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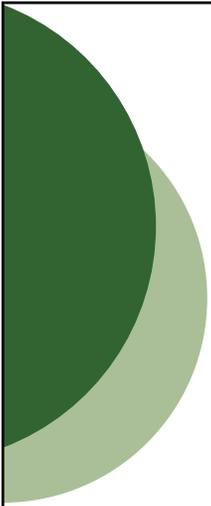
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Right of Way Methods and Tools to Control Project Cost Escalation

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Summary

The ability of state highway agency management to control project cost escalation is dependent on strategic and structured project development processes. Right-of-way costs are among the most difficult to control and, therefore, necessitate disciplined estimating and management procedures. Yet in many agencies there exist “stove pipe” divisional structures that lead to failures in communicating important project information affecting scope, design, and cost.

NCHRP Project 8-49 “Guidance on Cost Estimation and Management for Highway Projects During Planning, Programming, and Preconstruction,” and other estimating studies identified right-of-way cost estimating and management of right-of-way estimates and actual costs as critical to achieving estimate consistency and accuracy. The original NCHRP Project 8-49 addressed right-of-way cost estimating to a limited extent but the project’s scope did not allow for an in-depth treatment of this specialized area. This report describes the research process for additional NCHRP 8-49 work addressing right-of-way cost estimating and cost management. It provides an overview of the data gathering and analysis processes used to create a *Procedures Guide* specifically for right-of-way cost estimating.

Due to many factors, the actual expenditures for project right of way are frequently greater than the right-of-way cost estimate produced during the initial phase of project development. An agency’s use of a structured estimating process together with management of factors that are related to cost increases has the potential to significantly improve cost estimate accuracy and consistency throughout the project development process.

The research team found the following problems inherent to right-of-way cost estimation in the state highway agencies interviewed:

- The right-of-way cost estimation and cost estimate management processes generally lack structure and definition as compared to the other areas of cost estimation;
- There is a lack of integration and communication between those responsible for the right-of-way cost estimate and those responsible for development of the overall project cost estimate.
- There is a lack of integration and communication between those responsible for estimating and managing right-of-way cost and the project development team.

These problems are mainly process related. All of the state highway agencies interviewed were competent in assembling a right-of-way estimate but failed to complete one or more of the process steps that are necessary to achieving estimate accuracy. To address this problem the research produced as a separate document, *Procedures Guide for Right-of-Way Cost Estimation and Management*. The *Procedures Guide* introduces specific approaches to support the right-of-way cost estimating and management processes. The framework for the recommended procedures is a set of process flowcharts that graphically explain process steps, inputs, and outputs. There are five flowcharts: 1) an agency-level flowchart that shows the interaction of right-of-way cost estimating with

the project development process; 2) a conceptual right-of-way cost estimating flowchart that describes the required right-of-way estimate preparation steps during the planning stage of project development; 3) a baseline right-of-way cost estimating flowchart that depicts the required steps during programming; 4) an update right-of-way cost estimating flowchart that describes the required right-of-way estimate preparation steps during preliminary design to include a cost estimate management loop; and 5) a right-of-way cost management flowchart that describes the required management actions to control costs during the right-of-way appraisal and acquisition process. These flowcharts were developed based on a literature review and extensive conversations with SHA right-of-way staff. The charts show current practices integrated with what *should* be occurring. This report documents development of these right-of-way flowcharts and the flowcharts form the basis of the right-of-way *Procedures Guide*.

The findings of this research support the recommendation that a right-of-way cost estimate be completed during each of the first three project development phases – planning, programming, and preliminary design. The research confirmed the importance of a structured right-of-way Cost Management process during final design. The cost management process must track appraisal amounts and cost of acquisitions, and analyze expenditure trends against the right-of-way budget.

General conclusions are:

- Systematic and structured processes for right-of-way estimating and cost management are lacking in many state highway agencies. The lack of defined processes impacts the agency's ability to consistently produce accurate right-of-way cost estimates. This lack of structure is compounded when a state highway agency is decentralized and each region/district completes estimates using different processes.
- Communication and coordination between right-of-way sections and development teams is generally lacking throughout the project development process.
- There are a small number of tools available to aid agencies estimate right-of-way cost. There are right-of-way database programs and programs for capturing right-of-way information that can support right-of-way estimate development.
- Typically, right-of-way estimating personnel are not involved in preparing planning right-of-way cost estimates. It was found that planning right-of-way cost estimates are often prepared by the planning section and the right-of-way section is not contacted for guidance.
- There is only limited or no connection between the right-of-way planning estimate and later estimates. The basis and documentation supporting the planning estimate is often not forwarded to those responsible for later right-of-way estimates.
- Cost estimation management is minimal throughout the cost estimation process and especially during the Preliminary Design project development phase.
- State highway agency right-of-way manuals tend to concentrate on the appraisal and acquisition process with little information documenting right-of-way cost estimation and cost management activities.

- Utilization of systematic risk analysis techniques are lacking and contingency, when assigned, is based in most cases on gross percentages.
- Clear and effective scope definition and communication of right-of-way requirements is critical to preparing an accurate right-of-way estimate.
- Right-of-way estimator experience and knowledge play a significant role in producing accurate right-of-way cost estimates.
- Right-of-way Cost Management (cost control) is used only to a minimum extent during the appraisal and acquisition process.

The *Procedures Guide* is a stand alone document that addresses each of these issues.

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CHAPTER 1

INTRODUCTION

BACKGROUND

Historically, a large portion of transportation projects have been underestimated (U.S. General Accounting Office, 1997; Flyvbjerg et al., 2002). Approximately 50 percent of the recent large transportation projects in the United States have overrun their initial budgets. This cost escalation problem is complex and difficult to address because the duration between the initiation of a project and the completion of construction often spans many years. State Highway Agencies (SHAs) have recognized that project cost escalation is a pervasive problem and have sought solutions through research efforts supported by American Association of State Highway and Transportation Officials (AASHTO) and the National Cooperative Highway Research Program (NCHRP). NCHRP Project 8-49 focused on the issue of project cost escalation and produced a Guidebook that describes a strategic approach to highway cost estimating and cost estimate management (Report 574 - Anderson et al., 2007a) . The aim of Report 574 is to provide SHAs with guidance for structuring their estimating and cost management processes to achieve estimate consistency and accuracy. It addresses estimating issues during the planning, programming, preliminary design, and final design phases of project development. The report does not address estimating for change orders or cost management during construction. In addition, Report 574 provides appropriate strategies, methods, and tools to develop, track, and document realistic cost estimates during project development.

Project 8-49 and other estimating studies identified right-of-way (ROW) cost estimating and management of right-of-way cost as critical to achieving consistency and accuracy in project cost projections. Although NCHRP Project 8-49 did address right-of-way cost estimating to a limited extent, the project's scope did not allow for an in-depth treatment of this specialized area. This report provides a more in-depth analysis of the problems and practices of right-of-way cost estimating and cost management.

PROBLEM

The NCHRP Project 8-49 findings, based on a critical review of estimating literature, recent estimating research, and current estimating practice, suggest that a component of project cost escalation is related to right-of-way cost. Specific findings related to right-of-way from the Project 8-49 research are:

- Actual expenditures for project right of way are frequently greater than the cost estimate produced during the initial phase of project development due to influencing factors such as poor estimating methods (difficulty with damages and condemnations), inconsistent application of contingency, and difficulty in accounting for future appreciation and other market conditions;

- Management of these influencing factors and the right-of-way estimating process has the potential to significantly contribute to cost estimate consistency and accuracy throughout the project development process;
- There is an opportunity to develop right-of-way specific cost estimating process steps based on successful SHA practices from around the country; and
- There is a need to provide specific guidance on how to minimize controllable influencing factors and implement strategies, methods, and tools such that right-of-way estimates are improved.

These findings established the initial basis and need for this research project. As part of this project a number of SHAs were interviewed about their right-of-way estimating practices. From those interviews it was clear that:

1. Cost escalation is a common occurrence related to right-of-way (confirming the first statement from the previous list); and
2. The right-of-way cost estimation and cost estimate management processes generally lack structure and definition as compared to the other areas of cost estimation;
3. There is a lack of integration and communication between those responsible for right-of-way cost estimating and those responsible for the overall project cost estimate.

These three issues are further compounded by uncertainties specific to right-of-way estimating, which include:

- Future highest and best use of the property;
- Damages due to partial takings of properties;
- Subsequent development of the property during the time interval between the cost estimate and actual acquisition;
- The number of parcels that proceed to Eminent Domain and the associated costs of such takings; and
- Inadequate project scope definition and information on parcels during the planning and programming phases of project development.

