Guidebook for Construction Management Practices for Rural Projects

DETAILS

32 pages | 8.5 x 11 | PAPERBACK

ISBN 978-0-309-25897-5 | DOI 10.17226/22633

AUTHORS

Hallowell, Matthew; Tran, Daniel; and Molenaar, Keith

March 2013

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Responsible Senior Program Officer: Gwen Chisholm Smith

Research Results Digest 381

GUIDEBOOK FOR CONSTRUCTION MANAGEMENT PRACTICES FOR RURAL PROJECTS

This digest was developed from research conducted under NCHRP Project 20-65, Task 40, "Construction Management Practices for Rural Projects—An Assessment." The Guidebook suggests construction management practices for rural projects and focuses on practical tools and techniques that apply to small rural construction professionals. The principal authors of this digest were Matthew Hallowell, Daniel Tran, and Keith Molenaar of the University of Colorado under subcontract to ICF International.

CONTENTS

INTRODUCTION

In *NCHRP RRD 381*, rural projects are defined as those that cost less than approximately $2 million and occur in an area with a population less than 50,000 people. The Guidebook focuses on practical tools and techniques that project managers and their employees can use to improve the following aspects of construction management:

1. Construction administration
2. Construction engineering and operation
3. Cost estimating techniques
4. Scheduling techniques
5. Quality control/quality assurance
6. Construction safety
7. Claims and disputes

1. CONSTRUCTION ADMINISTRATION

Definition

Construction administration is a process of setting requirements for contracting, project documentation, and communications.

Challenges

Documentation: Recordkeeping is an integral part of contract administration and is especially important for rural projects because of necessary communication with small communities that often do not formally assign resources to project oversight. Records should be archived for contracts, change orders, requests for information, payments, as-built drawings, materials specifications, quality control and quality assurance charts, injury reports, reports of access management concerns from citizens, right-of-way acquisition, and formal communications with contractors. Also, hard copies of such records should be kept because many small contractors have limited ability to communicate electronically in the field and are not proficient in the use of project management software.

Communication: Rural construction projects are often located in remote areas with limited access to resources such as available and reliable telecommunications, experienced personnel, equipment and tools, skilled labor and project management oversight, and records from past projects. Distance from the project office to the project

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

location can hinder proper administration and has caused the following issues:

- Difficulty in communication with the local public regarding progress and completion dates, affected areas, and access management;
- Difficulty in communication with the field crew regarding acceptable work practices, progress reporting, and quality assurance; and
- Challenges in coordinating with all stakeholders including local government, counties, special utility districts, residents, schools, business owners, and police.

Staffing: Although staffing is not an issue in all states, the remoteness of project sites can make it difficult to recruit and retain staff members who are experienced in the basics of scheduling (bar charts), estimating (parametric estimating and volume calculations), project control (progress reporting), safety management (federal regulations and proper hazard recognition practices), and quality control (sampling and recording). The lack of such staff can lead to challenges in achieving project goals and maintaining positive relationships with local stakeholders.

Environmental and other issues: The typical locations of rural projects involve agricultural and economic challenges such as monitoring the impact of projects on adjacent farming and the transportation of agricultural goods.

Best Practices

Project documentation: The main purpose of project documentation is to formalize and record acceptance of the quality and quantity of materials, change orders, and other related dispute information. Recordkeeping is also performed to improve the performance of future projects. For example, local agencies should maintain a comprehensive construction file record in a manner similar to state requirements and other federal aid projects (e.g., projects in an appropriate Regional Planning Affiliation [RPA], Metropolitan Planning Organization [MPO], or Transportation Improvement Program [TIP]). Project documentation should always be available for inspection by state departments of transportation (DOTs) and FHWA or FTA personnel. Please see Example 1.1 for a sample documentation checklist.

Communication enhancement: The key to success for rural transit projects is communication and regular updates between the agency and the contractor team and between the project management (contractor and agency) and the local community. Effective communication includes the following techniques:

- Hold weekly project update meetings with the contractor to encourage candid information regarding safety, productivity, and quality;
- Strengthen a proactive outreach to the local community through active participation in community meetings and providing project updates at regular intervals;
- Use mobile communication methods and require high-speed Internet at the project site when possible to maintain options for continuous communication;
- Discuss access issues with local residents and businesses prior to the start of the project to resolve issues before the community is impacted; and
- Provide flyers, conduct door-to-door contact, advertise in the newspaper, and hold multiple project meetings to convey good will with the local community.

Pre-construction meeting: The objective of a pre-construction meeting between the contractor and agency is to discuss project specifications, plans, scheduling, project updates, quality assurance procedures, change order management, and troubleshooting. The point-of-contact at the agency (facilitator) should be familiar with all project documents before the start of construction, which include the plans, specifications, general conditions, access management plans, right-of-way acquisitions, and any addenda to the contract. The attendees of the pre-construction meeting should include the facilitator, contractor, construction manager, and other stakeholders (utilities, railroad, etc.) who may impact or be impacted by the project. The duration of the meeting can be several hours to days, depending on the project scope and complexity. This meeting is the

agency's opportunity to ensure that there is common understanding of the project agreement and the respective roles. At this meeting, the agency can request samples of a progress schedule, a list of material sources, a list of subcontractors, and a map of haul roads and designated local detours. Please see the following examples for further details of resources associated with pre-construction meetings:

- Example 1.2 for Notice of Pre-construction Meeting
- Example 1.3 for Pre-construction Checklist

Resources

Standard specifications and construction manual: This resource often includes the standard state contract and construction manual.

Example Documents

Example 1.1: Documentation Checklist

(Source: Ohio DOT)

Documentation should support an audit. If it isn't documented, it didn't happen.

- □ Daily Diary. The daily diary should be up to date and contain the following information:
  - o All work performed by the contractor
  - o List of equipment
  - o Project personnel and hours worked
  - o Pay quantities. Check to see that they match the calculated values and how the pay quantity is determined.
  - o Daily weather conditions (weather affects the majority of work performed and is needed to determine time extensions based upon weather delays)
  - o Special notes and instructions to the contractor
  - o Any unusual events occurring on or adjacent to the project, even those not related to construction
- □ Measurements
  - o Measurements should be shown either in the daily diary or some other form of documentation. The inspector must indicate that the measurement is an actual field measurement. Even if the measurement is a plan dimension, note that the dimension has been field verified.
  - o If the measurements in the diary are transferred from other documentation, has the engineer indicated where to find that documentation?
- □ Calculations
  - o Do the calculations use the measured or plan dimensions? This should be indicated; field verification is required.
  - o Note whether a tape is included with the calculations.
  - o All calculations should include item of work, location, date, and initials.
- □ Materials
  - o Is the inspector getting necessary documentation for the materials records? Documentation should provide for quality, quantity, and basis for payment.
  - o How is the project manager organizing the materials documentation?
  - o The project engineer must approve all materials and solve any deficiencies.
- □ Permits (Tickets)
  - o Each permit must include: Job Mix Formulas (JMF), date, location, item, and initials.
  - o Any sequence of tickets that are not in order or have tickets missing needs to have a calculator tape verifying the accumulative total.
- □ Change Orders / Pricing for extra work
- □ Claims / Dispute Resolution
- □ Testing and Results
- □ Traffic
- □ Inspections
- □ Schedule and Completion Date / Time Extensions / Liquidated Damages
- □ Any plan changes
- □ Timeliness of payments
- □ Railroad or Utility Force Account
- □ Prevailing Wage and Disadvantaged Business Enterprise (DBE) (if applicable)

Example 1.2: Notice of Pre-construction Meeting

(Source: Tennessee DOT)

RE: **PRE-CONSTRUCTION CONFERENCE NOTICE**

PIN:
County:
Federal Project No.:
Description:

State Project No.:
Contract No.:
Reference No.:

To Whom it May Concern:

A pre-construction conference is to be held , at , at the in , for the contract referenced above. The discussion will include details relating to project construction. Your attendance and all pertinent subcontractors are requested to attend. Utility Companies involved will also need to be present.

