorandums of understanding (MOUs) and/or notices to proceed (NTP), when working to place orders for critical long lead equipment and/or specialty subcontracted services.
	Provide clear performance requirements.
	Recognize the potential for commercial consequences of early decisions to limit future alternatives.
13.4	**Accelerate the Notice to Proceed process, including early full releases to accommodate flash track needs.**
	Get key decision-makers (i.e., client, engineer, construction, procurement, legal, and the supplier/vendor) in the same room to work out project-specific terms and conditions, including cancellation provisions. Reconvene discussions, as needed, to secure final approvals.
	Require close contractor alignment with the client and require the contractor to demonstrate past successful experience with designated equipment supplier(s) on comparable projects.
	Engage Legal resources in pertinent negotiations and review of the NTP documentation.

Improvements and implementation measures	***Issues scored as "neutral" in your self- assessment (scores of 4, 5 or 6)***
10	**Focus procurement decisions on construction priorities (Tier I).**
10.1	**Adopt a construction-driven design philosophy to ensure that construction priorities are given due consideration.**
	Structure the procurement decisions on the basis of time certainty, speed of delivery, and ability to accommodate a flexible design.
	Use Pull Scheduling to defer design decisions until the latest responsible moment.
10.2	**Develop an agile and flexible procurement process that supports flash tracking.**
	Align design, procurement, construction, and operations and maintenance personnel around a shared goal of timely delivery.
	Adopt a concurrent engineering philosophy to bring downstream key stakeholders onto the project early.
	Perform an early market survey to identify material and equipment availabilities, as well as delivery expectations, to assess the need for alternative approaches or special measures.
10.3	**Fully engage subcontractors and suppliers in expediting critical activities.**
	Prequalify lower tier suppliers and subcontractors, prioritizing time certainty and speed of deliveries.
	Include incentives and/or penalties for meeting delivery commitments.
	Monitor and expedite all aspects of procuring materials, including fast delivery services (e.g., hot shot/expedited trucking services, shop expeditors, local escorts, employing site forces for commodities).
	Assess key procurement activities, recognizing the potentials for expediting even at the lower tier subcontractors and suppliers, if possible.
10.4	**Secure immediate, solution-focused, and empowered engineering support, as needed.**
	Anticipate increased levels of engineering support during construction, including full-time site representation.
	Ensure constant communication between the project team and engineering support to keep engineering appraised of upcoming needs.
	Secure expedited engineering responses to procurement and construction questions.
	Recognize the risk of inefficiencies and changes throughout the design process, especially in heavily overlapped concurrent engineering efforts.
10.5	**Ensure early and ready access to specialized equipment to support construction operations.**
	Plan the work across trades and contractors to optimize equipment use to limit congestion and minimize time on site.
	Develop contingencies in the event of equipment failures.
10.6	**Use single-source suppliers to the extent possible.**
	Secure early funding.
	Calculate time and money saved by not bidding or seeking the lowest price.
	Recognize the business model benefits of prioritizing schedule over costs.

14	**Use highly integrated 3-D modeling with all major users updating a common database.**
14.1	**Use compatible 3D software programs.**
	Consider specifying collaborative 3-D tools and their platforms in RFQs to suppliers. Establish the supplier's prior successful experience with the specified tools as a primary selection criteria.
	Limit project participation to firms that have demonstrated experience using the software.
	Include costs for 3-D tool license fees and associated training in the project budget.
14.2	**Use a single cloud-based platform for housing and sharing real-time 3-D models.**
	Perform a cost-benefit analysis to support an integrated 3-D modeling implementation decision. Secure executive and organizational support/alignment going forward.
	Engage a third-party IT consultant to set up the server(s) and train the team.
	Explore and consider continuing advances in collaborative technologies.
14.3	**Have a jointly developed and agreed-upon BIM execution plan (BEP) in place.**
	Engage an IT consultant to provide advice and input on establishing an implementable BEP.
	Include demonstrated experience at successfully implementing BEPs on past projects as a key IT consultant selection factor.
	Assign responsibility for managing the BEP development.

16	**Seek out suppliers and specialty contractors as sources of time-saving innovations**
16.1	**Ensure that meetings with suppliers and specialty contractors are effective and result in usable innovations.**
	Use interactive planning processes and pull scheduling approaches to elicit input
	Establish integrated teams that are tasked to accomplish project objectives.
	Establish a shared vision for the project by including suppliers early.
	Implement a 3-D collaborative strategy, starting in the initial FEP phases.
16.2	**Establish commercial measures and practices to share risk/reward, to align resources.**
	Develop contracting language with equitable shared risk and reward.
	Select contractor(s) based on the following: 1) availability of resources; 2) mobilization response time; and 3) proven management abilities.
	Continued ...

Organizational Considerations

Organizational Readiness: 6.7

Teir I Organizational Readiness: 8.0

	Practice	Self score
17	Engaging operations and maintenance personnel in the development and design process	5
18	Establishing a fully integrated project team, including design, construction, specialty contractors, commissioning, and operations personnel (Tier I)	8
19	Using team building and partnering practices	7
20	Delegating authority to the project level (i.e., maximizing decision-making authority at the project level) (Tier I)	8
21	Empowering the project team (ensuring that each organization is led by an empowered leader)	8
22	Having an owner with sufficient depth of resources and organizational strength	2
23	Selecting personnel with a can-do attitude and willingness to tackle challenging tasks	6
24	Having an engaged and empowered owner's engineer (owner's representative)	[illegible]
25	Staffing with multi-skilled personnel	3

To show incremental improvements (scores >6), check 'yes' on the Process Generator.

Critical Improvements and implementation measures Issues scored as "not probable" or "somewhat improbable" in your self-assessment (scores of 0, 1, 2 or 3)

22	**Have an owner with sufficient depth of resources and organizational strength**
22.1	**Assign available in-house resources on a dedicated basis.**
	Assign non-flash track responsibilities to other resources.
22.2	**Supplement traditional owner-staffed positions with contractor personnel.**
	Consider recently retired personnel from comparable owner organizations.
	Consider top-performing, trusted consultants and contractors who are familiar with the owner's expectations and practices. Include specific contractual provisions, where appropriate.
	Provide a training and orientation program for contractor personnel. Fill roles with competent people and empower the contract personnel to make decisions.
	Provide visible management support for the contractor personnel.
22.3	**Hire an EPC contractor to perform the owner's role.**
	Ensure that the EPC contractor has prior experience, capability, and personnel to fill the owner's role.
	Consider a mixed team of owner and contractor personnel versus exclusive staffing by the EPC contractor.
22.4	**Develop contract strategies that minimize owner resource requirements.**
	Use performance specifications and performance guarantees as methods for minimizing owner involvement.
22.5	**Create a joint venture with another owner organization that has sufficient depth of resources and strength of organization.**
	Approach another owner organization within the industry with similar management philosophies and values.
	Seek the appropriate legal advice for structuring a joint venture agreement.
	Limit intellectual property-sharing to lower value, non-proprietary, or mature technologies.
	Factor additional costs and administrative burden into project economics.
22.6	**Employ innovative contracting techniques to confirm that flash track pricing is appropriate for the level of risk.**
	Consider open book estimates and subsequent conversion to lump sum, after quantities, pricing, and labor availability are known.
	Negotiate with one supplier on an open book, lump sum basis, and agree on markups, productivity, and contingency levels prior to contract award.
	Contract for a bid check estimate from a third party to ensure reasonable pricing.
	If possible, negotiate with a trusted supplier that has delivered a similar project for a price verified through a bid check estimate or through competition.
	Proceed on a reimbursable contract basis or bid out. Have reasonable terms with fixed fee to start with in the event that a lump sum price cannot be agreed upon.
	Recognize likelihood of increased costs and loss of control in exchange for speed of delivery and minimization of owner resource requirements.

25	**Staff with multi-skilled personnel.**
25.1	**Create self-managed work teams.**
	Consider complementary skills in creating multi-skilled, work teams (e.g., civil, mechanical, electrical, and general).
	Recognize challenges on union projects..
25.2	**Employ skills based compensation strategies.**
	Base incentive pay on achievement and performance.
	Consider Retention incentives for longevity.
25.3	**Consider alternative recruitment and training strategies.**
	Consider certification programs and prior military (e.g., Seabee) training.
	Continued ....

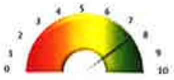
Improvements and implementation measures ***Issues scored as "neutral" in your self- assessment (scores of 4, 5 or 6)***

17	Engage operations and maintenance personnel in the development and design process.
17.1	**Include O&M staff in the development of design criteria and in design reviews to ensure operational issues are considered in the design process (e.g., accessibility, service histories, spare parts, and training).**
	Select personnel on the basis of technical aptitude, interpersonal skills, and buy-in to overall project performance.
	Select O&M personnel with a long-term stake in the project.
17.2	**Avoid design delays by securing site-specific knowledge on operational challenges, lessons learned, deferred maintenance, and service histories.**
	Request that O&M team members gather data that can be reviewed during the development phase, to avoid issues during the design phase.
	Engage O&M team members to discuss stakeholder needs, investor commitment, and conceptual design.
	Establish O&M guidance on their preferences for level of automation, technology, and sophistication of equipment, to accelerate decision-making.
	Employing decision-making tools, such as Choosing by Advantage or other consensus-based decision-making processes.
17.3	**Strong division of responsibilities (DOR) will help define O&M expectations and responsibilities.**
	Assign a senior team member with plant experience as a mentor or facilitator.
	Base the project team DOR on the capabilities of the staff.
	Jointly develop the O&M deliverables and team milestones to align with project schedule.

23	Select personnel with a can-do attitude and willingness to tackle challenging tasks.
23.1	**Conduct a joint team selection with all key parties, based on project success criteria.**
	Solicit input and direction on the selection process from key stakeholders' executive sponsors.
	Select a balanced team across team boundaries.
	Provide dynamics and organizational effectiveness training for the project leadership team.
	Recognize that certain personnel may be ill-suited to serve in an integrated organization.
23.2	**Implement a project-specific reward system for exemplary performance.**
	Define reward criteria and secure stakeholder and executive-level support.
23.3	**Negotiate continuity and removal clauses into the contractual terms.**
	Develop an effective mechanism to govern staff issues on the project.

Cultural Considerations


Cultural Readiness: 6 5'


Tier I Cultural Readiness: 8 0'

	Practice	Self score
26	Accepting a non-traditional paradigm or mindset	[illegible]
27	Having an active, involved, and fully committed owner	[illegible]
28	Establishing flexible project teams that avoid rigid hierarchy	6
29	Maintaining a no-blame culture and a mutually supportive environment	🟩
30	Having open communication and transparency (Tier I)	🟩
31	Staffing with cooperative and collaborative personnel	4
32	Having an open-minded team	4
33	Creating executive alignment among the contracted parties	🟩

To show incremental improvements (scores >6), check 'yes' on the Process Generator

ritical Improvements and implementation measures

Issues scored as 'not probable' or "somewhat improbable' in your self assessment (scores of 0, 1, 2 or 3)

26	**Accept a non-traditional paradigm or mindset.**
26.1	**Explore modularization techniques (e.g., those used in the shipbuilding industry).**
	Recognize that new paradigms may involve significant changes to the design, construction and owner roles.
	Recognize that barriers to successful high-level modularization methods (e.g., those used in the shipbuilding industry) are cultural and traditional rather than structural.
	Increase focus on constructability during the design process (i.e., design for production).
	Adopt generic or scalable design standards. Maximize standardized components.
	Developing a high level of supply chain integration. Consider BIM practices that can employ relevant building component information, such as standard design modules, procurement specifications and maintenance/operation manuals.
	Develop a preferred supplier network.
	Recognize that early decisions to modularize will yield the best time-savings results.
26.2	**Implement Critical Chain scheduling.**
	Conduct training in critical chain scheduling, which requires abandoning traditional concepts of time buffers or float on individual activities, and focusing on optimizing work flow.
	Add a skilled "change agent" to introduce Critical Chain concepts to the organization.
26.3	**Engage multiple design teams concurrently on a family (or set) of design proposals.**
	Recognize that, as the designs or the knowledge base evolves, the sets of solutions are narrowed through consensus to an optimal solution.
	Conduct training programs early on in the project.
	Employ a consensus review and decision-making process.
	Increase the frequency of coordination meetings.
	Limit participation to key critical suppliers and contractors.
26.4	**Partner with key suppliers/subcontractors.**
	Engage procurement early, establishing measures to ensure that planned procurement practices are consistent with flash track practices.
	Establish procurement practices focused on time certainty, speed, and flexibility to accommodate invariable changes due to concurrent engineering efforts.
	Start the process early of identifying material and equipment availabilities and delivery expectations.

Improvements and implementation measures ***Issues scored as "neutral" in your self- assessment (scores of 4, 5 or 6)***

28	**Establish flexible project teams that avoid rigid hierarchy.**
28.1	**Co-locate resources.**
	Set co-location expectations at beginning of project.
	Create "multi-team" rooms (e.g., "integrated big rooms" suited for collaborative efforts and visual media).
28.2	**Use highly visual communication media (e.g., Kanban boards, smart boards, and decision diagrams).**
	Set project expectations for innovative methods at the outset.
	Provide training to team members on the creation and use of visual communications media.
	Recognize the benefits of visual communications in conveying information, making decisions, and transforming paradigms.
28.3	**Select team members with diverse backgrounds.**
	Fill in personnel gaps where needed, to keep the project on track by using experienced and flexible people.
	Use a skill and experience matrix as part of the team selection process.
	Recognize that unexpected events are best dealt with through the collective efforts of teams with a range of skills and experiences.

31	**Staff with cooperative and collaborative personnel.**
31.1	**Create the optimal environment for cooperation.**
	Insist upon a culture of open communication and transparency.
	Maintain a "no blame" culture and a mutually supportive environment.
	Co-locate project team (i.e., owner, designer, builder, and/or key vendors) to the degree feasible.
	Recognize that traditional contracting and procurement practices are not conducive to collaboration and cooperation. Consider innovative procurement practices and relational contracting.
31.2	**Increase information flow.**
	Hold frequent and effective project review and periodic interactive planning meetings.
	Use highly visual communication media (e.g., Kanban boards, smart boards, and decision diagrams).
	Coordinate highly integrated 3-D modeling with all major users updating a common database.
	Establish a fully integrated project team including design, construction, specialty contractors, commissioning, and operations personnel, as early as possible.
31.3	**Select a project staff likely to thrive on flash track principles.**
	Consider the following characteristics when selecting project candidates: - technical strength—diversified cross-trained personnel within focused discipline - being a "self starters" with the ability to work a non-hierarchical organization - a "can do" attitude with the ability to overcome obstacles to meet goals - demonstrated commitment and follow through - collaborative nature.
31.4	**Assess team behaviors continuously.**
	Continuous evaluations and self-assessments in encouraging improvement initiatives.
	Replace team members whose performance or behavior adversely affects the team.
	Hold periodic offsite interactive planning sessions to refocus on objectives, identify barriers, and re-assess the best path forward collectively (in half-day sessions).
	Prepare concise monthly presentations to the executives, reviewing scope, commitments, expenditures, and team dynamics.

32	**Have an open-minded team.**
32.1	**Choose team members who have demonstrated flexibility in the past.**
	Staff with cooperative and collaborative personnel
32.2	**Kick off the project with a problem-solving "creativity" workshop.**
	Securing a skilled facilitator and exploring "Brainstorming" techniques other training alternatives. Adopt a structured meeting format with explicit objectives
	Conduct train the manager sessions; make the workshop leader an integral part of the organization.
	Establish accountability on follow through: - assigning explicit action items during the workshop - reporting on implementation in an open transparent manner - follow on meeting to report or clarify objectives/assignments
	Recognize that the work environment and managerial support are keys to the successful of creativity training
	Make sure that an executive and a project champion exists
32.3	**Look to fill team with young bright talent**

Planning Considerations

	Practice	Self score
34	Emphasizing coordination planning during the design process (Tier I)	🟩
35	Performing exhaustive front end planning	🟥
36	Identifying and procuring long lead items (Tier I)	🟩
37	Monitoring and driving corrective actions through the project controls process	🟨 4
38	Providing enough resources for critical path items (Tier I)	🟩
39	Considering speed of fabrication and construction during the selection of design alternatives (Tier I)	🟨 5
40	Recognizing and managing the additional flash track risks (Tier I)	🟥

To show incremental improvements (scores >6), check 'yes' on the Process Generator.

Critical Improvements and implementation measures

Issues scored as "not probable" or "somewhat improbable" in your self-assessment (scores of 0, 1, 2 or 3)

35	**Perform exhaustive front end planning.**
35.1	**Pull downstream stakeholders into the early planning for their input and identification of issues.**
	Include specialty subcontractors, vendors, suppliers, and operations and maintenance personnel in the project definition phase and design process.
	Solicit input and identification of issues as early as possible.
35.2	**Develop a deliverables matrix for multi-party alignment.**
	Set matrix development as a milestone for the initial phase of project.
	Consider employing a "Responsible, Accountable, Consulted, Informed" (RACI) matrix as a means to define the varied roles in completing tasks in a business process.
	Allow only one primary responsibility for each deliverable on a responsibility assignment matrix or RACI chart.
35.3	**Employ the CII PDRI adapted for use in a flash track setting.**
	Set expectations at the beginning of the project.
	Use a PDRI facilitator who is experienced with flash track projects.
35.4	**Establish decision-making processes tailored to flash track applications**
	Implement set-based design concepts, e.g., Lean Development principles.
	Consider the set-based design approach where a family (or set) of design proposals are pursued in parallel.
	Conduct training to teach "Choosing By Advantages" or other consensus decision-making techniques to the project team.
40	**Recognize and managing the additional flash track risks (Tier I).**
40.1	**Mitigate commonly incurred risks in concept, development, and definition phases**
	Risk of not having an adequate project understanding and being unable to define a clear business objective.
	Risk of inadequate funding to support essential early efforts.
	Risk of not engaging appropriately skilled and objective key essential stakeholders.
	Risk of not reaching a clear consensus in a timely manner (e.g., evolving requirements or scope creep).
	Risk of not having an adequate project understanding and being unable to define a clear business objective.
	Risk of poor schedule and cost estimates being used as the basis for investment decision.
	Risk of incomplete understanding of regulatory or other third party expectations.
40.2	**Mitigate commonly incurred risks in design phase**
	Risk of inadequate engagement with facility users and construction forces in the design process.
	Risk of higher costs due to conservative and/or sub-optimum designs.
	Risk of employing unproven innovative designs.
	Risk of insufficient or vague performance requirements.
	Risk of the inability to extend performance requirements to the balance of plant.
	Risk of incompatibility between different providers' systems.
	Risk of inadequately coordinating parallel design teams, and of failing to recognize interface requirements.
	Risk of interdisciplinary design conflicts due to concurrent and out-of-sequence design efforts.
	Risks of cost and schedule impact due to design recycling and/or a disruptive value engineering process.
	Continued ....

Improvements and Implementation measures *Issues scored as "neutral" in your self- assessment (scores of 4, 5 or 6)*

37 Monitor and driving corrective actions through the project controls process.

37.1 Drive reporting to be results-oriented; develop metrics and set benchmarks.

Project controls tools should be chosen for use only if they are purposeful and needed for flash track.

Use pull scheduling practices.

37.2 Set the expectation of outside-the-box thinking and challenge unsupported assumptions.

Make management accessible without barriers, to promote upward communication and decision-making in the process.

Develop forward-looking indicators that everyone is using.

Adapt the schedule to current project needs rather than driving to pre-defined milestones.

37.3 Ensure that the planning team has the skillset required to identify schedule slippage and quickly develop an early recovery plan.

Ensure that responsible project controls personnel engage and inform key stakeholder on all logic ties and dependencies.

Develop and continuously generate visible controls

39 Consider speed of fabrication and construction during the selection of design alternatives (Tier I).

39.1 Involve contractors and fabricators at the beginning of the project.

Consider constructability as part of the scope development (FEP-2).

Limit design approaches to proven technology or supplier-provided license technology. Use standardized equipment and assemblies whenever possible.

Create a robust process to explore viable alternatives.

Consider performing unit price bid evaluation for early commitments.

Consider using laser technologies (LiDar and other methods) to scan as-built conditions, subsurface utility engineering (SUE) to document existing conditions and similar practices more accurately

Use subcontractors and vendors with good standing relationships. Consider paying a stipend or fee for preconstruction services.

39.2 Create full models for design alternatives, i.e., procurement, construction, O&M, and risks associated with alternatives.

Obtain commitment from all parties to develop such alternatives.

Provide enough time and funding to support development of multiple solutions

39.3 Leverage pre-fabrication and modularization by using existing designs and prefabrication elements.

Adopt a "concurrent engineering" philosophy to bring key downstream stakeholders on board early.

Use 3-D modeling to anticipate interface issues.

Employ multiple design teams for design modules under a single integrator

Recognize the challenges and potential for rework in the event that interfaces had not been well-planned and thoroughly checked.

39.4 Ensure sufficient engineering support for speed of fabrication (e.g., 24-hour engineering).

Consider using design firms with well-established 24-hour design services.

Consider creating multi-shift decision-making teams with appropriate overlap.

Recognize the risk of 24-hour engineering and mitigate the inherent risk of designing in multiple time zones and/or location.

Execution Considerations

	Practice	Self score
41	Co-locating the project team (i.e., owner, designer, builder, and/or key vendors)	🟥
42	Simplifying approval procedures (Tier I)	4
43	Dedicating full-time personnel to the project (Tier I)	🟥
44	Selecting appropriate construction methods (Tier I)	6
45	Minimizing handoffs	🟩
46	Employing innovative construction methods	
47	Conducting frequent and effective project review meetings	

To show incremental improvements (scores >6), check 'yes' on the Process Generator.

Critical Improvements and implementation measures	Issues scored as "not probable" or "somewhat improbable" in your self-assessment (scores of 0, 1, 2 or 3)
41	**Co-locate the project team (i.e., owner, designer, builder, and/or key vendors).**
41.1	**Promote the benefits of face-to-face interaction.**
	Conduct frequent informal meetings and frequent effective project status meetings.
	Establish knowledgeable points of contact.
	Pair senior and junior staff (mentorship programs).
41.2	**Continually drive team-shared values and a focus on the customer.**
	Ensure that the key decision makers are site based/co-located.
	Ensure sufficient direction and motivation: 1) understand the value of each member, 2) address stress and fears, and 3) encourage creativity.
	Establish adequate support services, both technical and administrative.
	Monitor soft-side issues, in addition to process outcomes, barriers, information updates, and risk management.
	Recognize that the integrated design process demands the inclusive participation of key team members.
	Assign seasoned/coaching project managers.
41.3	**Prioritize communications.**
	Prioritize and promote effective, efficient information flow.
	Conduct frequent, short, and well-managed meetings.
43	**Dedicate full-time personnel to the project (Tier I).**
43.1	**Develop increased "bench strength." Create organizational capacities available to facilitate assignment of best resources.**
	Develop a business model supporting the benefits of having reserve capacity to handle flash track demands.
	Engage cross-trained, multi-skilled supervisors and personnel when possible. Engage personnel in work flow look-aheads and limit any engagement on non-project tasks.
43.2	**Create a collaborative decision-making process.**
	Create a formal documented decision-making process, including flow charts and roles/ responsibilities.
	Implement integrated teams to enhance collaborations.
43.3	**Engage key individuals in active roles throughout the project.**
	Involve personnel in decisions throughout all phases of the project.
	Continued ...

Improvements and implementation measures *Issues scored as "neutral" in your self- assessment (scores of 4, 5 or 6)*

42	Simplify approval procedures (Tier I).
42.1	**Simplify procurement and commercial aspects of the project.**
	Engage prequalified contractors and suppliers.
	Engage alliance contractors through master service agreements or comparable measures.
	Streamline pre-qualifications and competitive bid processes.
	Streamline the contract change approval process.
42.2	**Release funds as required to support optimal project execution.**
	Review project status with executive sponsors as required.
	Establish expectation as part of client gate process at project inception.
42.3	**Delegate authority to the project team.**
	Establish authority responsibilities and limits at project inception.
	Delegate authority at the project level to minimize decision delays.
42.4	**Engage permitting agencies early.**
	Limit project's footprint to limit the level of effort and submission requirements (e.g., to permitting agencies).
	Secure approval from permitting agencies well in advance of anticipated start dates.
	Engage regulatory agencies early to coordinate inspection roles and responsibilities.
42.5	**Establish a process to expedite approvals.**
	Establish a process to expedite approval as part of the project charter.
	Leverage the electronic communication system to streamline approvals.
	Exploit the benefit of co-location to expedite the approval process.
	Recognize the importance of simplifying approval procedures.
42.6	**Commit to flash track by the end of FEP-1 (Business Planning).**
	Establish commitment to flash track as part of the project charter.
	Define the key success factors that will enable optimum work flow.

44	Select appropriate construction methods (Tier I).
44.1	**Perform extensive critical path analysis, constructability analysis, and coordination of concurrent activities.**
	Conduct an aggressive, time-focused constructability and safety analysis.
	Establish clear priorities associated with construction method decisions: 1) safety; 2)schedule; 3) cost.
	Make program development decisions in FEP-2.
44.2	**Develop a 4-D animation showing how the project will be constructed, including craft mobilizations, staging areas, safety measures, rigging, modularized elements, and other pertinent constructability concerns.**
	Use historical information from previous projects to model equipment and components.
	Engage senior construction personnel with significant expertise in the process.
	Conduct multiple coordination meetings and reviews of the animation during development.
	Conduct detailed animation development meetings by phase and discipline with subject matter experts (e.g., civil, rigging/cranes, structural, and mechanical).
	Freeze the site layout drawing prior to finalizing the animation.
	Identify any assumptions made in regard to equipment sizing and delivery schedules.
44.3	**Perform a construction method analysis with a safety focus.**
	Ensure that senior management facilitates the proper balance between safety and schedule.
	Use drawings, 3D models, and pictures from previous projects to facilitate discussion.
	Ensure that the safety team performs daily reviews of constructability plan.
44.4	**Implement a flash track inspection plan.**
	Hold constructability meetings early in the detail design process to agree upon best constructability methods.
	Consider increased frequencies of shop inspections for critical equipment and prefabricated assemblies.
	Establish standard connection details and guidelines to facilitate construction and field changes.
	Employ full-scale mock-ups of pre-assemblies, as needed.
	Implement a phased systems turnover to allow incremental commissioning testing.

Scoring Summary

The following is a summary of the self assessed scores, category scores and overall score for the project.

	Contractual Considerations	**6.7**
	Issue	*Score*
1	Setting clear, specific scoping requirements (Tier I)	8
	Project scope has been put together quickly, but it is considered to be well defined.	
2	Establishing performance-based specifications	3
3	Aligning project participants' interests through contract	6
4	Establishing contract strategies specifically tailored to project conditions	7
5	Establishing clear change management procedures (Tier I)	5
6	Establishing an effective claims resolution process	2
	Owner's organization is slow in processing changes and tends top be adversarial for any changes. Reach out to Client to seek their A team.	
7	Funding early critical efforts (Tier I)	9
8	Reducing risks through the collective efforts of all stakeholders	6
	Delivery Considerations	**6.1**
	Issue	*Score*
9	Selecting team members and staff on the basis of their fast track experience or qualifications (Tier I)	7
10	Focusing procurement decisions on construction priorities (Tier I)	5
11	Selecting and awarding contracts to subcontractors in a timely manner (Tier I)	7
12	Staffing with personnel with strong leadership capabilities (Tier I)	8
13	Employing innovative procurement practices	1
	Client's organization is exceptionally ridged. Prospects for innovative approaches to procurement are unlikely.	
14	Using highly integrated 3D modeling with all major users updating a common database	5
15	Involving contractors, trades, and vendors in the design phase	7
16	*Seeking out suppliers and specialty contractors as sources of time-saving innovations*	5
	Organizational Considerations	**6.7**
	Issue	*Score*
17	Engaging operations and maintenance personnel in the development and design process	5
18	Establishing a fully integrated project team, including design, construction, specialty contractors, commissioning, and operations personnel (Tier I)	8
19	Using team building and partnering practices	7
20	Delegating authority to the project level (i.e., maximizing decision-making authority at the project level) (Tier I)	8
21	Empowering the project team (ensuring that each organization is led by an empowered leader)	8
22	Having an owner with sufficient depth of resources and organizational strength	3
23	Selecting personnel with a can-do attitude and willingness to tackle challenging tasks	6
24	Having an engaged and empowered owner's engineer (owner's representative)	7
25	Staffing with multi-skilled personnel	3
	Availability of personnel is limited. Reach out to senior management seeking the assignment of a selection of personnell	
	Cultural Considerations	**6.5**
	Issue	*Score*
26	Accepting a non-traditional paradigm or mindset	3
	Bringing in new approaches on the short-term will be challenging. Seek assistance from our champion to sell Flash track concepts	
27	Having an active, involved, and fully committed owner	8
28	Establishing flexible project teams that avoid rigid hierarchy	
29	Maintaining a no-blame culture and a mutually supportive environment	8
30	Having open communication and transparency (Tier I)	8
31	Staffing with cooperative and collaborative personnel	4
32	Having an open-minded team	4
33	Creating executive alignment among the contracted parties	8

	Planning Considerations	**5.7**
	Issue	*Score*
34	Emphasizing coordination planning during the design process (Tier I)	8
35	Performing exhaustive front end planning	3
	Project time line has not permitted extensive FEP effort.	
36	Identifying and procuring long lead items (Tier I)	8
37	Monitoring and driving corrective actions through the project controls process	4
38	Providing enough resources for critical path items (Tier I)	7
39	Considering speed of fabrication and construction during the selection of design alternatives (Tier I)	5
40	Recognizing and managing the additional flash track risks (Tier I)	3
	Need to pay special attention to Flash Track risks!	
	Execution Considerations	**4.8**
	Issue	*Score*
41	Co-locating the project team (i.e., owner, designer, builder, and/or key vendors)	1
	Co-location at remote site is not practical. Look for alternatives such as consolidating personnel in operations center and seek authorization to pier diem, as needed.	
42	Simplifying approval procedures (Tier I)	4
43	Dedicating full-time personnel to the project (Tier I)	2
	Seek assistance from senior management, asap!	
44	Selecting appropriate construction methods (Tier I)	6
45	Minimizing handoffs	8
46	Employing innovative construction methods	7
	Project scope is uncomplicated, established practices properly managed are appropriate. N/A.	
47	Conducting frequent and effective project review meetings	8
OVERALL READINESS SCORE		**6.0**

APPENDIX R

Flash Track Tool Recommendations

The full list of recommendations and suggestions are shown on the following pages.