Complicating the uncertainties listed above is the human factor related to acquiring property for highway projects. The “human factor” can be defined as the uncertainty and unpredictability related to dealing with property owners when a public agency is attempting to acquire a property. The reaction of individuals affected by the proposed project is difficult to predict. Moreover the impacts of all these factors are intensified because of appreciating land values. Therefore, this research developed a structured process approach for right-of-way estimating that addresses these important issues.

RESEARCH OBJECTIVE

The requested action to address the transportation industry's problems associated with right-of-way cost estimation and management of right-of-way estimates is summarized by the research objective statement:

Develop an all-inclusive set of right-of-way cost estimation and cost estimate management procedures based upon literature and current SHA practice, which integrates cost estimate steps documented in NCHRP Report 574 to support the right-of-way process.

RESEARCH FRAMEWORK

The research framework in this study is similar to that utilized in the Project 8-49 study and documented in Report 98 (Anderson et al., 2007b). NCHRP Report 98 is the research report for NCHRP Project 8-49. This framework establishes the basis by which the research was conducted in a systematic manner and resulted in a Procedures Guide for right-of-way cost estimation. The framework established the basis for the scope of work and associated tasks for the research study described in the report herein.

Process Steps and Tools

In this research, process steps refer to the steps involved in cost estimation and cost estimate management within the right-of-way process associated with project development. The cost estimation and cost estimate management steps documented in NCHRP Report 574 were expanded and adapted to right-of-way cost estimation as applicable to current SHA practices. Through SHA interviews, this research sought to document successful practices and tools important to right-of-way cost estimation and management. The process steps and tools are integrated in an ease to use approach as a "how to" procedure that provides guidance to SHAs. The "how to" Procedure Guide is based on right-of-way process flowcharts developed and revised during interview with SHAs. It is clear that accurate estimates are produced consistently only when all steps in the estimating and management processes are accomplished.

Project Development Process

As discussed in the NCHRP Reports 574 and 98, estimates are made at various times during the project development process. NCHRP Project 8-49 defined the project development process phases as: planning, programming, preliminary designs, final design, advertise and bid, and construction. Figure 1 and Table 1 illustrate the global process and define the typical activities for each of the phases.

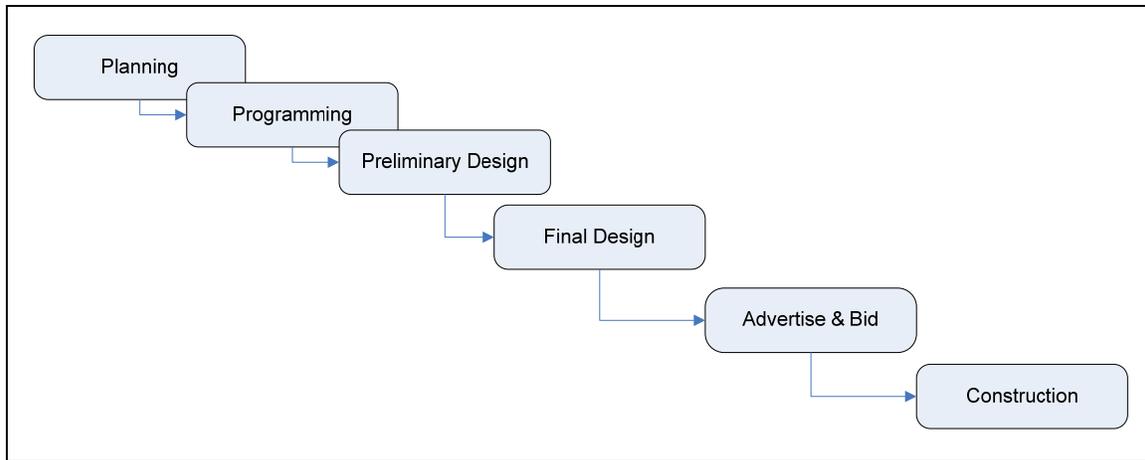


Figure 1. Typical Project Development Phases for Highway Projects (NCHRP 8-49 Report 574)

Table 1: Development phases and typical activities (Anderson and Blaschke 2004; NCHRP 8-49 Report 574)

Development Phases	Typical Activities
Planning	Purpose and need; improvement or requirement studies; environmental considerations; right of way considerations; public involvement/participation; interagency conditions.
Programming	Environmental analysis; schematic development; public hearings; right of way impact; project economic feasibility and funding authorization.
Preliminary Design	Right of way development; environmental clearance; design criteria and parameters; surveys/utility locations/drainage; preliminary plans such as alternative selections; geometric alignments; bridge layouts.
Final Design	Right of way acquisitions; PS&E development – final pavement and bridge design, traffic control plans, utility drawings, hydraulics studies/drainage design, final cost estimates.
Advertise and Bid	Prepare contract documents, advertise for bid, pre-bid conference; receive and analyze bids.
Construction	Determine lowest responsive bidder, initiate contract, mobilization; inspection and materials testing; contract administration; traffic control, bridge, pavement, drainage construction.

These project development phases are important to the right-of-way research because they serve as benchmarks along a project timeline by which appropriate right-of-way process steps and tools can be identified. In general, the right-of-way cost estimation process is complex and differs from SHA to SHA, and sometimes may vary between SHA districts/regions. Additionally, it should be noted that the phases typically overlap one another. Right-of-way cost estimation and cost estimate management occurs during the first four project development phases: planning, programming, preliminary design, and final design (Appendix A). It is recognized that additional right-of-way needs may be identified during construction due to unforeseen project conditions or scope changes. These added requirements should also be estimated using a structured approach as recommended in the Procedures Guide. Quite often these changes represent only a minor portion of a project's overall right of way cost. Consequently, this research concentrated on right-of-way cost estimates and cost management completed during each of the first four phases of project development.

SCOPE OF WORK

The following five tasks were defined by the NCHRP project panel to address the right-of-way cost estimation problem and accomplishment of the research objective. The research framework discussed above established the basis for performing the following tasks:

- Task 1 – Conduct Literature Review
- Task 2 – Examine and Document Successful Right-of-Way Cost Estimation and Cost Management Practices
- Task 3 – Develop Tools for Right-of-Way Cost Estimation and Cost Management Practices
- Task 4 – Develop Procedures on Right-of-Way Cost Estimation and Cost Management Practices
- Task 5 – Prepare Final Report and Right-of-Way Cost Estimating and Management Procedure Guide

Task 1 – Conduct Literature Review

The objective of the review was to identify documented practices in the area of right-of-way estimating and to establish the basis for the research through later tasks.

Task 2 - Examine and Document Successful Right-of-Way Cost Estimation and Cost Management Practices

The goal of Task 2 was to identify current successful practices in the right-of-way cost estimation and cost management areas. This task was completed through on-site interviews of SHAs, municipalities, and FHWA representatives. Several phone interviews were conducted to follow up and address ambiguities or to clarify open issues from the on-site interviews.

Task 3 – Develop Tools for Right-of-Way Cost Estimation and Cost Management Practices

The main goal of this task was to identify tools currently in use by SHAs for right-of-way cost estimating and cost estimate management. These tools were catalogued for presentation in the Right-of-Way Procedures Guide.

Task 4 – Develop Procedures on Right-of-Way Cost Estimation and Cost Management Practices

The main goal of Task 4 was to develop a set of process steps to document right-of-way cost estimation and cost estimate management. Process steps, inputs, and outputs are displayed in flowcharts related directly to the project development process phases outlined in NCHRP Report 574 (Figure 1).

Task 5 – Prepare Final Report and Right-of-Way Cost Estimating and Management Procedures Guide

The objective of Task 5 was to document all aspects of the research including conclusions in a research report and to create a Procedures Guide for right-of-way cost estimation and cost estimate management. The Right-of-Way Procedures Guide serves as a “how to” guide that presents a structured process for achieving accurate cost estimates and encompasses best-practices, process steps, and tools from Tasks 2, 3, and 4. The research report outlines how the research was conducted and the Procedures Guide developed.

LIMITATIONS

There are several limitations associated with this research. The limitation with the most impact on the content was the issue of the small overall number of SHAs interviewed. The budget and time available for the research project restricted the number of SHAs that could be contacted specifically about right-of-way estimating. This was addressed by using contacts identified during the initial NCHRP 8-49 Project and with help from the FHWA’s Office of Real Estate Services. Experience from the 18 formal SHA interviews conducted during the earlier phase of the NCHRP 8-49 project also provided the research team with valuable information (Anderson et al., 2007a). Thus, the intent was to focus on a representative sample of SHAs thought to be progressive in the area of right of way cost estimation.