By copy of this notice, all utility companies are advised to attend and provide a representative capable of presenting a workable relocation plan.

It is required that you bring the following information, if applicable, to the conference:

1. Plan of construction operation and work schedule as specified in Subsection 105.06 of the Tennessee Department of Transportation (T.D.O.T.) Standard Specifications.
2. Erosion Control Plan as specified in Subsection 209.05 of the T.D.O.T. Standard Specifications.
3. Name of the person in charge of the project, traffic control, erosion control and their home telephone, mobile and beeper number.
4. Plan for detouring/controlling traffic.
5. Material Suppliers List - including name and location of suppliers as specified in Subsection 106.07 of the T.D.O.T. Standard Specifications.
6. Listing of ALL subcontractors and the items and/or material they are involved with.
7. Letter certifying that all temporary traffic control items to be used fully comply with the Department of Transportation requirements as specified in Subsection 712.02 of the T.D.O.T. Standard Specifications. This letter must be signed and notarized.
8. Contractor Employee Safety and Health Program (ESHP) Certification Letter (Special Provision 107SHP & Circular Letter 107.01-01).
9. Proposed trainees and classifications as specified in Special Provision 1240.
10. A copy of the signed agreement between the prime contractor and each DBE subcontractor as specified in Special Provision 1247.
11. 407 Process Control Plan for asphalt as specified in Subsection 407.03 of the T.D.O.T. Standard Specifications.
12. 604 Process Control Plan for concrete as specified in Subsection 604.03 of the T.D.O.T. Standard Specifications.

If a subcontractor or utility company representative is not able to attend, please notify this office. If I may be of assistance or additional information is needed, please contact me at . Persons having a disability that require access to participate at the meeting may contact the local government at , TTY , no less than (seven) days prior to the meeting.

Sincerely,

cc: Regional Construction
Regional Materials & Tests
Regional Safety
Environmental Planning and Permits Division
Regional ADA Coordinator
Civil Rights Office
contract file
Environmental Division Natural Resources Office
Environmental Ecology Section

Example 1.3: Pre-construction Checklist
(Source: Ohio DOT)

- ☐ Project staffing list including normal business and emergency contact phone numbers for key staff members of the Local Public Agency (LPA) and Construction Project Engineer (CPE), contractor, and subcontractors. Also, responsibilities of each party including identification of those responsible for Equal Employment Opportunity (EEO), Prevailing Wage, and Disadvantaged Business Enterprise (DBE) (if applicable).
- ☐ List of material suppliers, Materials Management Process
- ☐ Testing and Inspection Implementation Plan
- ☐ Plan Notes
- ☐ Proposal Notes
- ☐ Progress Schedule
- ☐ Completion Date / Interim Completion Dates
- ☐ Special Uses of "As Per Plan" Reference Items
- ☐ Phasing Requirements
- ☐ Haul roads (notice to owner of facility)
- ☐ Detour routes and lane width restrictions (required to provide notice to agency if on state route)
- ☐ Special Provisions
- ☐ Addenda
- ☐ Change Order Review and Claims Resolution Processes
- ☐ Status of utility relocations, especially those that need to be addressed immediately to avoid delays
- ☐ Status of railroad review of contractor's permits, demolition, false work, track protection, temporary crossings, erection plans, flagger services, and associated force account(s)
- ☐ Prevailing wage requirements and procedures
- ☐ EEO responsibilities, nondiscriminatory hiring requirements, and requirements of the on-the-job training program
- ☐ DBE goals and procedures
- ☐ Protection and restoration of property
- ☐ Waste / Borrow Agreements
- ☐ Fabrication Approvals
- ☐ Maintenance of Traffic Review

2. CONSTRUCTION ENGINEERING AND OPERATION

Definition

Construction engineering and operation is a process of supervising construction activities, material testing, and inspection products, and managing equipment.

Challenges

Staffing: In most states, it can be difficult to attract agency employees to projects in rural areas. Nevertheless, to achieve project success in rural areas, agencies need competent staff to administer contracts, inspect products, and assist with interaction in the local community. The project manager should be a full-time engineer who is aware of the project status at all times.

Remote locations: Since rural projects are usually far from agency headquarters, it can be challenging to manage travel time and efficient use of vehicles.

Best Practices

Staff management: To increase cost efficiency, an agency may supplement core staff by hiring professional consultants who are certified or registered to review, interpret, and amend contracts; perform material inspections and use basic statistics to assess quality; and speak with the local community members. If a competent agency representative is not available, a local consultant with these skills should be hired. When selecting a consultant, an agency should consider the members of the consultant's team, their past success with the aforementioned competencies, and their rates. Agency administration should review and approve any major deviations from the initial consultant agreement and contracts when applicable. For examples of staffing letters and requests for qualification, please see Examples 2.1 and 2.2, respectively.

Typically, an effective staff performs the following duties for management of a rural project:

- Performs on-site inspection and approval;
- Collects material samples and performs quality tests (e.g., aggregate site distribution);
- Enhances communication and coordination between inspectors and the contractor and between the project team and local community;
- Performs quality control tests in accordance with federally accepted methods (see http://www.fhwa.dot.gov/bridge/qcqa.htm);
- Sets up and uses mobile material testing labs;
- Coordinates contact with local material suppliers;
- Collects project documentation for record-keeping; and
- Schedules and facilitates coordination meetings.

Change orders: Change orders involve the addition, deletion, or other modification of work requested by the agency. Change order management can be difficult on any project because all delays and price changes must be negotiated independently of the original contract. For rural projects, all change orders must be clearly documented and reviewed by individuals with experience in contract administration and management. For "major" change orders, notification must be submitted to the upper administration (e.g., District or State Construction Engineering Department) for review and concurrence prior to the contractor performing the work. Major change orders typically include:

- $25,000 for projects with a scope between $0 and $500,000;
- The lesser of 5% of the total bid contract or $100,000 for projects greater than $500,000; and
- Any change orders that affect the work limits or result in new environmental impacts.

Example 7.1 in Section 7 provides a sample of the change order notification form.

Environmental impact and mitigation: Impact to the local environment is a major issue for rural construction projects because they are often located in areas of environmental sensitivity or protection. Environmental concerns include impacts to wetlands, disposal or introduction of hazardous waste, and historical and social/economic aspects of the rural project. The National Environmental Policy Act of 1969 (NEPA) requires all projects with federal funding to conform to the NEPA standards. All NEPA standards can be found at http://www.environment.fhwa.dot.gov/projdev/index.asp with

specific guidance for implementation, documentation, decision making, and safety in addition to case studies. The agency and contractor must be familiar with NEPA and the State Environmental Policy Act (SEPA) requirements. According to NEPA Sec. 102 [42 USC § 4332], a detailed statement of the following is required for federally funded projects:

- "the environmental impact of the proposed action,
- any adverse environmental effects which cannot be avoided should the proposal be implemented,
- alternatives to the proposed action,
- the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."