Contractual Considerations

1	**Set clear, specific scoping requirements (Tier I).**
1.1	**Set explicit performance requirements**
	Allocate sufficient early engineering support to ensure that scope is reasonable, attainable, and sufficiently defined for subsequent detailed design efforts.
	Conduct targeted focus groups with end-users. Rank their needs and preferences, and maintain focus on strategic business objectives and project timelines.
	Proactively pursue key operational requirements. Elicit critical operational and maintenance information by asking specific questions on service histories, preferred vendors, accessibility, and other operational considerations.
	Understand the technical limitations as well as the cost and schedule implementations of each design alternative.
	Employ relational—rather than transactional—contracts, with a focus on equitable risk allocations.
	Ensure that the organization's contracting and procurement practices are compatible with and supportive of flash track projects.
1.2	**Set hard milestones for top-level design documents, such as Process and Instrumentation Diagrams (P&IDs), General Arrangement and Design Criteria.**
	Focus on task management, emphasizing the use of CII's PDRI.
	Anticipate increased front-end costs to avoid inadequate input and a perception of evolving requirements. Develop an early understanding of plant operations and business model requirements.
	Seek provisional regulatory approvals. Treat regulatory requirements as an additional customer need.
	Recognize potential for increased site costs due to early conservative design assumptions.
1.3	**Align and involve key stakeholders early, as part of the construction execution-strategy team.**
	Ensure that the requirements of all stakeholders are addressed during FEP-0 through FEP-1, including proactively seeking key operational requirements by early involvement of operational/maintenance personnel.
	Form and maintain a project team of individuals with technical expertise and the authority to speak for their organization.
	Maintain a focus on strategic business objectives to avoid "scope creep."
	Allocate sufficient funding for early engineering and staffing across all needed skill sets. Anticipate increased front-end expenditures.
	Select team members on the basis of favorable past experiences. Favor preferred contractors and partner alliances.
	Ensure efficient task management to prevent re-cycling of ideas. Keep focus on the critical project needs.
	Maintain a commitment to continuity of key players and decision-makers, from the early phases through project completion.
1.4	**Develop the construction-execution plan early.**
	Select early competent quality contractors.
	Confirm Owner's commitment, understanding, and ability to support a rapidly accelerated process.
	Assess project objectives critically, ensuring a proper construction-execution strategy.
2	**Establish performance-based specifications.**
2.1	**Hold frequent discussions with original equipment manufacturers (OEM), contractors, and internal user groups, throughout the scoping process.**

	Empower key stakeholders to speak for their organizations.
	Assign strong, project-level leadership with senior management support. Avoid re-visiting of prior resolutions.
	Plan meetings in advance, with clear agendas and all parties prepared. Distribute meeting minutes with action items and follow-ups.
	Secure executive alignment. Obtain explicit commitments from key contractors and suppliers through memorandums of agreement (MOUs) or comparable instruments.
	Employ collaborative tools, such as joint objectives, co-location, joint IT-resources, team building, and dispute resolution.
	Recognize that early selection of OEMs may steer solutions from a more objective performance requirements.
2.2	**Prescribe performance requirements based on clear and concise descriptions of 1) input feeds, 2) required outputs, and 3) reference to applicable industry standards.**
	Adequate front-end investigation, including discussion with OEMs, contractors, and owner's stakeholders.
	Draw from lessons learned from earlier projects (highlighting both what is wanted and what is undesirable).
	Recognize "red flags" (e.g., unclear or ambiguous language, inadequate criteria for evaluating compliance, unverifiable quality requirements, and inadequate early funding).
	Solicit external expertise to define technical requirements and/or to validate the developed performance specifications.
	Engage proven suppliers and contractors. Pursue a pre-qualification process early on.
	Define firm scope locks (i.e., design freeze).
2.3	**Employ contracts that are consistent with flash track strategies.**
	Award relational contracts that are sufficiently flexible to address flash track requirements.
	Award contracts that facilitate problem-solving and empower dispute resolution at the project level.
	Award contracts that foster collaborative behavior, promote open communications, and reward teamwork.
	Include mechanisms that effectively address changes. Adopt clear change management procedures.
	Ensure that contracts are simple and committed to good faith and fair dealings.
2.4	**Consider alternative procurement practices.**
	Prequalify contractors through Master Service Agreements (MSA) with pre-approved payment terms.
	Select contractors on the basis of best value, focusing on competence, prior experience, and collaborative ability. Set weightings for important selection criteria, such as delivery date, availability of resources, and others.
	Incentivize early completion and project cost-savings measures.
	Foster long-term partnering in the procurement process.
	Incentivize collaboration and high performance on safety, quality, schedule, reliability, teamwork, and cost.
	Extend collaborative and performance incentives to sub-contractors.
3	**Align project participants' interests through contract.**
3.1	**Involve key project participants early.**
	Increase early funding to cover additional costs of early engagement of key stakeholders.
	Engage multiple suppliers and contractors (e.g. equipment suppliers and specialty contractors).
	Compensate contractors for early participation.

	Create a system for expediting the procurement phase: 1. Create a database with a list of qualified project players. 2. Develop RFQ and RFP templates. 3. Formulate robust evaluation criteria.
3.2	**Select a project team, including key suppliers and contractors, with previous positive experience working together.**
	Establish the selection criteria, describing prior experience and team selection requirements, before receipt of bids.
	Recognize potential for increased bid costs from reduced competition.
3.3	**Conduct an alignment workshop.**
	Employ a skilled meeting leader or facilitator.
	Collectively define measures to promote a culture of open dialog, timely decision-making, issue resolution, and consensus building. Subsequently, capture these measures within the construction contract.
	Define the following deliverables for the end of the alignment workshop including a clear scope of work; an explicit Division of Responsibility (DOR); and agreements on interface schedules.
3.4	**Employ a "speed dating" selection technique among short-listed teams, based on demonstrated team synergy and compatibility.**
	Explain the objectives of the process, such as the following - securing early feedback on the project's flash track objectives - creating a better understanding of the contractor on the other side of the table - creating a better understanding of what is possible.
	Select a strong, competent project manager, along with his or her core team members, who have executed projects together.
	Explore the contractor's commitment to provide key personnel and resources to the flash track project, including access to top executives, as needed.
3.5	**Develop an equitable contract, with shared incentive provisions that are tied to team performance on shared goals and targets.**
	Avoid members with a risk-averse attitude. Get all members’ buy-in to risk assignment.
	For subcontractors and vendors who join the project in a later phase, develop a subcontract agreement similar to the original contract between key players. This agreement should include similar shared values, goals, and targets. Develop the incentive and disincentive plan around their contributions to achieving those shared goals.
3.6	**Explore project labor agreements (PLAs) or other measures targeted to essential flash track requirements.**
	Commit to a safe and heathy worksite.
	Aligning rewards to the achievement of project objectives.
	Promoting innovative, open, and effective employee relations. Relaxed trade jurisdiction provisions and skills-based compensation.
	Sliding scale incentive pay based on verifiable productivity measures.

4	**Establish contract strategies specifically tailored to project condition.**
4.1	**Use of IPD, alliance, and/or incentive-based contracts.**
	Conduct an information session to bring all parties on board with the implications of these contract types, showcasing the potential schedule, cost, and quality benefits of successful relational contracts.
	Consider incentivized reimbursable contracts or other procurement practices, to enable an early start of the work with minimal definition.
	Recognize that organizations may be unable or reluctant to embrace new contract

	approaches.
4.2	**Review owner's available contracting strategies and rank them according to their demonstrated historic performance, to employ relational contracting.**
	Consider elements of owner's past successful measures in the development of a project-specific flash track contract.
	Recognize challenges of acquiring sufficient "relational knowledge" or of realizing mutual trust with a first-time use of relational contracting.
4.3	**Project Team executives draft a succinctly written project-specific agreement and then involve the attorneys to finalize the contract language.**
	Avoid standard terms and conditions, including unreasonable exculpatory provisions. Consider the following key flash track contracting strategies: - construction input to the design process - early funding to support inclusive project development and planning - increased use of performance specifications and contracts - incremental commissioning or pre-commissioning - appropriate flash track risk allocation - payments tied to demonstrated accomplishments (milestones) - streamlining the change provision process - cash flow problems must not be allowed to inhibit the progress of the project.
	Assign skilled, well-informed Owner's Representatives willing to accept a new project management paradigm.
5	**Establish clear change management procedures (Tier I).**
5.1	**Develop a project Change Notification Procedure (CNP).**
	Agree to develop a project CNP targeting expedited reviews, approvals, and the processing of any payments for meeting early project milestones.
	Reach early consensus and agreement on notification/submission requirements and cost estimating practices, specifically on labor and equipment rates, work hour calculations, miscellaneous and indirect costs, overhead, profit, subtrade quotes, and processing timelines.
	Consider measures such as simplifying the approval and processing process, negotiating a change order allowance, and making payment provisions for a percentage of estimated costs for disputed costs.
	Recognize the importance of timely payments. Understand that changes and rework are common on flash track projects.
5.2	**Delegate authority to the project team.**
	Empower the resident project manager with the authority to approve critical changes.
	Establish a clear project charter and alignment, affording the resident manager direct access to executive sponsors.
	Schedule status updates with senior management.

6	**Establish an effective claims resolution process.**
6.1	**Use contract provisions to reduce likelihood of claims.**
	Avoid inequitable risk-shifting contract provisions through the following: 1) assigning risk to the party who can best control it; 2) assigning risk to the party who can bear it at the lowest cost; and 3) assigning risk to the owner when no other party can bear the risk or control the cost.
	Incorporate measures to mitigate the most significant flash track risks such as the following: 1) cost overruns and inaccurate cost estimating; 2) design errors and omissions; 3) delay damages; 4) numerous change orders; 5) construction rework and modifications; and 6) overlooked work (assigned to no party).

	Employ relational contracting, such as IPD, partnering, or alliance contracts (or the equivalent), that appropriately share risks, foster good working relations, rely on open and timely communications, and encourage non-adversarial relationships.
	Specify a project requirement to employ pull scheduling and critical chain processes to reduce the likelihood of scope gap or overlap.
	Align stakeholders contractually through shared risk and reward programs.
	Secure executive sponsor commitment to administer dispute resolution process in a timely and effective manner.
	Recognize the likelihood of hidden cost premiums due to inequitable risk allocations. Understand the increased likelihood of claims on flash track projects.
6.2	**Agree to no work slowdowns or stoppages for claims.**
	Consider contract provisions such as payment provisions for a percentage of estimated costs for disputed costs or other measures to preempt the execution of the work.
	Outline expectations of no work slowdowns or stoppages during the team chartering and formation stages.
	Contract with an independent party to document claims during the project to ensure that accurate/fair information is available during claim resolution.
	Recognize the imperative to avoid disruptions and potential delays due to unresolved claims.

7	**Fund early critical efforts (Tier I).**
7.1	**Obtain early release of an allowance for discretionary funds to the project leadership team.**
	Establish early release of funds as part of the front-end planning (FEP) client approval.
	Review scope, commitments, and expenditures regularly with executive sponsors.
	Recognize the ripple effect of late release of funding on down stream activities.
7.2	**Set a firm "scope lock" date.**
	Establish scope locks as part of FEP Kickoff.
	Use pull scheduling to keep the "scope lock" date as late as possible, to optimize opportunities to explore alternatives.
7.3	**Employ a "target value design" process in lieu of "value engineering."**
	Educate, advocate, and persuade executive sponsors on the benefits of the target value design process.
	Develop a reliable target cost during the project definition phase.
	Train project team on target value design practices.

8	**Reduce risks through the collective efforts of all stakeholders.**
8.1	**Engage all stakeholders in interactive risk analysis sessions at the early stages of the project, including owner, engineer, contractor, key equipment OEMs, key subcontractors, and start-up personnel.**
	Adopt an active risk-assessment process driven by the leadership team to accomplish the following: 1) identify and assess project risks effectively; 2) manage risks of concurrent activities; and 3) mitigate potential communication failures.
	Schedule follow-up risk analysis sessions at appropriate times.
	Engage the engineer, contractor, key OEMs, and key subcontractors on the basis of their resumes and prior favorable relationships.
8.2	**Define the role of operations personnel in the design and construction process, and engage them in it.**
	Review operational guidelines, such as maintenance access, at the beginning of issued-for-construction drawings for each discipline, to ensure that they are sufficient.

	Align the team on project goals and the business case during project kickoff.
	Focus on redundancy requirements and ensure that they are adequate to afford sufficient flexibility.
8.3	**Include the owner's plant personnel in the contractor's planning team on turnaround, retrofit, and outage projects, offering hands-on insights on the facility.**
	Highlight positive examples of what plant personnel's knowledge of a facility can offer, such as lessons learned, key constraints, maintenance histories, and potential risks.
	Have senior management present the project charter to the team at the start so that everyone understands their respective roles.
8.4	**Employ a dynamic, interactive risk register linked to the project schedule, to capture traditional risk register elements, as well as the potential errors and changes caused during the heightened concurrent design and construction of flash track delivery.**
	Review the risk register every month, until all risks are either accepted, mitigated, reduced, or retired.
	Develop a risk register visual tool and store it in a common workspace, for access by the team at all times.
	Establish an effective feedback loop to get information out to the project team and to influence decision-making.
	Assign a strong leader who will serve as risk facilitator.

Delivery Considerations

9	**Select team members and staff on the basis of their fast track experience or qualifications (Tier I).**
9.1	**Secure release of key and best candidates from their current roles.**
	Secure senior management support early in the process.
	Provide immediate notification and identification of proposed replacement's abilities and qualifications.
	Provide sufficient support resources and tools to limit workload of key personnel.
	Explore standard contract terms with all clients to permit release of key personnel under certain provisions. If possible, amend standard terms to define the condition under which a contractor can remove and substitute key personnel.
9.2	**Identify essential project flash track skills, including the following:** **- dealing with uncertainty and managing risks (i.e., being a self-starter)** **- overcoming obstacles (i.e., having a can-do attitude)** **- working flexibly outside the normal boundaries (i.e., being multi-skilled)** **- demonstrating commitment to following through towards assigned goals** **- being technically strong and "natural" collaborators.**
	Assign team leaders that are both task- and relationship-oriented. Appoint a project champion who oversees the big picture and is fully sensitive to flash-track needs.
	Recognize that motivated, highly-skilled, result-oriented personnel are key traits to flash track.
	Recognize the traits that can be incompatible with flash track principles (e.g., managing versus doing, inflexibility, micro-managing).
	Include key personnel highly familiar with company standards and innovative flash track processes.
	Select a well-balanced team.
9.3	**Engage senior personnel early in execution roles to perform the following:** **- Start process as other personnel can be re-assigned (turn-overs).** **- Identify and eliminate obstacles.** **- Get a better picture of project needs.**

	Provide sufficient support resources to enable the attention of key personnel to critical tasks. Eliminate distractions from critical efforts.
	Have senior personnel set the stage for aligning personnel with essential Flash-Track skills.
	Maintain continuity of and access to senior personnel throughout project's duration.
	Amend pricing structure to capture costs of a higher level of executive support.
	Recognize the importance and costs of continuity of personnel and senior management.

10	**Focus procurement decisions on construction priorities (Tier I).**
10.1	**Adopt a construction-driven design philosophy to ensure that construction priorities are given due consideration.**
	Structure the procurement decisions on the basis of time certainty, speed of delivery, and ability to accommodate a flexible design.
	Use Pull Scheduling to defer design decisions until the latest responsible moment.
10.2	**Develop an agile and flexible procurement process that supports flash tracking.**
	Align design, procurement, construction, and operations and maintenance personnel around a shared goal of timely delivery.
	Adopt a concurrent engineering philosophy to bring downstream key stakeholders onto the project early.
	Perform an early market survey to identify material and equipment availabilities, as well as delivery expectations, to assess the need for alternative approaches or special measures.
10.3	**Fully engage subcontractors and suppliers in expediting critical activities.**
	Prequalify lower tier suppliers and subcontractors, prioritizing time certainty and speed of deliveries.
	Include incentives and/or penalties for meeting delivery commitments.
	Monitor and expedite all aspects of procuring materials, including fast delivery services (e.g., hot shot/expedited trucking services, shop expeditors, local escorts, employing site forces for commodities).
	Assess key procurement activities, recognizing the potentials for expediting even at the lower tier subcontractors and suppliers, if possible.
10.4	**Secure immediate, solution-focused, and empowered engineering support, as needed.**
	Anticipate increased levels of engineering support during construction, including full-time site representation.
	Ensure constant communication between the project team and engineering support to keep engineering appraised of upcoming needs.
	Secure expedited engineering responses to procurement and construction questions.
	Recognize the risk of inefficiencies and changes throughout the design process, especially in heavily overlapped concurrent engineering efforts.
10.5	**Ensure early and ready access to specialized equipment to support construction operations.**
	Plan the work across trades and contractors to optimize equipment use to limit congestion and minimize time on site.
	Develop contingencies in the event of equipment failures.
10.6	**Use single-source suppliers to the extent possible.**
	Secure early funding.
	Calculate time and money saved by not bidding or seeking the lowest price.
	Recognize the business model benefits of prioritizing schedule over costs.

11	**Make timely selection and award contracts to subcontractors (Tier I).**
11.1	**Identify regional contractors and suppliers that can fulfill flash track project needs.**
	Develop a standing list of prequalified contractors, subcontractors, and suppliers willing to

	quickly deploy to support flash track demands.
	Prior to awards, re-emphasize project goals and expectations, formally confirming their project execution plan, including available key personnel/resources, project organization chart, workforce loading schedule.
11.2	**Delegate procurement authority to the project level.**
	Establish a project execution plan that delegates award authority to a fully empowered project team.
	Ensure that sufficient funding is available to support project level decision-making.
11.3	**Use blanket Master Service Agreements (MSA) with preferred contractors.**
	Establish these MSAs in anticipation of flash track assignments.
	Ensure that all contracts require "open communication and collaboration" for all project activities.

12	**Staff with personnel with strong leadership capabilities (Tier I).**
12.1	**Identify and cultivate strong leadership traits.**
	Assign team leaders that are both task- and relationship-oriented.
	Assign team leaders that are exceptional in cultivating strong team environments.
	Attract and integrate top-talent retirees to improve the leadership culture and to mentor future leaders of the organization.
	Secure management commitment to support effective personnel fully, and replace key leaders that do not perform.
12.2	**Facilitate leadership throughout the organization.**
	Empower the project team to make decisions.
	Invest resources in training and developing employees into leaders.
	Establish an executive committee that monitors the team dynamics.
12.3	**Assign key leadership to the project prior to kick off meeting.**
	Communicate the urgency of incorporating strong leaders in the early phase of the flash track project to free them up from their existing assignments.
	Assess alternative staffing approaches to ensure that stronger personnel can be available for the flash track project.

13	**Employ innovative procurement practices.**
13.1	**Explore alternatives used successfully on other flash track efforts.**
	Employ procurement practices based on time certainty, speed of delivery, and ability to accommodate a flexible design.
	Execute work through established Master Service Agreements with preferred contractors and suppliers.
	Adopt policies of “relational competitive partnering” or take a long-term perspective on procurement practices where proven contractors are selected on the basis of their past performance and pricing.
	Ensure early engagements of contractors/consultants to define the scope of work more precisely. Consider employing a target value design process.
	Proceed under reimbursable contracts with succinct rate sheets. Consider Open Book procurement measures.
	Incentivize timely performance with early completion bonuses and similar measures.
	Avoid inequitable risk-shifting contract provisions, embracing shared risk or risk contingency concepts.
13.2	**Employ relational contract strategies.**
	Ensure prudent selection of contract partners. Team selection based on shared values and willingness to collaborate.

	Avoid changes to participation at the executive level (characterized as cancerous in an alliance), ensuring stable senior management representation.
	Maintain a one-on-one relationship among senior elements of the alliance parties.
	Promote consistency in spirit within the contract alliance.
	Employ alliance contracts with vendors. Demonstrate benefits of relational contracting, such as alliance and IPD contracts, to the owner.
	Recognize that poorly executed relational contracts, without mutual trust, are problematic.
13.3	**Offer incremental or progressive notices to proceed to major equipment suppliers and subcontractors.**
	Secure executive-level support and alignment among the contracted parties.
	Complete substantive risk assessments and cost-benefit analysis.
	Actively engage the owner's representative in the decision process.
	Use vendor-indicative pricing to establish the basis of pricing for memorandums of understanding (MOUs) and/or notices to proceed (NTP), when working to place orders for critical long lead equipment and/or specialty subcontracted services.
	Provide clear performance requirements.
	Recognize the potential for commercial consequences of early decisions to limit future alternatives.
13.4	**Accelerate the Notice to Proceed process, including early full releases to accommodate flash track needs.**
	Get key decision-makers (i.e., client, engineer, construction, procurement, legal, and the supplier/vendor) in the same room to work out project-specific terms and conditions, including cancellation provisions. Reconvene discussions, as needed, to secure final approvals.
	Require close contractor alignment with the client and require the contractor to demonstrate past successful experience with designated equipment supplier(s) on comparable projects.
	Engage Legal resources in pertinent negotiations and review of the NTP documentation.

14	**Use highly integrated 3-D modeling with all major users updating a common database.**
14.1	**Use compatible 3D software programs.**
	Consider specifying collaborative 3-D tools and their platforms in RFQs to suppliers. Establish the supplier's prior successful experience with the specified tools as a primary selection criteria.
	Limit project participation to firms that have demonstrated experience using the software.
	Include costs for 3-D tool license fees and associated training in the project budget.
14.2	**Use a single cloud-based platform for housing and sharing real-time 3-D models.**
	Perform a cost-benefit analysis to support an integrated 3-D modeling implementation decision. Secure executive and organizational support/alignment going forward.
	Engage a third-party IT consultant to set up the server(s) and train the team.
	Explore and consider continuing advances in collaborative technologies.
14.3	**Have a jointly developed and agreed-upon BIM execution plan (BEP) in place.**
	Engage an IT consultant to provide advice and input on establishing an implementable BEP.
	Include demonstrated experience at successfully implementing BEPs on past projects as a key IT consultant selection factor.
	Assign responsibility for managing the BEP development.

15	**Involve contractors, trades, and vendors in the design phase.**
15.1	**Execute contracts and agreements that allow stakeholders to be brought on board early.**
	Adopt a concurrent engineering philosophy to bring key downstream stakeholders on

	board early.
	Develop a cost benefit metric to assess the value of early involvement.
15.2	**Conduct a workshop with contractors, trades, and vendors to maximize benefits from their input.**
	Employ a strong leader to keep this workshop on task, keeping all parties interested and engaged.
	Engage multiple potential suppliers/subcontractors in workshops.
	Offer incentives to prospective service providers that contribute to the early development and design process.
	Use lessons learned from prior projects to enhance workshop effectiveness.

16	**Seek out suppliers and specialty contractors as sources of time-saving innovations**
16.1	**Ensure that meetings with suppliers and specialty contractors are effective and result in usable innovations.**
	Use interactive planning processes and pull scheduling approaches to elicit input
	Establish integrated teams that are tasked to accomplish project objectives.
	Establish a shared vision for the project by including suppliers early.
	Implement a 3-D collaborative strategy, starting in the initial FEP phases.
16.2	**Establish commercial measures and practices to share risk/reward, to align resources.**
	Develop contracting language with equitable shared risk and reward.
	Select contractor(s) based on the following: 1) availability of resources; 2) mobilization response time; and 3) proven management abilities.
	Base contractor selection criteria on the value of time-saving innovations.

Organizational Considerations

17	**Engage operations and maintenance personnel in the development and design process.**
17.1	**Include O&M staff in the development of design criteria and in design reviews to ensure operational issues are considered in the design process (e.g., accessibility, service histories, spare parts, and training).**
	Select personnel on the basis of technical aptitude, interpersonal skills, and buy-in to overall project performance.
	Select O&M personnel with a long-term stake in the project.
17.2	**Avoid design delays by securing site-specific knowledge on operational challenges, lessons learned, deferred maintenance, and service histories.**
	Request that O&M team members gather data that can be reviewed during the development phase, to avoid issues during the design phase.
	Engage O&M team members to discuss stakeholder needs, investor commitment, and conceptual design.
	Establish O&M guidance on their preferences for level of automation, technology, and sophistication of equipment, to accelerate decision-making.
	Employing decision-making tools, such as Choosing by Advantage or other consensus-based decision-making processes.
17.3	**Strong division of responsibilities (DOR) will help define O&M expectations and responsibilities.**
	Assign a senior team member with plant experience as a mentor or facilitator.
	Base the project team DOR on the capabilities of the staff.
	Jointly develop the O&M deliverables and team milestones to align with project schedule.

18	**Establish a fully integrated project team, including design, construction, specialty**

	contractors, commissioning, and operations personnel (Tier I).
18.1	**Ensure early involvement of key project participants.**
	Use relational contracting methods to expedite the procurement phase.
	Select the contractor(s) based on the following criteria: 1) availability of resources; 2) mobilization response time; and 3) proven management abilities.
18.2	**Employ "speed dating" selection technique among short listed teams to demonstrate team synergy and compatibility**
	Select a strong, competent project manager, along with his or her core team members, who have executed projects together.
	Seek candidate's commitment to allocating personnel and resources to the project.
	Confirm alignment and engagement of top executives.
18.3	**Select a project team with pre-existing working relationships.**
	Select a strong, competent project manager, along with his or her core team, whom have executed projects together.
	Focus on team dynamics and performance, in addition to individual skills and capabilities.
	Select team players with trusting past work relationships.
18.4	**Implement an alignment workshop(s) to promote a project culture of shared values, interests, and goals.**
	Employ a meeting leader or facilitator.
	Focus the workshop on developing a culture for open dialog, timely decision-making, issue resolution, and consensus building. Incorporate the results into the contract.
	Define the following deliverables for the end of the alignment workshop including a clear scope of work; an explicit Division of Responsibility (DOR); and agreements on interface schedules.
	Use team building and partnering practices as part of the workshop.

19	**Use team building and partnering practices.**
19.1	**Facilitate team building.**
	Build a team of collaborative personnel who can readily adapt to a non-hierarchical, project-focused effort.
	Clearly define team member responsibilities and communicate the imperative need for collaborations.
	Encourage team integration, transparency, mutual trust, and a no-blame culture.
	Secure the commitment and stewardship of senior management (executive alignment).
19.2	**Assess and maintain team wellness.**
	Conduct evaluations and self-assessments of team wellness.
	Conduct periodic offsite interactive planning meetings to refocus on objectives, identify barriers, and re-assess the best path forward collectively (in half-day sessions).
	Employ targeted training to increase use of common tools and common language and to promote a shared perspective of the project objectives.
	Involve key contractors and suppliers early in the process.
19.3	**Encourage interactions across disciplines and all working levels.**
	Balance and manage teams to promote interactions. Recognize that the backbone of technical collaboration is having continuous meetings in small groups.
	Implement a mentoring program that trains and exposes younger personnel to future roles.
	Co-locate personnel resources.
19.4	**Celebrate successes.**
	Use individual recognitions and group-level rewards.
	Recognize interim milestone completions.

	Encourage interactions across disciplines and all working levels.

20	**Delegate authority to the project level (i.e., maximizing decision-making authority at the project level) (Tier I).**
20.1	**Have early project alignment meetings, including executives from each stakeholder group, to set decision-making parameters for project team.**
	Delegate decision-making to the lowest competent level, to promote rapid and effective decisions.
	Assign a strong project manager with good decision-making skills.
	Create a good communications system. Hold regular well-managed project review meetings.
20.2	**Create an executive project dashboard to report on the cost, schedule, and budget consequences of any deviations, corrective actions, and barriers.**
	Explicitly describe any barriers and executive assistance needed to move forward.
	Identify critical risk factors, their consequences, and planned mitigations measures.
	Update dashboard to reflect the pace of change in the project.
	Keep dashboards simple and readily available (on-line access).
20.3	**Consider using a third-party facilitator to gain alignment.**
	Ensure executive communication to drive home the importance of full project team buy-in.
	Carefully choose a third-party facilitator with proper experience (e.g., CII PDRI).

21	**Empower the project team (ensuring that each organization is led by an empowered leader).**
21.1	**Establish clear parameters (e.g., budget, schedule, scope, and changes) that permit the project team to operate without external approvals.**
	Communicate expectations and exceptions to standard procedures to all project team members.
	Set KPIs and periodically report actual results against target metrics. Form an independent review team to audit reported results.
	Establish regular reporting intervals and intermediate milestones. Measure progress against those milestones.
21.2	**Delegate decision-making authority to the project manager.**
	Maintain an appropriate level of executive oversight through a stage-gate review process.

22	**Have an owner with sufficient depth of resources and strength of organization.**
22.1	**Assign available in-house resources on a dedicated basis.**
	Assign non-flash track responsibilities to other resources.
22.2	**Supplement traditional owner-staffed positions with contractor personnel.**
	Consider recently retired personnel from comparable owner organizations.
	Consider top-performing, trusted consultants and contractors who are familiar with the owner's expectations and practices. Include specific contractual provisions, where appropriate.
	Provide a training and orientation program for contractor personnel. Fill roles with competent people and empower the contract personnel to make decisions.
	Provide visible management support for the contractor personnel.
22.3	**Hire an EPC contractor to perform the owner's role.**
	Ensure that the EPC contractor has prior experience, capability, and personnel to fill the owner's role.
	Consider a mixed team of owner and contractor personnel versus exclusive staffing by the EPC contractor.

22.4	**Develop contract strategies that minimize owner resource requirements.**
	Use performance specifications and performance guarantees as methods for minimizing owner involvement.
22.5	**Create a joint venture with another owner organization that has sufficient depth of resources and strength of organization.**
	Approach another owner organization within the industry with similar management philosophies and values.
	Seek the appropriate legal advice for structuring a joint venture agreement.
	Limit intellectual property-sharing to lower value, non-proprietary, or mature technologies.
	Factor additional costs and administrative burden into project economics.
22.6	**Employ innovative contracting techniques to confirm that flash track pricing is appropriate for the level of risk.**
	Consider open book estimates and subsequent conversion to lump sum, after quantities, pricing, and labor availability are known.
	Negotiate with one supplier on an open book, lump sum basis, and agree on markups, productivity, and contingency levels prior to contract award.
	Contract for a bid check estimate from a third party to ensure reasonable pricing.
	If possible, negotiate with a trusted supplier that has delivered a similar project for a price verified through a bid check estimate or through competition.
	Proceed on a reimbursable contract basis or bid out. Have reasonable terms with fixed fee to start with in the event that a lump sum price cannot be agreed upon.
	Recognize likelihood of increased costs and loss of control in exchange for speed of delivery and minimization of owner resource requirements.