Other limitations are associated with the differences that exist between SHAs, including differences in organizational structure (centralized versus decentralized), terminology, acronyms, and project development phase timing. These differences between SHAs impacted data collection and were addressed during interviews by taking detailed and thorough notes that documented the specific attributes of a SHA relative to right-of-way cost estimation. In addition, the structure of the interview protocol aided in reducing the impact of these limitations. The unique environments within which each of the SHAs operates affected the research. The operating environment of each SHA is affected by

state laws, politics, and social factors. Subsequently, these issues were addressed by specific questions in the interview protocol.

REPORT OUTLINE

This report consists of five chapters. The first chapter discusses the problem and the basis for the study, the scope of work, and the approach by which the research was conducted. Chapter 2 describes the literature review but concentrates on the state-of-practice discovered through interviews and discussions with SHAs and other public agencies. The chapter explains the current processes that are used by public agencies and the tools being used to support right-of-way estimate development. Additionally, Chapter 2 covers critical issues that impact the cost estimation process and may potentially lead to cost escalation. Chapter 3 is a critical review of the current state-of-practice and provides an in-depth discussion of successful practices and critical issues. Chapter 4 describes the methodology and the development of the right-of-way procedures at the agency level and throughout the project development process in the form of process flowcharts. Finally, Chapter 5 covers the study's conclusions and recommendations for acquiring agencies.

CHAPTER 2

STATE OF PRACTICE

This chapter discusses the methodology and findings of Tasks 1 and 2 of the research effort. The purpose of Task 1 was to complete a comprehensive literature review relative to right-of-way cost estimating while Task 2 involved examining and documenting successful right-of-way cost estimation and cost management practices.

The literature review completed by the research team for NCHRP Project 8-49 served as the foundation for additional searchers of published information concerning right-of-way estimation. It was necessary to update the original literature review because of the fact that there has been additional work around the country directed at the issue of estimation accuracy since the NCHRP 8-49 literature review was conducted. The present literature review specifically targets right-of-way issues. Therefore, the main objective of Task 1 was to identify documented practices in the area of cost estimation and cost estimate management specifically relevant to the right-of-way component of project development. This review primarily focused on current literature and established the basis for the later stages of the research.

The main objective of Task 2 was to gain an overview of SHA right-of-way practice. Additionally, the practices of several other agencies engaged in estimating the cost of future right-of-way purchases were examined. Consequently, successful SHA and local public agency practices in estimating and managing right-of-way costs were examined in detail. The research team assembled data on state of practice cost estimating and cost estimate management techniques including process steps and tools in relation to the project development phases presented in Chapter 1.

LITERATURE REVIEW

The objective was to identify documented practices in the area of cost estimation and cost estimate management specifically relevant to the right-of-way component of project development. The literature review included locating and reviewing information found in technical papers, reports, and documents. The sources were:

- General internet search engines;
- Transportation Research Board's TRIS Online (Transportation Research Information Systems);
- Academic databases, such as LexisNexis and Engineering Village 2;
- ASCE Civil Engineering database;
- Selected SHA websites; and
- Presentations and papers posted on AASHTO's Subcommittee on Right-of-Way and Utilities website.

The literature review concentrated on documenting and comparing factors and variables that impact right-of-way cost estimating such as project type, property value prior to the project, anticipation of future land use change, timeline, information available at the time of the estimate, and type of acquisition. Information related to the right-of-way cost estimation and cost management processes and tools in the literature were surveyed. The accumulated information was reviewed, analyzed, and summarized. Although there is an abundance of literature on appraisal and acquisition of right-of-way, the research team discovered only a limited amount of information that specifically related to right-of-way cost estimation and cost estimate management.

Right-of-Way Cost Estimation and Management

The initial NCHRP 8-49 research identified right-of-way costs to be a critical highway project cost escalation driver. This was further confirmed by the literature review. Right-of-way cost estimation is a complex undertaking which is dependent on a magnitude of parameters that are difficult to quantify, even in the case of an identifiable date only a few years in the future. Right-of-way cost estimates must capture all costs that affect the expense of acquiring the needed property. This is exceedingly difficult due to the uncertainties involved in many aspects of right-of-way acquisition. It is typically necessary to capture deterministic values for each parcel in the following categories:

- Land;
- Property improvements;
- Damages to property in partial takings;
- Utility relocation; and
- Relocation assistance.

The literature particularly stresses the difficulty in estimating right-of-way cost due to uncertainty in real estate appreciation and the issue of damages resulting from a partial take. Land values constantly fluctuate and future values are difficult to assess, especially in the case of estimates completed during the earliest stages of project development. Damages are affected by the size and shape of the remainder area, location of the remaining access points, reductions in highest and best use, and length of remaining frontage (Buffington et al., 1995).

In addition, takings by eminent domain or condemnation must be considered when developing an estimate as that process increases the cost of an acquisition because of legal fees and the court's sympathy toward a land owner. Eminent domain proceedings add cost uncertainty because real estate value is determined by judges or juries instead of by definitive market information. Almost 80 percent of all acquisitions are completed without condemnation (CTC Associates and WisDOT, 2006) leaving about 20 percent of parcels, on average, that proceed to eminent domain. However, the percentage of properties proceeding to eminent domain increases when owner's legal fees are paid by the SHA (FHWA, 2006).

The US Supreme Court case of *Kelo versus City of New London*, which was decided in on June 23, 2005 (Kelo, 2005), impacted eminent domain expense throughout the nation

(Cambridge Systematics, 2006). The Kelo case involved the use of eminent domain by the city of New London, Connecticut for a community redevelopment project which benefited a private entity. The Court ruled 5-4 that the city's action was permissible under the Takings Clause of the Fifth Amendment. Following wide criticism of the ruling, during the period immediately following the ruling and through July 31, 2006, 29 states enacted changes to their eminent domain laws in one or more of three ways: 1) restricting the use of eminent domain to certain situations; 2) requiring additional procedures when using eminent domain; and/or 3) defining or redefining certain terms associated with eminent domain (U.S. Government Accountability Office, 2006). Federal legislation was also passed in 2006 to address the issue of using Federal funds in eminent domain. Section 726 of *The Transportation, Treasury, Housing and Urban Development, The Judiciary, and Independent Agencies Appropriations Act of 2006* established that federal funds can only be utilized for public use where "public use" excludes economic redevelopment (Towcimak, 2006). Public use is further clarified "not be construed to include economic development that primarily benefits private entities" (Transportation, 2006). While the language of the 2006 Appropriations Act was applicable only to projects funded by the act there is similar language in the 2008 Act (PL. 110-161).

New compensation requirements which benefit property owners have also been passed by some states since the Kelo decision (Feldman, 2007). These state acts address:

- Acquisition costs including appraisal fees, attorney fees, and expert witness fees;
- Relocation costs including actual costs of rebuilding structures and compensating business for loss of business; and
- "Supercompensation" payments, meaning paying a certain percentage over fair market value.

The accuracy of an estimate is also affected by time constraints placed on completing the estimate, the quality of information available, and project and parcel complexity. Accuracy suffers under estimate preparation time constraints because the estimator has a limited amount of time to research the project and appraisal data. Similarly, the quality of available information can have a negative effect on the estimate since the estimate can only be as accurate as the information upon which it is based. In an attempt to improve right-of-way cost estimates, several tools and models for right-of-way cost estimation have been developed. Recently a cost estimation model was developed by Kockelman et al. (2004) in cooperation with TxDOT. Based on data from TxDOT and a commercial property database (CoStar) three models were developed. The accuracy of these Models in predicting parcel acquisition cost was acceptable in the case of agricultural and vacant parcels but the model lacked accuracy in the area of commercial and residential takings. Although the models were not accurate predictors in these areas, the authors argue that the tool may be used in budgeting for gross total right-of-way cost in a TxDOT District (Kockelman 2004).

Early right-of-way estimates are often only gross approximations arrived at by using a percentage of the estimated construction cost (CTC Associates and WisDOT, 2006) or some other order of magnitude estimating technique. Project definition is frequently nebulous during the planning phase of project development; therefore right-of-way

boundaries at this point are not well defined. Furthermore, there may be multiple project alternatives being considered during the planning stage of project development. Alignment changes are likely and these may significantly affect the right-of-way cost estimate.