Please see Example 2.3 for a sample of the environmental checklist.

Project bundling: Sometimes it can be advantageous to cluster multiple small rural projects in one geographic location to more efficiently use staff, interact with the local community, manage access issues for local businesses, and reduce overhead associated with inspection and material testing. Project bundling is commonly used by mature agencies as a best practice.

Other considerations: In addition to NEPA and SEPA, agencies must also ensure that state guidelines, construction guidelines and policies, and standard specifications are followed. The most restrictive requirements must be met.

Resources

Staff: To increase efficiency on rural projects, agencies should consider:

- Partnering with state police for signal controls;
- Using maintenance forces to help construction inspection; and
- Using consultants to support field office staff.

Construction manual and standard specifications: This resource includes a testing manual; inspection guidelines; state construction manual and standard specification; and best practices, lessons learned, and other internal program manuals.

Communication enhancement: Communication can be enhanced by using high-speed Internet, cell phones, and electronic file processing at the worksite when feasible.

Example Documents

Example 2.1: Staffing Letter
(Source: Pennsylvania DOT)

- The name, title, address, and telephone number of the Project Manager the Local Project Sponsor proposes to manage the project and act as its official contact with the Department, to whom correspondence is to be directed, and who is to have authority to speak for and bind the Local Sponsor in all matters relating to the contract, including the approval of work orders. This individual is to supervise the Inspector-in-Charge either directly or through an intermediate staff.
    - If a consulting engineer is appointed by the Local Project Sponsor to provide guidance and assistance to the full-time employee or elected public official designated as its Project Manager, the Local Sponsor is to provide the Department with a copy of the consultant agreement.
- The name of the individual who will be assigned to the project full time as the Inspector-in-Charge. A resume for the Inspector-in-Charge is to be included and the designee's qualifications are to be readily discernible.
- The number of subordinate inspectors who will be assigned to the project. Resumes for subordinate inspectors are to be included and each prospective inspector’s qualifications are to be readily discernible.
- Inspection of fabricated structural steel, aluminum, and/or timber, as well as precast and pre-stressed concrete products, will be provided by the Bureau of Construction and Materials, Materials Testing Division, Structural Materials Section, to ensure proper fabrication.

Example 2.2: Request for Qualifications (RFQ)

(Source: Maine DOT)

SUBJECT: _____ Services
Requirement: The Municipality of _____ is seeking the services of a consultant for

_____
_____
_____

CRITERIA - Interested consultant firms must provide responses to the questions provided below.

Criteria (1) Experience in the area of expertise. Provide a brief synopsis of projects in the listed categories/areas of expertise your firm has been engaged in over the past 3 years.

Criteria (2) Staff. Provide a brief outline of the qualifications for key staff who will be used on the project. If you plan to use sub-consultants, include this information: List office locations and particular strengths. Projects included in résumés to exhibit relevant experience must include as a minimum: project description, dollar amount, start and completion dates.

Criteria (3) Methods for controlling costs. Briefly describe how the firm controls and monitors client costs, including construction costs that result from your firm's plans and designs.

Criteria (4) Ability of firm to maintain schedule. Provide a brief outline of your firm's methods of quality control, schedule control, and ability to handle current workload. Describe how your firm will manage its projects and how it intends to maintain effective communication with the Municipality.

DUE Month/Day/Year no later than 0:00 P.M. Any Statement of Qualifications (SOQ) received after that time and date will not be accepted. All requests for clarification and/or additional information must be submitted via e-mail to _____, SUBJECT: Clarification to RFQ for_____ or by fax_____ to the individual referenced by Attention on the cover page of this RFQ no later than 0:00 p.m. on month/day/year. When appropriate, responses to requests, as well as any Municipality-initiated changes, will be provided to all prospective proposers as amendments to the RFQ, and will be placed on the Municipal website:_____no later than month/day/year. IT WILL BE THE PROPOSER'S RESPONSIBILITY TO CHECK THE REFERENCED WEBSITE FOR ANY NEW AMENDMENTS. (**Note:** The Proposer must include reference to all amendments on their response to this RFQ.)

Submit your SOQ by e-mail to _____ (if less than 5Mb) – If over 5Mb, please submit by CD (no DVD's) to:
Municipality of _____
Attn: _____
INSERT MAILING ADDRESS
Each SOQ will be acknowledged by return e-mail. Please label any CDs submitted with the e-mail address to which an acknowledgement should be sent.

Example 2.3: Environmental Checklist

(Source: Nebraska Department of Roads [DOR])

ENVIRONMENTAL

- ☐ Ensure that the preferred alternative in the environmental document is consistent with the state transportation improvement program and/or Safety Schedule of Improvements with regards to design concept and scope. If necessary, amend improvement program.
- ☐ Type and date of environmental clearance.
- ☐ Is a reevaluation required for the Categorical Exclusion/Environmental Assessment/ Finding of No Significant Impact or Environmental Impact Statement to determine if the National Environmental Policy Act (NEPA) document, findings, and commitments remain valid or is a supplemental NEPA document required?
- ☐ Are historic or archeological resources involved? Is Section 106 processing complete and documented?
- ☐ Is noise analysis/attenuation designed and included in the plans and specifications? Are there exceptions to noise attenuation?
- ☐ Date of wetlands finding.
- ☐ Threatened/endangered species or critical habitats involved? US Fish and Wildlife Services consultation date.
- ☐ Are floodplains involved? Finding date.
- ☐ Are the environmental commitments as approved in the environmental document incorporated into the final plans and specifications? *(23 CFR 635.309).*
- ☐ Has a copy of the environmental commitment listing been received?
- ☐ Is SW3P plan adequate? *(23 CFR 635.309).*
  - ☐ Have Project-Specific Locations been addressed?
- ☐ Have utilities been addressed?
  - ☐ Is status of utilities report included in the proposal?
- ☐ Is there concurrent utility adjustment with contract work? Expected clearance date.
- ☐ Where required, verify there are agreements between the local public agency and affected utilities.
- ☐ Is responsibility for NEPA addressed regarding utilities and Project-Specific Locations *(PSLs)*?

SOCIO-ECONOMIC	**Yes**	**No**
Are the anticipated environmental impacts resulting from the proposed action likely to fall disproportionately on the minority and/or low-income populations, including populations with Limited English Proficiency (LEP)?	☐	☐

(continued on next page)

Example 2.3 (Continued).

Will the proposed project increase traffic in low-income and minority neighborhoods?	☐	☐
Will minority-owned businesses that serve a minority or low-income population be impacted by the project?	☐	☐
Will access from minority or low-income neighborhoods to various services or cultural destinations (church, parks, community center) be affected by the proposed project?	☐	☐
Will the project require displacement of any minority or low-income residences?	☐	☐
Are there noise or air quality impacts to minority or low-income populations?	☐	☐
If YES, describe any potential adverse effects and the affected population (e.g., minority, low-income, elderly, or disabled), and describe proposed measures to mitigate for any adverse impacts:	☐	☐

3. COST ESTIMATING

Definition

Construction cost estimating is the process of analyzing a specific scope of work and predicting the cost.