23	**Select personnel with a can-do attitude and willingness to tackle challenging tasks.**
23.1	**Conduct a joint team selection with all key parties, based on project success criteria.**
	Solicit input and direction on the selection process from key stakeholders' executive sponsors.
	Select a balanced team across team boundaries.
	Provide dynamics and organizational effectiveness training for the project leadership team.
	Recognize that certain personnel may be ill-suited to serve in an integrated organization.
23.2	**Implement a project-specific reward system for exemplary performance.**
	Define reward criteria and secure stakeholder and executive-level support.
23.3	**Negotiate continuity and removal clauses into the contractual terms.**
	Develop an effective mechanism to govern staff issues on the project.

24	**Have an engaged and empowered owner's engineer (owner's representative).**
24.1	**Involve the owner's engineer in the early phases of the project.**
	Develop a clearly defined synopsis of the project's business model, objectives, and other key considerations.
	Clearly define the roles of the owner's engineer and issue a corresponding division of responsibilities early on the project.
24.2	**Co-locate the Owner's Engineer with the project team.**
	Minimize communication barriers.
	Employ town hall meetings to facilitate communications.
24.3	**Delegate decision-making authority to the Owner's Engineer.**
	Establish a clear Delegation of Authority to streamline the approval process.
	Document the decision-making process during the chartering effort.

25	**Staff with multi-skilled personnel.**
25.1	**Create self-managed work teams.**
	Consider complementary skills in creating multi-skilled, work teams (e.g., civil, mechanical, electrical, and general).
	Recognize challenges on union projects.
25.2	**Employ skills based compensation strategies.**
	Base incentive pay on achievement and performance.
	Consider Retention incentives for longevity.
25.3	**Consider alternative recruitment and training strategies.**
	Consider certification programs and prior military (e.g., Seabee) training.
	Explore in house training and on the job training.

Cultural Considerations

26	**Accept a non-traditional paradigm or mindset.**
26.1	**Explore modularization techniques (e.g., those used in the shipbuilding industry).**
	Recognize that new paradigms may involve significant changes to the design, construction and owner roles.
	Recognize that barriers to successful high-level modularization methods (e.g., those used in the shipbuilding industry) are cultural and traditional rather than structural.
	Increase focus on constructability during the design process (i.e., design for production).
	Adopt generic or scalable design standards. Maximize standardized components.
	Developing a high level of supply chain integration. Consider BIM practices that can employ relevant building component information, such as standard design modules, procurement specifications, and maintenance/operation manuals.
	Develop a preferred supplier network.
	Recognize that early decisions to modularize will yield the best time-savings results.
26.2	**Implement Critical Chain scheduling.**
	Conduct training in critical chain scheduling, which requires abandoning traditional concepts of time buffers or float on individual activities, and focusing on optimizing work flow.
	Add a skilled "change agent” to introduce Critical Chain concepts to the organization.
26.3	**Engage multiple design teams concurrently on a family (or set) of design proposals.**
	Recognize that, as the designs or the knowledge base evolves, the sets of solutions are narrowed through consensus to an optimal solution.
	Conduct training programs early on in the project.
	Employ a consensus review and decision-making process.
	Increase the frequency of coordination meetings.
	Limit participation to key critical suppliers and contractors.
26.4	**Partner with key suppliers/subcontractors.**
	Engage procurement early, establishing measures to ensure that planned procurement practices are consistent with flash track practices.
	Establish procurement practices focused on time certainty, speed, and flexibility, to accommodate invariable changes due to concurrent engineering efforts.
	Start the process early of identifying material and equipment availabilities and delivery expectations.

27	**Have an active, involved, and fully committed owner.**
27.1	**Provide a dedicated owner's representative with relevant project experience who can make timely and informed decisions.**

	Heighten awareness that time is of the essence and that the traditional approval cycles are inadequate in a flash track environment.
	Develop a schedule of decisions and highlight their relationship to design-procurement-construction activities.
	Educate the owner about the flash track process. Include the benefits of interim informal reviews and interim permit approvals.

28	**Establish flexible project teams that avoid rigid hierarchy.**
28.1	**Co-locate resources.**
	Set co-location expectations at beginning of project.
	Create "multi-team" rooms (e.g., “integrated big rooms” suited for collaborative efforts and visual media).
28.2	**Use highly visual communication media (e.g., Kanban boards, smart boards, and decision diagrams).**
	Set project expectations for innovative methods at the outset.
	Provide training to team members on the creation and use of visual communications media.
	Recognize the benefits of visual communications in conveying information, making decisions, and transforming paradigms.
28.3	**Select team members with diverse backgrounds.**
	Fill in personnel gaps where needed, to keep the project on track by using experienced and flexible people.
	Use a skill and experience matrix as part of the team selection process.
	Recognize that unexpected events are best dealt with through the collective efforts of teams with a range of skills and experiences.

29	**Maintain a no-blame culture and a mutually supportive environment.**
29.1	**Maintain open communications across the project team.**
	Set a primary expectation with frequent reinforcing messages.
	Instill a "no surprises" culture where the contractor is encouraged (required) to bring forward issues and concerns as quickly as possible.
29.2	**Embed owner's personnel within the contractor's design, estimating, and construction team.**
	Assign collaborative owner personnel who are open to flash track's "no blame" teaming philosophy.
	Appoint a senior member of the construction management team to be the flash track champion.
	Align objectives early through formal chartering sessions.
29.3	**Ensure that senior leadership of all groups is dedicated to maintaining a "no blame" culture.**
	Set as a chartering criteria.
	Frequently revisit the team's commitment to maintaining a "no blame" culture.

30	**Have open communication and transparency (Tier I).**
30.1	**Co-locate resources.**
	Identify office location and sufficient work spaces at project kickoff.
	Set co-location expectations at the beginning of the project.
	Expedite the project task force work area.
30.2	**Use highly visual communication media (e.g., Kanban boards, smart boards, and decision diagrams).**

	Set project expectations for innovative methods at the outset.
	Provide training to team members on usage of the tools.
	Recognize the benefits of visual communications in conveying information, making decisions, and transforming paradigms.
30.3	**Establish an issue resolution process.**
	Set project expectations at the outset.
	Set a timeline and responsibilities for closure, including frequencies of status reports.
	Establish an escalation process for unresolved issues.
30.4	**Define measures to ensure commercial accuracy.**
	Consider "open book" accounting.
	Define fixed rates for labor and equipment, mark-up, overhead, and other pricing measures. Define invoice submission requirements at the outset of the project.

31	**Staff with cooperative and collaborative personnel.**
31.1	**Create the optimal environment for cooperation.**
	Insist upon a culture of open communication and transparency.
	Maintain a “no blame” culture and a mutually supportive environment.
	Co-locate project team (i.e., owner, designer, builder, and/or key vendors) to the degree feasible.
	Recognize that traditional contracting and procurement practices are not conducive to collaboration and cooperation. Consider innovative procurement practices and relational contracting.
31.2	**Increase information flow.**
	Hold frequent and effective project review and periodic interactive planning meetings.
	Use highly visual communication media (e.g., Kanban boards, smart boards, and decision diagrams).
	Coordinate highly integrated 3-D modeling with all major users updating a common database.
	Establish a fully integrated project team including design, construction, specialty contractors, commissioning, and operations personnel, as early as possible.
31.3	**Select a project staff likely to thrive on flash track principles.**
	Consider the following characteristics when selecting project candidates: - technical strength—diversified cross-trained personnel within focused discipline - being a "self starters" with the ability to work a non-hierarchical organization - a "can do" attitude with the ability to overcome obstacles to meet goals - demonstrated commitment and follow through - collaborative nature.
31.4	**Assess team behaviors continuously.**
	Continuous evaluations and self-assessments in encouraging improvement initiatives.
	Replace team members whose performance or behavior adversely affects the team.
	Hold periodic offsite interactive planning sessions to refocus on objectives, identify barriers, and re-assess the best path forward collectively (in half-day sessions).
	Prepare concise monthly presentations to the executives, reviewing scope, commitments, expenditures, and team dynamics.

32	**Have an open-minded team.**
32.1	**Choose team members who have demonstrated flexibility in the past.**
	Staff with cooperative and collaborative personnel.
32.2	**Kick off the project with a problem-solving "creativity" workshop.**
	Secure a skilled facilitator.

	Conduct "train the leader" sessions and make the workshop facilitator an integral part of the organization.
	Establish a culture of reliable commitments.
	Create a work environment conductive to creativity.
	Make sure that an executive and/or a project champion supports the creative process.
32.3	**Integrate young bright talent into the team.**

33	**Create executive alignment among the contracted parties.**
33.1	**Form a senior executive management team from all entities engaged in the project.**
	Select executives who know each other or share a similar culture.
	Create an executive team governance document (e.g., an MOU).
	Select executives who are well-versed in relational contracting strategies.
	Establish provisions to change executives, if necessary to successfully achieve flash track objectives.

Planning Considerations

34	**Emphasize coordination planning during the design process (Tier I).**
34.1	**Co-locate project personnel to promote their ability to collaborate, identify, and resolve design issues quickly, and to remove obstacles to project success.**
	Assign strong facilitative leadership with experience, skills, and abilities to keep the team focused and productive.
	Conduct team-building activities to remove barriers and build a cohesive culture.
34.2	**Commit to construction-driven engineering and procurement.**
	Select and empower a strong project manager able to lead a team to abandon traditional thinking, challenging engineering and construction teams to find unique solutions.
	Engage procurement during conceptual planning to start long lead purchase activities and bring key service providers on board early.
	Ensure that the project team has a high level of decision-making authority.
34.3	**Identify and monitor “pinch points,” such as the following:** **- system or contract interfaces** **- over-populated work zones (i.e., personnel and equipment)** **- compatibilities of contractor logistic and procurement planning.**
	Create awareness of flow of information, personnel, materials, or other assets, and train the team to identify and resolve pinch points.
34.4	**Define and monitor each participant's role and responsibilities to avoid mirrored or duplicate efforts.**
	Clearly define each team member’s roles and responsibilities in a division of responsibilities (DOR) matrix to prevent duplication and to spotlights roles and tasks that have been overlooked.
34.5	**Employ pull scheduling or just-in-time work flow scheduling to develop networks of commitments and key decision points.**

35	**Perform exhaustive front end planning.**
35.1	**Pull downstream stakeholders into the early planning for their input and identification of issues.**
	Include specialty subcontractors, vendors, suppliers, and operations and maintenance personnel in the project definition phase and design process.
	Solicit input and identification of issues as early as possible.
35.2	**Develop a deliverables matrix for multi-party alignment.**
	Set matrix development as a milestone for the initial phase of project.

	Consider employing a "Responsible, Accountable, Consulted, Informed" (RACI) matrix as a means to define the varied roles in completing tasks in a business process.
	Allow only one primary responsibility for each deliverable on a responsibility assignment matrix or RACI chart.
35.3	**Employ the CII PDRI adapted for use in a flash track setting.**
	Set expectations at the beginning of the project.
	Use a PDRI facilitator who is experienced with flash track projects.
35.4	**Establish decision-making processes tailored to flash track applications**
	Implement set-based design concepts, e.g., Lean Development principles.
	Consider the set-based design approach where a family (or set) of design proposals are pursued in parallel.
	Conduct training to teach “Choosing By Advantages" or other consensus decision-making techniques to the project team.

36	**Identify and procuring long lead items (Tier I).**
36.1	**Align the procurement team with the other project players (early engagement of procurement personnel into the project team) on the overall flash track approach.**
	Engage procurement input in FEP-1, if possible, but no later than FEP-2.
	Build a procurement team with flash track experience.
	Empower key site personnel to make procurement decisions, as required. Limit authorized site buyers to one or two individuals who make purchases within a price ceiling, in consultation with or immediate communication afterward with the home office.
36.2	**Use early, incremental, or phased funding releases to suppliers.**
	Align owner, contractor, and supplier in a jointly defined procurement path, on the basis of incremental release and payments, including advance purchases for subsequent assignment to the EPC contractor, as needed.
	Include a firm deliverables expectations within the purchase order.
	Select suppliers with existing relationships who have a reputation for excellent work.
	Recognize that lead times can entail development of shop drawings, fabrication backlogs, and delivery schedules.
36.3	**Consider alternatives to owner’s specifications for equipment or material, to accelerate delivery.**
	Complete a technical assessment of alternatives if the proposed alternative will meet the owner's performance requirements.
	Recognize that alternative equipment and/or material may involve a trade-off on the long-term performance.
36.4	**Propose alternative suppliers to deliver items faster than owner’s approved suppliers.**
	Provide owner’s terms and conditions and other requirements that may be unknown to suppliers and thus affect rapid fabrication and delivery.
	Present commercial terms and qualifications to the owner for consideration.
36.5	**Develop both sole-supplier and preferred-supplier relationships.**
	Identify preferred suppliers for common items or commodities (e.g., steel and standard instruments). Identify sole suppliers for unique or proprietary items.
	Formulate contractual language to allow pricing movement on the basis of pre-agreed terms. Identify shop space priority terms to do the following: 1) move to the front of the line, and 2) commit to future date reservation.
	Work with suppliers to ensure shop space. Options for priority work include premium payments for either reserved space on specified dates or the ability to move to the front of the line as soon as work is ready.

37	Monitor and driving corrective actions through the project controls process.
37.1	**Drive reporting to be results-oriented; develop metrics and set benchmarks.**
	Project controls tools should be chosen for use only if they are purposeful and needed for flash track.
	Use pull scheduling practices.
37.2	**Set the expectation of outside-the-box thinking and challenge unsupported assumptions.**
	Make management accessible without barriers, to promote upward communication and decision-making in the process.
	Develop forward-looking indicators that everyone is using.
	Adapt the schedule to current project needs rather than driving to pre-defined milestones.
37.3	**Ensure that the planning team has the skillset required to identify schedule slippage and quickly develop an early recovery plan.**
	Ensure that responsible project controls personnel engage and inform key stakeholder on all logic ties and dependencies.
	Develop and continuously generate visible controls.

38	Provide enough resources for critical path items (Tier I).
38.1	**Manage, prioritize, and provide sufficient resources to critical path items.**
	Recognize that having adequate resources to optimize the critical path will result in less than optimal utilization of resources.
	Facilitate interactive planning sessions for key stakeholders to improve understanding and agreement on interdependencies between various disciplines.
38.2	**Employ a flash track decision-making process, to empower the project team, focus decisions on construction priorities, and actively engage the owner.**
	Address potential organizational resistance through examples of successes and lessons learned from comparable projects.
	Make provisions to assure that key decision-makers are available when key decisions are needed.
38.3	**Employ alternative scheduling techniques and decision-making practices.**
	Consider using the critical chain methodology to reduce overall duration, by consolidating the schedule buffer across multiple activities rather than including the buffer within each activity.
	Consider “Agile” scheduling practices, short-term look-ahead schedules, and "sprints," which break down three-to-four weeks of work into more manageable packages.
	Consider dynamic scheduling, with probabilities assigned to both upstream (reliability) and downstream (sensitivity) risks.
	Consider employing 4D (3D + time [work/space planning]) and 5D (4D + cost [cost and resources]) as an integrated planning tool.
	Consider employing “choosing by advantage,” set-based design, and other consensus decision-making processes.
	Recognize that people have a much higher level of commitment if they are involved in the decision-making process.
38.4	**Heighten focus on personnel and funding resources.**
	Dedicate full-time personnel to the project, as needed.
	Ensure organizational support in providing the best personnel resources suited for flash track efforts.
	Recognize the importance of providing sufficient early funding and timely processing of changes.
	Anticipate increased front-end expenditures.
38.5	**Employ technologies in project development and early design phases to investigate**

	alternatives more fully.
	Consider laser-scanning at existing facilities to map as-built conditions precisely.
	Invest in higher levels of subsurface utility engineering (SUE) to map existing utilities more accurately, as needed.
	Investigate modularization alternatives from the outset of the project.
	Employ 3-D, 4-D, and 5-D modeling as work space planning tools.

39	**Consider speed of fabrication and construction during the selection of design alternatives (Tier I).**
39.1	**Involve contractors and fabricators at the beginning of the project.**
	Consider constructability as part of the scope development (FEP-2).
	Limit design approaches to proven technology or supplier-provided license technology. Use standardized equipment and assemblies whenever possible.
	Create a robust process to explore viable alternatives.
	Consider performing unit price bid evaluation for early commitments.
	Consider using laser technologies (LiDar and other methods) to scan as-built conditions, subsurface utility engineering (SUE) to document existing conditions and similar practices more accurately.
	Use subcontractors and vendors with good standing relationships. Consider paying a stipend or fee for preconstruction services.
39.2	**Create full models for design alternatives, i.e., procurement, construction, O&M, and risks associated with alternatives.**
	Obtain commitment from all parties to develop such alternatives.
	Provide enough time and funding to support development of multiple solutions.
39.3	**Leverage pre-fabrication and modularization by using existing designs and prefabrication elements.**
	Adopt a "concurrent engineering" philosophy to bring key downstream stakeholders on board early.
	Use 3-D modeling to anticipate interface issues.
	Employ multiple design teams for design modules under a single integrator.
	Recognize the challenges and potential for rework in the event that interfaces had not been well-planned and thoroughly checked.
39.4	**Ensure sufficient engineering support for speed of fabrication (e.g., 24-hour engineering).**
	Consider using design firms with well-established 24-hour design services.
	Consider creating multi-shift decision-making teams with appropriate overlap.
	Recognize the risk of 24-hour engineering and mitigate the inherent risk of designing in multiple time zones and/or location.

40	**Recognize and managing the additional flash track risks (Tier I).**
40.1	**Mitigate commonly incurred risks in concept, development, and definition phases**
	Risk of not having an adequate project understanding and being unable to define a clear business objective.
	Risk of inadequate funding to support essential early efforts.
	Risk of not engaging appropriately skilled and objective key essential stakeholders.
	Risk of not reaching a clear consensus in a timely manner (e.g., evolving requirements or scope creep).
	Risk of not having an adequate project understanding and being unable to define a clear business objective.
	Risk of poor schedule and cost estimates being used as the basis for investment decision.
	Risk of incomplete understanding of regulatory or other third party expectations.

40.2	**Mitigate commonly incurred risks in design phase**
	Risk of inadequate engagement with facility users and construction forces in the design process.
	Risk of higher costs due to conservative and/or sub-optimum designs.
	Risk of employing unproven innovative designs.
	Risk of insufficient or vague performance requirements.
	Risk of the inability to extend performance requirements to the balance of plant.
	Risk of incompatibility between different providers' systems.
	Risk of inadequately coordinating parallel design teams, and of failing to recognize interface requirements.
	Risk of interdisciplinary design conflicts due to concurrent and out-of-sequence design efforts.
	Risks of cost and schedule impact due to design recycling and/or a disruptive value engineering process.
	Risk of not securing all regulatory approvals.
	Risk of incompatible BIM platforms.
40.3	**Mitigate commonly incurred risks in the procurement phase.**
	Risks of contract and/or procurement practices being incompatible with flash track objectives.
	Risk of insufficient resources and/or funding to meet peak demands of the flash track schedule.
	Risk of late deliveries and/or lead times exceeding schedule requirements.
	Risks of increased expenditures for expedited procurements (e.g., reserved shop time, air freighting, and cancellation fees).
	Risk due to lack of experience in relational contracting (i.e., failure to develop mutual trust).
	Risk of errors or omissions in purchase of materials or equipment (e.g., failure to meet specification requirements, inadequate documentation, and faulty estimates).
	Risk of higher costs or additional bid contingencies for inappropriate risk assignments and/or unknown elements where there is no firm scope.
	Risks of higher costs for limited completion due to pre-qualifications, sole- or single-sourcing, and/or conducting work under existing master service agreement or reimbursable contracts.
40.4	**Mitigate commonly incurred risks in the construction phase**
	Risk of faulty contractor selection from the perspective of resource capacity, skills, finance, or culture.
	Risk of changes to completed work.
	Risks of construction rework.
	Risk of increased change orders due to changing conditions or requirements.
	Risk of reduced efficiencies due to increased staffing, overtime, congested work areas and/or inadequate work flow planning.
	Risk of compromising safety, health or environment standards to achieve the schedule.
40.5	**Mitigate commonly incurred risks during commissioning**
	Risk of failing to meet performance requirements, inadequate documentation, and other requirements.
	Risk of lack of commissioning resource availability (e.g., vendor specialists and test equipment).
40.6	**Mitigate commonly incurred risks of poorly formed project teams.**
	Risk of poor leadership.
	Risks of failing to establish trust and cooperation within the project team and the supply

	chain.
	Risk of limited personnel resources, inadequate staffing, and/or non-dedicated resources.
	Risk of lack of continuity of key players and/or decision makers.
	Risk of organizational resistance to change.
40.7	**Mitigate commonly incurred risks due to inequitable risk-shifting contract provisions.**
	Incorporate measures to mitigate the most significant flash track risks such as the following: 1) cost overruns and inaccurate cost estimating; 2) design errors and omissions; 3) delay damages; 4) numerous change orders; 5) construction rework and modifications; and 6) overlooked work (assigned to no party).
	Explore shared risks or a risk pool.
	Assign risk to the party who can best control it or who benefits most from a favorable outcome.
	Assign risk to the owner, when no other party can bear the risk or control the cost.
	Focus the team's attention on reducing over-all risk, rather than on attempting to transfer risks to some other entity.

Execution Considerations

41	**Co-locate the project team (i.e., owner, designer, builder, and/or key vendors).**
41.1	**Promote the benefits of face-to-face interaction.**
	Conduct frequent informal meetings and frequent effective project status meetings.
	Establish knowledgeable points of contact.
	Pair senior and junior staff (mentorship programs).
41.2	**Continually drive team-shared values and a focus on the customer.**
	Ensure that the key decision makers are site based/co-located.
	Ensure sufficient direction and motivation: 1) understand the value of each member, 2) address stress and fears, and 3) encourage creativity.
	Establish adequate support services, both technical and administrative.
	Monitor soft-side issues, in addition to process outcomes, barriers, information updates, and risk management.
	Recognize that the integrated design process demands the inclusive participation of key team members.
	Assign seasoned/coaching project managers.
41.3	**Prioritize communications.**
	Prioritize and promote effective, efficient information flow.
	Conduct frequent, short, and well-managed meetings.

42	**Simplify approval procedures (Tier I).**
42.1	**Simplify procurement and commercial aspects of the project.**
	Engage prequalified contractors and suppliers.
	Engage alliance contractors through master service agreements or comparable measures.
	Streamline pre-qualifications and competitive bid processes.
	Streamline the contract change approval process.
42.2	**Release funds as required to support optimal project execution.**
	Review project status with executive sponsors as required.
	Establish expectation as part of client gate process at project inception.
42.3	**Delegate authority to the project team.**
	Establish authority responsibilities and limits at project inception.
	Delegate authority at the project level to minimize decision delays.

42.4	**Engage permitting agencies early.**
	Limit project's footprint to limit the level of effort and submission requirements (e.g., to permitting agencies).
	Secure approval from permitting agencies well in advance of anticipated start dates.
	Engage regulatory agencies early to coordinate inspection roles and responsibilities.
42.5	**Establish a process to expedite approvals.**
	Establish a process to expedite approval as part of the project charter.
	Leverage the electronic communication system to streamline approvals.
	Exploit the benefit of co-location to expedite the approval process.
	Recognize the importance of simplifying approval procedures.
42.6	**Commit to flash track by the end of FEP-1 (Business Planning).**
	Establish commitment to flash track as part of the project charter.
	Define the key success factors that will enable optimal work flow.

43	**Dedicate full-time personnel to the project (Tier I).**
43.1	**Develop increased "bench strength." Create organizational capacities available to facilitate assignment of best resources.**
	Develop a business model supporting the benefits of having reserve capacity to handle flash track demands.
	Engage cross-trained, multi-skilled supervisors and personnel when possible. Engage personnel in work flow look-aheads and limit any engagement on non-project tasks.
43.2	**Create a collaborative decision-making process.**
	Create a formal documented decision-making process, including flow charts and roles/ responsibilities.
	Implement integrated teams to enhance collaborations.
43.3	**Engage key individuals in active roles throughout the project.**
	Involve personnel in decisions throughout all phases of the project.
	Employ individuals with skills in multiple facets of the project.

44	**Select appropriate construction methods (Tier I).**
44.1	**Perform extensive critical path analysis, constructability analysis, and coordination of concurrent activities.**
	Conduct an aggressive, time-focused constructability, and safety analysis.
	Establish clear priorities associated with construction method decisions: 1) safety; 2) schedule; 3) cost.
	Make program development decisions in FEP-2.
44.2	**Develop a 4-D animation showing how the project will be constructed, including craft mobilizations, staging areas, safety measures, rigging, modularized elements, and other pertinent constructability concerns.**
	Use historical information from previous projects to model equipment and components.
	Engage senior construction personnel with significant expertise in the process.
	Conduct multiple coordination meetings and reviews of the animation during development.
	Conduct detailed animation development meetings by phase and discipline with subject matter experts (e.g., civil, rigging/cranes, structural, and mechanical).
	Freeze the site layout drawing prior to finalizing the animation.
	Identify any assumptions made in regard to equipment sizing and delivery schedules.
44.3	**Perform a construction method analysis with a safety focus.**
	Ensure that senior management facilitates the proper balance between safety and schedule.

	Use drawings, 3D models, and pictures from previous projects to facilitate discussion.
	Ensure that the safety team performs daily reviews of constructability plan.
44.4	**Implement a flash track inspection plan.**
	Hold constructability meetings early in the detail design process to agree upon best constructability methods.
	Consider increased frequencies of shop inspections for critical equipment and prefabricated assemblies.
	Establish standard connection details and guidelines to facilitate construction and field changes.
	Employ full-scale mock-ups of pre-assemblies, as needed.
	Implement a phased systems turnover to allow incremental commissioning testing.

45	**Minimize handoffs.**
45.1	**Use one firm in the design-build mode for single-point accountability.**
	Employ a robust pre-qualification program and selection process. Select a contractor with a proven track record.
	Assign selected specialty contractors to the prime contractor, requiring alignment meetings between parties.
	Create one fully integrated team with the owner and the design-build contractor.
	Limit the number of subcontractors to simplify coordination matters.
45.2	**Assign an overarching Project Manager to manage the work from development through startup.**
	Appoint a strong project leader who is both task- and relationship-oriented, who can see the full picture and is fully sensitive to flash track needs.
	Streamline communication to integrate and align all key stakeholders fully and seamlessly.
	Eliminate duplicate efforts through consolidation of shared services, such as document control, IT, and other functions.
	Develop a consolidated project controls team, providing objective cost estimates and project status, and prioritizing work flow.
45.3	**Employ a turnkey execution strategy.**
	Accept increased costs in exchange for speed of delivery. Consider open book estimate (OBE) and subsequent conversion to lump sum pricing after quantities, pricing, and labor availability are known.
	Negotiate with one supplier on an open book, lump sum basis, agreeing on mark-ups, productivity, and contingency levels prior to contract award.
	Pay for a bid-check estimate from a third party to ensure reasonable pricing.
	Negotiate with a trusted supplier that has delivered a high-quality project at a competitive price.
	Limit the approach to proven technology or supplier-provided license technology.
	Proceed on a reimbursable contract basis with the intent to achieve a lump sum contract. Have reasonable reimbursable terms with a fixed fee contingency in the event that agreement on a lump sum price cannot be reached.
45.4	**Ensure early participation of key project participants. Form a core project management team with representatives from different companies or teams.**
	Conduct alignment sessions and team-building activities. Select team members with similar organizational culture and values or past working relationships.
45.5	**Staff with multi-skilled personnel.**
	Engage cross-trained, multi-skilled supervisors and personnel whenever possible.

46	Employ innovative construction methods.
46.1	**Engage specialized contractors to provide input to designers and others on the project team.**
	Consider modularization and offsite fabrication opportunities.
	Identify early opportunities for specialized contractors.
	Use the best talent available in the organization early.
46.2	**Consider breaking large projects in multiple sub-projects.**
	Use a senior team to coordinate efforts of sub-teams.
46.3	**Incentivize early construction completion ideas.**
	Implement a structured incentive program that provides the desired results.

47	Conduct frequent and effective project review meetings.
47.1	**Encourage active participation in project meetings.**
	Establish a review matrix and milestone criteria at the beginning of the project.
	Establish and continually reinforce key team cultural standards, such as having shared goals, valuing all ideas, having a no-blame culture.
47.2	**Use visual communication media (e.g., Kanban boards, smart boards, and decision diagrams).**
	Set project expectations for new and innovative communication methods at project inception.
47.3	**Support continuous information flow.**
	Distribute information in advance of scheduled team meetings.
	Eliminate status only reviews ("report outs").
	Ensure that information is truly relevant/important.

APPENDIX S

Validation Questionnaire

Prior to finalizing the Flash Track tool, an external validation process was undertaken. RT 311 industry members sought out 13 candidate projects considered to have been Flash Track efforts. The validation process entailed the completion of a structured questionnaire and a retrospective completion of the Flash Track tool. The validation questionnaire included numerical rating questions and open-ended questions about the tool. The validation questionnaire is shown on the following pages.

RT311: External Validation

Question packet for external validation of the tool

Reason for Flash Track? ______________________________

Team Member ______________________________

Please complete and return by February 28, 2015

Part I:

Instructions:

This first set of questions should be answered **as if the project had not yet begun**. Please think back to the early stages of the project and answer the following questions regarding the readiness to undertake this project on a Flash-Track basis. Try not to consider what was learned after the project began. Please use the definition table below to help guide your responses to each question. Please circle the number that best represents your answer to each question.

Definitions of Issue Scores	
Score	Meaning
0,1	Unprepared
2,3	Somewhat Unprepared
4,5,6	Neutral
7,8,9	Somewhat Prepared
10	Very Prepared

Questions:

1. On a scale of 0-10, **Overall,** how ready did you think you were to undertake this project on a Flash-Track basis?

   0 1 2 3 4 5 6 7 8 9 10

2. On a scale of 0-10, how prepared were you with respect to **Contractual** considerations?

   0 1 2 3 4 5 6 7 8 9 10

3. On a scale of 0-10, how prepared were you with respect to **Project Delivery** considerations?

   0 1 2 3 4 5 6 7 8 9 10

4. On a scale of 0-10, how prepared were you with respect to **Organizational** considerations?

   0 1 2 3 4 5 6 7 8 9 10

5. On a scale of 0-10, how prepared were you with respect to **Cultural** considerations?

   0 1 2 3 4 5 6 7 8 9 10

6. On a scale of 0-10, how prepared were you with respect to **Planning** considerations?

   0 1 2 3 4 5 6 7 8 9 10

7. On a scale of 0-10, how prepared were you with respect to **Execution** considerations?

0 1 2 3 4 5 6 7 8 9 10

Part II:

Instructions:

This set of questions should be answered **based on the project as it was experienced**. Please think back to the end of the project and answer the following questions regarding the readiness to undertake this project on a Flash-Track basis. Try to consider what was learned after the project began. Please use the definition table below to help guide your responses to each question. Please circle the number that best represents your answer to each question.