It was reported that early public involvement in the form of public meetings is beneficial because it allows the State Highway Agency to gauge the level of support for a project. This can serve as an indicator of the rate of condemnations and even the amount of contingency to include in the estimate (CTC Associates and WisDOT, 2006). A larger right-of-way cost contingency might be necessary if public support is absent as this may be an indicator as to the number of condemnation parcels that can be expected.

Selected SHA websites including those of the California, Florida, Georgia, Minnesota, Ohio, Wisconsin, and Virginia Departments were searched for procedures and manuals on cost estimation of right-of-way and other aspects of right-of-way procurement. Much of the material found on the SHA websites was related to appraisal and acquisition of property including procedures and forms used throughout the process. Caltrans devotes a chapter of its Right of Way Manual (Right, 2007) to right-of-way cost estimating. This information can be found online at www.dot.ca.gov/hq/row/rowman/manual/ch4.pdf (Estimating, 2007). The manual specifically discusses aspects of the estimate and general estimate information. The Ohio DOT has a specific procedure for estimating cost of right of way (2300 Cost Estimation... 2007). This procedure is tied to the Ohio DOT project development process.

Right-of-Way Appraisal and Acquisition

It should be emphasized that much of the literature focuses on the appraisal and acquisition of the parcels as opposed to directly discussing cost estimation and cost estimate management. Kockelman discusses how the dollar amount for appraised property values is established through three methods: 1) the Sales Comparison Approach; 2) the Income Approach; and 3) the Cost Approach (Kockelman et al. 2004). These approaches vary in methodology and application. The Sales Comparison Approach in which comparable sales in the area establish the base dollar value of the property is by far the most common approach. The Income Approach is typically used in commercial or investment properties. It attempts to estimate the income that will be realized from the property. The Cost Approach is used when comparable sales cannot be found in the area and calculates the cost of replacement minus any depreciation of the existing structure.

The Uniform Act of 1970 (Uniform, 1997) governs the treatment of property owners for all Federally-funded projects by providing a set of procedures and standards for right-of-way acquisition. The major implementation of this act is that all property owners be justly compensated for their property and they receive relocation assistance.

Condemnations are a concern when acquiring property since they have the potential to increase costs and delay the project. Condemnation rates (or the percentage of properties which move to condemnation proceedings) vary from state to state. The FHWA notes that the percentage of parcels proceeding to condemnation can potentially be reduced by: 1) the use of mediation methods between the property owners and public agency; 2) the use of well trained right-of-way agents handling acquisitions who have the authority to

negotiate settlements; and 3) the use of quick settlements in lieu of allowing the property owner a long period of time to consider the offer (FHWA Office of Real Estate Services, 2006)

Hakimi and Kockelman (2006) discuss best acquisition processes while considering the uniqueness of each state depending on political, social, environmental, and other factors. They recommend that the public should be contacted early in the process and that states should update laws and statutes to outline compensable items with the goal to streamline the acquisition process. Additionally, special acquisition techniques such as land exchange, land consolidation, and advanced acquisition should be utilized. Such techniques may not be available in all states however such techniques should be considered to the extent allowed under state law. A few such techniques are outlined in the “European Right of Way and Utilities Best Practices” report (*European*, 2002)

In summary, the method of right-of-way appraisal and acquisition can affect the accuracy and consistency of cost estimation and cost estimate management. Appraisal and acquisition methods must be understood by those who prepare right-of-way cost estimates. The appraisal and acquisition methods should be integrated into the overall project development process. As noted in the literature review of cost escalation factors completed in the NCHRP 8-49 research, inaccuracies and/or delays in right-of-way acquisitions can have a profound impact on project cost escalation.

Literature Review Summary

The literature review provided a basis for further research. Right-of-way appraisals and acquisitions make up a large portion of the right-of-way literature. The right-of-way cost estimation literature that was discovered was limited to several statistical estimating models, discussion of the impact of the Kelo case, and provided several piecemeal descriptions of the line items of an estimate. It provided selected information on the impacts of condemnations, land appreciation, and damages. The research methodology used to examine the right-of-way cost estimation and estimate management process following the literature is discussed in the next chapter.

RESEARCH METHODOLOGY

In addition to the literature review, a series of on-site and telephone interviews were conducted with agencies across the United States. The goal of these interviews was to collect data on current successful right-of-way cost estimation and cost estimate management practices. Seven SHAs and two local public agencies were interviewed.

Interview Protocol

An interview protocol was developed to guide data collection during interviews. The objective of the interview protocol was to capture successful practices including right-of-way cost estimation process steps and tools. It was modeled after the interview protocol used for NCHRP Project 8-49. Questions were developed based upon findings of the

literature review. In particular, the literature review findings identified problem areas that needed to be addressed through the interviews.

The interview protocol covered six areas and consisted of 15 questions. Additionally, the areas of interest to this research were similar to those in the original NCHRP Project 8-49, but were more specific to right-of-way issues. The interview questions examined six areas within right-of-way cost estimation and cost estimating management:

1. Determining Right-of-Way Requirements;
2. Right-of-Way Cost Estimate Preparation;
3. Right-of-Way Cost Estimate Reviews;
4. Right-of-Way Cost Estimate Communication;
5. Right-of-Way Cost Estimate Management; and
6. State Laws and Other Factors that affect the Right-of-Way process.

The six areas of interest governed the organization of the interview protocol. Section 1 of the protocol explored the process steps and tools employed by the SHAs to determine right-of-way requirements. Based on these steps and tools, Section 2 examined how right-of-way estimators produced estimates for the defined right-of-way requirements. More specifically, it addressed policies and procedures guiding estimate preparation, the elements of each estimate, how environmental issues were handled in the estimate, whether risk and uncertainty was considered, and if contingency was applied to the estimate. Estimate review processes and practices were the focus of Section 3 of the protocol. Section 4 addressed the issue of estimate communication and included training of estimators and communication of estimating procedures. Additionally, Section 4 covered the issue of contacting property owners. Section 5 of the protocol focused on how differences were reconciled between estimates, the procedures for handling changes in right-of-way requirements, and triggers for an update to right-of-way cost estimates. The effect of state laws and other factors like environmental, political, and social issues on the right-of-way process and estimates were addressed in Section 6. The effects of acquisition techniques such as advanced acquisition, incentive offers, and other non-standard techniques on estimating right-of-way costs were also explored in Section 6.

The protocol was prefaced by several introductory pages which confirmed the interview time and date, described the background of the research, and provided instructions and interview expectations. The background material covered previous NCHRP 8-49 findings relative to right-of-way including a discussion of the typical project development phases relevant to right-of-way and the basis for the right-of-way research. The instruction and interview expectation sections outlined such aspects of the interview as the phased approach to be employed relative to each of the questions during the interview and other details. Included in the interview package were the project development phase flowcharts for planning, programming, preliminary design, and final design that had been developed during the earlier NCHRP 8-49 work. These flowcharts were included to bridge the terminology differences that exist between agencies and address some of the factors limiting this research, which were discussed in Chapter 1. A copy of the interview protocol including all introductory material is provided in Appendix B.

Interview Participants

The seven SHAs interviewed included: California, Florida, Georgia, Minnesota, Washington State, Wisconsin, and Virginia. These SHAs were selected based upon input provided in Phase I of NCHRP Project 8-49. Each appeared to have systematic and relatively successful right-of-way cost estimation practices from which the research could benefit. As noted in the methodology, interviews were completed with participants from both the central office and with right-of-way administrators in districts/regions around the state. In addition to interviewing SHAs, the City of Phoenix Street Transportation Department and the O'Hare Modernization Program Office of the City of Chicago were interviewed to provide further perspectives on right-of-way cost estimation and cost estimate management. A list of interview participants by position from each agency is provided in Table 2.

Interview Process

Due to the complexity of the right-of-way cost estimation process and the information being collected from SHAs, onsite interviews were the main activity utilized for data collection. The option of a survey was ruled out because surveys would not provide adequate information describing the right-of-way cost estimation process. The majority of issues could not be answered with yes/no or multiple choice answers. It was necessary to acquire in-depth information about the cost estimation process that included some elaboration and explanation on the part of the interview participants. Onsite interviews provided the opportunity to clearly communicate specifics about the process and provide the detail necessary for developing the right-of-way cost estimation and cost estimate management flowcharts.