Challenges

Historical data: Typically, rural projects lack historical data that can be used to perform accurate cost estimates because of limited data in rural regions (e.g., location-specific material, labor, and property costs). Additionally, risk and uncertainty (e.g., undiscovered ground conditions, unknown conditions of the pavement layers, etc.) have a significant impact on the accuracy of a cost estimate.

Remote locations: Compared with urban projects, rural projects may experience higher costs due to mobilization, transportation, maintenance, and protection of traffic costs. Further, it can be difficult to estimate the cost of materials due to the varying distances from sources of materials.

Competition: Often, rural projects involve less bid competition than urban projects because of fewer interested contractors. Also, the small material quantities can drive up unit material prices as the contractor cannot take advantage of bulk processing or procurement.

Prevailing wages: The Department of Labor requires prevailing wages for all federally funded projects through the Davis Bacon and Related Act (DBRA). According to the Department of Labor, "These Acts apply to contractors and subcontractors performing on federally funded or assisted contracts in excess of $2,000 for the construction, alteration, or repair (including painting and decorating) of public buildings or public works" (see http://www.dol.gov/compliance/guide/dbra.htm). Many contractors are not aware of this federal requirement and, as a result, will underbid the project because their labor rates are too low. In the request for bids, the agency should make a clear statement that prevailing wages are to be used in accordance with the act and the Department of Labor. The DBRA federal wage rates and working conditions are available on the Department of Labor website.

Best Practices

Documentation and historical data: Accurate estimates typically result from the collection and use of historical bid data as the basis for estimating current costs. Experienced agency representatives suggest using the lowest of three bidders' prices on previous projects in similar locations as a basis for future unit estimates in that region. However, it should be noted that historical data can be difficult to obtain or non-existent in some areas. Whenever possible, local agencies or consultants must document historical costs in a geographic area, bid history information for the areas where the work is being performed, and material locations to facilitate estimating.

Using historical data to predict costs on rural projects requires the estimator to:

- Collect and record accurate historical cost data from the region where the project will be constructed or similar regions in the state;
- Understand the factors that may influence cost (e.g., distance between the project site and reputable, high-value suppliers) and adjust for these factors; and
- Compare the estimate with the bid history for the same or similar regions.

An independent project cost estimate can be produced for each contract and change order. In rural projects, this may be accomplished by considering labor, materials, and equipment costs rather than relying on past unit prices. The final construction estimate should list the item number, description, quantity, units, cost per unit, item cost, and total cost. When cost is a critical concern, multiple cost estimating methods should be conducted and compared to ensure consistency and yield a defensible decision.

Please see Example 3.1 for a sample of a cost estimating checklist.

Site investigation: Site investigations involve deploying staff throughout the state to develop personnel with knowledge in all pertinent areas, thus making comparisons among regions more

accurate. Such personnel can add value by working proactively when it is clear that new contractors will be bidding and/or selected for the work. Site investigation includes investigating the specific characteristics of the geographic region that could influence material or production costs, speaking with contractor representatives who have experience in the region, and locating and leveraging local resources that can increase efficiency or accuracy.

Project bundling: Combining multiple small projects into a larger cluster can result in better material prices because of bulk ordering and can generate interest from larger and more competitive contractors.

Resources

Historical data and bid history: Finding historical data and speaking with experienced agency staff and contractors is critical to achieve an accurate estimate. Historical data include past unit-price and parametric cost estimates with similar materials to the project under consideration.

Specification, cost catalog, and booklet: The following elements are fundamental resources for cost estimating:

- State agency cost catalog;
- Means heavy/highway cost catalog; and
- Detailed cycle time spreadsheets for equipment, material, and labor.

Example Document

Example 3.1: Engineer's Estimate Checklist
(Source: Tennessee DOT)

- ☐ Does the estimate include a pay item for all work included in the plans?
- ☐ Are all unit prices reasonable?
- ☐ Provide specific review of unit prices for major items (*major items include those with greater cost and/or greater quantity than other bid items*). Compare quantities with plans and proposal.
- ☐ Check to see if nonparticipating items are listed separately (*in both the estimate and plans*).
- ☐ Has there been a change in cost over 25% from the preliminary estimate(s)? Why?
- ☐ Is there an estimate for railroad work (if needed)?

4. SCHEDULING TECHNIQUES

Definition

A schedule is a timetable of activities that describes when a certain task will be performed relative to other activities and who will be working on that task. There are three basic scheduling techniques: milestone dates, bar chart, and critical path method (CPM).

Challenges

Local and environmental issues: Many characteristics of rural areas may cause schedule delays during construction, such as festivals, school bus routes, harvests, and environmental issues. The main schedule-related challenges are:

- Limited access to the project site;
- Environmental constraints;
- Lengthy detours;
- Local weather; and
- Material lead times.

Critical path method (CPM) or bar charts: Another challenge of scheduling rural projects is the fact that most contractors and agencies do not use scheduling software. Rather, bar charts are most commonly used, which are easy to create and interpret.

Best Practices

Use of appropriate scheduling techniques: Using an appropriate scheduling technique influences the success of rural projects. The selected scheduling techniques should be easy to update and change. Generally, a milestone schedule with a bar chart is sufficient for a small, rural project. Nevertheless, critical path method scheduling is becoming more common as software has improved and more graduates are familiar with the methods required to conduct CPM analyses.

Detailed schedule management: This strategy consists of the following considerations:

- Provide as much time as possible to complete the project in one season;
- Require and review progress schedules from the contractor;
- Use local resources to minimize the on-site hauls and off-site hauls of materials;
- Discuss the schedule or major milestones (e.g., demolition, foundation excavation, footing) with community leaders;
- Provide advance notice of working schedules;
- Provide detours and notice of closing road in advance;
- Use maintenance crews if available to expedite key milestones; and
- Conduct weekly job meetings to resolve schedule issues quickly.

Milestone dates are set for the completion of certain activities. While the progress schedule is the responsibility of the contractor, the agency project manager must review and accept the progress schedule. If the schedule is not logical or is unreasonable, the project manager should ask for clarification and reasons for delays. If the project falls behind schedule, the project manager may put the contractor on notice and direct the contractor to take necessary action to expedite the completion of the work. Additionally, the project manager may require the contractor to submit a revised schedule that demonstrates how and when the contractor will complete the work (typically within 7 days of notice). Please see Example 4.1 for an example of a milestone schedule.

Bar charts are a simple graphical presentation of the major work activities with the start and completion dates. For simple rural construction projects, bar charts are an appropriate technique. Fortunately, even small contractors are familiar with this technique or can easily interpret the visuals. Please see Example 4.2 for a sample of the bar chart scheduling technique.

CPM scheduling involves the analysis of the sequential and time characteristics of projects by the use of networks. A variety of CPM software is available for this technique. Agencies often require contractors to use this technique in their standard specifications to clearly identify the critical path of interrelated tasks or items of work required to complete the project. However, the results of this research indicate that CPM is not yet commonly used for rural projects, and the mandatory use of CPM scheduling software is not currently recommended. However, if a contractor chooses to use CPM software and has the ability

to create and maintain it, even small rural projects can benefit from an understanding of the critical path items. Please see Example 4.3 for an example of a CPM schedule. The New York State Department of Transportation provides excellent resources for CPM scheduling, including software tutorials and the mechanics of CPM, at: https://www.dot.ny.gov/main/business-center/contractors/construction-division/primavera.