Definitions of Issue Scores	
Score	Meaning
0,1	Unprepared
2,3	Somewhat Unprepared
4,5,6	Neutral
7,8,9	Somewhat Prepared
10	Very Prepared

Questions:

1. On a scale of 0-10, **Overall**, based on lessons learned, how ready were you to undertake this project on a Flash-Track basis?

0 1 2 3 4 5 6 7 8 9 10

2. On a scale of 0-10, how prepared were you with respect to **Contractual** considerations?

0 1 2 3 4 5 6 7 8 9 10

3. On a scale of 0-10, how prepared were you with respect to **Project Delivery** considerations?

0 1 2 3 4 5 6 7 8 9 10

4. On a scale of 0-10, how prepared were you with respect to **Organizational** considerations?

0 1 2 3 4 5 6 7 8 9 10

5. On a scale of 0-10, how prepared were you with respect to **Cultural** considerations?

   0 1 2 3 4 5 6 7 8 9 10

6. On a scale of 0-10, how prepared were you with respect to **Planning** considerations?

   0 1 2 3 4 5 6 7 8 9 10

7. On a scale of 0-10, how prepared were you with respect to **Execution** considerations?

   0 1 2 3 4 5 6 7 8 9 10

Part III:

Instructions:

This set of questions should be answered **based on the project as it was experienced**. Please answer each question to describe what kinds of issues were experienced in each category. Please focus on the type of issues rather than on the specific problems or challenges encountered.

Questions:

1. What are some issues the project experienced related to **Contractual** considerations?

2. What are some issues the project experienced related to **Project Delivery** considerations?

3. What are some issues the project experienced related to **Organizational** considerations?

4. What are some issues the project experienced related to **Cultural** considerations?

5. What are some issues the project experienced related to **Planning** considerations?

6. What are some issues the project experienced related to **Execution** considerations?

7. On a scale of 0-10, **Overall**, how successful was this project?

0 1 2 3 4 5 6 7 8 9 10

Part IV:

Instructions:

Please complete the Tool to provide readiness scores for each of the following 47 practices in the 6 categories. This set of questions should be answered **based on the project as it was experienced**.

Part V:

Instructions:

Please consider the mitigating gaps and strategies provided by the Report function in the tool and answer the following questions **based on the project as it was experienced**. For the first four questions please select a response from this list:

1) strongly disagree
2) disagree
3) agree
4) strongly agree

Questions:

1. The output and results provided in the tool would help you overcome the challenges you encountered?

2. The practices presented in the tool describe the kinds of practices you encountered in executing the project?

3. The practices presented in the tool are important considerations for the success of projects being undertaken on a Flash-Track basis?

4. Having prior knowledge of the practices presented in the tool would have helped prevent situations you have experienced on site?

5. Are there issues that your project team considered that were not discussed in the tool? Please list them.

6. On a scale of 0-10, **Overall,** how easy was it to use the Tool?

0 1 2 3 4 5 6 7 8 9 10

7. Do you have any suggestions for the improvement of the Tool?

APPENDIX T

Validation Survey Results

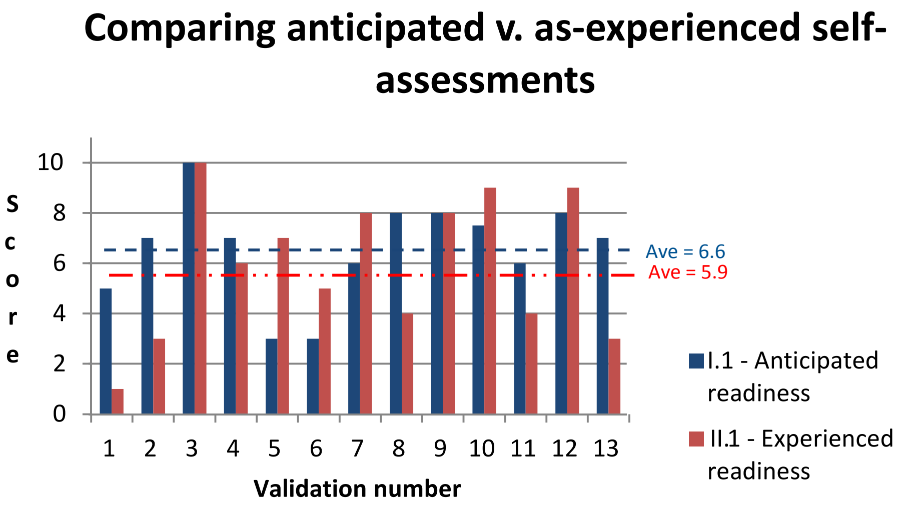
The retrospective validation questionnaire included a number of questions for which validators provided numeric scores and responses to open ended questions, including:

- Parts I & II - Pre- and post-project readiness assessments
- Part III – Project issues encountered and assessment of projects overall success
- Part IV – Tool exercise and comparison of Tool's scoring; and
- Part V – Rating the Tool.

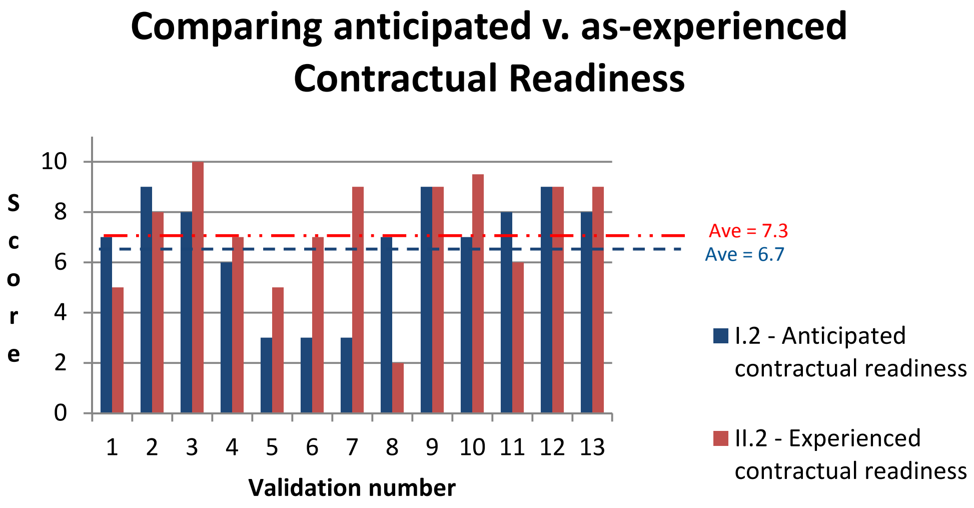
The following pages illustrate the scores and commentaries provided.

1. Parts I & II - Pre- and post-project assessments

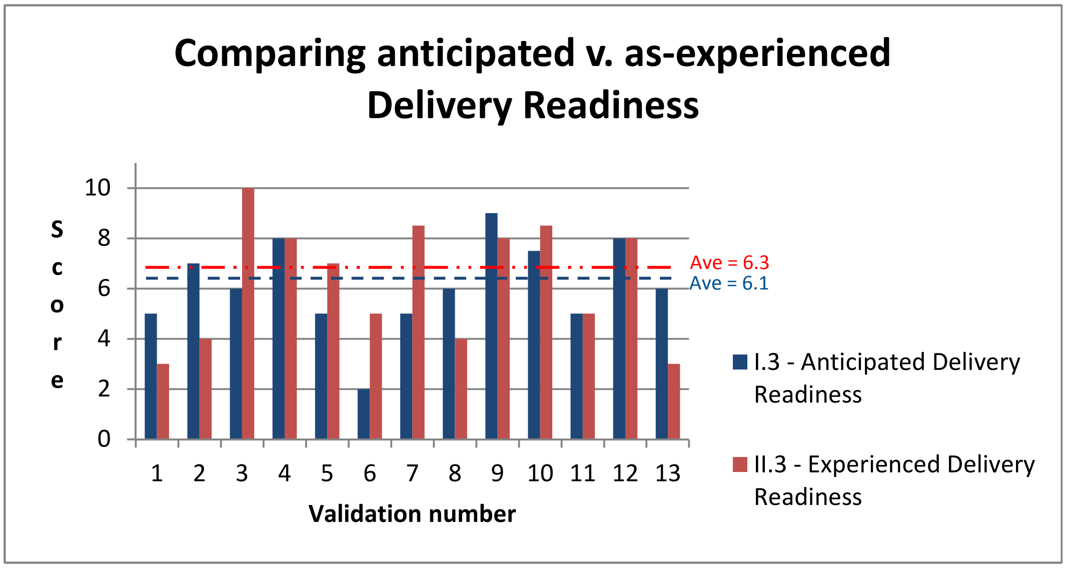
On a scale of 0-10, **Overall**, based on lessons learned, how ready did you think you were (were you) to undertake this project on a Flash-Track basis



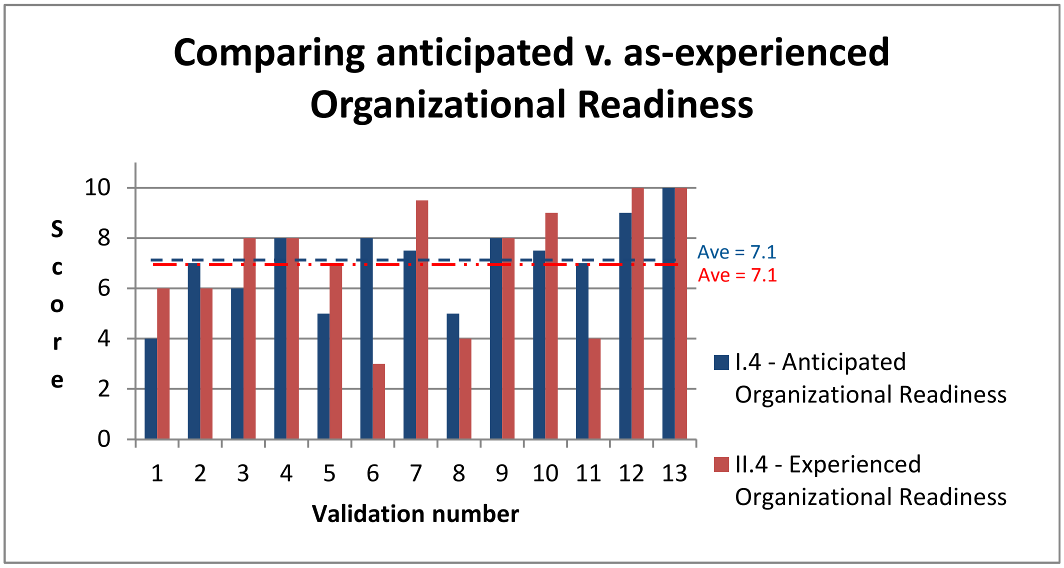
2. On a scale of 0-10, how prepared did you think you were (were you) with respect to **Contractual** considerations?



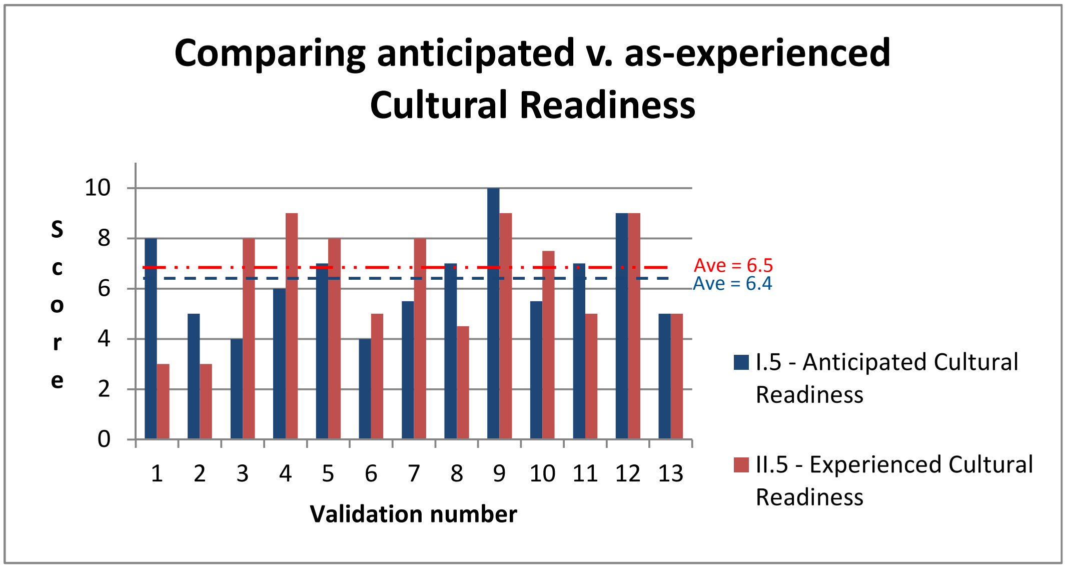
3. On a scale of 0-10, how prepared were you with respect to **Project Delivery** considerations?



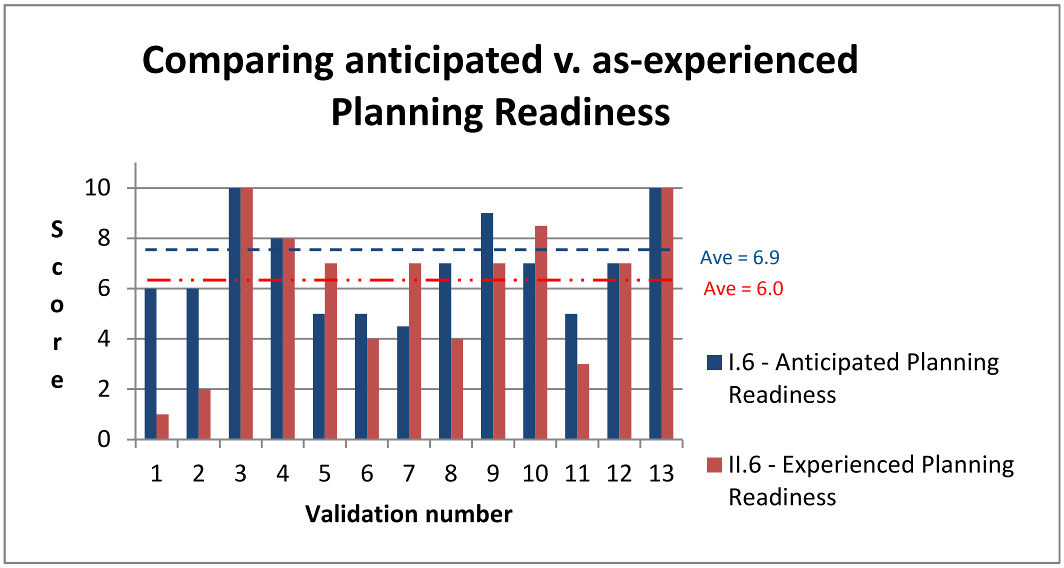
4. On a scale of 0-10, how prepared were you with respect to **Organizational** considerations?



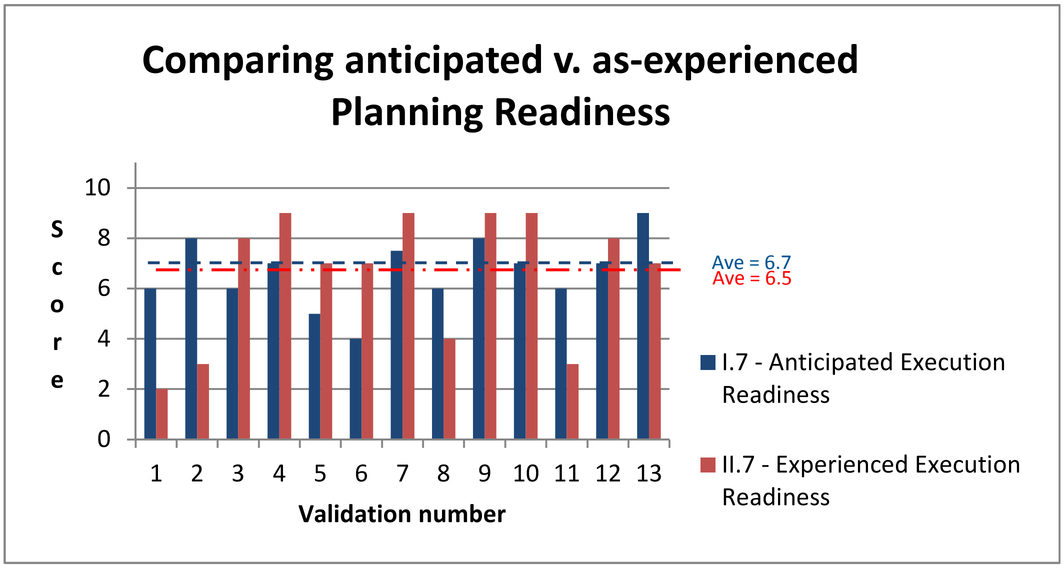
5. On a scale of 0-10, how prepared were you with respect to **Cultural** considerations?



6. On a scale of 0-10, how prepared were you with respect to **Planning** considerations?



7. On a scale of 0-10, how prepared were you with respect to **Execution** considerations?

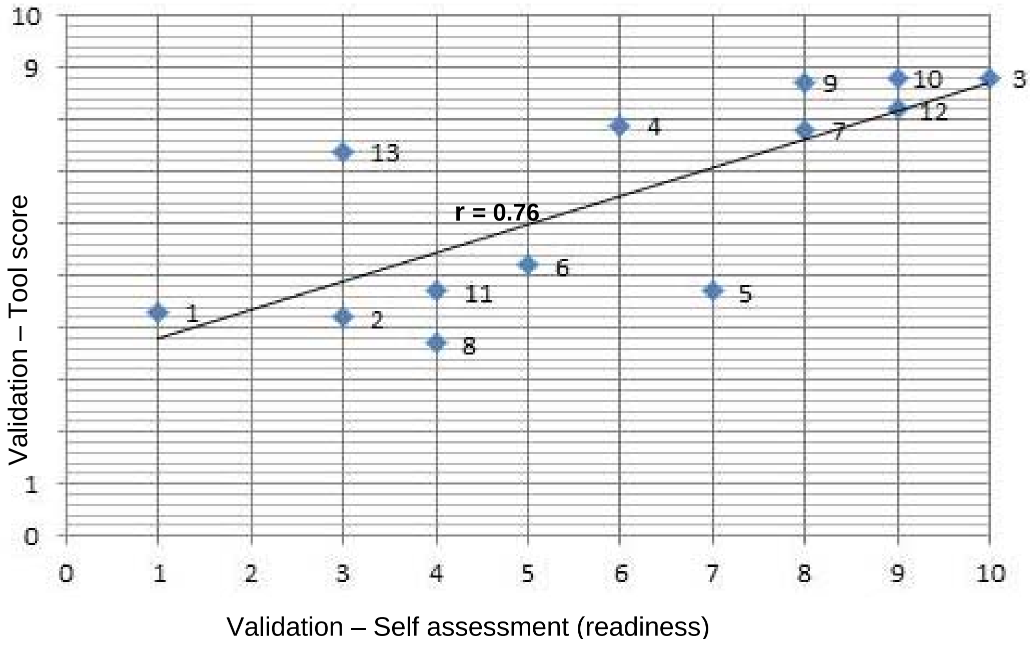


Comparison of user retrospective self-assessment of readiness (Part II, Question 2) to Category Tool score (Part IV)

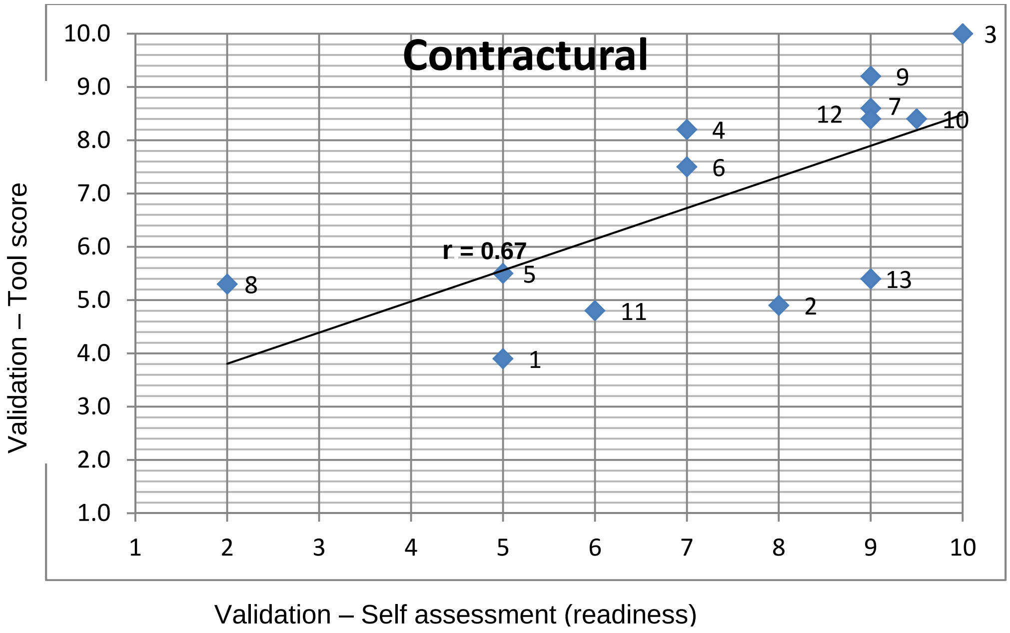
r – Pearson correlation coefficient

◆ - Retrospective validation project (1-13)

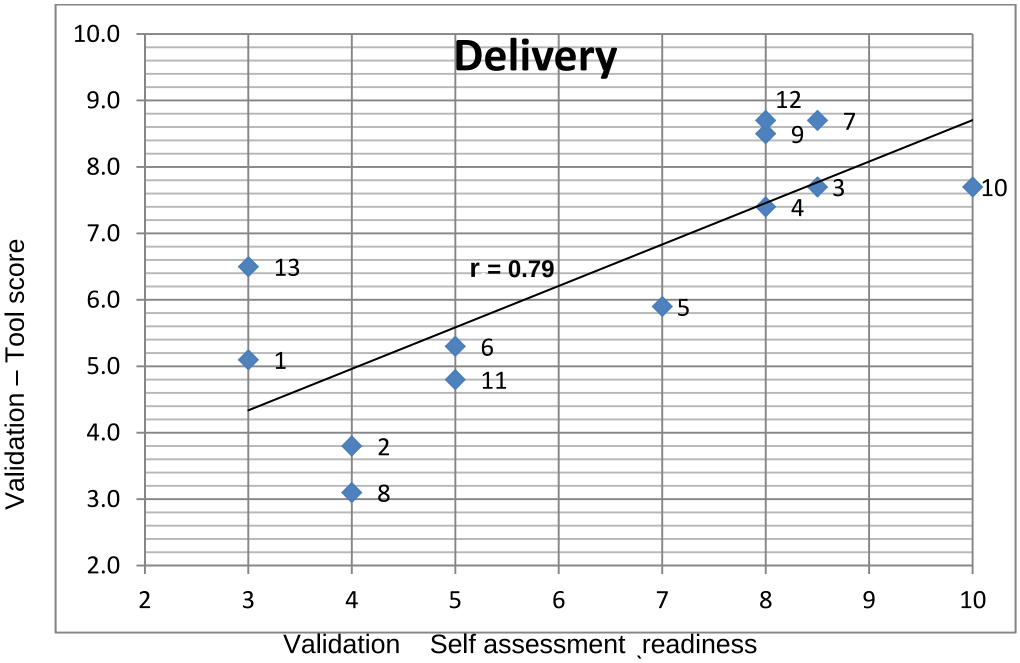
On a scale of 1-10, based on lessons learned, how ready were you with respect to **Overall** considerations?



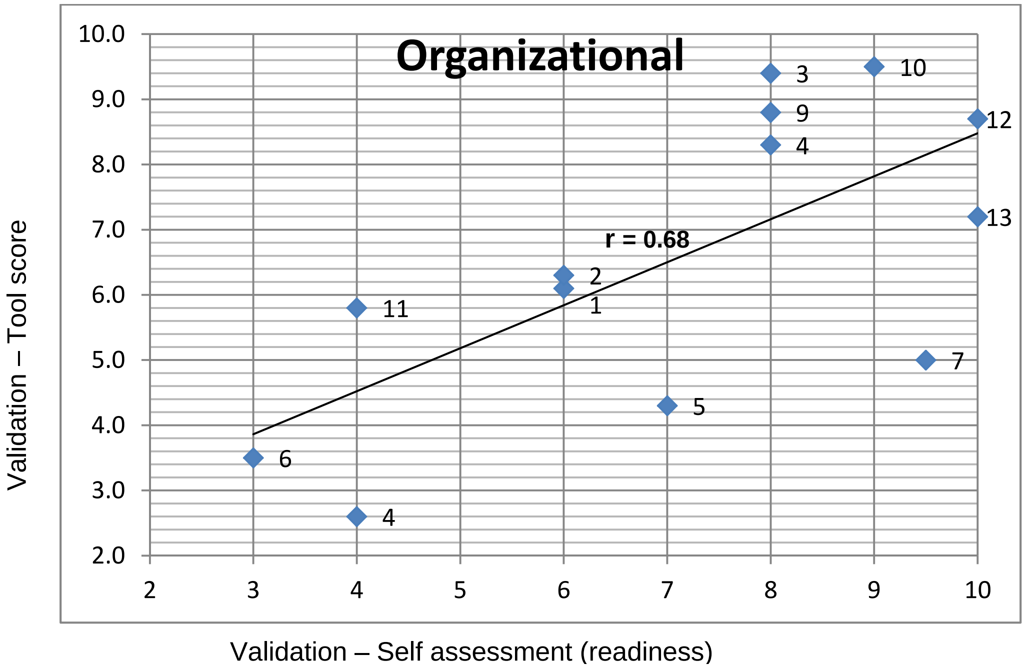
On a scale of 1-10, based on lessons learned how ready were you with respect to **Contractual** considerations?



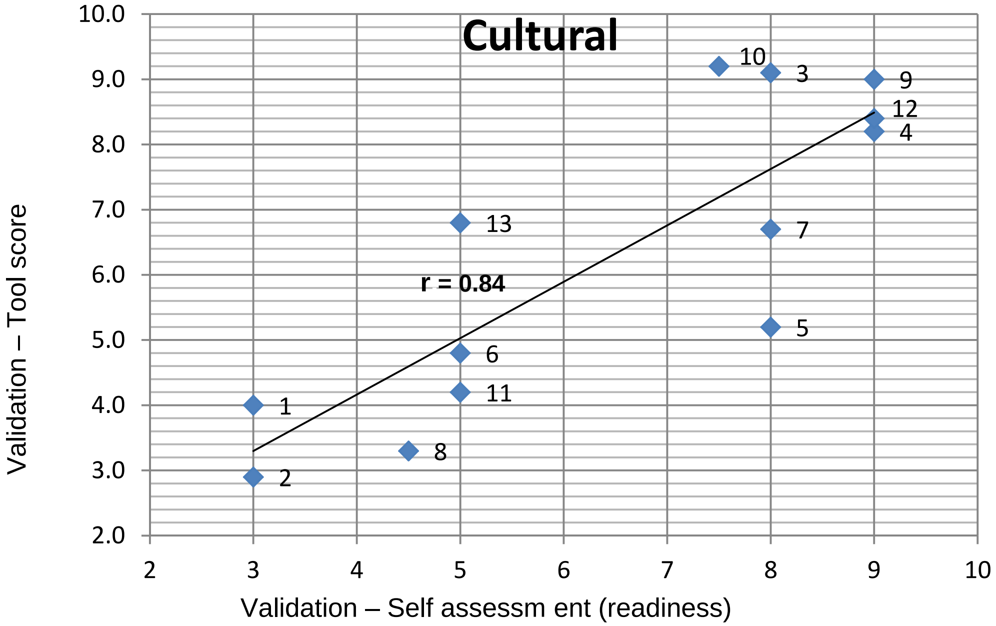
On a scale of 1-10, based on lessons learned, how ready were you with respect to **Delivery** considerations?



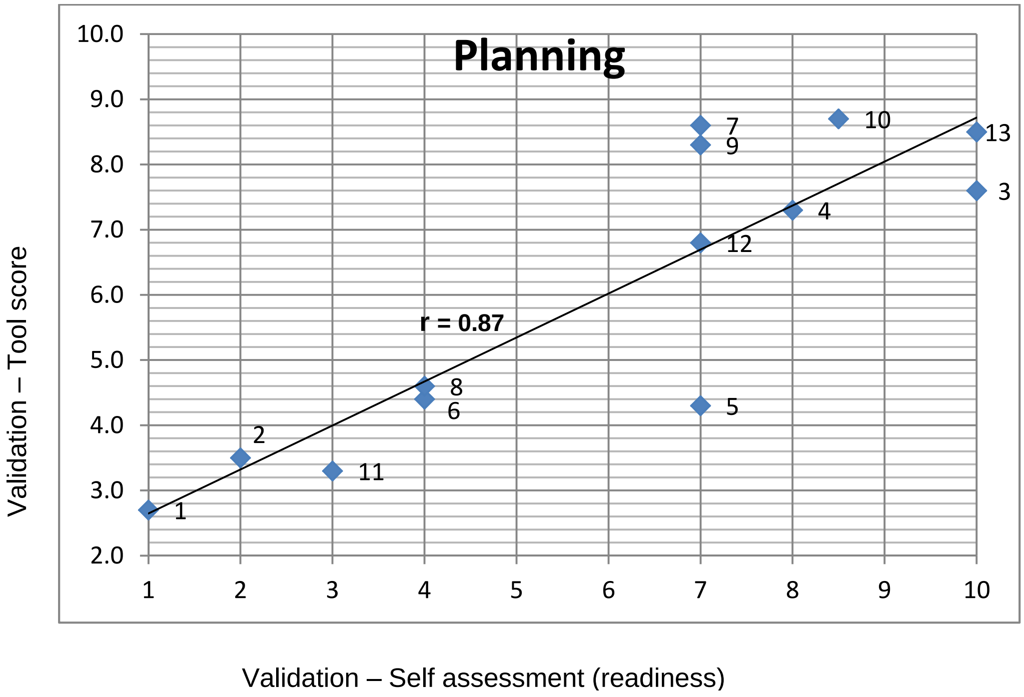
On a scale of 1-10, based on lessons learned, hove ready were you with respect to **Organizational** considerations?



On a scale of 1-10, based on lessons learned, hove ready were you with respect to **Cultural** considerations?



On a scale of 1-10, based on lessons learned, hove ready were you with respect to **Planning** considerations?



On a scale of 1-10, based on lessons learned, hove ready were you with respect to **Execution** considerations?

Matching RT 311 practices to the kinds of issues experienced in each category
Validation Questionnaire, Part III, Questions 1-6

1) What are some issues the project experienced related to Contractual considerations?