Interviews were conducted with SHAs and other organizations having experience with right-of-way acquisition. The interview process focused on the four phases of project development to provide a frame of reference for linking the application of successful right-of-way practices to the project development timeline. This enabled effective data collection and helped to identify differences as project development progresses. Contacts were acquired through Phase I of the NCHRP 8-49 Project and the FHWA Office of Real Estate Services also provided suggestions. Eighteen formal SHA interviews (Anderson et al., 2007b) were conducted during the earlier phase of the NCHRP 8-49 project. Experience from the previous research and recommendations provided the research team with valuable contacts possessing considerable experience and knowledge of successful practices. Some SHAs, especially large states, are highly decentralized and rely on the districts/regions within the state to manage projects and perform estimates. Therefore, when interviewing SHAs the research team attempted to capture perspectives from both central office right-of-way administrators and other administrators in districts/regions around the state. This provided diverse perspectives on right-of-way cost estimation and related issues.

Table 2. Agency interview participants

Highway Agency	Interview Participants
California	Senior ROW Agent – Headquarters Office
	Senior ROW Agent – Headquarters Office
	Senior ROW Agent – North Region
	Senior ROW Agent – North Region
	Senior ROW Agent – District 3
	ROW Manager – South Region
	Senior ROW Agent – South Region
	Associate ROW Agent – South Region
	ROW Agent – South Region
	ROW Estimator – South Region
Georgia	Appraisal & Review Manager
	Manager, ROW Cost Estimates
Florida	Manager, Appraisal & Appraisal Review
	Director, Office of Right of way
	Deputy State Manager, Appraisal & Cost Estimating
	State Cost Estimating Administrator
	District One Cost Estimates Administrator (Bartow/Lakeland)
Minnesota	District Seven Cost Estimates Administrator (Tampa)
	Right-of-Way Program Manager – Central Office
	Assistant Director, R/E & Policy Development – Central Office
	ROW Engineer – District 1
	ROW Engineer – District 2
	ROW Engineer – District 3
	ROW Engineer – District 4
	ROW Engineer – District 5
	ROW Engineer – District 6
	ROW Engineer – District 7
ROW Engineer – District 8	
Washington State	ROW Engineer – Metro
	Assistant Director for Appraisal and Appraisal Review Program
	Appraisal Specialist, Olympia Region
Wisconsin	Appraiser, Olympia Region
	Real Estate Supervisor – SE Region
	Real Estate Supervisor – SE Region
	Real Estate Supervisor – NW Region
	Real Estate Supervisor – District 3
Virginia	Real Estate Supervisor – District 5
	Division Realty Office – FHWA
City of Chicago	Assistant Director ROW Manager
	Projects Administrator
	Relocation Manager
City of Phoenix	Director of Public Affairs
	Traffic engineering Supervisor
	Acting Assistant Real Estate Administrator

The first step in the interview process was to contact the agencies. Upon initial contact with the potential interview participants, the interview protocol was transmitted by email to the participants several days prior to the scheduled interview. This provided the

participants a chance to review the protocol and prepare for the interview. Interviews were set up in two to three hour blocks to allow ample time to cover the entire process from the first planning estimate to the activities required during final design.

In most cases, the interview was conducted by two individuals from the research team. One member would typically act as facilitator while the other took detailed notes. Both team members took an active part in the interview. The first 15 minutes of the interview typically consisted of introductions, a summary of the research background and framework, the objective of the research, and statement of the research team's expectations of the interview. Additionally, the status of the project and findings of previous interviews were summarized to provide the participants with the current status and direction of the research project. Following the introductory portion of the interview, the participants were probed for information regarding the SHA's project development process and any special terminology. This served to provide the research team a base for further questions and to relate participant answers to project development phases (planning, programming, preliminary design, and final design). Then, the facilitator would guide the interview towards the first right-of-way estimate completed during planning. From this point on, a discussion proceeded in which interview participants would tell the "story" behind the SHA's right-of-way cost estimation process. As the interview was coming to a close, issues not yet covered were addressed using the interview protocol as a checklist. The members of the research team would typically use the time following the interview to make additional notes on general impressions of the interview. All details were recorded in the interview protocol under the related questions.

In lieu of proceeding straight through the interview questions one by one, the majority of the interviews began with general discussions, which led into specific topics within the context of right-of-way cost estimation and cost estimate management. This practice was adopted during the first interview with the Minnesota Department of Transportation. That interview served as a "test" dialogue for the newly developed protocol. Consequently the protocol questions served more as a checklist to ensure that all issues were covered. Shortly following the interview, an interview report was prepared which consisted of filling out the protocol based on the interview notes. An example of a completed interview report for a State DOT can be found in Appendix C. This allowed the team to capture and understand the process for right-of-way cost estimation and cost estimate management utilized by the SHAs throughout all phases of project development. In addition to the on-site interviews, conference calls via telephone were utilized to follow up on any issues unclear after the initial interview.

Documents Collected

State highway agency right-of-way estimating tools were documented during interviews and any documents describing the tools or examples of the tools that the agency used were requested at the time of the interviews or in follow-up emails and telephone calls. The documents gathered ranged from cost estimate maps used to determine right-of-way requirements to cost estimate spreadsheets used in completing estimates. Screenshots of right-of-way tracking and estimate systems were also requested and provided by the SHAs. The SHAs were always asked for copies or web addresses of manuals, policies,

and procedures that supported their right-of-way cost estimation and cost estimate management processes.

STATE OF PRACTICE CHARACTERISTICS

Critical issues relating to right-of-way estimating were identified during the interviews as those most difficult to estimate or issues that may have a significant impact (good or bad) on creating an accurate estimate. Based on the responses of the interview participants, the most notable critical issues include (not presented in an order of importance or priority rank):

- Condemnations
- Damages
- Inflation and other market conditions
- Risk analysis and assigned contingency
- Scope definition
- Estimating tools
- Estimator experience and knowledge

Condemnations

Estimating the costs of condemnations is very difficult because of two major factors. First, there is the issue of determining the number of condemnations, or what percentage of parcels will move to condemnation proceedings. FHWA Office of Real Estate Services' report on state condemnation practices (2006) indicated that approximately 80 percent of acquisitions are completed without condemnation while FHWA online data reported 12.5 percent condemnation rate for 2004 and 12 percent for 2005 (FHWA, 2007). This variable is study specific and may vary drastically between projects, between regions/districts, or even within regions/districts. As discussed previously in the literature review, the condemnation rate is heavily dependent on state laws governing the process and whether the public agency is responsible for paying acquisition costs of the property owner such as appraisals, expert witnesses, and other legal fees (FHWA Office of Real Estate Services, 2006).

The second issue is the actual cost of the condemnation proceedings. Condemnation expenses include engineering, appraiser, and economists' fees plus attorney and court costs, and the final condemnation award amount. The fee portion together with legal cost may add significantly to the cost of a condemnation proceeding. Additionally, states have specific laws concerning condemnations. In one state it is the financial responsibility of the acquiring agency to reimburse the property owner for an independent appraisal if such is requested by an owner. This stipulation is a result of the Supreme Court Kelo decision. Condemnations may cost a project more than just money; the proceedings may cost the project valuable time. Proceedings can delay a project schedule. Time delays then impact estimated construction cost. The cost and rate of

condemnations is heavily dependent on state laws and social factors that exist in a particular local.

Damages

Damages due to partial takings of a property were indicated by agencies to be one of the most difficult aspects of right-of-way estimating. The definition of the term under 23 CFR Ch. I (4–1–02 Edition) § 710.105 Definitions is:

Damages means the loss in value attributable to remainder property due to severance or consequential damages, as limited by State law, that arise when only part of an owner's property is acquired.

Damages are primarily an issue in acquiring a portion of a business. Assigning a cost to damages can be very subjective and many times, the accuracy of the estimated cost is dependent on the experience of the estimator.

Real Estate Inflation and Other Market Conditions

Assessing the potential impact of inflation/appreciation and other related real estate market conditions is a challenge. This is an issue in preparing cost estimates during every project development phase. Property values increase at rates different than the inflation rates for construction materials and labor. Properties in highly urban areas or areas where there is substantial growth potential may be subject to substantial increases in the market value of land. The results of the interviews in this project were consistent with the interviews and data collection in Phase I of NCHRP Project 8-49 concerning inflation and other market conditions.

Risk Analysis and Assigned Contingency

The majority of agencies interviewed made no attempt to conduct a formal detailed risk analysis of items that could impact right-of-way cost although most agencies did assign contingency amounts in some manner. A detailed risk analysis can be defined as a systematic method of identifying and evaluating risks using a formalized agency procedure. The majority of agencies reported that they did not specifically address risk analysis in a formalized and documented procedure. Only two SHAs reported performing detailed risk analyses where specific project risks are identified and then addressed by some application of contingency. These two instances are presented later in the report. Risks effecting right-of-way derive from the schedule, property appreciation, condemnations, damages, and other issues that exhibit uncertainty or may be unknown. Moreover, the use of contingencies was an issue throughout the SHAs interviewed. Four SHAs reported the regular practice of applying a contingency to their right-of-way estimates: the two aforementioned states using detailed risk analysis and two others who explicitly assign a contingency. Other SHAs may apply contingency values subjectively based on the estimator's opinion or judgment about the cost estimate.