Resources

Standard practices: This resource includes state standard practices and schedule template guidelines. Please see Example 4.4 for a sample of the schedule template.

Communication enhancement: Maintaining open communication among all parties involved in a project prevents unexpected delays. Communication can be enhanced by:

- Holding a weekly meeting with the contractor and agency representative to resolve potential delay issues;
- Obtaining completion dates or interim completion dates from the contractor; and
- Discussing potential delays with local stakeholders.

Example Documents

Example 4.1: Milestone Scheduling Technique

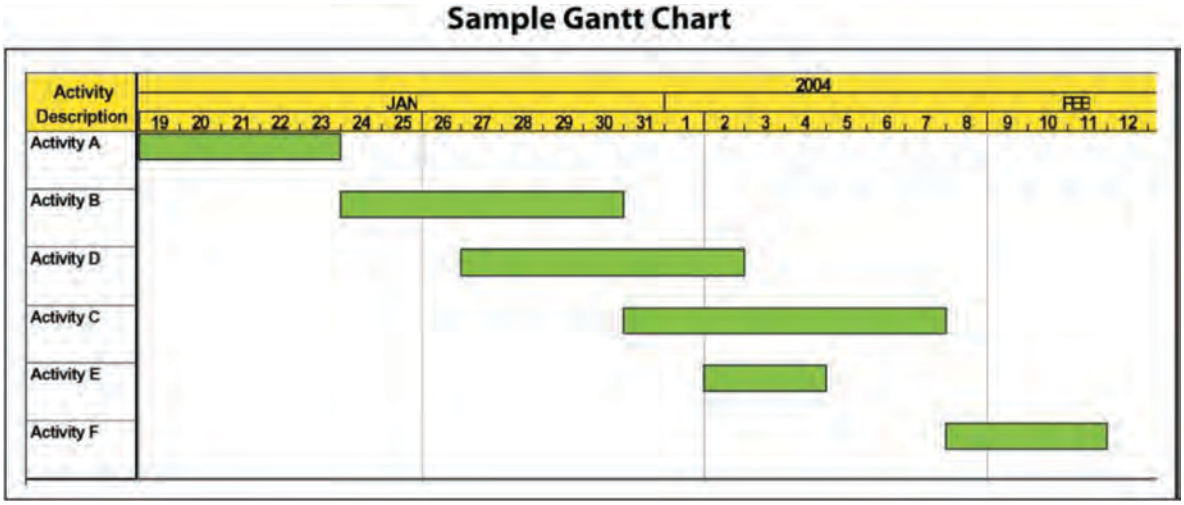
(Source: New Jersey DOT)

Bridge Item
Contractor Production Rates
One Span Bridge (40 to 100 feet Range)

BRIDGE TYPE/BRIDGE ITEM	TYPE 1	2	3	4	5
	NEW ON NEW ALIGNMENT	NEW ON SAME ALIGNMENT	SUPERSTRUCTURE REPLACEMENT	DECK REPLACEMENT	B, C & LMC
Demolition	--	16-28 days	8-16 days	7-14 days	--
Foundation Excavation	2-4 days	2-4 days	--	--	--
Piles	4-6 days	4-6 days	--	--	--
Footing	2-4 days	2-4 days	--	--	--
Abutment, Pier, & WW's	6-8 days	6-8 days	--	--	--
Substructure Curing Framing	14 days 2-4 days	14 days 2-4 days	-- 2-4 days	-- --	-- --
Deck Joints	2-4 days	2-4 days	2-4 days	2-4 days	2-4 days
Deck Forms	7-12 days	7-12 days	7-12 days	7-12 days	--
Shear Connectors	1-2 days	1-2 days	1-2 days	1-2 days	--
Deck	2-4 days	2-4 days	2-4 days	2-4 days	--
Deck Slab Curing Header	14 days 1-2 days	14 days 1-2 days	14 days 1-2 days	14 days 1-2 days	-- --
Parapets	2 days	2 days	2 days	2 days	--
Preformed Joint	1 day	1 day	1 day	1 day	1 day
Railing/Fence	3 days	3 days	3 days	3 days	--
Sawcut Deck	1 day	1 day	1 day	1 day	1 day
Substructure Rehabilitation	--	--	6-12 days	2-4 days	--
Deck Repairs	--	--	--	--	6-12 days
LMC	--	--	--	--	2-4 days
LMC Curing	--	--	--	--	14 days
TOTAL	64-85 days	80-113 days	50-77 days	43-63 days	26-36 days

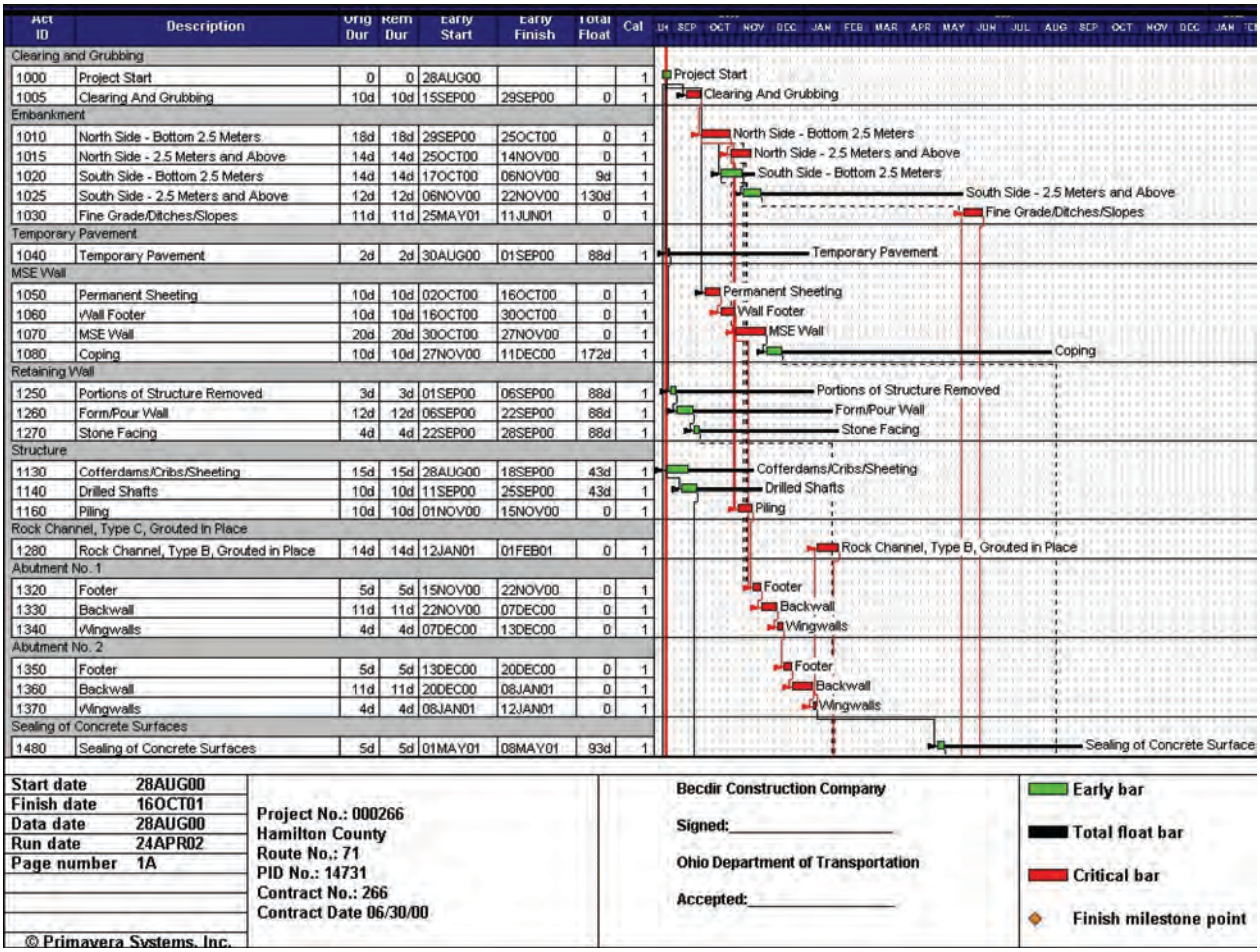
Allow 2 months (steel beams) and 3 months (concrete beams) for working drawing approval, fabrication and delivery. Designer shall verify anticipated timeframes prior to Final Submission.