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
1, Contractual	Inability to meet stated performance and schedule guarantees	15. Involving contractors; trades and vendors in the design phase 11. Making timely selection and award contracts to subcontractors 17. Engagement of operations & maintenance personnel in the development and design process 35. Performing exhaustive front end planning 37. Monitoring and driving corrective actions through the project controls process 44. Selecting appropriate construction methods
1, Contractual	Implementer changed design aspects of original project layout approach based on poor front end planning	35. Performing exhaustive front end planning 7. Funding early critical efforts 15. Involving contractors; trades and vendors in the design phase
1, Contractual	Performance Bond not established in haste of proceeding with work	4. Establishing contract strategies specifically tailored to the project condition 35. Performing exhaustive front end planning 40. Recognizing and managing the additional fast track risks
1, Contractual	Lack of depth in implementer organization not recognized prior to contract execution	15. Involving contractors; trades and vendors in the design phase 9. Selecting team members and staff based on their fast track experience or qualifications See implementation measures with regard to engaging proven contractors (#2, 11, etc...)
1, Contractual	Schedule incentives/penalties were not balanced adequately to drive schedule performance	4. Establishing contract strategies specifically tailored to the project condition 8. Reducing risks through collective efforts of all stakeholders
1, Contractual	Subcontracts under prime not aligned on safety reporting requirements	3. Aligning project participants' interests through contract 4. Establishing contract strategies specifically tailored to the project condition 33. Creating executive alignment amongst the contracted parties
1, Contractual	No specific process to resolve change order, disputes on expedited basis	5. Establishing clear change management procedures 6. Establishing an effective claims resolution process
1, Contractual	Highly leveraged existing global service agreements with process control vendors - Why was this important? Removed any question with regard to pricing for parts, services, and any issues with procurement that might implicate an audit sensitivity	4. Establishing contract strategies specifically tailored to the project condition 11. Making timely selection and award contracts to subcontractors

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
1, Contractual	Contractors and subcontractors working directly with owner; needed to ensure no double billing (pace did not allow time for deep investigation) - Headquarter based audit teams were brought in to perform investigation	30. Having open communication and transparency 45. Minimizing hand-offs 3. Aligning project participants' interests through contract
1, Contractual	Setting clear expectation and timelines with vendor services and procurement contacts - Invited in presidents and vice presidents of each vendor company to sit with site management to share how they were prepared to put their full effort to support the project - Had owner presidents contact vendor presidents to personally thank them for supporting the project (personal phone calls, etc.)	1. Setting clear; specific scoping requirements 33. Creating executive alignment amongst the contracted parties 20. Delegating authority to project level (maximize decision-making authority to the project level) 28. Establishing flexible project teams that avoid rigid hierarchy 10. Focusing procurement decisions on construction priorities 11. Making timely selection and award contracts to subcontractors
1, Contractual	Large fast-track project require a dedicated CMT (contract management team)	4. Establishing contract strategies specifically tailored to the project condition 10. Focusing procurement decisions on construction priorities 43. Dedicating full-time personnel to the project
1, Contractual	Management of Warranty not defined	40. Recognizing and managing the additional fast track risks 8. Reducing risks through collective efforts of all stakeholders
1, Contractual	EPCM contract with our Company holding paper on pre-purchased equipment and construction contracts. Client viewed us as General Contractor performing design-build.	22. Having an owner with sufficient depth of resources and strength of organization 26. Accepting a new paradigm or mindset differing from that of traditional practices
1, Contractual	a. Construction scope split between 2 major General Contractors: i. XXXX- Underground Mechanical, Civil and Rail. ii. Another Contractor-Above Ground, Structural, Mechanical, Electrical	45. Minimizing hand-offs 3. Aligning project participants' interests through contract 34. Emphasizing coordination planning during the design process 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
1, Contractual	b. This resulted in significant work coordination issues.	See above
1, Contractual	c. Other 1, Contractual considerations were not thought to be significant factors in poor flash track performance.	See above
1, Contractual	Working with Specialty Contractors that were contracted separately to client proved to be difficult	3. Aligning project participants' interests through contract 45. Minimizing hand-offs
1, Contractual	We served as the site managing contractor but some of the other contractors had no 1, Contractual relationship, which caused issues to be difficult to	3. Aligning project participants' interests through contract 45. Minimizing hand-offs
1, Contractual	Project had a unique tax abatement requirement that required a considerable amount of work with local suppliers/vendors who we were unfamiliar with and they were not familiar with our company.	4. Establishing contract strategies specifically tailored to the project condition 40. Recognizing and managing the additional fast track risks

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
1, Contractual	Unresponsive purchasing team.	10. Focusing procurement decisions on construction priorities 33. Creating executive alignment amongst the contracted parties 11. Focusing procurement decisions on construction priorities 13. Employing innovative procurement practices
1, Contractual	Delegation of authority wasn't commensurate with flash-track. Very central upper management approvals and excessive procedures governed the speed of contracting.	33. Creating executive alignment amongst the contracted parties 20. Delegating authority to project level (maximize decision-making authority to the project level) 21. Empowering the project team (each organization led by an empowered leader) 28. Establishing flexible project teams that avoid rigid hierarchy 42. Simplifying approval procedures
1, Contractual	A bunch of lawyers involved who established excessive requirements for Confidentiality Disclosure Agreements (CDA's). These requirements unnecessarily delayed the award of essentially all project contracts, even for contractors who wouldn't be closely involved with the new technology being installed. Contractors who wouldn't see the final technology were illogically subject to such CDA's, (i.e.: earth work, asphalt, etc.). These delays quickly compounded into over-crowding the site in order to make up for lost time.	4. Establishing contract strategies specifically tailored to the project condition 28. Establishing flexible project teams that avoid rigid hierarchy 42. Simplifying approval procedures
1, Contractual	In many cases, contract terms were too onerous for the work actually required.	1. Setting clear; specific scoping requirements 2. Establishing performance-based specifications 5. Establishing clear change management procedures 42. Simplifying approval procedures
1, Contractual	Owner had to alleviate concerns of the engineering consultant and contractors that it was acceptable to circumvent standard processes and utilize nonstandard design solutions.	See implementation measures for: 22. Having an owner with sufficient depth of resources and organizational strength 24. Having an engaged and empowered owner's engineer (owner's representative 15. Involving contractors, trades, and vendors in the design phase 18. Establishing a fully integrated project team, including design, construction, specialty contractors, commissioning, and operations personnel (Tier I) 17. Engaging operations and maintenance personnel in the development and design process
1, Contractual	This project was with a long standing partner where both parties understand shared risk and reward. However, Change management procedures were very poorly followed.	5. Establishing clear change management procedures

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
1, Contractual	This project was with a long standing partner where both parties understand shared risk and reward. As a result, there were very few issues. Change management procedures could have been more rigorously followed.	5. Establishing clear change management procedures
1, Contractual	Interpretation of contract terms and moving LD's. This led to early advocate intervention and contract management notification letters which had to be sorted out to prevent on-site delays and re-aligning the sites scheduled activities and deliverables.	4. Establishing contract strategies specifically tailored to the project condition 8. Reducing risks through collective efforts of all stakeholders 40. Recognizing and managing the additional fast track risks 6. Establishing an effective claims resolution process

2) What are some issues the project experienced related to Project Delivery considerations?

2, Delivery	Key team members changed out during execution	See implementation measures for: 40. Recognizing and managing the additional Flash Track risks 9. Selecting team members and staff on the basis of their fast track experience or qualifications
2, Delivery	Work was commenced with-out a master execution plan resulting in certain job aspects conflicting with other installation requirements	7. Funding early critical efforts 12. Staffing with personnel with strong leadership capabilities Issue addressed under #1 Implementation measures
2, Delivery	Constructability reviews not completed during up front planning resulted in numerous field changes	15. Involving contractors; trades and vendors in the design phase 7. Funding early critical efforts
2, Delivery	Constructability reviews not completed with implementing contractors sub-contractors	39. Considering speed of fabrication and construction during the selection of design alternatives 44. Selecting appropriate construction methods
2, Delivery	Design build approach utilized but designer did not involve builder in design review	15. Involving contractors; trades and vendors in the design phase
2, Delivery	Design flaw encountered during construction that required redesign to accommodate construction means and methods	15. Involving contractors; trades and vendors in the design phase 39. Considering speed of fabrication and construction during the selection of design alternatives 44. Selecting appropriate construction methods
2, Delivery	Specialty contractors not utilized, implementer utilized in-house sister organization with limited experience specific to project.	16. Seeking out suppliers and specialty contractors as a source for time saving innovations 22. Having an owner with sufficient depth of resources and strength of organization
2, Delivery	Craft productivity significantly less than plan necessitating crashing schedule with more craft.	34. Emphasizing coordination planning during the design process 15. Involving contractors; trades and vendors in the design phase 39. Considering speed of fabrication and construction during the selection of design alternatives

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
2, Delivery	Exploited contractor procurement process (using owner pricing / agreements) – significant savings on time	10. Focusing procurement decisions on construction priorities 11. Making timely selection and award contracts to subcontractors 4. Establishing contract strategies specifically tailored to the project condition
2, Delivery	Direct contact with the vendor factory floor (frequent visits), twice per day contact with the vendors	37. Monitoring and driving corrective actions through the project controls process 47. Frequent project review meetings
2, Delivery	AFE –Funding Approved Coordination of other dependent projects was in place	7. Funding early critical efforts
2, Delivery	Design execution was not well defined. Localization and completion of design was not coordinated with procurement and construction requirements.	15. Involving contractors; trades and vendors in the design phase 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel 10. Focusing procurement decisions on construction priorities 11. Making timely selection and award contracts to subcontractors
2, Delivery	Client accepted waiving quality assurance and factory testing of pre-purchased equipment, but was relentless during warranty period obtaining specified requirements.	33. Creating executive alignment amongst the contracted parties 22. Having an owner with sufficient depth of resources and strength of organization
2, Delivery	Client accepted installations placed into operation without quality assurance testing and commissioning, but was relentless and unforgiving for systems failures.	33. Creating executive alignment amongst the contracted parties 22. Having an owner with sufficient depth of resources and strength of organization
2, Delivery	Client accepted partial system operation to meet early manufacturing requirements, but was difficult scheduling system installation completion when this impacted operations.	37. Monitoring and driving corrective actions through the project controls process 1. Setting clear, specific scoping requirements
2, Delivery	a. Customer did not realize they were in flash track mode until it was too late.	37. Monitoring and driving corrective actions through the project controls process 1. Setting clear, specific scoping requirements
2, Delivery	b. Customer had poor leadership	12. Staffing with personnel with strong leadership capabilities
2, Delivery	c. 3-D modeling useful at times but not accessible enough to the team to be fully valuable.	14. Highly integrated 3-D modelling with all major users updating a common database
2, Delivery	d. Little or no contractor involvement during the early design phase	15. Involving contractors; trades and vendors in the design phase 16. Seeking out suppliers and specialty contractors as a source for time saving innovations

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
2, Delivery	i. Due to late identification of budget issues, the project went through a major re-design after contractor mobilization. This drove the project into a flash track mode. Contractors were involved and provided input during this re-design phase, however, it was too late to allow for sufficient flash track planning.	15. Involving contractors; trades and vendors in the design phase 16. Seeking out suppliers and specialty contractors as a source for time saving innovations 44. Selecting appropriate construction methods 47. Frequent project review meetings
2, Delivery	FEL was really low quality and ended up having to be completed in parallel with detail design efforts	7. Funding early critical efforts 35. Performing exhaustive front end planning
2, Delivery	The design team developed too much detail in hopes to package the new technology to be installed on a lump sum basis, with competitive bidding based on best proposal (not necessarily lowest price). The intent was good, but several design changes inevitably followed which created a large cumulative impact of change. For example, if on average it's reasonable to accept about 10% change on TIC lump-sum contracts, the changes actually incurred overshadowed that expectation. So many changes made it difficult to assess the cumulative impact of changes in terms of dollars. At this point, the lump-sum strategy should have been changed to accommodate the ever-changing nature of the design, with perhaps a shift to a T&M approach. However, upper management's false perception that lump-sum contracting would hold the contractor accountable created false expectations that large scale changes would be inadmissible. This situation made some contractors rightfully defensive and incentivized them not to immediately act in the owner's best interest, because the changes were so difficult to firm price. So a lot of contingency was added. This in turn created distrust among contractors and the owner.	13. Employing innovative procurement practices
2, Delivery	Because E&I (Electrical and Instrumentation) is usually last in the design process, this portion was performed on a T&M NTE approach, knowing the previous issues with constant changes. This approach worked out well and accommodated changes more flexibly and faster.	13. Employing innovative procurement practices
2, Delivery	Project manager stated that he was not satisfied with isometric production status	14. Highly integrated 3-D modelling with all major users updating a common database

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
2, Delivery	Isometric production did have some negative effect on pipe shop production	14. Highly integrated 3-D modelling with all major users updating a common database
2, Delivery	Project still maintained a 3.5 week turnaround on pipe spool fabrication / paint	NA
2, Delivery	One of the prime subcontracts (electrical) had an inexperienced subcontractor with respect to client expectations. This led to multiple gaps in project 2, Delivery methods.	36. Identifying and procuring long lead time items
2, Delivery	One of the prime subcontract (controls & automation) had three different parties executing in three different sites. This led to a lack of leadership on the first implementation, but it was corrected for the future sites based on site #1 lessons learned	45. Minimizing hand-offs 3. Aligning project participants' interests through contract 47. Frequent project review meetings
2, Delivery	Consortium partner not in full alignment with project's needs. Poor engineering drawings did not reflect as installed equipment. The site ran several schedules that made it difficult to determine progress status and created a integration nightmare and impacted numerous systems when all schedule were finally integrated and baseline. Poor QA/QC impacted component deliveries and led to numerous delays.	3. Aligning project participants' interests through contract 33. Creating executive alignment amongst the contracted parties 14. Highly integrated 3-D modelling with all major users updating a common database 2. Establishing performance-based specifications 4. Establishing contract strategies specifically tailored to project conditions 45. Minimizing handoffs

3) What are some issues the project experienced related to Organizational considerations?

3, Org.	Project team not co-located. Construction support scattered in multiple site trailers, design provided through several corp offices.	41. Co-location of project team (owner; designer; builder; and/or key vendors)
3, Org.	Key team members associated with conceptual design changed out prior to field implementation.	See implementation measures for: 40. Recognizing and managing the additional Flash Track risks 9. Selecting team members and staff on the basis of their fast track experience or qualifications 23. Selecting personnel with a can-do attitude and willingness to tackle challenging tasks 1. Setting clear, specific scoping requirements

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
3, Org.	Implementer often bypassed craft superintendent, foremen reporting structure in directing craft labor causing confusion in daily work plans.	12. Staffing with personnel with strong leadership capabilities 31. Staffing with cooperative and collaborative personnel
3, Org.	Limited engagement of site owner personnel resulted in late design change request.	22. Having an owner with sufficient depth of resources and strength of organization 27. Having an active; involved and fully committed owner 24. Having an engaged and empowered Owner's Engineer (Owner's representative) 5. Establishing clear change management procedures
3, Org.	Team building not utilized. Stress between organizations high as implementer problems encountered	19. Using team building and partnering practices 30. Having open communication and transparency
3, Org.	Organizational alignment missed opportunity to engage craft early in process and align goals	11. Making timely selection and award contracts to subcontractors 15. Involving contractors; trades and vendors in the design phase 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
3, Org.	Difference experiences on successful project execution (lack of significant project experience in the base organization)	9. Selecting team members and staff based on their fast track experience or qualifications 23. Selecting personnel with a can do attitude and willingness to tackle challenging tasks
3, Org.	Relationships throughout the company; used worldwide relationships to benefit of project	33. Creating executive alignment amongst the contracted parties
3, Org.	Established accountability between design contractors, Establish a construction management team	34. Emphasizing coordination planning during the design process 3. Aligning project participants' interests through contract 4. Establishing contract strategies specifically tailored to the project condition 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel 39. Considering speed of fabrication and construction during the selection of design alternatives 30. Having open communication and transparency
3, Org.	Company was not prepared or experienced with project execution in (outside US).	9. Selecting team members and staff based on their fast track experience or qualifications 22. Having an owner with sufficient depth of resources and strength of organization

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
3, Org.	Company did not prioritize project needs (including resources) due to commitments to other more lucrative Client projects.	33. Creating executive alignment amongst the contracted parties 3. Aligning project participants' interests through contract 38. Providing enough resources to critical path items 40. Recognizing and managing the additional fast track risks
3, Org.	Company did not understand urgency of obtaining work permits for "Flash Track" project and engaged traditional services not meeting the schedule requirements.	22. Having an owner with sufficient depth of resources and strength of organization
3, Org.	Company support organization was not effective resolving Company and Project issues.	22. Having an owner with sufficient depth of resources and strength of organization
3, Org.	a. Owner O&M involvement from a previous rail unloading facility added value.	9. Selecting team members and staff based on their fast track experience or qualifications
3, Org.	b. Minimal team building	19. Using team building and partnering practices 47. Frequent project review meetings
3, Org.	c. Owner leadership team did not contribute to raising the morale among project stakeholders (engineering contractors, key suppliers, construction contractors). Morale did exist, but it was due to a sense of pride among the project participants.	22. Having an owner with sufficient depth of resources and strength of organization 24. Having an engaged and empowered Owner's Engineer (Owner's representative) 19. Using team building and partnering practices 26. Accepting a new paradigm or mindset differing from that of traditional practices
3, Org.	d. Lack of decision making at the project level.	20. Delegating authority to project level (maximize decision-making authority to the project level) 21. Empowering the project team (each organization led by an empowered leader) 42. Simplifying approval procedures
3, Org.	High difficulty to manage engineering work at multiple locations, involving owner and multiple external engineering organizations.	41. Co-location of project team (owner; designer; builder; and/or key vendors)
3, Org.	Owner engineers wanting to do all the engineering even if they didn't have the organization to support the large project. In view of the challenge, external organizations were engaged at a later stage with the oversight of the owner engineering organization. However, the owner engineers didn't manage third parties well because they were used to designing themselves rather than actually managing others.	11. Making timely selection and award contracts to subcontractors 22. Having an owner with sufficient depth of resources and strength of organization 26. Accepting a new paradigm or mindset differing from that of traditional practices

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
3, Org.	The purchasing team was set up as MRO (Maintenance, Repair and Overhall), rather than project oriented. The project required a capital buying team, but the team offered was MRO functional, which is more effective for day-to-day mill buying, but not for capital fast-track projects. This led the purchasing organization to become highly specialized by category of buying. This made the team silo-oriented, more rigid and less responsive to capital needs. This wrong setup also generated several unsolicited suggestions by the purchasing team to recommend certain types of equipment that they could get for better prices, as opposed to supporting the equipment selected by the engineers in the first place. This dynamic complicated reaching alignment between the engineering and purchasing teams, and therefore affected the schedule.	4. Establishing contract strategies specifically tailored to the project condition 13. Employing innovative procurement practices 28. Establishing flexible project teams that avoid rigid hierarchy 42. Simplifying approval procedures 26. Accepting a new paradigm or mindset differing from that of traditional practices
3, Org.	The purchasing organization was never quite aligned as being part of the project team; they were “part of the company” and as such had several competing priorities. So when conflicts between tasks arose, the project wasn’t necessarily the first to get the resources and commitment required. Due to the misplaced incentives, the purchasing organization essentially tried to maximize “their profits and bonuses” based on company incentives rather than the project’s.	10. Focusing procurement decisions on construction priorities 33. Creating executive alignment amongst the contracted parties
3, Org.	The on-site construction management organization was very knowledgeable but very rigid to consider new ways of doing things. This prevented some contractors from delivering more innovative solutions. Furthermore, the project manager had little influence on the construction management team because the latter functionally reported to other divisions within the company.	46. Employing innovative construction methods 28. Establishing flexible project teams that avoid rigid hierarchy 16. Seeking out suppliers and specialty contractors as a source for time saving innovations 13. Employing innovative procurement practices 20. Empowering the project team (each organization led by an empowered leader) 42. Simplifying approval procedures 26. Accepting a new paradigm or mindset differing from that of traditional practices
3, Org.	Same comment as number one (1, Contractual) above.	NA
3, Org.	Participants felt that the project had good team synergy and no real issues were experienced.	NA

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
3, Org.	1. Significant amount of turnover in the project team from FEP thru EPC phase	See implementation measures for: 40. Recognizing and managing the additional Flash Track risks 9. Selecting team members and staff on the basis of their fast track experience or qualifications 23. Selecting personnel with a can-do attitude and willingness to tackle challenging tasks 1. Setting clear, specific scoping requirements
3, Org.	2. A lack of multi-skilled capability in several team members	25. Staffing with multi-skilled personnel
3, Org.	3. Non-existent involvement of executive sponsors in project early on	33. Creating executive alignment amongst the contracted parties
3, Org.	One of the prime equipment vendors was overwhelmed at the beginning with the pace and complexity of simultaneous site executions. The vendor made adjustments in their staffing plan in future installations to mitigate this.	23. Selecting personnel with a can do attitude and willingness to tackle challenging tasks 9. Selecting team members and staff based on their fast track experience or qualifications 47. Frequent project review meetings
3, Org.	Organizational boundaries were not established early in the project. As such no clear directives on how to manage site and overall construction priorities. Scheduled priorities were completed but not followed which led to project delays resulting in added costs that were not budgeted or accounted for. team conflicts also hindered decisions diminishing teams effectiveness to manage accordingly.	34. Emphasizing coordination planning during the design process 37. Monitoring and driving corrective actions through the project controls process 3. Aligning project participants' interests through contract 33. Creating executive alignment amongst the contracted parties 45. Minimizing hand-offs

4) What are some issues the project experienced related to Cultural considerations?

4, Cultural	Executives did not intervene during execution challenges	Issue addressed under #6, 7 in Implementation Measures
4, Cultural	No executive alignment sessions hosted during front end planning	33. Creating executive alignment amongst the contracted parties
4, Cultural	Site owner engagement minimal through out	22. Having an owner with sufficient depth of resources and strength of organization 27. Having an active; involved and fully committed owner 24. Having an engaged and empowered Owner's Engineer (Owner's representative)
4, Cultural	Communication transparency on safety, schedule, cost performance lacking throughout execution	30. Having open communication and transparency 19. Using team building and partnering practices 31. Staffing with cooperative and collaborative personnel

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
4, Cultural	Field challenges resulted in finger pointing and 1, Contractual posturing	1. Setting clear; specific scoping requirements 8. Reducing risks through collective efforts of all stakeholders 15. Involving contractors; trades and vendors in the design phase 29. Maintaining a no blame culture and mutually supportive environment
4, Cultural	Strong conviction and leadership in doing what's right (solid execution principles); tested daily/hourly by local leadership about execution strategy	12. Staffing with personnel with strong leadership capabilities 23. Selecting personnel with a can do attitude and willingness to tackle challenging tasks
4, Cultural	Multiple Interfaces - Three engineering firms were involved in the Project	34. Emphasizing coordination planning during the design process 24. Having an engaged and empowered Owner's Engineer (Owner's representative) 27. Having an active; involved and fully committed owner 33. Creating executive alignment amongst the contracted parties
4, Cultural	Company resources were from US, Scotland, Ireland, Singapore and Malaysia.	22. Having an owner with sufficient depth of resources and strength of organization
4, Cultural	Local construction workers were unskilled and spoke XXXXXXX.	9. Selecting team members and staff based on their fast track experience or qualifications 40. Recognizing and managing the additional fast track risks
4, Cultural	Local construction workers were indigenous peoples requiring close supervision and extensive safety training.	9. Selecting team members and staff based on their fast track experience or qualifications 40. Recognizing and managing the additional fast track risks
4, Cultural	Obtaining imported skilled labor (even from XXXXX) was difficult due to local labor laws.	9. Selecting team members and staff based on their fast track experience or qualifications 40. Recognizing and managing the additional fast track risks
4, Cultural	a. Owner was committed and active, but not innovative	46. Employing innovative construction methods 16. Seeking out suppliers and specialty contractors as a source for time saving innovations 22. Having an owner with sufficient depth of resources and organizational strength 24. Having an engaged and empowered owner's engineer (owner's representative)
4, Cultural	b. Multiple contractors did not work well together. Each was pushed to complete work for themselves and this frequently caused them to get in the way of each other, ultimately slowing down the execution of the overall project.	3. Aligning project participants' interests through contract 45. Minimizing hand-offs 19. Using team building and partnering practices
4, Cultural	c. Customer attempted to create executive partnering, but this was not effective.	12. Staffing with personnel with strong leadership capabilities 33. Creating executive alignment amongst the contracted parties 3. Aligning project participants' interests through contract

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
4, Cultural	The owner engineering team was used to performing smaller projects. The culture change to have them work on this big project was a challenge. For example, the organization had people with project manager titles who were really project engineering managers. Also, their experience was very different	22. Having an owner with sufficient depth of resources and strength of organization 26. Accepting a new paradigm or mindset differing from that of traditional practices
4, Cultural	The owner engineering team was salary employed, which meant they got paid 40 hours a week regardless of whether they worked 40, 50, or 60 hours. This made it difficult to motivate the team to try to catch up when they were late on deliverables -unlike external engineering providers, who are used to getting paid for overtime. The significance of this lies in that about 50-60% of the engineering was done in house. So the consequences to the schedule	22. Having an owner with sufficient depth of resources and strength of organization
4, Cultural	Geographical 4, Cultural differences also played out in the project's disadvantage. The local labor at the project site was mostly unionized with very little give-and-take about terms and conditions. It had to be their way. Because of these difficulties, the project board even considered moving it to a different location. When the decision was finally made to install the original location, the project was slightly behind and carried on with very little input and buy-in on the scope from the operations team at the facility. In perspective, the market target established to be online by 2012, but still in 2010 the team didn't know where it was going to build the facility.	4. Establishing contract strategies specifically tailored to the project condition 3. Aligning project participants' interests through contract 15. Involving contractors; trades and vendors in the design phase
4, Cultural	South Louisiana culture was also very different than north Louisiana's and the rest of the south east. For instance, 98% of the schools near Port Hudson offer free lunches, meaning that poverty is well marked in that area. Therefore, most of the available workforce that came to work had no skills or were just happy to pocket a month's worth of payment and leave. A significant portion of the local construction workforce didn't really have a desire to make a long-term career in the construction industry, especially many on the helper level. It became very difficult to screen these people out. Many made them to work intentionally looking for a "free-ride", and ultimately filed lawsuits and claims that jeopardized the project.	23. Selecting personnel with a can do attitude and willingness to tackle challenging tasks 9. Selecting team members and staff based on their fast track experience or qualifications
4, Cultural	The biggest issue experience in this area was a result of the culture at the facility being accustomed to utilizing nested contractors, of which, several were union. The project was being executed primarily "open shop"	Addressing union/non-union issues?

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
4, Cultural	At first plant personnel / operations were not very supportive since the project team was being brought in from outside the area. This included owner management personnel overseeing the project execution.	19. Using team building and partnering practices 26. Accepting a new paradigm or mindset differing from that of traditional practices
4, Cultural	Safety was not a priority/value with plant operations. They were just driving for the work to get done.	
4, Cultural	The client PM had a definite "blame" culture that was never addressed. There was a good informal information sharing to executives/project sponsors on both sides, but there was a lack of transparency provided to them by client PM. The team failed to quantify all the change because there was so much of it occurring on the overall project.	29. Maintaining a no blame culture and mutually supportive environment
4, Cultural	The prime equipment vendor had a definite "blame" culture that had to be addressed early on. There was good informal information sharing to executives/project sponsors on both sides, but there was a lack of a formal process (monthly review or other) that could have been better.	29. Maintaining a no blame culture and mutually supportive environment 31. Staffing with cooperative and collaborative personnel 19. Using team building and partnering practices
4, Cultural	Clients way of managing does not fall-in-line with industry standards. Moreover, this created and pitted contractors against each other which	22. Having an owner with sufficient depth of resources and strength of organization 24. Having an engaged and empowered Owner's Engineer (Owner's representative)
4, Cultural	Team communications transitioned to blame culture as project was stressed with multiple design challenges	29. Maintaining a no blame culture and mutually supportive environment 30. Having open communication and transparency
4, Cultural	Communications transparency suffered early on in execution	30. Having open communication and transparency
4, Cultural	No team building exercises implemented	19. Using team building and partnering practices
4, Cultural	Prime contractor oversold itself to owners management as to its capability to perform as an EPC for specific work	15. Involving contractors; trades and vendors in the design phase 9. Selecting team members and staff based on their fast track experience or qualifications See implementation measures with regard to engaging proven contractors (#2, 11, etc...)

5) What are some issues the project experienced related to Planning considerations?