Scope Definition and Estimating Tools

Determining a project's right-of-way requirements early in the development process is problematic, particularly during the Planning phase (e.g., 10 to 20 years out from the estimated construction letting year). Phase I of NCHRP Project 8-49 found that actual cost of project right of way is frequently greater than the estimated cost that was projected during the early stages of project development. Two primary factors can explain this: 1) inadequate scope definition; and 2) the absence of effective tools and methods to complete right-of-way cost estimates. Right-of-way estimates made during the planning phase of project development are often solely based on a percentage of estimated construction costs. Agencies using this method maintain that the cost benefit is not substantial enough to invest manpower in more detailed right-of-way estimates at this early stage because limited project scope information is available, there are multiple alignments to consider, and there will be inevitable changes to the project as scope is refined as the project moves through the development process. This is not the case, however, with the Cities of Chicago and Phoenix which finance their projects with bond money and therefore must have accurate cost estimates before going to the bond market. Both cities work hard to define project scope in detail early in project development and to develop accurate early right-of-way cost estimates.

Estimator Experience and Knowledge

Estimator experience was consistently noted as having a large impact on the quality and accuracy of right-of-way cost estimates. In achieving estimate accuracy the estimator's knowledge of the project area and market plays a role in many subtle ways. SHAs are facing issues related to personnel turnover, especially related to employees with 15 to 20 or even 30 years of experience in right-of-way cost estimating. These people are quickly reaching retirement and when they depart, invaluable experience and knowledge will be lost.

OVERVIEW OF CURRENT PRACTICE

A right-of-way cost estimate is produced during each of the first three phases of project development: planning, programming, and preliminary design. Before preparation of the estimates, right-of-way requirements must be provided by planners or the project design team to establish the basis of the estimate. Following preliminary design, appraisals and acquisition typically commence. Typically, no further cost estimates are generated at final design, but right-of-way cost management should continue as purchases are executed. Right-of-way cost management occurs during final design and is completed by comparing actual costs reflected in the appraisals and acquisitions to the estimated costs. If actual costs exceed the estimated amount, the project manager is notified and action is taken to either request additional funds or to make design changes that might reduce right-of-way cost. Additional right-of-way needs are sometimes identified during construction. When this occurs the staff members responsible for right-of-way cost management must work closely with the agencies construction and design sections to minimize the impact of these new right-of-way requirements.

The following subsections discuss the current and general state of practice relative to each of the project development phases. Current practices are discussed in a general manner that outlines the overall state of practice in the SHAs interviewed. Later in this chapter, specific successful practices will be covered and critical review of these practices is presented.

Determining Right-of-Way Requirements

The basis of a right-of-way cost estimate is the right-of-way requirements and this is dependent on the level of project scope definition. Even in the case of a planning-level right-of-way cost estimate where the estimate is based on a percentage of estimating construction cost, the right-of-way estimate is dependent on the planner's ability to develop a reasonable scope definition to confirm the percentage applied. Typically, scope definition is clarified as the project development process proceeds from the initial planning phase to final design and construction.

The need for a project is typically defined in the initial project development phase of planning where scope definition is often nothing more than a statement of purpose and need. The scope at this point in time is expressed in very general or broad terms and usually consists of only an approximate number of lanes or a width, several potential alignments, with little definitive supporting information available. A right-of-way estimator is typically not involved at this stage, and it was found that right-of-way estimates are often completed within the agency's Planning Division and not the responsibility of the right-of-way Division. As previously stated, a percent of the estimated construction cost is often used at this point in the process.

At the programming phase of project development the scope of the project has been further defined and usually an alignment relating to right-of-way needs has been determined. In the case of most SHAs, the right-of-way division or group will receive a request from the project manager for a right-of-way cost estimate. This request is often accompanied by an aerial map or other visual representation of the project site with approximate right-of-way boundaries indicated. This aerial map defines the right-of-way requirements for the project. The total area to be acquired may also be indicated. In some cases SHAs reported that rough parcels would be indicated along with parcel areas, but this is not common practice at programming.

Right-of-way requirements during preliminary design are reflected in an updated aerial map or a preliminary drawing provided by the design engineers. The map typically shows the refined right-of-way boundaries, defines each parcel and shows parcel boundaries, and provides the areas required for each parcel.

Final right-of-way plans exist at the final design phase in which all right-of-way requirements are explicitly defined as parcels. No further estimates are completed at this point as right-of-way appraisals begin followed by acquisition of parcels. It is likely that some changes may occur during final design which will impact the right-of-way requirements; while such changes are typically minor in extent they can have significant impacts to right-of-way cost. In that case, new right-of-way plans may be released and reconciliation of the cost changes occurs, if necessary.

General Right-of-Way Cost Estimating Practices during Planning

During planning, right-of-way estimates in many SHAs are usually based on percentages of construction costs. Historical right-of-way costs from general databases or right-of-way cost from comparable projects may also be used to produce this early estimate. Construction costs for planning estimates, as outlined in the NCHRP Report 574, are frequently based upon lane-mile cost factors and prepared by planners. If right of way is required the estimate for this project cost component often does not involve the right-of-way division. Planners also prepare the right of way estimate. In general, planning estimates are used for long-term budgeting. The right-of-way amount defined in the planning estimate appears to have minimal bearing on later estimates.

General Right-of-Way Cost Estimating Practices during Programming

When preparing the programming estimates, a field visit to the project location is usually completed by the estimator. The right-of-way estimator assigned to complete this early estimate will generally either walk or drive the project and make notes of pertinent details like improvements to be removed, potential damages due to partial takings, and the general topography of the project area. Improvements to be removed include any structure, pavement, outdoor sign, or any other enhancement to the property that is necessary to remove before construction begins. A determination must be made by the estimator related to the current use of the property since the land values may be drastically different for each of use. The estimator must determine whether the use of the property is residential, commercial, industrial, or agricultural land. The right-of-way estimator will prepare the estimate based on the right-of-way requirements per the aerial map and any data obtained during the project site visit.

SHAs typically have a cost estimate sheet or checklist to ensure that all elements affecting right-of-way costs are considered. This is the case for the estimates completed during programming, which usually sets the baseline budget (the estimate by which all other estimates are compared for cost management purposes). A cost estimate sheet will have line items for all elements to be included in the estimate. Typically, the major estimate elements are: 1) land; 2) improvements; 3) relocation costs; 4) damages; and 5) condemnations.

Land values are established by comparable sales in the general project area using resources such as the tax assessor's records, area realtors, or commercial realtor databases. At this point in project development, the estimate is normally completed on a gross area basis. Therefore, the estimator is looking to establish a value to apply to the total right-of-way area on a price per acre or price per square-foot basis depending on property usage.

Improvements to the raw land and the condition of the existing site improvements must be included in the cost estimate. In addition to justly compensating a land owner for their property, improvements, such as buildings, outdoor signs, and parking lots, must be included in the compensation.

Relocation costs for all displaced individuals and their belongings are included in the estimate. Most SHAs appear to have reasonable data for estimating relocation costs and

apply a set dollar amount based on recent historical costs and depending on the type of displacement (business, residential owners, or residential tenants).

Damages are hard to estimate in almost every case. Estimating such cost requires judgment on the part of the estimator. A value must be assigned based upon the size, shape, and use of the parcel remainder. The estimator's experience and knowledge of the area are very important in establishing this amount.

Condemnations are based on historical data and/or previous experience of the estimator in the project area. The condemnation rate (or the percentage of parcels that will proceed to condemnation) must be estimated in addition to the actual costs of those parcels that may proceed to condemnation. The condemnation rate differs drastically from state to state due to state laws adjudicating property rights and state laws governing condemnation proceedings. Condemnation rates are estimated based upon recent project experience in the area, but estimating the condemnation rates are still quite subjective since there is always a human factor involved. The "human factor" can be defined as the uncertainty and unpredictability related to dealing with property owners when an agency is attempting to acquire their property. The reaction of individuals to an agency acquiring property is difficult to predict. If the condemnation rate is estimated accurately, the cost of condemnations will usually be accurate since they are primarily based upon state laws.