Example 4.2: Bar Chart Scheduling Technique
(Source: Florida DOT)



Example 4.3: CPM Scheduling Technique

(Source: Ohio DOT)



Act ID	Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float	Cal
Clearing and Grubbing							
1000	Project Start	0	0	28AUG00			1
1005	Clearing And Grubbing	10d	10d	15SEP00	29SEP00	0	1
Embankment							
1010	North Side - Bottom 2.5 Meters	18d	18d	29SEP00	25OCT00	0	1
1015	North Side - 2.5 Meters and Above	14d	14d	25OCT00	14NOV00	0	1
1020	South Side - Bottom 2.5 Meters	14d	14d	17OCT00	06NOV00	9d	1
1025	South Side - 2.5 Meters and Above	12d	12d	06NOV00	22NOV00	130d	1
1030	Fine Grade/Ditches/Slopes	11d	11d	25MAY01	11JUN01	0	1
Temporary Pavement							
1040	Temporary Pavement	2d	2d	30AUG00	01SEP00	88d	1
MSE Wall							
1050	Permanent Sheeting	10d	10d	02OCT00	16OCT00	0	1
1060	Wall Footer	10d	10d	16OCT00	30OCT00	0	1
1070	MSE Wall	20d	20d	30OCT00	27NOV00	0	1
1080	Coping	10d	10d	27NOV00	11DEC00	172d	1
Retaining Wall							
1250	Portions of Structure Removed	3d	3d	01SEP00	06SEP00	88d	1
1260	Form/Pour Wall	12d	12d	06SEP00	22SEP00	88d	1
1270	Stone Facing	4d	4d	22SEP00	28SEP00	88d	1
Structure							
1130	Cofferdams/Cribs/Sheeting	15d	15d	28AUG00	18SEP00	43d	1
1140	Drilled Shafts	10d	10d	11SEP00	25SEP00	43d	1
1160	Piling	10d	10d	01NOV00	15NOV00	0	1
Rock Channel, Type C, Grouted In Place							
1280	Rock Channel, Type B, Grouted in Place	14d	14d	12JAN01	01FEB01	0	1
Abutment No. 1							
1320	Footer	5d	5d	15NOV00	22NOV00	0	1
1330	Backwall	11d	11d	22NOV00	07DEC00	0	1
1340	Wingwalls	4d	4d	07DEC00	13DEC00	0	1
Abutment No. 2							
1350	Footer	5d	5d	13DEC00	20DEC00	0	1
1360	Backwall	11d	11d	20DEC00	08JAN01	0	1
1370	Wingwalls	4d	4d	08JAN01	12JAN01	0	1
Sealing of Concrete Surfaces							
1480	Sealing of Concrete Surfaces	5d	5d	01MAY01	08MAY01	93d	1

Example 4.4: Use of Schedule Template
(Source: Washington State DOT)

It is recommended that the following items be considered:

1. **Scope** – Modify the template activities to reflect the scope of the current project and ensure that all necessary deliverables are addressed including the appropriate level of detail based on the needs of the project.

2. **Activity Durations** – Review and confirm activity durations.

3. **Interfaces** – Review and either confirm schedule logic (relationships) or modify relationships to internal and external activities to ensure that the schedule reflects the appropriate project interfaces.

4. **Milestones** – Review and confirm that milestones are included as required in the Project Control and Reporting Manual and that they are properly constrained in the schedule.

5. **Resources** – Review and confirm that Primavera Scheduler role-based generic resources assigned to activities reflect the pool of resources available for the current project.

6. **Budget** – Update budget information so it reflects the current project.

7. **Constraints** – Avoid the use of constraints, wherever possible.

8. **Calendars** – Confirm that the template includes the project calendars appropriate for the current project.

9. **Activity and Project Codes** – Review and modify activity codes and project codes to reflect the scope and needs of the project.

10. **Filters and Layouts** – Review and modify schedule groupings, summaries, and report layouts to meet the regional management and reporting needs of the current project.

11. **Control Accounts** – Review and confirm the appropriate control accounts for the current schedule. Refer to the Control Account Guidelines on the Project Management Web Portal for additional information on control accounts.

5. CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL (QA/QC)

Definition

Construction Quality Assurance (QA) includes all those planned and systematic actions necessary to provide confidence that a product or facility will perform satisfactorily in service. Quality Control (QC) includes those QA actions and considerations necessary to assess and adjust production and construction processes so as to control the level of quality being produced in the end product.

Challenges

Remote locations: Because of long distances between the project site and testing facilities, it can be timely to get certified testing documents for materials. It can also be difficult for agency representatives with materials and statistics knowledge to reach the project site in person.

Lack of resources: This challenge is related to a lack of experienced staff and equipment to effectively perform the QA/QC work. It can be difficult to find qualified staff who understand the highway QA/QC process and procedures, particularly on those projects with federal requirements. The FHWA currently requires that inferential statistics be used to confirm the quality of samples when quality control is performed by the contractor and independent quality assurance is performed by the agency. Thus, competent site representatives must understand and be able to apply the fundamentals of two-sample statistical tests. FHWA provides specific guidelines for QA/QC that must be followed on federally funded projects (http://www.fhwa.dot.gov/construction/) and the National Highway Institute offers training to governmental QA/QC inspectors for highway and transit construction. These resources are comprehensive and provide levels of detail that are outside the scope of this guide. The resources also help to define competence in this area as someone who understands the construction process and the materials included in the final product, the target values for the materials (performance), acceptable tolerance limits, methods for independent or split-sample testing, and two-sample statistical tests for comparing contractor and agency results when a conflict exists, the proper procedure for resolving QA/QC conflicts.

Best Practices

Material testing: The local agency should have a comprehensive acceptance testing and inspection program that provides adequate assurance that the construction materials conform to contract requirements. The agency engineer and/or project manager must ensure that all materials are sampled, tested, and inspected in accordance with local, state, or federal standards. Although project distances and inexperienced personnel can cause issues, creating special employee retention programs and recognizing the need for travel time during scheduling and estimating can reduce their adverse impacts.