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
5, Planning	Only conceptual planning performed resulting in significant missed scope on implementation details	34. Emphasizing coordination planning during the design process 37. Monitoring and driving corrective actions through the project controls process
5, Planning	Constructor not involved during conceptual planning	15. Involving contractors; trades and vendors in the design phase
5, Planning	All phases of the project cycle were started at the same time. Construction proceeded on preliminary concepts at risk, design slow to release and significant rework once issued.	37. Monitoring and driving corrective actions through the project controls process 44. Selecting appropriate construction methods
5, Planning	Owner forced vendor design to align more with company versus industry installation standards	22. Having an owner with sufficient depth of resources and strength of organization 32. Having an open minded team 26. Accepting a new paradigm or mindset differing from that of traditional practices
5, Planning	Projects controls process was not robust enough to gauge progress, track resources	37. Monitoring and driving corrective actions through the project controls process 5. Establishing clear change management procedures 34. Emphasizing coordination planning during the design process
5, Planning	Project team was not co-located	41. Co-location of project team (owner; designer; builder; and/or key vendors)
5, Planning	Front end planning limited to macro issues of base layout, major material procurements and minimal construction considerations.	35. Performing exhaustive front end planning 10. Focusing procurement decisions on construction priorities 11. Making timely selection and award contracts to subcontractors 15. Involving contractors; trades and vendors in the design phase 16. Seeking out suppliers and specialty contractors as a source for time saving innovations 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel 8. Reducing risks through collective efforts of all stakeholders 44. Selecting appropriate construction methods
5, Planning	Detailed design progressed without input of implementers constructor	15. Involving contractors; trades and vendors in the design phase 16. Seeking out suppliers and specialty contractors as a source for time saving innovations 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel 8. Reducing risks through collective efforts of all stakeholders
5, Planning	No effort made for modularization or special fixtures to enhance field productivity (largely stick built approach)	39. Considering speed of fabrication and construction during the selection of design alternatives

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
5, Planning	No advance planning related to craft resources and skills sets	11. Making timely selection and award contracts to subcontractors 34. Emphasizing coordination planning during the design process 39. Considering speed of fabrication and construction during the selection of design alternatives
5, Planning	Critical success factor was creation of project task lists and schedules; these were shared with ever vendor and every member of the team - Provided clear definition of when the task was complete; set up project for successful turnover to the base plant	37. Monitoring and driving corrective actions through the project controls process 30. Having open communication and transparency
5, Planning	Progress curves were developed right from the beginning and stewarded daily – posted on the walls	37. Monitoring and driving corrective actions through the project controls process
5, Planning	Contracted a 3rd party scheduler to be full time on progress and task lists	43. Dedicating full-time personnel to the project
5, Planning	Dedicated Planner/Scheduler to maintain Integrated Schedule, Add contingency to vendor's 2, Delivery schedule.	43. Dedicating full-time personnel to the project 37. Monitoring and driving corrective actions through the project controls process 38. Providing enough resources to critical path items
5, Planning	Client schedule drove 50% critical path construction, with extensive overlapping of design, procurement and construction activities.	34. Emphasizing coordination planning during the design process 37. Monitoring and driving corrective actions through the project controls process 38. Providing enough resources to critical path items 10. Focusing procurement decisions on construction priorities 11. Making timely selection and award contracts to subcontractors
5, Planning	Schedule constraints resulted in extensive activity splitting.	34. Emphasizing coordination planning during the design process 37. Monitoring and driving corrective actions through the project controls process
5, Planning	Traditional considerations for quality control were separated to expedite the deliveries and installations.	See implementation measures for: 44. Selecting appropriate construction methods 42. Simplifying approval procedures
5, Planning	Minimum system completion required addition of safe isolation breaks and processes.	See implementation measures for: 40. Recognizing and managing the additional Flash Track risks 44. Selecting appropriate construction methods
5, Planning	a. Flash track schedule required high level of constructability planning, this was attempted, but not effective.	12. Staffing with personnel with strong leadership capabilities 34. Emphasizing coordination planning during the design process 37. Monitoring and driving corrective actions through the project controls process 14. Highly integrated 3-D modelling with all major users updating a common database

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
5, Planning	b. Multiple construction contractor schedules were never aligned or consolidated to properly coordinate all of the field work.	18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel 14. Highly integrated 3-D modelling with all major users updating a common database
5, Planning	c. Owner's insistence to hold unrealistic completion dates precluded proper critical path evaluation and management. Therefore every activity became critical path. A true and reasonable critical path was never identified or managed. The XXXX validation team felt that this significant hurt the field execution and therefore overall schedule performance of the project.	37. Monitoring and driving corrective actions through the project controls process 26. Accepting a new paradigm or mindset differing from that of traditional practices
5, Planning	Comment to Readiness Tool: Issue number 38 is "Provide enough resources to critical path items". On this project there were plenty of resources provided to critical path items, but they were not employed effectively. The XXXX validation team thought issue 38 would be better worded as "Managing, prioritizing and providing enough resources to critical path items."	38. Providing enough resources to critical path items Suggestion for improvement
5, Planning	Outside influences caused delays and re-planning	7. Funding early critical efforts 35. Performing exhaustive front end planning
5, Planning	Later than planned deliveries due to vendors/suppliers not meeting dates	36. Identifying and procuring long lead time items 37. Monitoring and driving corrective actions through the project controls process 10. Focusing procurement decisions on construction priorities
5, Planning	Late addition of scope to the project based on changes in client's needs	1. Setting clear; specific scoping requirements 17. Engagement of operations & maintenance personnel in the development and design process
5, Planning	Managing other contractors schedules	3. Aligning project participants' interests through contract 14. Highly integrated 3-D modelling with all major users updating a common database
5, Planning	Managing integration of client's commissioning activities into the plan	17. Engagement of operations & maintenance personnel in the development and design process
5, Planning	Failed to recognize true durations for insulation installation	34. Emphasizing coordination planning during the design process 35. Performing exhaustive front end planning

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
5, Planning	The project manager was brought to manage the full scope at the end of P2 phase, which was late for such a fast-track project. Many decisions that could have influenced the outcome of the project were made by the wrong people earlier on.	11. Making timely selection and award contracts to subcontractors Discussed under….
5, Planning	Some owner stakeholders and upper management believed in the idea that the bigger the job, the more detailed planning and scheduling had to be. But this notion is an illusion on big projects. In fact, too much emphasis was placed on details of the planning to ensure success rather than focusing on having a strong and robust level 1 and 2 schedules. The very dynamic nature of the project was managed with too much rigidity. The rigid prescription to planning not only generated false expectations that the project would go well, but also demanded a lot of explanations when small aspects of the project deviated, which further withdrew attention and energy from working the big picture. This rigor in schedule in turn opened the door for assigning blames that ultimately affected the team performance.	40. Recognizing and managing the additional fast track risks
5, Planning	As the project grew larger, site logistics were planned poorly and ultimately didn't provide for adequate infrastructures to get people in and out, or communicate closely with the large workforce.	34. Emphasizing coordination planning during the design process
5, Planning	Unfortunately, there were a tremendous number of opportunities to do better. The planning was not done by the people ???	37. Monitoring and driving corrective actions through the project controls process
5, Planning	Did not adequately review plans and scope of work for the contractor/owner of third party faculties during the design phase.	34. Emphasizing coordination planning during the design process
5, Planning	Pipe shop loading / steel galvanizer pinch points caused soliciting secondary shops to support efforts	34. Emphasizing coordination planning during the design process
5, Planning	Developing, understanding, and monitoring critical deliveries	36. Identifying and procuring long lead time items 37. Monitoring and driving corrective actions through the project controls process
5, Planning	Constraints imposed by OSHA / Insurance inspections	40. Recognizing and managing the additional fast track risks
5, Planning	Work in other areas by other contractors diluted some plant resources causing some coordination and/or delay issues	34. Emphasizing coordination planning during the design process

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
5, Planning	Several of the planning efforts in the FEP phase were not as complete as needed. The vendor accountability from client on deliver dates had multiple gaps. There were a few dimensional alignment issues in the FEP package that had to be corrected early in DD to intercept fabrication schedules. The largest identified gap in FEP was in the electrical area and the mitigation plan developed early in the EPC phase was inadequate and had to be adjusted in the field during the first shutdown at the cost of a significant schedule impact.	7. Funding early critical efforts 35. Performing exhaustive front end planning 37. Monitoring and driving corrective actions through the project controls process 40. Recognizing and managing the additional fast track risks
5, Planning	Some of the planning efforts in the FEP phase were not as complete as needed. The warranty and 2, Delivery timing accountability from client to the vendors had gaps. There were a few dimensional alignment issues in the FEP package that had to be corrected early in DD to intercept fabrication schedules. The largest identified gap in FEP was in the controls arena and the mitigation plan developed early in the EPC phase was inadequate and had to be adjusted in the field during the first shutdown.	35. Performing exhaustive front end planning 37. Monitoring and driving corrective actions through the project controls process 40. Recognizing and managing the additional fast track risks 7. Funding early critical efforts
5, Planning	One master schedule should be shared with all contractors. Having separate schedules did not reflect all activities and the impact to each contractor to manage without knowing where erection or commissioning intersect.	34. Emphasizing coordination planning during the design process 3. Aligning project participants' interests through contract 38. Monitoring and driving corrective actions through the project controls process 41. Co-location of project team (owner; designer; builder; and/or key vendors) 14. Highly integrated 3-D modelling with all major users updating a common database

6) What are some issues the project experienced related to Execution considerations?

6, Execution	Team not co-located onsite	41. Co-location of project team (owner; designer; builder; and/or key vendors)
6, Execution	Key team members changed out	Issue addressed under other areas
6, Execution	planning, design and execution was being run in parallel	18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
6, Execution	No discovery work performed in advance	35. Performing exhaustive front end planning
6, Execution	Construction parts of the entire project started at once	34. Emphasizing coordination planning during the design process

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
6, Execution	Safety was at risk	8. Reducing risks through collective efforts of all stakeholders 40. Recognizing and managing the additional Flash Track risks 2. Establishing performance-based specifications
6, Execution	Design developed by implementer independent of construction reviews	15. Involving contractors; trades and vendors in the design phase 16. Seeking out suppliers and specialty contractors as a source for time saving innovations 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel 8. Reducing risks through collective efforts of all stakeholders 44. Selecting appropriate construction methods
6, Execution	Structural design problem encountered that held up construction means and methods pending redesign	15. Involving contractors; trades and vendors in the design phase 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel 44. Selecting appropriate construction methods
6, Execution	Craft resources with specific skill sets in short supply	9. Selecting team members and staff on the basis of their fast track experience or qualifications 25. Staffing with multi-skilled personnel 40. Recognizing and managing the additional Flash Track risks
6, Execution	Minimal to no effort expended to innovate approach to accomplishing work	16. Seeking out suppliers and specialty contractors as a source for time saving innovations 46. Employing innovative construction methods 32. Having an open minded team 31. Staffing with cooperative and collaborative personnel
6, Execution	Visible presence of the leadership (first to arrive, last to leave) - On site, in key meetings	12. Staffing with personnel with strong leadership capabilities 23. Selecting personnel with a can do attitude and willingness to tackle challenging tasks
6, Execution	Process control leadership team and an empowered process control execution team - Supported best in class safety performance	20. Delegating authority to project level (maximize decision-making authority to the project level) 21. Empowering the project team (each organization led by an empowered leader) 12. Staffing with personnel with strong leadership capabilities Expand on discussion of best personnel in the Implementation Measures
6, Execution	Inspect frequency based on criticality of equipment.	See implementation measures for: 42. Simplifying approval procedures 44. Selecting appropriate construction methods

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
6, Execution	Allow engineering firm to utilize their advanced tools and standard processes	14. Highly integrated 3-D modeling with all major users updating a common database Consider adding to … See implementation measures for: 39. Considering speed of fabrication and construction during the selection of design alternatives
6, Execution	Obtain buy-in from all parties	1. Setting clear; specific scoping requirements 15. Involving contractors; trades and vendors in the design phase 16. Seeking out suppliers and specialty contractors as a source for time saving innovations 17. Engagement of operations & maintenance personnel in the development and design process 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
6, Execution	Risk management required full time focus.	40. Recognizing and managing the additional fast track risks 43. Risk management required full time focus.
6, Execution	Project team members needed encouragement and career enhancements.	21. Empowering the project team (each organization led by an empowered leader)
6, Execution	Client decision maker on site to provide needed decisions 24/7.	24. Having an engaged and empowered Owner's Engineer (Owner's representative)
6, Execution	Clear definition of system completion to support manufacturing was needed.	1. Setting clear; specific scoping requirements
6, Execution	Management of warranty issues required substantial resources.	40. Recognizing and managing the additional fast track risks
6, Execution	a. As stated before, the XXXX validation team believes this project transitioned into a flash track mode post construction mobilization when the project went through a major re-design after IFC dwgs were issued.	1. Setting clear; specific scoping requirements 4. Establishing contract strategies specifically tailored to project conditions
6, Execution	Comment to Readiness Tool: Issue number 47 is worded as “Frequent project review meetings” The XXXX validation team felt that this should be worded as “Frequent and effective project review meetings.” On this project the project review meetings were very frequent, but were less effective than they should have been.	47. Frequent project review meetings Suggestion for improvement
6, Execution	Schedule was so tight that any slippage impacted execution and caused team to be reactive	34. Emphasizing coordination planning during the design process 35. Performing exhaustive front end planning

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
6, Execution	Realized a good amount of "out of sequence" work	34. Emphasizing coordination planning during the design process 35. Performing exhaustive front end planning
6, Execution	Design team had to move forward w/o vendor data; causes management issues and rework due to break in standard work processes	39. Considering speed of fabrication and construction during the selection of design alternatives 37. Monitoring and driving corrective actions through the project controls process
6, Execution	The technology being installed was new and unproven, which added to the challenges during execution.	See implementation measures for: 40. Recognizing and managing the additional Flash Track risks 39. Considering speed of fabrication and construction during the selection of design alternatives
6, Execution	The team executed as best as it could with the knowledge that it had about the unproven technology being installed.	See implementation measures for: 40. Recognizing and managing the additional Flash Track risks 39. Considering speed of fabrication and construction during the selection of design alternatives
6, Execution	Considering the large scale of the project, a demonstration plant should have been developed first, following the serial number one plant. But the opposite happened.	See implementation measures for: 40. Recognizing and managing the additional Flash Track risks 39. Considering speed of fabrication and construction during the selection of design alternatives
6, Execution	Population density ended up too large at the job site due to late engineering and schedule pressures.	34. Emphasizing coordination planning during the design process 25. Staffing with multi-skilled personnel 45. Minimizing hand-offs
6, Execution	The driver to market pressure was driving bad decision-making that focused on solely making them fast rather than making them carefully fast. Decisions weren't based on the right thing to do, but the "we just gotta make it" mentality.	See implementation measures for: 40. Recognizing and managing the additional Flash Track risks 39. Considering speed of fabrication and construction during the selection of design alternatives 41. Co-locating the project team (i.e., owner, designer, builder, and/or key vendors) 42. Simplifying approval procedures
6, Execution	Error in the design of an innovative solution that was carried into construction and required some re-work.	See implementation measures for: 37. Monitoring and driving corrective actions through the project controls process 38. Providing enough resources for critical path items
6, Execution	Productivity issues that required mitigation efforts due to heat (high temperature) impact requiring additional rest periods, extended overtime, congestion, and push-back from operations personnel	37. Monitoring and driving corrective actions through the project controls process
6, Execution	It too time to get consistency (required time to build relationships and trust)	See implementation measures with regard to engaging proven contractors (#2, 11, etc…)

Category	Issue in reponse to questions III.1 to III.6	Relevant Flash Track Practice
6, Execution	There was some design optimization of mechanical footings that had to be corrected on future site rollouts after the first location that could have been caught earlier in the process.	37. Monitoring and driving corrective actions through the project controls process 40. Recognizing and managing the additional fast track risks 47. Frequent project review meetings
6, Execution	There was some design optimization of mechanical footings that had to be corrected on future site rollouts after the first location that could have been caught earlier in the process.	37. Monitoring and driving corrective actions through the project controls process 40. Recognizing and managing the additional fast track risks
6, Execution	Poor deliveries were the biggest obstacle to executing the project. Late deliveries impacted several contractors requiring recovery action plans in order to hold schedule to achieve key milestones. This required the addition of additional manpower.	36. Identifying and procuring long lead time items 10. Focusing procurement decisions on construction priorities 37. Monitoring and driving corrective actions through the project controls process 7. Funding early critical efforts

189 = Count of Issues Encountered

Category	**Issue in reponse to questions III.1 to III.6**	**Relevant Flash Track Practice**

Breakdown by six categories (per response to questionnaire)

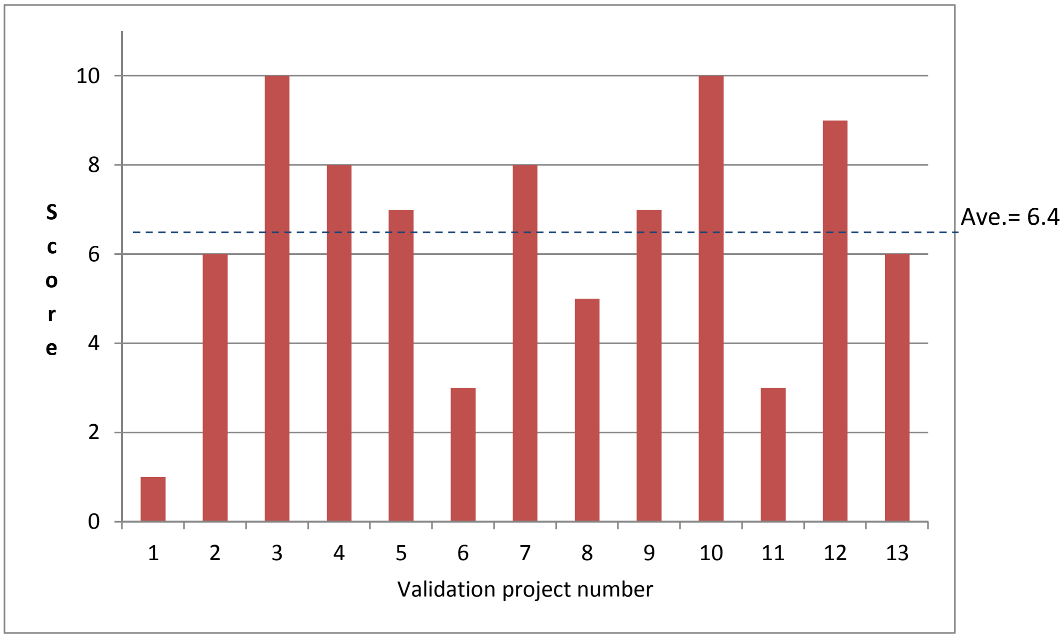
Category	Issues	Percentage
Contractual	27	14.3%
Delivery	29	15.3%
Organizational	29	15.3%
Cultural	28	14.8%
Planning	40	21.2%
Execution	36	19.0%
	189	100%

Distribution of Validation respondent to one of the 47 essential Flash Track Practices:

- Contractual - 72 (17%)
- Delivery 87 (20%)
- Organization 70 (16%)
- Cultural 52 (12%)
- Planning 100 (23%)
- Execution 45 (11%)

Part III - Retrospective commentary and scoring

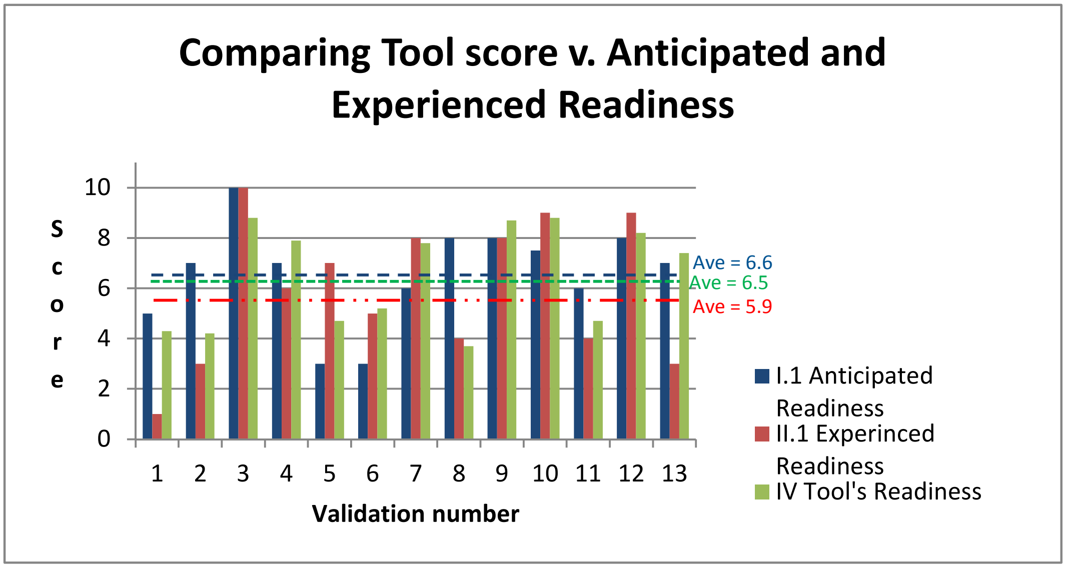
7. On a scale of 0-10, **Overall**, how successful was this project?



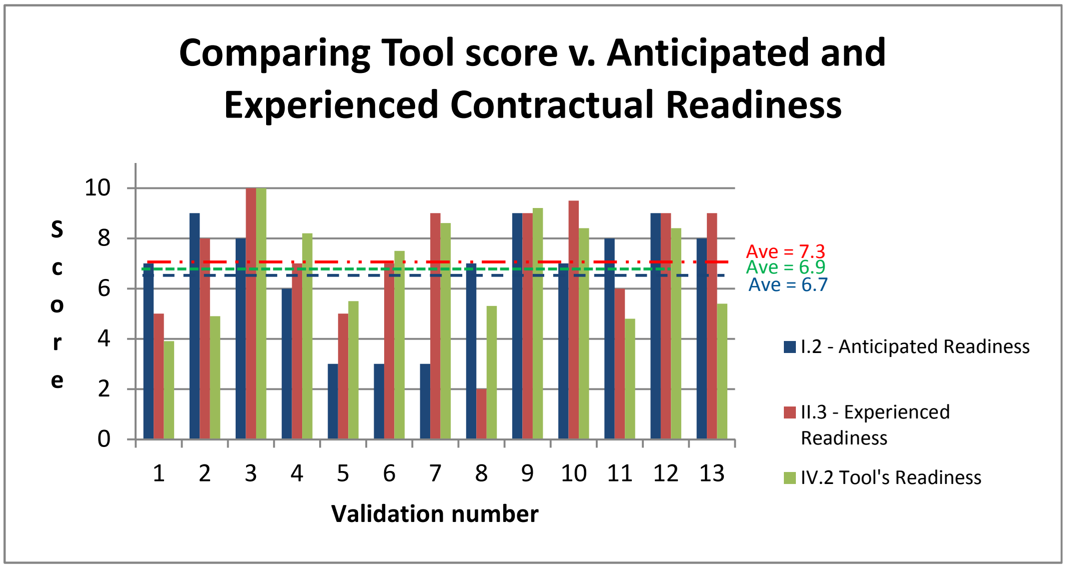
Part IV - Complete the Tool (exercise)

Comparing Tool score to pre- and post-project assessments

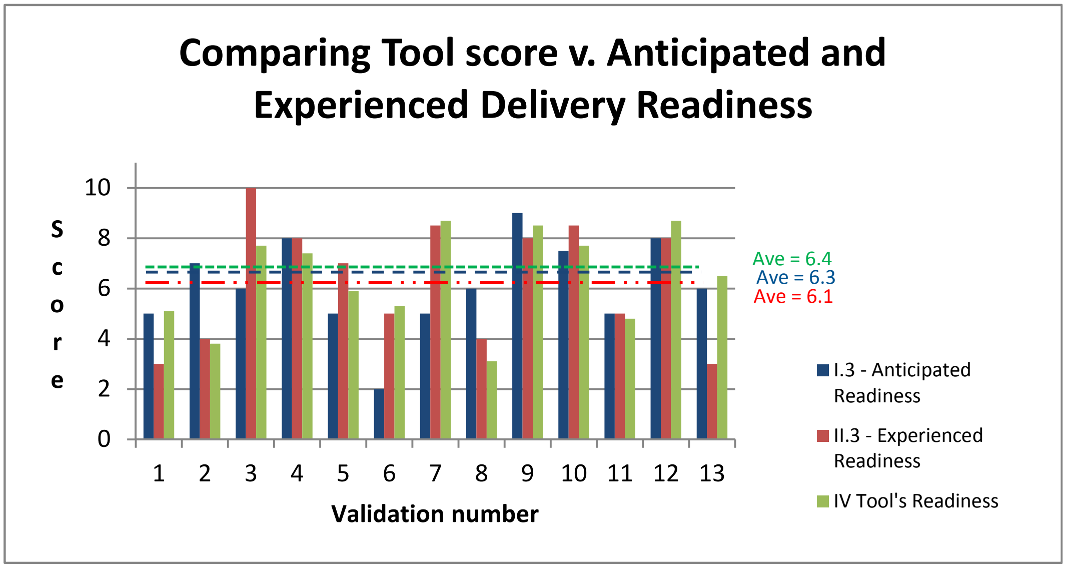
1. On a scale of 0-10, **Overall**, based on lessons learned, how ready did you think you were (were you) to undertake this project on a Flash-Track basis



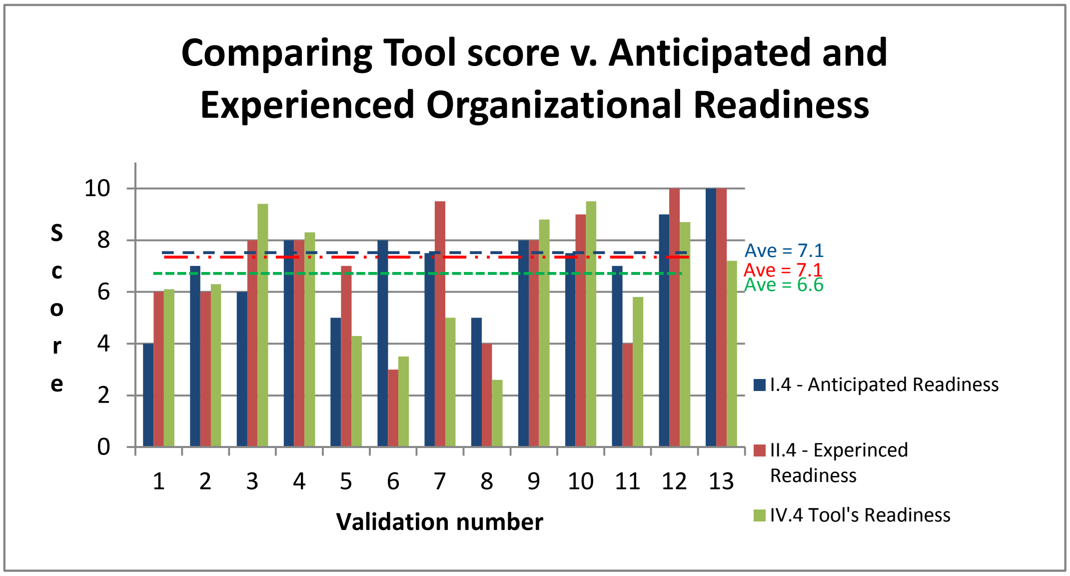
2. On a scale of 0-10, how prepared were you with respect to **Contractual** considerations?



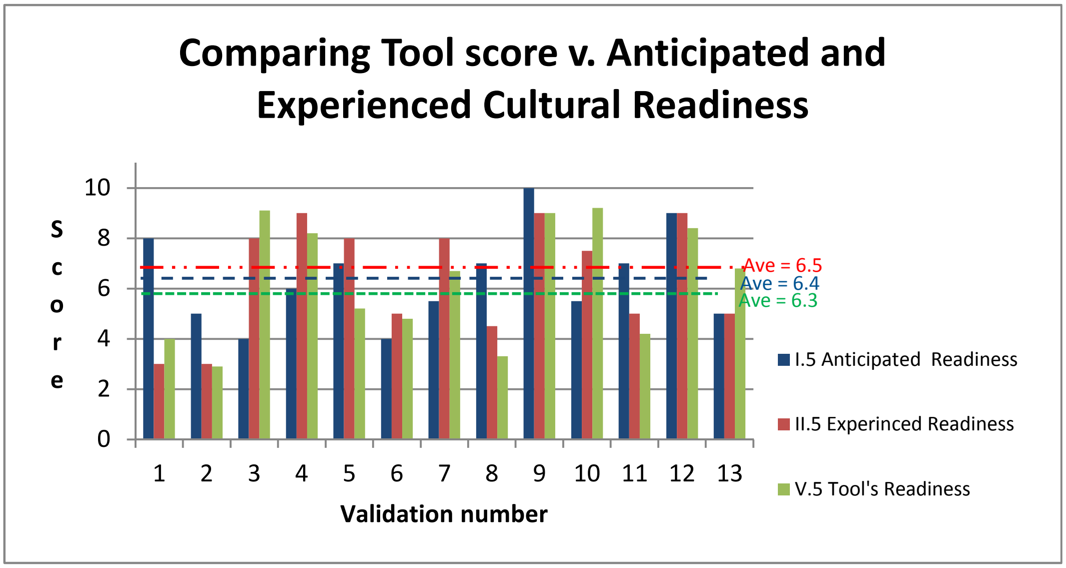
3. On a scale of 0-10, how prepared were you with respect to **Project Delivery** considerations?



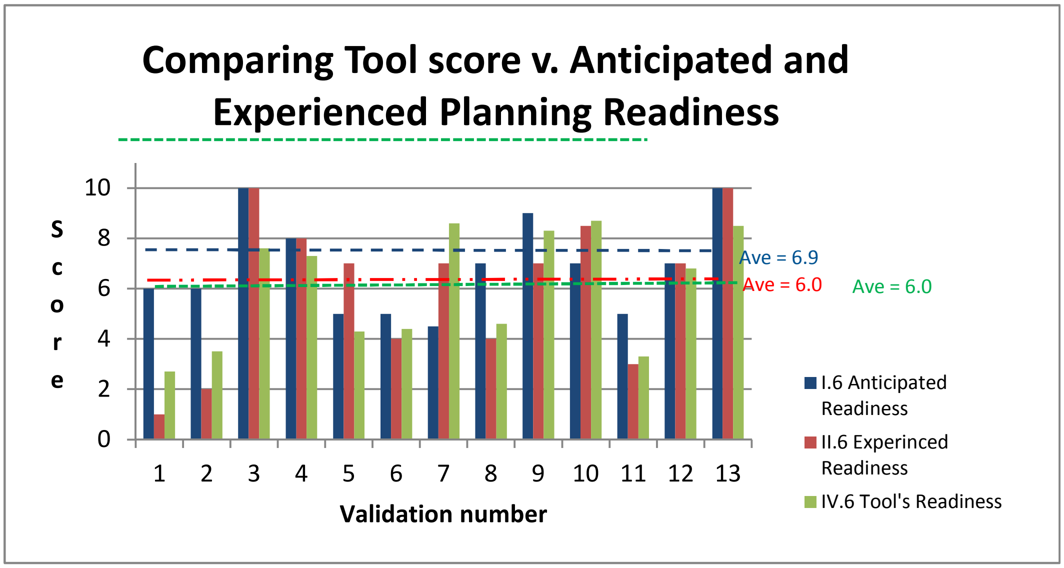
4. On a scale of 0-10, how prepared were you with respect to **Organizational** considerations?



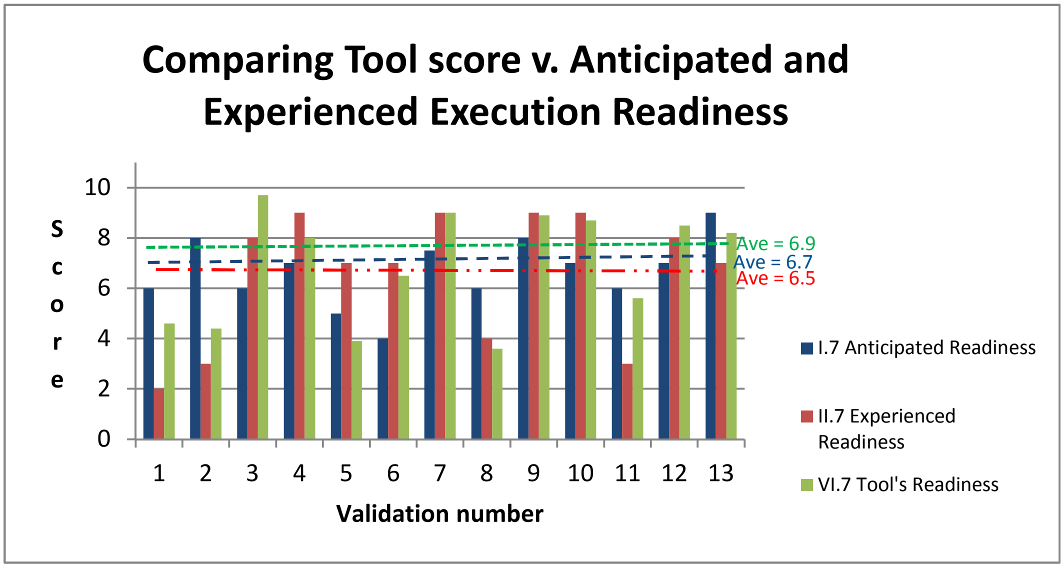
5. On a scale of 0-10, how prepared were you with respect to **Cultural** considerations?