General Right-of-Way Cost Estimating Practices during Preliminary Design

At the preliminary design phase of project development the right-of-way cost estimate is further refined. In most cases, this is a completely new estimate developed by the right-of-way division personnel, but it may be an update of a previously developed estimate. This varies by SHAs practice. The estimator usually makes a project site visit to explore any issues not apparent from aerial photos or preliminary plans defining the right-of-way requirements. The project manager or project engineer will often accompany the right-of-way cost estimator to provide input on probable design scenarios that will impact the right-of-way requirements and cost, and the potential trade-offs between right-of-way and design may be discussed.

Again, a cost estimate sheet is used in producing the estimate to insure that all aspects of right-of-way cost are included in the estimate. The same line items included in the programming estimate sheet are examined for this estimate but now in more detail (e.g. parcel information should be available by this point in project development). The preliminary design estimate is completed using parcel by parcel data where a cost is estimated for each individual parcel. This is the last cost estimate completed before the project is programmed in the State Transportation Improvement Program (STIP).

Other than the estimates described here, update estimates may occur when major changes occur in project design. These changes, though, must be communicated to the Right-of-Way Division by the project manager or project engineer. Communication becomes important in this case. Many SHAs attempt to update estimates annually, but some SHAs noted that the size of their right-of-way offices or groups of individuals is too small for a comprehensive annual update.

General Right-of-Way Practices during Final Design

Final right-of-way plans are released during the final design phase and appraisals begin followed by acquisition. No further cost estimates are prepared. Right-of-way acquisition can begin in earlier phases through protective buying, hardship acquisition and other early acquisition actions but most SHA responded that these were seldom used because of bureaucratic issues such as state laws restricting the length of time right of way can be held after purchasing and prior to construction on the property.

In general, the right-of-way agents in charge of appraisals and acquisition will be aware of cost overruns, but requesting more funds seems to be the current practice instead of attempting to manage costs to a previously set budget. This is a major issue, which is addressed later in the analysis section of Chapter 3.

Estimate Review and Approval Practices

Review of a completed estimate during any of the project development phases is typically limited to a visual scan by the estimator's supervisor. In specific cases where the cost of right-of-way is extremely high in value, a division head may be required to sign off on the estimate. The SHAs contacted had no formal and documented review process covering right-of-way cost estimates. The right-of-way supervisor typically has many years of experience with right-of-way estimates and performs a high-level review of the cost estimate by using "rules of thumb" and heuristics that they have developed through their years of estimating experience. This is completed by examining the major elements of the estimate which have a large impact on right-of-way cost. The supervisor then determines whether these elements of the estimate appear consistent with past cost experience and subsequently approves or disapproves.

State Laws and Other Factors

State laws and environmental, political, and social factors affect the right-of-way cost estimation process and impact right-of-way cost. The effects of these laws and factors vary by state. The *Kelo versus City of New London* case which went to the U.S. Supreme Court seems only to have affected SHAs to a limited extent as most highway agency practices were in conformance with the requirements prior to the case result. However, changes have been made to the eminent domain laws in several states. Interviews confirmed that some state legislatures have passed laws requiring the SHAs to reimburse property owners for private appraisals, attorney fees, and/or other acquisition costs up to a certain value. Furthermore, some states have tightened right-of-way condemnation requirements in the areas of notification and time to response to SHA actions. All states have a defined process for condemnation proceedings and, depending on the state, condemnation actions have the potential to delay project construction starts.

CHAPTER SUMMARY

This chapter described the state of practice relative to highway right-of-way cost estimation and cost estimate management. A literature review was completed and

interviews conducted with SHAs. The interviews with seven SHAs together with agencies in the Cities of Chicago and Phoenix resulted in the identification of critical issues related to cost escalation and the overall state of right-of-way estimating practice. Chapter 3 focuses on the critical review of SHA practice and identifies successful practice process steps and tools.

CHAPTER 3

CRITICAL REVIEW OF THE STATE OF PRACTICE

Chapter 2 summarized the state of practice based upon the literature review and SHA and City agency interviews. This chapter provides a critical review of SHA practice in dealing with right-of-way estimation and management of right-of-way estimates. All of the agency right-of-way practices, discussed in the following sections, are from the literature review or the agency interviews. Successful practices discovered during the state of practice review are discussed in detail followed by a summary of those practices.

METHODOLOGY

The review consisted of evaluating the information presented in the literature and the data collected during the agency interviews. The review process led to the identification of the successful practices discussed here and in the Procedures Guide. The research team focused primarily on the agency interviews when completing the review as the literature search revealed little information on right-of-way cost estimation and cost estimate management. The review and analysis of practices was accomplished by the project team relying on their individual cost estimating expertise. Decisions were made by team consensus.

The research team utilized a process-focused approach to review the materials since the main objective of the research was to “*Develop an all-inclusive set of ROW cost estimation and cost estimate management procedures.*” Within the project phases the research team considered general cost estimation and cost estimate management steps reflected in NCHRP Report 574 (Anderson et al., 2007a). These steps are:

1. Determine Estimate Basis;
2. Prepare Estimate;
3. Determine Risk/Contingency;
4. Review Estimate;
5. Obtain Appropriate Approval;
6. Determine Estimate Communication Approach;
7. Monitor Project Scope/Project Conditions;
8. Communicate Estimate and Approval; and
9. Adjust Cost Estimate.

The first four of these steps are defined in NCHRP Report 574 as cost estimating steps, while step 5 through step 9 are cost estimating management steps. Although the manner in which these steps are performed varies depending on the project development phase the distinction between estimating and management steps is important. These steps are integrated throughout the right-of-way flowcharts that were developed as a product of

this research. The steps are discussed further in Chapter 4. These steps are critical to the preparation of consistent and accurate estimates throughout all phases of the project development process. The practices of SHAs were evaluated for effectiveness in view of the need to have a structured process that contains all of the listed estimate steps.

GENERAL RIGHT-OF-WAY COST ESTIMATING PROCEDURE

Before reviewing SHA practices, it is necessary to outline the general process behind completing a right-of-way cost estimate. The process steps are a consequence of the general project cost estimating steps detailed in NCHRP Report 574 and current SHA practice as revealed through the interviews. The right-of-way specific steps summarized here in generic form are utilized, to some degree, for each of the right-of-way cost estimates prepared during project development.

Right-of-way requirements, which are defined by the project scope, establish the right-of-way estimate basis. These requirements are an input to the right-of-way cost estimation process and therefore establish the basis for the cost estimate. They typically include information such as the width of the project or number of lanes (dictates minimum right-of-way width) and other physical parameters which define what real estate will be required. Receipt of this information marks the beginning of the cost estimating activities. The preparation-of-estimate activities are:

- Gathering data through field visits and from other sources of information to include assessment of improvements, land values, real estate inflation rates, condemnation rates, and possible damages;
- Quantifying estimate parameters such as total real estate or parcel areas;
- Computing cost by applying values to estimate parameters and other line items including damages, property improvements, etc; and
- Adjusting the estimate for inflation, uncertainties, and risk.

After the cost estimate is computed, it is reviewed (usually by a right-of-way supervisor or manager) and then after approval, it is communicated to the appropriate project or program management staff.

RIGHT-OF-WAY COST ESTIMATION

Right-of-way cost estimates are completed during the first three project development phases: planning, programming, and preliminary design. There is some variance between SHAs regarding when estimates are performed relative to a specific SHA project development process and the number of estimates prepared in each of the development phases. The following section covers the practices utilized in each phase to prepare right-of-way cost estimates, both tools and general estimating approaches used by SHAs are presented. Planning will be covered first followed by programming and then preliminary design.

Planning Estimate

The right-of-way planning estimate is generally the first estimate produced to quantify right-of-way cost. The typical timeline for the planning estimate is 10 to 20 years prior to the forecasted construction letting time. These estimates are generally based on tentative right-of-way requirements since the project is being projected to occur in the distance future. Another factor that contributes to the uncertainty of these early estimates is the inability to predict future changes in real estate values caused by such issues as governmental introduced zoning changes, market conditions, and varying appreciation rates.

In many agencies this estimate is not prepared by the right-of-way section. Instead, it is often prepared by the planning division and the right-of-way section is consulted on an as-needed basis, if consulted at all. Four of the nine interviewed agencies do not involve their right-of-way personnel at this point and resort to gross historical costs, comparable projects, or to a percentage of the estimated construction cost to create the right-of-way estimate.