Any failed materials should be adequately documented and retested. Documentation shall include discussion on whether the material needs rework prior to retesting. Only laboratories certified by AASHTO or the state should be permitted. Please see Example 5.1 for a specific material testing procedure for rural projects.

Construction inspection: Inspections can be challenging because of the resources required to send a competent person to a remote location. Nevertheless, inspections still need to be performed to ensure a quality project. An effective strategy is to assign a region to a single inspector who travels strategically from site to site, spending time at the sites with the most active, measurable work. This staff member's responsibility is to ensure the adherence to the plans and specifications, and to perform basic statistical computations when necessary. The sampling strategy, assurance testing, and results should be well documented and stored electronically. The local agency is often responsible for project inspection. A contingency plan should be devised if an agency representative cannot physically sample and test at the worksite.

The agency should store and review all quality reports to make sure that the work meets the specifications. An agency staff member (e.g., the District Assistant Construction Engineer) should be responsible for providing guidance and assistance to the local inspector staff, and notifying the project man-

ager of any serious deficiencies. Please see the following examples for specific resources:

- Example 5.2 for the local agency QC responsibilities
- Example 5.3 for the state QA responsibilities

Managing contractors: The following methods of contractor oversight have proven to be effective:

- Follow standard practice;
- Do not pay the contractor for sub-standard work;
- Require testing firms to have an on-site technician throughout the placement of materials that are time-sensitive;
- Manage workloads for small crews;
- Require delivery sample within a specific time frame; and
- Require a detailed plan to handle temperature loss of hot mix asphalt during delivery and concrete set time on concrete items.

Resource enrichment: An effective strategy of using resources needs to:

- Provide on-site education and assistance for the contractor;
- Provide training and certification program for material technicians;
- Use consultants to supplement staff during critical times;
- Enhance communication and flexibility to meet requirements of the QC/QA work;
- Move staff around the state or region when possible to meet workload demands; and
- Enhance centralized material testing and auditing.

Resources

Construction manual and standard specifications typically include:

- Construction manuals;
- Standard specifications;
- Testing manuals and inspection guidelines;
- Internal program manuals;
- A list of pre-qualified products for use on the projects; and
- A checklist for quality control.

Agency and consultant staff can enhance effectiveness by employing a division quality inspector, educating field staff in quality assurance procedures, locating and using reliable testing facilities, supplementing staff with consultants to address local competency gaps, and increasing the frequency of site visits.

Example Documents

Example 5.1: Material Testing Procedure
(Source: Nebraska DOR)

The sampling and testing procedures shall consist of:

- Frequency guide schedules for verification sampling and testing which will give general guidance to personnel responsible for the program and allow adaptation to specific project conditions and needs;

- Identification of the specific location in the construction or production operation at which verification sampling and testing is to be accomplished; and

- Identification of the specific attributes to be inspected which reflect the quality of the finished product.

Note: Materials shall be sampled and tested by qualified individuals *(testers)* using calibrated testing equipment. Only qualified laboratories will be allowed to participate in the testing program.

1. Tester:

Each tester must be qualified through state requirements. The State Quality Assurance Managers will be responsible for certifying individuals throughout the state. The testers will be certified through successful completion of training provided by the state engineer.

2. Equipment:

The materials testing equipment shall be calibrated based on the manufacturer's recommendation. The calibration certification shall be available for inspection at all times.

3. Laboratory:

Only qualified labs are eligible to perform materials testing.

Example 5.2: Local Agency QC Responsibilities
(Source: Nebraska DOR)

Local agency QC responsibilities for construction administration and inspection include, but are not limited to, the following:

- Appoint a qualified full-time public employee.
- Maintain project field diaries, files, and records. Prepare a weekly report of working days charged.
- Furnish a professional engineer and/or architect for the duration of the project's construction.
- Conduct a pre-construction conference and document the proceedings.
- Monitor the construction contract documents for compliance.
- Perform construction surveying and staking related to the project.
- Review work zone traffic control devices daily.
- Provide railroad companies with official notice.
- Make all project decisions in a timely manner to avoid undue delay.
- Ensure that proper controls are exercised when measuring and calculating items of work.
- Respond to any complaints or questions by the public in a timely manner.
- When a change order or time extension is required, the change order review and approval process must follow the state requirements.
- Provide for and ensure that all materials incorporated in the project are sampled and tested.
- Verify the existence and sufficiency of required material specifications.
- Inspect the project for compliance with NEPA.
- Monitor and require compliance by the contractor with contract provisions such as prevailing wage, Equal Employment Opportunity (EEO), and Disadvantaged Business Enterprise (DBE) legal requirements.
- Estimates and payments should promptly be paid to the contractor for completed work and to railroads for completed force account work and flagger services.
- Prepare a set of As-built plans to be submitted to the Department of Roads.
- Make timely decisions should a contractor file a contract complaint, dispute, or claim.

Example 5.3: State QA Responsibilities
(Source: Nebraska DOR)

State QA responsibilities for construction administration include, but are not limited to, the following:

- Appoint a State Representative to the project.
- Attend the pre-construction conference and reassure that the change order review and approval process is discussed, confirm the policy for preparing and approving progress estimates, and assure environmental commitments will be incorporated into the project.
- Be a resource to the local agency on technical and/or administrative issues unique to or not expected by the local agency.
- Be a resource to the local agency for the prompt resolution of contractor complaints, disputes, and claims. Assist the local agency with the approval to the resolution of complaints, disputes, or claims that extend the project construction time frame and/or increase project costs.
- Review the construction contract, permits, and agreements, and become familiar with the project site and plans prior to the start of construction.
- Follow the change order review and approval process.
- Review, verify, and accept all appropriate requests.
- Review and monitor the documentation pertaining to the construction activity, daily work logs, field reports, materials, and progress estimates.
- Visit the project site at least on a weekly basis to assure that the traffic control is done in accordance with the plans, confirm the erosion control is properly placed and retained as per the plans and specs, monitor the environmental commitment, verify that the inspection efforts are commensurate with the construction work, and check documentation for materials sampling, testing, and certification.
- Monitor and provide guidance on federal and state contract provisions in the areas of EEO, DBE, and Prevailing Wage Compliance.
- Monitor the environmental stewardship for the project.
- Be a technical resource and provide assistance, when requested, to the LPA in the areas of testing, certification, and QC/QA.

6. CONSTRUCTION SAFETY

Definition

Managing construction safety involves the processes of identifying, assessing, controlling, and communicating conditions that have the potential to cause injury to workers or the traveling public.

Challenges

Remote locations: Rural projects are often located in low traffic volume but high traffic speed areas on secondary roads. Such roads often have inattentive or distracted drivers, narrow lanes, low populations, and a limited work area. All of these factors may increase the frequency and severity of incursions. Further, rural projects tend to have less agency oversight, and contractors' safety programs can be underdeveloped and incomplete.

Small contractors: Small construction companies tend to have higher incident rates than larger firms with more safety resources. Also, small companies, especially those working in rural areas, are less likely to be inspected by compliance officers. Because of these issues, rural projects tend to have more injuries.