6. On a scale of 0-10, how prepared were you with respect to **Planning** considerations?

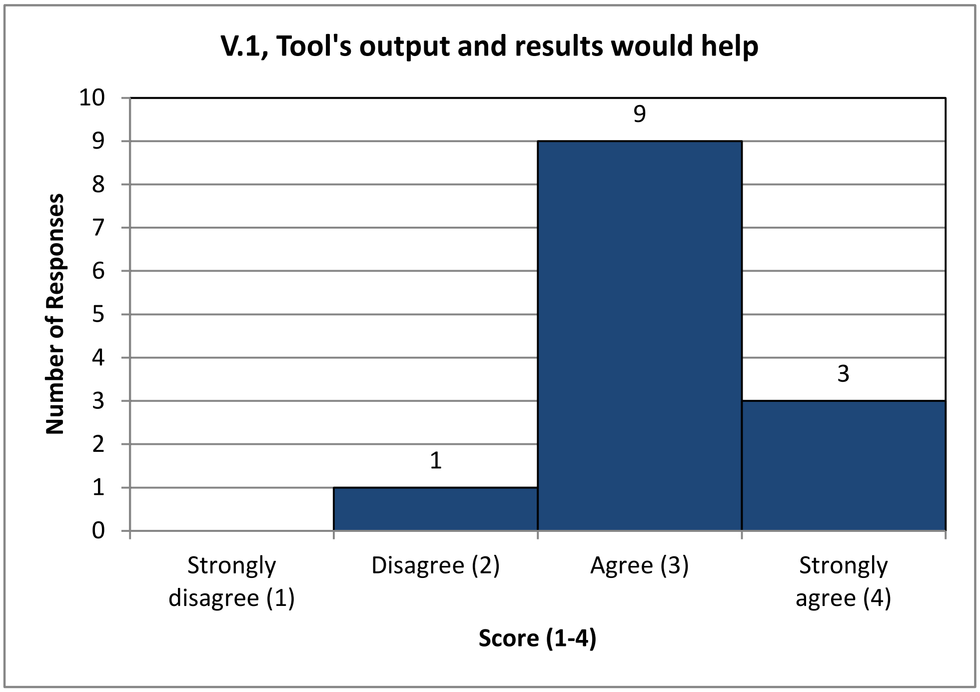


7. On a scale of 0-10, how prepared were you with respect to **Execution** considerations?

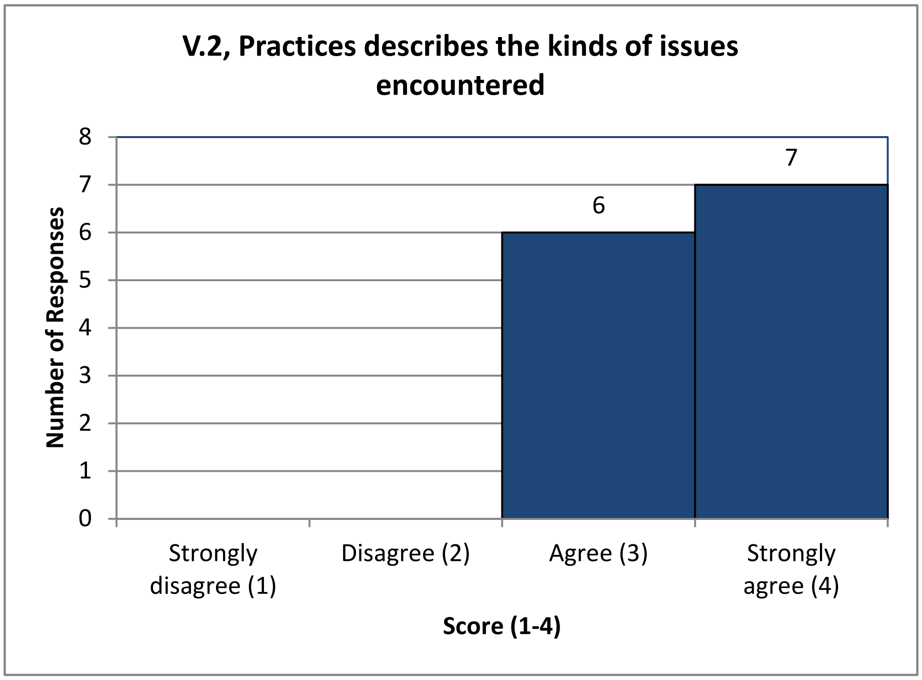


Part V - Rating the Tool

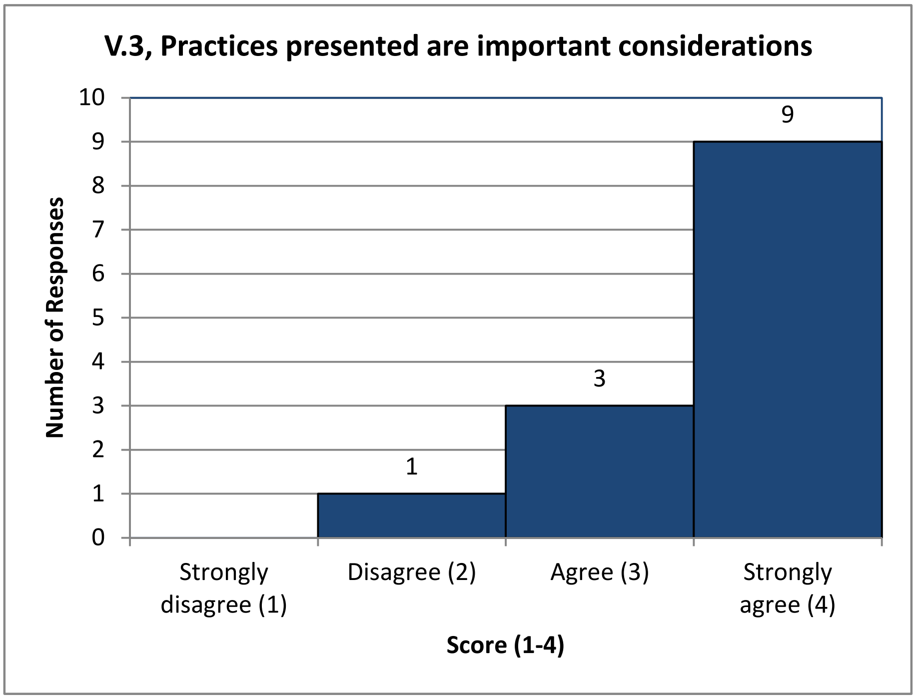
1. The output and results provided in the tool would help you overcome the challenges you encountered?



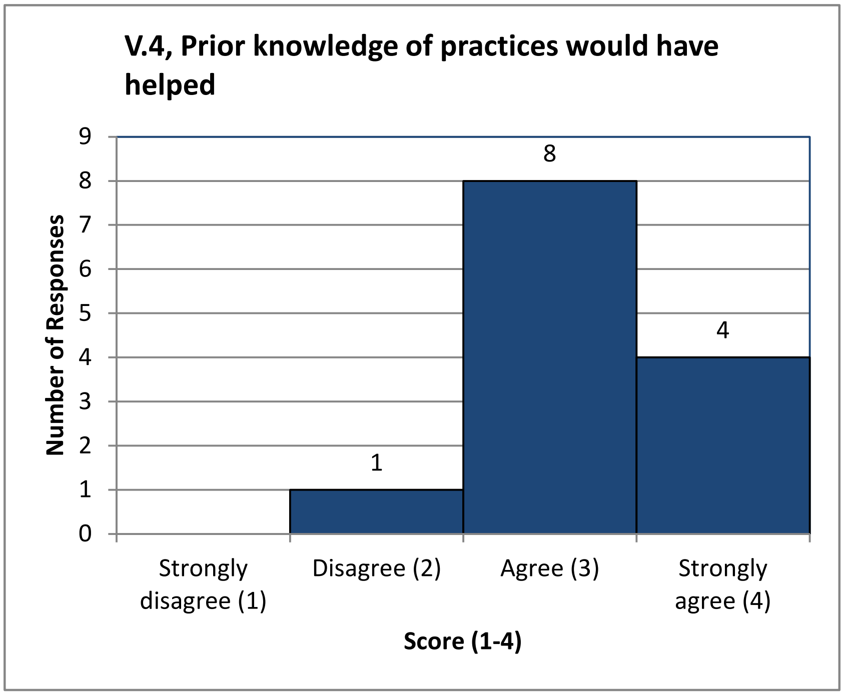
2. The practices presented in the tool describe the kinds of practices you encountered in executing the project?



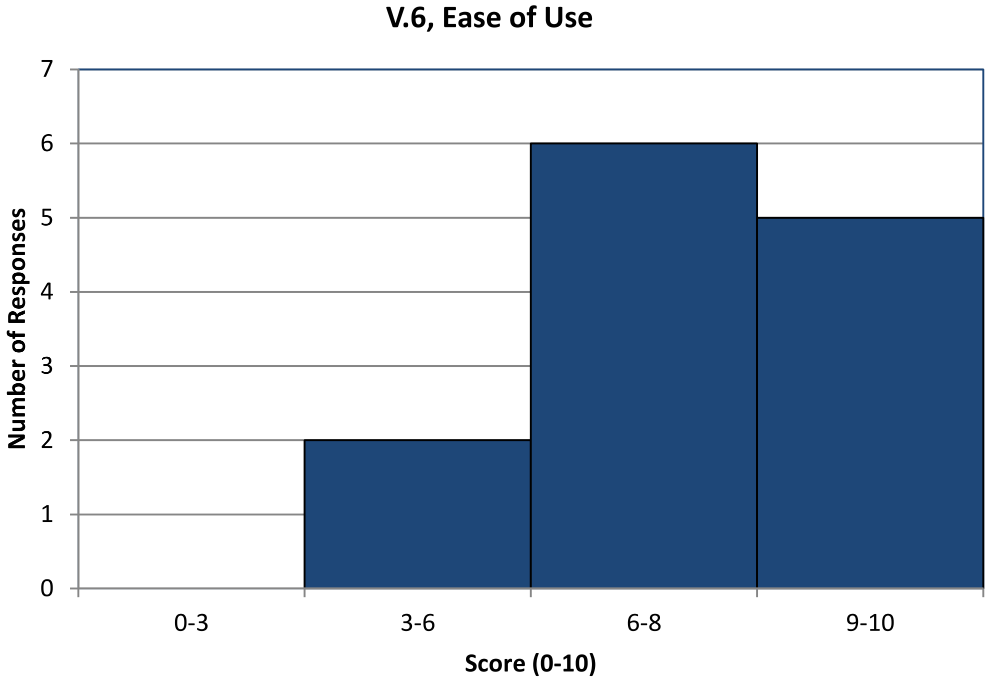
3. The practices presented in the tool are important considerations for the success of projects being undertaken on a Flash-Track basis?



4. Having prior knowledge of the practices presented in the tool would have helped prevent situations you have experienced on site?



6 On a scale of 0-10, **Overall,** how easy was it to use the Tool?



Validation Process - Recommendations for Improvements

Item	Project No./ Suggestion	7. Do you have any suggestions for the improvement of the Tool?	Act	Class
1	1.7	Capture "safety" issues in Implementation Measures	*S-Q*	*FT*
2	4	Consider addressing "inspect frequency" based on criticality of equipment in Implementation Measures	*S-Q*	*FT*
3	5	Consider addressing "QA/QC" in Implementation Measures	*S-Q*	*FT*
4	7	Define how the results relate to risk.	S-Q	*FT*
5	8.9	Consider addressing "QA/QC" in Implementation Measures. Risks of bad decision-making that focused on solely making them fast rather than making them carefully fast. Consequences of errors in the design of an "innovative solution" that was carried into construction and required some re-work.	*S-Q*	*FT*
6	10.4	Consider addressing "safety" in Implementation Measures.	*S-Q*	*FT*
7	10.5	Consider discussion of union v. non-union work	*S-Q*	*FT*
8	13	Consider addressing "QA/QC" in Implementation Measures	*S-Q*	*FT*
9	3.2	How to score something that is not applicable?	Sc	*FT*
10	6.1	Re-consider the method for calculating the results. For our project the flash track readiness tool gave us an overall readiness score of 5.2. Our validation team was surprised it was that high. Based on judgment/instinct, they felt that the true flash track readiness score was about a 3. As we worked through the tool and evaluated each of the 47 issues, we took our best shot at scoring each of them fairly, so we felt that we scored the project correctly based on the methodology in the tool. So after we saw the results, we went back through the tool and tried to understand why the score wasn't lower. One of the theories that we have is that an issue that is scored as a "2" and an issue that is scored as an "8" do not truly average out to a "5". It's possible that the cumulative effect of these 2 issues is something lower than a "5" (even if they are weighted equally in flash track importance). The reason being is that negative impact from the issues that are scored low will outweigh the positive impact from the issues that are scored high. As we reviewed the individual issue scores we found a handful of issues that were scored very low and the comment was made "I don't care how many 8's and 9's you have, these 2's and 3's are going to kill your ability for successful flash track execution." We understand that the tier 1 issues are weighted heavier than the tier 2 issues and we agree that concept should continue. What we are proposing is some additional weighting in the results calculation such that the lower scored issues should have a greater negative effect than the positive effect of the higher scored issues. Maybe this would give us something closer to reality. Something to consider…	Sc	*FT*

Item	Project No./ Suggestion	7. Do you have any suggestions for the improvement of the Tool?	Act	Class
11	7	Identify an acceptable target range when this tool is used for early project evaluation.	Sc	*FT*
12	3.1	Add definition of fast track to landing page of the tool (to contrast with flash track)	L	*FT*
13	6.2	Issue number 47 is worded as "Frequent project review meetings" The XXXX validation team felt that this should be worded as "Frequent and effective project review meetings."	L	*FT*
14	6.3	Issue number 38 is "Provide enough resources to critical path items". On this project there were plenty of resources provided to critical path items, but they were not employed effectively. The XXXX validation team thought issue 38 would be better worded as "Managing, prioritizing and providing enough resources to critical path items."	L	*FT*
15	8.5	Define "exhaustive planning" better. Make sure the term doesn't get confused with the fallacy of having too much detail during planning. Sometimes it's just wiser to make decisions and moving without so much planning, or being 100% certain. The term exhaustive might contradict that principle. On fast-track, judgment will sometimes be more important than the perceived certainty arising out of planning.	L	*FT*
16	8.7	Improve the question mark on "selecting appropriate construction methods" under the Execution Tab. The concept can include Lean practices beneficial to construction methods, not just the ones listed.	L	*FT*
17	8.8	Expand on risks of undertaking "new and unproven technology" as either a Flash Track candidate or new and unproven approaches to executing the work	L	*FT*
18	10.1	Better definition and understand of relevancy and use of report.	L	*FT*
19	11	Some of the language used in the descriptors in the question mark blocks is not clear if you have never used it before. A technical writer should edit the document for clarity of use.	L	*FT*
20	12	Some of the language used in the descriptors in the question mark blocks is not clear if you have never used it before. A technical writer should edit the document for clarity of use.	L	*FT*
21	Other	Report Tab: Redraft language	L	*FT*
22	1.6	Expand on discussion of continuity of involvements of key players in Implementation Measures	*IM*	*FT*
23	2.6	Expand on constructability reviews in Implementation Measures	*IM*	*FT*
24	3.3	Consider commercial accountability (e.g., ensuring no double billing) in Implementation Measures	*IM*	*FT*

Item	Project No./ Suggestion	7. Do you have any suggestions for the improvement of the Tool?	Act	Class
25	8.6	Place more emphasis on developing strategic measures to improve “simplifying approval procedures”. Approval procedures have to be supper streamlined. This is an extremely key aspect of delivering successful fast-track projects. Effectively delegate authority to the project team.	*IM*	*FT*
26	4	Consider addressing "site specific issues" in Implementation Measures	*IM*	*FT*
27	1.1	Overall navigation was easy!	N	Ex
28	1.3	Difficult to reach last question in each tab via mouse or arrow keys	N	Ex
29	2.1	Overall navigation was easy!	N	Ex
30	CII	Practice 46 does not take numerical input	N	Ex
31	Other	Replace "Next Category" button on the last category page (Execution) with new "Results" button	N	Ex
32	Other	Format document to facilitating printing hard copies. Particularly, the Report tab.	N	Ex
33	1.2	Execution Tab speedometer not working	Ed	Ex
34	1.4	Typo on report output showing 2 Tier 1 speedometers	Ed	Ex
35	1.5	Color coding on potential improvement strategies not aligned with lower area recommendations	Ed	Ex
36	2.2	Execution Tab speedometer not working	Ed	Ex
37	2.3	Difficult to reach last question in each tab via mouse or arrow keys	Ed	Ex
38	2.4	Typo on report output showing 2 Tier 1 speedometers	Ed	Ex
39	2.5	Color coding on potential improvement strategies not aligned with lower area recommendations	Ed	Ex
40	8.3	On the Report tab, recommend either eliminating the colored Boxes with the practices located next to the Categories dials, or using that box as navigation panels that lead to more details.	Ed	Ex
41	8.4	Recommend showing the tool to the CII board in order to gather additional feedback on usability.	Ed	Ex
42	9	The tier 1 and 2 gauges on the results page, both read tier 1.	Ed	Ex
43	10.2	Gradient indicator on Execute tab does not indicate score	Ed	Ex
44	10.3	Result page shows both Tier categories indictors as Tier I	Ed	Ex

Item	Project No./ Suggestion	7. Do you have any suggestions for the improvement of the Tool?	Act	Class
45	CII	In the report, color code just the score and not the practice description, or change the transparency of the color behind each practice	Ed	Ex
46	CII	Needle in Execution Category does not show	Ed	Ex
47	CII	Last entry in culture does not take numerical input	Ed	Ex
48	CII	Results Tab: Tier II shows as Tier I- addressed	Ed	Ex
49	CII	Report Tab: Descriptions of the category is in multiple font	Ed	Ex
50	CII	In Report Tab: The improvement implementation strategies, some of the recommendation items did not have number or color. What are they?	Ed	Ex
51	Other	Home page - Increase size for short description of project and reason for being Flash Tracked. Also, add this information the Report page	Ed	Ex
52	Other	Report Tap: Correct all line alignment issues	Ed	Ex
53	Other	All: Standardize all sizing, locations of gauges, etc….. throughout the document	Ed	Ex
54	Other	Missing heading for Cultural Consideration on the Report page	Ed	Ex
55	Other	All: Resolve any appearance issues to improve on ease-of-use, etc…..	Ed	Ex
56	8.1	On the Report tab, recommend adding a "Navigation Panel" at the top of the page (e.g.: similar to the navigation panel on each of the six category tabs). On this navigation panel, the six categories would be presented, and a click on each would lead the user to the category requested (i.e.: contractual, delivery, organizational, cultural, planning, or execution) without the need to scroll up/down through the whole sheet in order to move to/from categories.	AF	Ex
57	8.2	On the Report tab, recommend grouping the "Improvements and implementation measures" into expandable boxes wherein deeper levels of detail are offered at the user request. For example, the "strategic mitigation measures" are all first hidden by default and grouped underneath each of the 47 practices, then shown only as the user clicks on the headers of each practice. Simultaneously, the expandable boxes can be applied to the Critical (Red), Recommended (Yellow) and Incremental (Green) improvements underneath the six categories. Otherwise, the information as presented currently seems overwhelming and difficult to navigate through.	AF	Ex
58	CII	Add a "Note Box" to each practice to capture the comments	AF	Ex

Item	Project No./ Suggestion	7. Do you have any suggestions for the improvement of the Tool?	Act	Class
		Class		
		EXCEL ISSUES (Ex)		32
		FLASH TRACK ISSUES (FT)		26
		Action		58
		Editorial (Ed)	23	
		Navigation (N)	6	
		Scoring (Sc)	3	
		Safety-QC (S-Q)	8	
		Added features (AF)	3	
		Language (L)	10	
		Implementation measures (IM)	5	
			58	

APPENDIX U

Network Analysis – Questionnire and Results

The final facet of this investigation involved a network analysis to understand the relationships and interdependencies between the essential practices and to identify the most central and critical practices. The following pages include:

Flash Track Network Survey

Purpose

The purpose of this survey is to gather data for a network analysis of the inter-relationships and inter-dependencies of the 47 essential practices identified as part of the Research Team 311

Data from this survey is expected to offer an early basis to ascertain the following information:

- Identification of interrelatedness and interdependencies of the 47 practices
- Indications of possible shared principles
- A measure of the relative importance of each practice

When used in business process improvement studies, this methodology is called Organizational Network Analysis (ONA)

Information gathered from this survey is not anticipated to be included in the RT311 Research Report, but may be included in my PhD Dissertation

Thank you for taking the time to complete this task

Bob Austin

Flash Track Network Survey

Instructions

The following pages include each of the 47 essential practices developed as part of the Research Team 311, Flash Track Projects effort Each practice is followed by a number of the other Flash Track practices that had been identified as enabling factors either by the research team, the Delphi process or in a content analysis of earlier research by others

For each questioned practice, consider which of the other Flash Track practices help to facilitate, enable compliment the successful achievement of the target practices Please select a minimum of 2 and maximum of 5 of the responses offered A separate check box is offered in the event that you believe another practice is appropriate

Once you've selected your choices, please list the practices selected based on an assessment of the strength of the connection in a text box offered at the end of each question Similar to the Research Team's earlier surveys, each question also includes a comments box to offer further insights Please feel free to add the practice number for any practices that had not been offered

Flash Track Network Survey

Contractural Considerarations

1. Contractual considerations involve recommended contract measures targeted to mitigating anticipated project risks due to flash track's heightened degree of concurrent

Setting clear; specific scoping requirements*
Select at least 2 and no more than 5

☐ 7 Funding early critical efforts

☐ 17. Engagement of operations & maintenance personnel in the development and design process

☐ 22 Having an owner with sufficient depth of resources and strength of organization

☐ 25 Staffing with multi-skilled personnel

☐ 27 Having an active; involved and fully committed owner

☐ 33 Creating executive alignment amongst the contracted parties

☐ 35. Performing exhaustive front end planning

☐ 40 Recognizing and managing the additional fast track risks

☐ 44 Selecting appropriate construction methods

☐ Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

2 Establishing performance-based specifications*
Select at least 2 and no more than 5

☐ 5 Establishing clear change management procedures

☐ 17 Engagement of operations & maintenance personnel in the development and design process

☐ 22 Having an owner with sufficient depth of resources and strength of organization

☐ 27 Having an active; involved and fully committed owner

☐ 44 Selecting appropriate construction methods

☐ 35 Performing exhaustive front end planning

☐ Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

3 Aligning project participants' interests through contract*
Select at least 2 and no more than 5

☐ 4. Establishing contract strategies specifically tailored to the project condition

☐ 13 Employing innovative procurement practices

☐ 18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel

☐ 19 Using team building and partnering practices

☐ 26 Accepting a new paradigm or mindset differing from that of traditional practices

☐ 33 Creating executive alignment amongst the contracted parties

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

4 Establishing contract strategies specifically tailored to the project condition*
Select at least 2 and no more than 5

☐ 1 Setting clear; specific scoping requirements

☐ 2 Establishing performance-based specifications

☐ 3 Aligning project participants' interests through contract

☐ 11 Making timely selection and award contracts to subcontractors

☐ 13 Employing innovative procurement practices

26 Accepting a new paradigm or mindset differing from that of traditional practices

27 Having an active; involved and fully committed owner

his practice (e g , 15, 7, 22)

5 Establishing clear change management procedures*
Select at least 2 and no more than 5

7 Funding early critical efforts
20 Delegating authority to project level (maximize decision-making authority to the project level)
24 Having an engaged and empowered Owner's Engineer (Owner's representative)
33 Creating executive alignment amongst the contracted parties
40 Recognizing and managing the additional fast track risks
42 Simplifying approval procedures
Please rank your three choices which facilitate achievement of this practice (e g , 15, 7, 22)

6 Establishing an effective claims resolution process*
Select at least 2 and no more than 5

☐ 3 Aligning project participants' interests through contract
☐ 4 Establishing contract strategies specifically tailored to the project condition
☐ 8 Reducing risks through collective efforts of all stakeholders
☐ 11 Making timely selection and award contracts to subcontractors
☐ 13 Employing innovative procurement practices
☐ 40 Recognizing and managing the additional fast track risks
Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

7 Funding early critical efforts*
Select at least 2 and no more than 5

☐ 1 Setting clear; specific scoping requirements
☐ 11 Making timely selection and award contracts to subcontractors
☐ 13 Employing innovative procurement practices
☐ 26 Accepting a new paradigm or mindset differing from that of traditional practices
☐ 33 Creating executive alignment amongst the contracted parties
☐ 40 Recognizing and managing the additional fast track risks
☐ 42 Simplifying approval procedures
Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

8 Reducing risks through collective efforts of all stakeholders*
Select at least 2 and no more than 5

☐ 1 Setting clear; specific scoping requirements
☐ 12 Staffing with personnel with strong leadership capabilities
☐ 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 22 Having an owner with sufficient depth of resources and strength of organization
☐ 24 Having an engaged and empowered Owner's Engineer (Owner's representative)
☐ 25 Staffing with multi-skilled personnel
☐ 40 Recognizing and managing the additional fast track risks
☐ 42 Simplifying approval procedures
Please rank three choices which facilitate achievement of this practice (e g., 15, 7, 22)

Delivery Considerations

Delivery considerations entail approaches to bring together a project team so as to best manage the flash track delivery of a project

Selecting team members and staff based on their fast track experience or qualifications*
Select at least 2 and no more than 5

☐ 12. Staffing with personnel with strong leadership capabilities
☐ 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 23 Selecting personnel with a can do attitude and willingness to tackle challenging tasks
☐ 25. Staffing with multi-skilled personnel
☐ 31. Staffing with cooperative and collaborative personnel

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

10 Focusing procurement decisions on construction priorities*
Select at least 2 and no more than 5.

☐ 3 Aligning project participants' interests through contract
☐ 7. Funding early critical efforts
☐ 11 Making timely selection and award contracts to subcontractors
☐ 15 Involving contractors; trades and vendors in the design phase
39 Considering speed of fabrication and construction during the selection of design alternatives
☐ 47 Frequent and effective project review meetings

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

11 Making timely selection and award contracts to subcontractors*
Select at least 2 and no more than 5

☐ 3 Aligning project participants' interests through contract
☐ 4 Establishing contract strategies specifically tailored to the project condition
☐ 7 Funding early critical efforts
20 Delegating authority to project level (maximize decision-making authority to the project level)
21. Empowering the project team (each organization led by an empowered leader)
30. Having open communication and transparency

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

12 Staffing with personnel with strong leadership capabilities*
Select at least 2 and no more than 5.

☐ 18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 21 Empowering the project team (each organization led by an empowered leader)
☐ 26 Accepting a new paradigm or mindset differing from that of traditional practices
☐ 28 Establishing flexible project teams that avoid rigid hierarchy
☐ 33 Creating executive alignment amongst the contracted parties
☐ 40 Recognizing and managing the additional fast track risks

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

Flash Track Network Survey

13 Employing innovative procurement practices*
Select at least 2 and no more than 5

1 Setting clear; specific scoping requirements
2 Establishing performance-based specifications
4 Establishing contract strategies specifically tailored to the project condition
16 Seeking out suppliers and specialty contractors as a source for time saving innovations
18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
33 Creating executive alignment amongst the contracted parties

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

14. Highly integrated 3-D modelling with all major users updating a common database*
Select at least 2 and no more than 4

☐ 3 Aligning project participants' interests through contract
☐ 7 Funding early critical efforts
☐ 34 Emphasizing coordination planning during the design process
☐ 33 Creating executive alignment amongst the contracted parties
☐ 39 Considering speed of fabrication and construction during the selection of design alternatives

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

15 Involving contractors; trades and vendors in the design phase*
Select at least 2 and no more than 4.

☐ 10 Focusing procurement decisions on construction priorities
☐ 16 Seeking out suppliers and specialty contractors as a source for time saving innovations
☐ 18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 36 Identifying and procuring long lead time items

Please rank your three choices which facilitate achievement of this practice (e g., 15, 7, 22)

16 Seeking out suppliers and specialty contractors as a source for time saving innovations*
Select at least 2 and no more than 3.

☐ 10 Focusing procurement decisions on construction priorities
☐ 13 Employing innovative procurement practices
☐ 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 39 Considering speed of fabrication and construction during the selection of design alternatives

Please rank three choices which facilitate achievement of this practice (e.g , 15, 7, 22)

Organizational Considerations

Organizational considerations entail approaches to structure and manage a project to optimize the project team's performance

17 Engagement of operations & maintenance personnel in the development and design process*
Select at least 2 and no more than 4

☐ 1 Setting clear; specific scoping requirements
☐ 8 Reducing risks through collective efforts of all stakeholders
☐ 12 Staffing with personnel with strong leadership capabilities
☐ 18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 35. Performing exhaustive front end planning

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel*
Select at least 2 and no more than 5

☐ 3 Aligning project participants' interests through contract
☐ 19 Using team building and partnering practices
☐ 27 Having an active; involved and fully committed owner
☐ 31. Staffing with cooperative and collaborative personnel
☐ 33 Creating executive alignment amongst the contracted parties
☐ 40 Recognizing and managing the additional fast track risks
☐ 41 Co-location of project team (owner, designer, builder, and/or key vendors)
☐ 43 Dedicating full-time personnel to the project
☐ 47 Frequent and effective project review meetings

Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

19 Using team building and partnering practices*
Select at least 2 and no more than 5

☐ 1. Setting clear; specific scoping requirements
☐ 3 Aligning project participants' interests through contract
☐ 5 Establishing clear change management procedures
☐ 20 Delegating authority to project level (maximize decision-making authority to the project level)
☐ 31 Staffing with cooperative and collaborative personnel
☐ 41 Co-location of project team (owner, designer, builder, and/or key vendors)
☐ 47 Frequent and effective project review meetings

Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

20 Delegating authority to project level (maximize decision-making authority to the project level)*
Select at least 2 and no more than 5

☐ 12 Staffing with personnel with strong leadership capabilities
☐ 21 Empowering the project team (each organization led by an empowered leader)
☐ 24 Having an engaged and empowered Owner's Engineer (Owner's representative
26 Accepting a new paradigm or mindset differing from that of traditional practices
30 Having open communication and transparency
☐ 33 Creating executive alignment amongst the contracted parties
42 Simplifying approval procedures
47 Frequent and effective project review meetings
Please rank your three choices which facilitate achievement of this practice (e g , 15, 7, 22)

21 Empowering the project team (each organization led by an empowered leader)*
Select at least 2 and no more than 5

☐ 20 Delegating authority to project level (maximize decision-making authority to the project level)
☐ 24 Having an engaged and empowered Owner's Engineer (Owner's representative)
☐ 28. Establishing flexible project teams that avoid rigid hierarchy
☐ 42 Simplifying approval procedures
Please rank three choices which facilitate achievement of this practice (e.g , 15, 7, 22)

22 Having an owner with sufficient depth of resources and strength of organization
Select at least 2 and no more than 5

☐ 43 Dedicating full-time personnel to the project
☐ 24 Having an engaged and empowered Owner's Engineer (Owner's representative)
☐ 42 Simplifying approval procedures
☐ 40 Recognizing and managing the additional fast track risks
☐ 38 Providing enough resources to critical path items
Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

23 Selecting personnel with a can do attitude and willingness to tackle challenging tasks*
Select at least 2 and no more than 5

☐ 9 Selecting team members and staff based on their fast track experience or qualifications
☐ 28 Establishing flexible project teams that avoid rigid hierarchy
☐ 32 Having an open minded team
☐ 33 Creating executive alignment amongst the contracted parties
☐ 38 Providing enough resources to critical path items
Please rank your top three choices which facilitate achievement of this practice (e.g , 15, 7, 22)

24 Having an engaged and empowered Owner's Engineer (Owner's representative)*
Select at least 2 and no more than 5

☐ 20 Delegating authority to project level (maximize decision-making authority to the project level)
☐ 27. Having an active; involved and fully committed owner
☐ 41 Co-location of project team (owner, designer, builder, and/or key vendors)
☐ 43 Dedicating full-time personnel to the project
☐ 47 Frequent and effective project review meetings

Please rank three choices which facilitate achievement of this practice (e g., 15, 7, 22)

25 Staffing with multi-skilled personnel
Select at least 2 and no more than 4

☐ 9 Selecting team members and staff based on their fast track experience or qualifications
☐ 40 Recognizing and managing the additional fast track risks
☐ 43 Dedicating full-time personnel to the project
☐ 45 Minimizing hand-offs

Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

Cultural Considerations

Cultural considerations involve the project teams charactoristics that to collaboratively overcome gaps in scope, risk events design issues and project changes in a proactive way to minimize the negative effects on the project outcomes.

26 Accepting a new paradigm or mindset differing from that of traditional practices*
Select at least 2 and no more than 5

☐ 12 Staffing with personnel with strong leadership capabilities
☐ 13 Employing innovative procurement practices
☐ 16 Seeking out suppliers and specialty contractors as a source for time saving innovations
☐ 27 Having an active; involved and fully committed owner
☐ 32 Having an open minded team
☐ 33 Creating executive alignment amongst the contracted parties
☐ 46 Employing innovative construction methods
Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

27. Having an active; involved and fully committed owner*
Select at least 2 and no more than 5.

☐ 4 Establishing contract strategies specifically tailored to the project condition
☐ 24 Having an engaged and empowered Owner's Engineer (Owner's representative)
☐ 40 Recognizing and managing the additional fast track risks
☐ 41 Co-location of project team (owner, designer, builder, and/or key vendors)
☐ 42 Simplifying approval procedures
☐ 43 Dedicating full-time personnel to the project
Please rank three choices which facilitate achievement of this practice (e g., 15, 7, 22)

28 Establishing flexible project teams that avoid rigid hierarchy*
Select at least 2 and no more lhan 5.

☐ 18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 21 Empowering the project team (each organization led by an empowered leader)
☐ 23 Selecting personnel with a can do attitude and willingness to tackle challenging tasks
☐ 25 Staffing with multi-skilled personnel
31 Staffing with cooperative and collaborative personnel
☐ 41 Co-location of project team (owner, designer, builder, and/or key vendors)
Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

29 Maintaining a no blame culture and mutually supportive environment*
Select at least 2 and no more than 5

☐ 3 Aligning project participants' interests through contract
4 Establishing contract strategies specifically tailored to the project condition
20 Delegating authority to project level (maximize decision-making authority to the project level)
☐ 30 Having open communication and transparency
31 Staffing with cooperative and collaborative personnel
33 Creating executive alignment amongst the contracted parties
43 Dedicating full-time personnel to the project
Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

Appendix U Network Analysis - Survey, Adjacency Matrix and Comparative Rankings

Flash Track Network Survey

30 Having open communication and transparency*

3 Aligning project participants' interests through contract
8 Reducing risks through collective efforts of all stakeholders
14 Highly integrated 3-D modelling with all major users updating a common database
20 Delegating authority to project level (maximize decision-making authority to the project level)
31 Staffing with cooperative and collaborative personnel
☐ Please rank your top three choices which facilitate achievement of this practice (e g., 15, 7, 22)

31 Staffing with cooperative and collaborative personnel*
Select at least 2 and no more than 5

☐ 9 Selecting team members and staff based on their fast track experience or qualifications
☐ 25 Staffing with multi-skilled personnel
☐ 28 Establishing flexible project teams that avoid rigid hierarchy
☐ 29 Maintaining a no blame culture and mutually supportive environment
☐ 32 Having an open minded team
☐ 33 Creating executive alignment amongst the contracted parties
☐ 41 Co-location of project team (owner, designer, builder, and/or key vendors)
☐ 47 Frequent and effective project review meetings
Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

32. Having an open minded team*
Select at least 2 and no more than 5

☐ 16 Seeking out suppliers and specialty contractors as a source for time saving innovations
☐ 19 Using team building and partnering practices
☐ 21 Empowering the project team (each organization led by an empowered leader)
☐ 23 Selecting personnel with a can do attitude and willingness to tackle challenging tasks
☐ 31. Staffing with cooperative and collaborative personnel
☐ 33 Creating executive alignment amongst the contracted parties
☐ 47 Frequent and effective project review meetings
Please rank top three choices which facilitate achievement of this practice (e g., 15, 7, 22)

33 Creating executive alignment amongst the contracted parties
Select at least 2 and no more than 5.

☐ 3. Aligning project participants' interests through contract
☐ 4 Establishing contract strategies specifically tailored to the project condition
☐ 5 Establishing clear change management procedures
☐ 7. Funding early critical efforts
☐ 42 Simplifying approval procedures
Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

Planning Considerations

Planning considerations involve the tools and techniques used to track, evaluate and improve schedule and cost performance

34 Emphasizing coordination planning during the design process*
Select at least 2 and no more than 5

☐ 8 Reducing risks through collective efforts of all stakeholders
☐ 12 Staffing with personnel with strong leadership capabilities
☐ 14 Highly integrated 3-D modelling with all major users updating a common database
☐ 20 Delegating authority to project level (maximize decision-making authority to the project level)
☐ 24 Having an engaged and empowered Owner's Engineer (Owner's representative)
☐ 41. Co-location of project team (owner, designer, builder, and/or key vendors)
☐ 47 Frequent and effective project review meetings

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

35 Performing exhaustive front end planning*
Select at least 2 and no more than 5

☐ 7 Funding early critical efforts
☐ 8 Reducing risks through collective efforts of all stakeholders
☐ 12. Staffing with personnel with strong leadership capabilities
☐ 17 Engagement of operations & maintenance personnel in the development and design process
☐ 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

36 Identifying and procuring long lead time items*
Select at least 2 and no more than 5.

☐ 7 Funding early critical efforts
☐ 16 Seeking out suppliers and specialty contractors as a source for time saving innovations
☐ 17 Engagement of operations & maintenance personnel in the development and design process
☐ 18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 20 Delegating authority to project level (maximize decision-making authority to the project level)
☐ 25 Staffing with multi-skilled personnel
☐ 35 Performing exhaustive front end planning

Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

37 Monitoring and driving corrective actions through the project controls process*

☐ 9 Selecting team members and staff based on their fast track experience or qualifications
☐ 26 Accepting a new paradigm or mindset differing from that of traditional practices
☐ 29 Maintaining a no blame culture and mutually supportive environment
☐ 30 Having open communication and transparency
☐ 33 Creating executive alignment amongst the contracted parties
☐ 34 Emphasizing coordination planning during the design process
☐ 39 Considering speed of fabrication and construction during the selection of design alternatives

Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

38 Providing enough resources to critical path items*
Select at least 2 and no more than 5

5 Establishing clear change management procedures
7 Funding early critical efforts
12 Staffing with personnel with strong leadership capabilities
14 Highly integrated 3-D modelling with all major users updating a common database
26 Accepting a new paradigm or mindset differing from that of traditional practices

Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

39 Considering speed of fabrication and construction during the selection of design alternatives*
Select at least 2 and no more than 5

☐ 10 Focusing procurement decisions on construction priorities
☐ 14 Highly integrated 3-D modelling with all major users updating a common database
☐ 15 Involving contractors; trades and vendors in the design phase
☐ 16 Seeking out suppliers and specialty contractors as a source for time saving innovations
☐ 34. Emphasizing coordination planning during the design process
☐ 46 Employing innovative construction methods

is practice (e g , 15, 7, 22)

40 Recognizing and managing the additional Flash Track risks*
Select at least 2 and no more than 5

☐ 8 Reducing risks through collective efforts of all stakeholders
☐ 10 Focusing procurement decisions on construction priorities
☐ 12 Staffing with personnel with strong leadership capabilities
☐ 18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 25 Staffing with multi-skilled personnel
☐ 47 Frequent and effective project review meetings

Please rank r top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

Flash Track Network Survey

Execution Considerations

Execution considerations involve project and construction management practices The ability to effectively execute the engineering, procurement and construction is a major driver in a successful flash track effort

41 Co-location of project team (owner, designer, builder, and/or key vendors)*
Select at least 2 and no more than 5

☐ 12 Staffing with personnel with strong leadership capabilities
☐ 18 Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 25 Staffing with multi-skilled personnel
☐ 28 Establishing flexible project teams that avoid rigid hierarchy
☐ 31 Staffing with cooperative and collaborative personnel
☐ 33 Creating executive alignment amongst the contracted parties
☐ 47. Frequent and effective project review meetings

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

42. Simplifying approval procedures*
Select at least 2 and no more than 5

☐ 14 Highly integrated 3-D modelling with all major users updating a common database
☐ 20 Delegating authority to project level (maximize decision-making authority to the project level)
☐ 21 Empowering the project team (each organization led by an empowered leader)
☐ 33 Creating executive alignment amongst the contracted parties
☐ 41 Co-location of project team (owner, designer, builder, and/or key vendors)

Please rank three choices which facilitate achievement of this practice (e g., 15, 7, 22)

43 Dedicating full-time personnel to the project*
Select at least 2 and no more than 3

☐ 25 Staffing with multi-skilled personnel
☐ 33. Creating executive alignment amongst the contracted parties
☐ 38 Providing enough resources to critical path items

Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

44 Selecting appropriate construction methods*
Select at least 2 and no more than 5

☐ 8 Reducing risks through collective efforts of all stakeholders
☐ 14 Highly integrated 3-D modelling with all major users updating a common database
☐ 15 Involving contractors; trades and vendors in the design phase
☐ 34 Emphasizing coordination planning during the design process
☐ 39 Considering speed of fabrication and construction during the selection of design alternatives
☐ 46 Employing innovative construction methods
☐ 47 Frequent and effective project review meetings

Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

45 Selecting appropriate construction methods *
Select at least 2 and no more than 5

8 Reducing risks through collective efforts of all stakeholders
14 Highly integrated 3-D modelling with all major users updating a common database
19 Using team building and partnering practices
25 Staffing with multi-skilled personnel
44 Selecting appropriate construction methods
Please rank your top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

46 Minimizing hand-offs *
Select at least 2 and no more than 4

☐ 15 Involving contractors; trades and vendors in the design phase
☐ 16 Seeking out suppliers and specialty contractors as a source for time saving innovations
33 Creating executive alignment amongst the contracted parties
39. Considering speed of fabrication and construction during the selection of design alternatives
Please rank top three choices which facilitate achievement of this practice (e g , 15, 7, 22)

47 Frequent and effective project review meetings *
Select at least 2 and no more than 5.

☐ 12. Staffing with personnel with strong leadership capabilities
☐ 18. Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel
☐ 27 Having an active; involved and fully committed owner
☐ 41. Co-location of project team (owner, designer, builder, and/or key vendors)
Please rank three choices which facilitate achievement of this practice (e g , 15, 7, 22)

Adjacency Matrix
- Summary of Responses -

(Showing distribution of practices above and below the (qualifying) threshold level.)

Enabling Practices

	Enabled Practices	1 Setting clear; specific scoping requirements	2 Establishing performance-based specifications	3 Aligning project participants' interests through contract	4 Establishing contract strategies specifically tailored to the project condition	5 Establishing clear change management procedures	6 Establishing an effective claims resolution process	7 Funding early critical efforts	8 Reducing risks through collective efforts of all stakeholders	9 Selecting team members and staff based on their fast track experience or qualifications	10 Focusing procurement decisions on construction priorities	11 Making timely selection and award contracts to subcontractors	12 Staffing with personnel with strong leadership capabilities	13 Employing innovative procurement practices	14 Highly integrated 3-D modelling with all major users updating a common database	15 Involving contractors; trades and vendors in the design phase	16 Seeking out suppliers and specialty contractors as a source for time saving innovations	17 Engagement of operations & maintenance personnel in the development and design process	18 Establishing a fully integrated project team including design; construction; specialty contractors;	19 Using team building and partnering practices	20 Delegating authority to project level (maximize decision-making authority to the project level)	21 Empowering the project team (each organization led by an empowered leader)	22 Having an owner with sufficient depth of resources and strength of organization	23 Selecting personnel with a can do attitude and willingness to tackle challenging tasks	24 Having an engaged and empowered Owner's Engineer (Owner's representative)	25 Staffing with multi-skilled personnel	26 Accepting a new paradigm or mindset differing from that of traditional practices	27 Having an active; involved and fully committed owner	28 Establishing flexible project teams that avoid rigid hierarchy	29 Maintaining a no blame culture and mutually supportive environment	30 Having open communication and transparency	31 Staffing with cooperative and collaborative personnel	32 Having an open minded team	33 Creating executive alignment amongst the contracted parties	34 Emphasizing coordination planning during the design process	35 Performing exhaustive front end planning	36 Identifying and procuring long lead time items	37 Monitoring and driving corrective actions through the project controls process	38 Providing enough resources to critical path items	39 Considering speed of fabrication and construction during the selection of design alternatives	40 Recognizing and managing the additional fast track risks	41 Simplifying approval procedures	42 Simplifying approval procedures	43 Dedicating full-time personnel to the project	44 Selecting appropriate construction methods	45 Minimizing hand-offs	46 Employing innovative construction methods	47 Frequent project review meetings
1	Setting clear; specific scoping requirements	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	5	0	0	0	0	3	0	0	2	0	4	0	0	0	0	0	4	0	6	0	0	0	0	0	0	0	0	2	0	0	0
2	Establishing performance-based specifications	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	2	0	0	0
3	Aligning project participants' interests through contract	0	0	0	9	0	0	0	0	0	0	0	0	4	0	0	0	0	3	0	0	0	0	0	0	0	4	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Establishing contract strategies specifically tailored to the project condition	6	5	8	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Establishing clear change management procedures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	2	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	5	0	7	0	0	0	0	0
6	Establishing an effective claims resolution process	0	0	6	6	0	0	0	8	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
7	Funding early critical efforts	4	0	0	0	0	0	0	0	0	0	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	3	0	0	0	0	0	0	3	0	3	0	0	0	0	0
8	Reducing risks through collective efforts of all stakeholders	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	7	0	0	0	4	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
9	Selecting team members and staff based on their fast track experience or	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	3	0	0	0	0	5	0	5	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Focusing procurement decisions on construction priorities	0	0	0	0	0	0	8	0	0	0	7	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	1
11	Making timely selection and award contracts to subcontractors	0	0	6	8	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Staffing with personnel with strong leadership capabilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	9	0	0	0	0	4	0	6	0	0	0	0	4	0	0	0	0	0	0	2	0	0	0	0	0	0	0
13	Employing innovative procurement practices	3	6	0	6	0	0	0	0	0	0	0	0	0	0	0	9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Highly integrated 3-D modelling with all major users updating a common	0	0	3	0	0	0	3	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	0	0	0	0	4	0	0	0	0	0	0	0	0
15	Involving contractors; trades and vendors in the design phase	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	9	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
16	Seeking out suppliers and specialty contractors as a source for time saving	0	0	0	0	0	0	0	0	0	7	0	0	6	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
17	Engagement of operations & maintenance personnel in the development and design process	7	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
18	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	6	0	4	0	0	0	0	0	0	0	7	0	4	0	0	0	3
19	Using team building and partnering practices	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	8	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	3
20	Delegating authority to project level (maximize decision-making authority	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	8	0	0	4	0	2	0	0	0	6	0	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0	1
21	Empowering the project team (each organization led by an empowered	1	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	9	0	0	0	2	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
22	Having an owner with sufficient depth of resources and strength of	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	3	0	2	6	0	0	0	0
23	Selecting personnel with a can do attitude and willingness to tackle	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	7	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0
24	Having an engaged and empowered Owner's Engineer (Owner's	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	0	0	0	2
25	Staffing with multi-skilled personnel	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	7	0	5	0	0
26	Accepting a new paradigm or mindset differing from that of traditional	0	0	0	0	0	0	0	0	0	0	0	6	4	0	0	2	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	7	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0
27	Having an active; involved and fully committed owner	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6	3	6	0	0	0	0
28	Establishing flexible project teams that avoid rigid hierarchy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	9	0	5	0	2	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
29	Maintaining a no blame culture and mutually supportive environment	0	0	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	8	7	0	5	0	0	0	0	0	0	0	0	0	1	0	0	0	0
30	Having open communication and transparency	0	0	3	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
31	Staffing with cooperative and collaborative personnel	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	8	8	0	0	5	0	0	0	0	0	0	0	0	5	0	0	0	0	0	4
32	Having an open minded team	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	5	0	7	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	Creating executive alignment amongst the contracted parties	0	0	9	9	5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
34	Emphasizing coordination planning during the design process	0	0	0	0	0	0	0	3	0	0	0	1	0	6	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	5
35	Performing exhaustive front end planning	0	0	0	0	0	0	8	5	0	0	0	1	0	0	0	0	7	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix U Network Analysis - Survey, Adjacency Matrix and Comparative Rankings

Adjacency Matrix

- Summary of Responses -

(Showing distribution of practices above and below the (qualifying) threshold level.)

Enabling Practices

	Enabled Practices	Setting clear; specific scoping requirements 1	Establishing performance-based specifications 2	Aligning project participants' interests through contract 3	Establishing contract strategies specifically tailored to the project condition 4	Establishing clear change management procedures 5	Establishing an effective claims resolution process 6	Funding early critical efforts 7	Reducing risks through collective efforts of all stakeholders 8	Selecting team members and staff based on their fast track experience or qualifications 9	Focusing procurement decisions on construction priorities 10	Making timely selection and award contracts to subcontractors 11	Staffing with personnel with strong leadership capabilities 12	Employing innovative procurement practices 13	Highly integrated 3-D modelling with all major users updating a common database 14	Involving contractors; trades and vendors in the design phase 15	Seeking out suppliers and specialty contractors as a source for time saving innovations 16	Engagement of operations & maintenance personnel in the development and design process 17	Establishing a fully integrated project team including design; construction; specialty contractors; 18	Using team building and partnering practices 19	Delegating authority to project level (maximize decision-making authority to the project level) 20	Empowering the project team (each organization led by an empowered leader) 21	Having an owner with sufficient depth of resources and strength of organization 22	Selecting personnel with a can do attitude and willingness to tackle challenging tasks 23	Having an engaged and empowered Owner's Engineer (Owner's representative) 24	Staffing with multi-skilled personnel 25	Accepting a new paradigm or mindset differing from that of traditional practices 26	Having an active; involved and fully committed owner 27	Establishing flexible project teams that avoid rigid hierarchy 28	Maintaining a no blame culture and mutually supportive environment 29	Having open communication and transparency 30	Staffing with cooperative and collaborative personnel 31	Having an open minded team 32	Creating executive alignment amongst the contracted parties 33	Emphasizing coordination planning during the design process 34	Performing exhaustive front end planning 35	Identifying and procuring long lead time items 36	Monitoring and driving corrective actions through the project controls process 37	Providing enough resources to critical path items 38	Considering speed of fabrication and construction during the selection of design alternatives 39	Recognizing and managing the additional fast track risks 40	Simplifying approval procedures 41	Simplifying approval procedures 42	Dedicating full-time personnel to the project 43	Selecting appropriate construction methods 44	Minimizing hand-offs 45	Employing innovative construction methods 46	Frequent project review meetings 47
36	Identifying and procuring long lead time items	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	6	1	2	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
37	Monitoring and driving corrective actions through the project controls	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	4	7	0	0	2	4	0	0	0	0	1	0	0	0	0	0	0	0	0
38	Providing enough resources to critical path items	0	0	0	0	0	0	8	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	8	0	0	0	0
39	Considering speed of fabrication and construction during the selection of design alternatives	0	0	0	0	0	0	0	0	0	7	0	0	0	1	7	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	5	0
40	Recognizing and managing the additional fast track risks	0	0	0	0	0	0	0	9	0	2	0	6	0	0	0	0	0	5	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
41	Co-location of project team (owner; designer; builder; and/or key vendors)	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	7	0	0	0	0	0	0	2	0	0	6	0	0	7	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	5
42	Simplifying approval procedures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	6	0	0	0	0	0	0
43	Dedicating full-time personnel to the project	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	7	0	0	0	0	8	0	0	0	0	0	0	0	0	0
44	Selecting appropriate construction methods	0	0	0	0	0	0	0	2	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	5	0	0	0	0	0	0	8	1
45	Minimizing hand-offs	0	0	0	0	0	0	0	4	0	0	0	0	0	6	0	0	0	0	3	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0
46	Employing innovative construction methods	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	6	0	0	0	0	0	0	0	0
47	Frequent project review meetings	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	6	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0

# Selected:	6	2	9	7	3	0	8	8	4	4	3	11	7	3	4	6	5	15	3	9	6	3	3	7	9	7	8	5	2	5	8	3	19	4	4	2	0	3	6	8	10	7	7	3	1	3	10
# Potential choices:	6	2	10	7	4	0	9	8	4	4	4	12	6	7	4	7	5	14	4	10	6	3	3	7	10	7	6	5	2	5	8	3	19	4	4	1	0	3	6	10	10	8	7	3	1	3	11
% selected from choices offered:	100%	100%	90%	100%	75%	-	89%	100%	100%	100%	75%	92%	117%	43%	100%	86%	100%	107%	75%	90%	100%	100%	100%	100%	90%	100%	133%	100%	100%	100%	100%	100%	100%	100%	100%	200%	-	100%	100%	80%	100%	88%	100%	100%	100%	100%	91%
# above threshold value:	3	2	6	5	1	0	5	4	2	3	1	5	1	2	4	5	3	8	1	4	5	1	3	2	2	1	3	5	1	3	8	3	4	2	2	0	0	2	4	4	9	1	5	1	1	3	3
% choices reaching threshold value:	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Practice no:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

Notes:
1. Respondents # 4 and #5 suggested the addition of 4 enabling practices (#27 enabling #7, #36 enabling #38 respectively and #13 and #18 enabling #14). Shown in green.
2. Respondents # 4 also suggested that practices #3 shown as enabling practice # 14 (selected by 3 others)and practice #26 shown as enabling #38 (selected by 1 other) be removed from the questionairre. Not shown.
3. Fifteen (15) fixed choices were not selected by any of the nine respondents.

Below threshold:	127
Above threshold:	143
Added:	4
No selections:	15

CII RT-311 Successful Delivery of Flash Track Semantic Network Analysis (SeNA)

Response summary: Nine members of the industry expert manal contributed

			Degree Centrality											
Issue #	Issue		Undirected	In-degree	Out-degree	Eigenvector Centrailty	Degree Rank	Eigenvector Centrality Rank	Out-degree Rank	In-degree Rank	RI Rank	Round 3 rank	AHP Rank	Tier
1	Setting clear; specific scoping requirements	Contractual	4	1	3	0.021	26	18	18	44	2	1	22	I
2	Establishing performance-based specifications	Contractual	5	3	2	0.020	13	19	26	21	45	42	46	II
3	Aligning project participants' interests through contract	Contractual	6	2	6	0.028	8	12	4	39	37	42	38	II
4	Establishing contract strategies specifically tailored to the project condition	Contractual	7	3	5	0.022	4	16	5	22	29	19	40	II
5	Establishing clear change management procedures	Contractual	4	4	1	0.017	27	28	36	3	9	19	44	I
6	Establishing an effective claims resolution process	Contractual	4	4	0	0.022	28	17	45	12	38	46	47	II
7	Funding early critical efforts	Contractual	5	0	5	0.014	14	32	6	47	7	6	26	I
8	Reducing risks through collective efforts of all stakeholders	Contractual	6	3	4	0.038	9	6	11	24	27	31	45	II
9	Selecting team members and staff based on their fast track experience or qualifications	Delivery	4	4	2	0.012	29	38	27	4	35	9	24	I
10	Focusing procurement decisions on construction priorities	Delivery	5	4	3	0.018	15	23	19	5	5	4	14	I
11	Making timely selection and award contracts to subcontractors	Delivery	4	3	1	0.014	30	33	37	16	10	6	19	I
12	Staffing with personnel with strong leadership capabilities	Delivery	5	1	5	0.016	16	29	7	45	6	16	11	I
13	Employing innovative procurement practices	Delivery	3	3	1	0.013	39	35	38	25	39	39	42	II
14	Highly integrated 3-D modelling with all major users updating a common database	Delivery	3	1	2	0.007	40	42	28	40	40	24	43	II
15	Involving contractors; trades and vendors in the design phase	Delivery	6	3	4	0.030	10	11	12	26	26	24	20	II
16	Seeking out suppliers and specialty contractors as a source for time saving innovations	Delivery	7	4	5	0.031	5	9	8	11	36	35	25	II
17	Engagement of operations & maintenance personnel in the development and design process	Organizational	5	3	2	0.031	17	10	29	27	23	31	13	II
18	Establishing a fully integrated project team including design; construction; specialty contractors; commissioning and operations personnel	Organizational	12	5	8	0.073	1	1	2	1	4	2	12	I
19	Using team building and partnering practices	Organizational	3	2	1	0.028	41	13	39	41	41	27	39	II
20	Delegating authority to project level (maximize decision-making authority to the project level)	Organizational	6	3	4	0.019	11	21	13	17	19	16	7	I
21	Empowering the project team (each organization led by an empowered leader)	Organizational	5	3	5	0.016	18	30	9	23	16	23	31	II
22	Having an owner with sufficient depth of resources and strength of organization	Organizational	4	3	1	0.009	31	40	40	28	31	42	34	II
23	Selecting personnel with a can do attitude and willingness to tackle challenging tasks	Organizational	3	3	3	0.007	42	43	20	29	11	13	35	II
24	Having an engaged and empowered Owner's Engineer (Owner's representative)	Organizational	4	3	2	0.014	32	34	30	30	20	19	32	II
25	Staffing with multi-skilled personnel	Organizational	3	3	2	0.005	43	45	31	31	44	42	41	II
26	Accepting a new paradigm or mindset differing from that of traditional practices	Cultural	4	3	1	0.009	33	41	41	32	43	27	30	II
27	Having an active; involved and fully committed owner	Cultural	7	5	3	0.040	6	4	21	2	12	47	29	II
28	Establishing flexible project teams that avoid rigid hierarchy	Cultural	4	4	4	0.020	34	20	14	13	42	35	23	II
29	Maintaining a no blame culture and mutually supportive environment	Cultural	4	4	1	0.018	35	24	42	14	32	24	15	II
30	Having open communication and transparency	Cultural	5	2	3	0.023	19	15	22	37	8	5	6	I

CII RT-311 Successful Delivery of Flash Track-Semantic Network Analysis
(SeNA) Response summary: ⍰ Nine members of the industry expert manal contributed

Issue #	Issue		Degree Centrality			Eigenvector Centrailty	Degree Rank	Eigenvector Centrality Rank	Out-degree Rank	In-degree Rank	RI Rank	Round 3 rank	AHP Rank	Tier
			Undirected	In-degree	Out-degree									
31	Staffing with cooperative and collaborative personnel	Cultural	8	4	8	0.040	3	5	3	10	14	13	21	II
32	Having an open minded team	Cultural	4	3	3	0.012	36	39	23	33	22	41	37	II
33	Creating executive alignment amongst the contracted parties	Cultural	4	3	3	0.015	37	31	24	34	18	31	27	II
34	Emphasizing coordination planning during the design process	Planning	4	3	2	0.019	38	22	32	18	13	27	10	I
35	Performing exhaustive front end planning	Planning	6	4	2	0.032	12	8	33	15	47	11	18	II
36	Identifying and procuring long lead time items	Planning	3	3	0	0.013	44	36	46	19	1	6	2	I
37	Monitoring and driving corrective actions through the project controls process	Planning	2	2	0	0.005	47	46	47	42	25	35	33	II
38	Providing enough resources to critical path items	Planning	3	2	2	0.006	45	44	34	38	17	15	3	I
39	Considering speed of fabrication and construction during the selection of design alternatives	Planning	5	4	4	0.018	20	25	15	6	24	12	8	I
40	Recognizing and managing the additional fast track risks	Planning	7	4	4	0.041	7	3	16	7	15	10	4	I
41	Co-location of project team (owner; designer; builder; and/or key vendors)	Execution	9	4	9	0.051	2	2	1	9	30	19	17	II
42	Simplifying approval procedures	Execution	5	3	2	0.024	21	14	35	20	33	27	9	I
43	Dedicating full-time personnel to the project	Execution	5	1	5	0.013	22	37	10	46	3	3	5	I
44	Selecting appropriate construction methods	Execution	5	4	1	0.018	23	26	43	8	21	31	1	I
45	Minimizing hand-offs	Execution	3	3	1	0.005	46	47	44	35	34	35	16	II
46	Employing innovative construction methods	Execution	5	3	3	0.018	24	27	25	36	46	39	28	II
47	Frequent project review meetings	Execution	5	2	4	0.034	25	7	17	43	28	16	36	II

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