Best Practices

Safety compliance: Local staff and agency administration should have standardized safety expectations for all contractors. The expectations should include, at a minimum: a site-specific safety plan, pre-task planning meetings with job hazard analyses, a supervisor responsible for safety, OSHA-mandated recordkeeping, and stop-work authority for workers if conditions pose imminent danger. The local agency staff must also have procedures to verify that the contractor has established and implemented such a program. Approval should come from the state agency. The industry best practice for rural project safety includes the following in addition to the aforementioned minimum elements:

- Use training and awareness programs;
- Hold regular safety meetings at least every 10 working days;
- Employ a worker-to-worker observation program;
- Offer rewards for safe behavior;
- Perform drug screening and testing;
- Include comprehensive plans for each major milestone activity; and
- Require contractors to review the traffic control plan on a regular basis.

Increase site visibility: Because rural projects are often located at remote areas with distractions (e.g., beautiful view, little public exposure), contractors need to increase site visibility by promoting proper lighting, signage for detours, and flashing lights (preferably police lights). Please see the following sample checklists for promoting roadside construction safety:

- Example 6.1 for the Construction Zone Safety Checklist
- Example 6.2 for the Roadside Safety Checklist

Other considerations: The agency should be uncompromising when it comes to required safety minimums. In addition to promoting safety for the contractor, the site will also be safer for the agency inspectors and project managers.

Resources

Safety guidelines/training and standard specifications typically include:

- Traffic control manual;
- Department's safety manual;
- Contractor's safety plan;
- OSHA regulations;
- Internal program manuals;
- Safety refresher training and other reminders;
- Requirement for regular safety meetings;
- Requirement for contractors to submit a safety plan and assign the site safety responsibility in the contract;
- Safety training videos; and
- Standard specifications.

Example Documents

Example 6.1: Construction Zone Safety Checklist

(Source: Nebraska DOR)

- ☐ Is a detailed traffic control plan required?
- ☐ Review traffic control plan for overall adequacy. See 23 CFR 630.1012.
- ☐ Is there a need/provision for temporary signing, markers, barriers, etc.?
- ☐ Are provisions made for protecting motorists from drop-offs?
- ☐ Are crash-worthy devices such as positive separation barriers, sand barrel arrays, or crash attenuators provided as needed? Are they delineated? Are relatively flat areas and deflection distances behind the barriers sufficient?

Attach a detour map.

Approximate length of detour: _____

Select the best description of the planned detour:

- ☐ Detour will use local roads with no improvements.
- ☐ Detour will involve improvements to local roads with no resulting impacts on safety or the environment.
- ☐ Detour will involve improvements to local roads and will impact safety and/or the environment.
- ☐ Detour will use only state-owned roads.

Describe impacts:

Example 6.2: Roadside Safety Checklist

(Source: Tennessee DOT)

ROADSIDE SAFETY	Yes	No	N/A
Portable Barrier Used	☐	☐	☐
If no, explain:			
Barrier Properly Connected	☐	☐	☐
If no, explain:			
Impact Attenuator Used	☐	☐	☐
If no, explain:			
Impact Attenuator Condition	☐	☐	☐
If no, explain:			

	Good	Poor	N/A
Portable Condition	☐	☐	☐
If poor, explain:			

BARRIER DELINEATION	Good	Poor	N/A
Lights	☐	☐	☐
If poor, explain:			
Reflectors	☐	☐	☐
If poor, explain:			
Vertical Panels	☐	☐	☐
If poor, explain:			

7. CLAIMS AND DISPUTES

Definition

A claim is a formal demand for compensation made by one party to a contract to another party in accordance with the contract document. Contracts normally stipulate that claims and disputes be first submitted to the owner or its representative. If the claim is denied, the resulting dispute can then be submitted to various levels of appeal.

Challenges

Documentation: The documentation process is a major challenge when claims and disputes occur in rural projects. Poor documentation, conflicting records, lack of existing utility information, and a loose recordkeeping system are major problems in dispute resolution when a dispute or claim is filed. Without records, the case reverts to tort law and can be costly to the agency.

Timely resolution process: Lack of proper documentation can also delay claims and disputes resolution. Often, there is inadequate information to support a claim for rural projects. Also, upper management is often located in urban areas while rural projects are often located in remote areas. These distances can result in difficulties in the dispute resolution process.

Best Practices

Effective resolution practices: The dispute resolution process may take longer on rural projects because of inadequate information to support the agency when a claim is filed. It is suggested that the local agency formalize a claims management process that includes progressive administrative reviews prior to formal legal action by the contractor. Resolution of all claims must be in accordance with the established claims management process. The following practices have proven to be effective:

- Adhere to the contract requirements for documentation and schedules;
- Follow the contract provisions;
- Follow a model of informal partnering on small projects; and
- Enhance communication with contractor.

Other considerations: Agencies must also ensure that state guidelines, construction guidelines and policies, and standard specifications are followed.

Resources

The main resources for a dispute resolution are contract documents and legal advice. In addition, the following resources are also helpful for the dispute resolution process:

- Standard specifications and plans;
- Construction policy bulletins;
- State dispute resolution procedures; and
- Agency's field guide.

Please see Example 7.1 for a sample change order notification form.

Example Document

Example 7.1: Change Order Notification Form

(Source: Ohio DOT)

The District Construction Monitor must be notified of all "significant" change orders for concurrence. "Significant" is defined as follows: $25,000 for projects between $0 and $500,000; the lesser of 5% or $100,000 for projects greater than $500,000; and any change orders that affect the work limits or result in new environmental impacts.

Will this work delay the project?		**Yes**		**No**
Is this a CLAIM?		**Yes**		**No**

Ref. No.	Pro Rata	New Item or Extension of Existing	Item Description	Quantity or Lump Sum	Unit Price or Lump Sum	Total Cost

Attach any supporting documentation and address the questions on the back of this form.

1. Why is the work necessary?
2. Why didn't the plan provide for the work?
3. Is the work within the project's scope and within the footprint?
4. Is there any impact to the environmental documentation?
5. What changes are involved and where are they to take place?
6. Who is responsible? (Indicate if plan error, owner request, contractor request.)
7. Will this impact the schedule?

AUTHOR ACKNOWLEDGMENTS
This study was conducted for the NCHRP 20-65 Standing Committee on Public Transportation, with funding provided through the National Cooperative Highway Research Program (NCHRP) Project 20-65(40), "Construction Management Practices for Rural Projects: An Assessment." Project 20-65 is intended to fund quick response studies on behalf of the Standing Committee on Public Transportation. The guidebook and research report were prepared by MATTHEW HALLOWELL, DANIEL TRAN, and KEITH MOLENAAR of the University of Colorado under subcontract to ICF International. The work was guided by a technical working group.

Transportation Research Board
500 Fifth Street, NW
Washington, DC 20001

THE NATIONAL ACADEMIES™
Advisers to the Nation on Science, Engineering, and Medicine

The nation turns to the National Academies—National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council—for independent, objective advice on issues that affect people's lives worldwide.
www.national-academies.org

ISBN 978-0-309-25897-5
90000
9 780309 258975

Subscriber Categories: Public Transportation

These digests are issued in order to increase awareness of research results emanating from projects in the Cooperative Research Programs (CRP). Persons wanting to pursue the project subject matter in greater depth should contact the CRP Staff, Transportation Research Board of the National Academies, 500 Fifth Street, NW, Washington, DC 20001.