Right-of-way requirements at the planning phase are usually based upon a preliminary or conceptual project scope definition; therefore, right-of-way requirements are imprecise and will likely change. In addition, there are often several project alignments being considered, which adds uncertainty to the estimate. Five interviewed agencies (three SHAs and the cities of Chicago and Phoenix) do develop a bottom-up right-of-way cost estimate completed by right-of-way personnel as part of their planning estimate. They believe this effort provides them with a more accurate prediction of future project cost.

This sub-section discusses and reviews four practices used by SHAs for the planning-level right-of-way cost estimate:

1. Early Scope Definition;
2. Conceptual Cost Estimate Map;
3. Percent-based ROW Cost Estimate; and
4. Unit Cost Estimate Approach.

The section first discusses early scope definition. In general, project scope definition is an integral part of establishing the estimate basis; this also holds true for the right-of-way cost estimate. Many of the SHAs interviewed do not spend much time defining the project scope during the early stages of project development and consequently, this lack of definition increases the uncertainty with respect to right-of-way requirements. Another problem identified was the failure to communicate right-of-way requirements to right-of-way staff. A tool that may be useful in communicating right-of-way requirements effectively is a conceptual cost estimate map, which is discussed following early scope definition. Planning-level right-of-way cost estimates are typically completed by a unit-cost approach or a percent-based approach. These approaches will be discussed last in this section to highlight the pros and cons of each. These approaches lack accuracy and consistency since there are many complexities inherent in estimating the cost of right-of-way.

Early Scope Definition

Scope definition is critically important to the development of a cost estimate. In the case of a right-of-way cost estimate, scope definition is directly related to the completeness of the stated project right-of-way requirements. Consequently, if project scope does not explicitly defined the right-of-way requirements and accuracy right-of-way cost estimate cannot be produced.

One SHA attempts to increase the exactitude of early project scope definition through a field visit of the project site (or multiple sites if there is more than one potential alignment). This visit is completed by an individual from the planning division along with the project manager. During the visit, likely project designs and pertinent project scope information such as the facility type, the number lanes, and access points are discussed. Following a thorough study of the information gathered as a result of the site visit, the planner communicates the right-of-way requirements to the right-of-way estimator. In this agency the estimate is completed based on research of land values (tax assessor records), condemnation rates, and other location specific attributes. The level of effort and detail used by this agency is in contrast with percent-based or unit-cost estimate approaches used by other agencies, which do not consider location-specific attributes. It has been shown through the literature and is evident through the interviews that location specific attributes have a large impact on estimate accuracy.

Some SHAs argue that developing this level of detail during the planning process is a waste of staff resources, since there are likely to be many future changes to the project scope. In the case of the Chicago and Phoenix and at least two of the SHAs this is not true because they work hard early in planning to develop a definitive project scope. In many cases SHAs could significantly improve project estimates if an increased effort was made to better define the project scope including right-of-way requirements. This commitment does, however, dictate a greater investment of time and resources early in project development but according to those agencies that make the investment it enhances control of project cost.

Conceptual Cost Estimate Map

The conceptual cost estimate map is a tool used by designers to communicate right-of-way requirements to right-of-way personnel. This map is used in conjunction with early scope definition. The term “conceptual” is used since it captures the early “conceptual” scope. Typically, the project designer provides the right-of-way estimator with an aerial photograph or drawing of all possible project alignments. The approximate right-of-way boundaries are drawn on these documents to communicate the right-of-way limits to the estimator. This easy to read tool clearly portrays the right-of-way requirements. One caution with this method is that the clear representation may convey more accuracy than is the case at such an early stage of planning.

One SHA does not complete early scope definition but still uses a conceptual cost estimate map to show the proposed location of the project. This SHA provides an aerial photograph to the right-of-way division but the photograph does not include any lines denoting right-of-way boundaries. Approximate cross sections are then applied by the right-of-way division to determine the right-of-way approximate requirements.

Percent-based Right-of-Way Cost Estimate

Three of the SHAs interviewed use a percent-based right-of-way cost estimate procedure to develop a planning cost estimate. The percent-based cost estimate involves applying a percentage value to the estimated construction cost to determine the right-of-way cost portion for the planning estimate. During the interviews it was not clear how these percentages were determined. It seems that the percentage value was established so far in the past that staff could not explain how the percentage value was derived. The percent-of-construction estimate approach is advocated by SHAs for planning estimates based on the supposition that a more detailed right-of-way cost estimate would increase staff workload and require a more complete definition of scope. Using a percentage provides a quick and easy method for computing a right-of-way cost estimate when right-of-way requirements are lacking.

Although the percentage-based approach is quick and easy, two SHAs are of the opinion that these estimates are usually inaccurate and contribute to the cost escalation experienced on projects. The research findings seem to support this belief, as this percentage based estimate does not take into account location specific factors that effect right-of-way cost.

One SHA in particular used this percent based method as recent as 2004 but has transitioned away from such a procedure. The percentages were published in a state-wide estimating guide, which defined the percentage to be used based on project type. Another SHA completed a study on past planning estimates with the objective of exploring the basis and accuracy of planning level right-of-way cost estimates. This SHA is one of those where the right-of-way section does not provide the planning-level right-of-way estimate. The study was initiated by the right-of-way section as a result of some inconsistency related to cost escalation issues between planning estimates and later right-of-way estimates. This was really an attempt to understand the approach used by the planning division. The agency found that these percent-of-construction estimates are only a close approximation about half of the time.

Unit-Cost Approach

Another method utilized during planning to develop a right-of-way estimate, again typically where the right-of-way section is not charged with creating the estimate, is the use of unit-cost values (per acre or sq. ft). These unit costs are typically derived from historical data or by simply contacting the district/region where the project is located and asking for a cost value. Such values are often little more than a guess. Like percentage-based right-of-way estimates, these can prove to be poor approximations of right-of-way cost as the issues that impact costs such as improvements, damages, and access issues (all location-specific attributes) may not be addressed using the unit-cost approach.

Programming and Preliminary Design Estimates

NCHRP Report 574 found that project cost estimates completed during the programming and preliminary design stages of project development are similar (Anderson et al., 2007a). The communication of right-of-way requirements, the cost estimation process steps, and the cost estimation tools that are used to create these estimates are similar.

Therefore, the critical review in this section discusses programming and preliminary design right-of-way cost estimation together.

In general, and depending on project complexity there may be a number of cost estimates prepared during the programming phase. The last programming estimate is usually completed based on a preferred alternative. Once this estimate is approved, the project is placed in a priority program. This authorized priority program may span a period of five to ten years prior to the construction letting date. It should be noted that the length of the priority program varies from state to state depending on both the structure of the agency and the state laws that govern SHA business. During preliminary design several estimates may be developed. At some point, the right-of-way cost estimate is typically completed for inclusion in the State Transportation Improvement Program (STIP). After its inclusion in the STIP, the project is fiscally constrained. In some states, the priority program is the same as the STIP or perhaps one year further out from letting than the STIP (four years for federally funded projects).

Although there are many similarities between right-of-way cost estimates completed during programming and the cost estimates completed during preliminary design, there are several differences that are noted in this section. These differences typically stem from: 1) the level of scope definition (i.e., right-of-way requirements) upon which these estimates are based; and 2) the level of detail and information used to prepare these estimates (e.g., acres versus parcel estimates).

Scope definition is refined as the project development process proceeds, therefore the right-of-way requirements become better defined as the project moves from programming through preliminary design. The preferred highway alignment is typically chosen during the programming phase and right-of-way boundaries and rough parcels are known with more certainty than at the planning phase. These right-of-way requirements are identified on aerial photographs or schematic drawings, which are provided to the right-of-way section by the project manager or the lead designers. By the time the preliminary design estimates are developed, the majority of right-of-way boundaries are definite and exact parcels are identified.

In general, this section covers the critical review of the different practices, tools, and approaches used to complete the preliminary design and programming estimates found through the research. Specific tools covered in this section are: the cost estimate map employed to communicate right-of-way requirements; estimate documents utilized in preparing estimates; estimate accuracy definition to communicate the certainty/uncertainty in estimates; and estimating software. The remainder of this section covers the practices and approaches which include: the use of historical data in estimates; the use of appraisers as estimators; a parcel-by-parcel cost estimate approach; estimate reviews; and specific risk analysis and application of contingency practices.

Cost Estimate Map

The cost estimate map provided to right-of-way estimators at programming and preliminary design is similar in format to the conceptual cost estimate map discussed in the previous section on planning, but it provides more project detail. Right-of-way boundaries are now specified but with greater certainty. Additionally at programming, the map should include rough parcel boundaries and approximate right-of-way areas.

The map provided at preliminary design will include even more detail with greater certainty as a function of the project development evolution. Parcel boundaries and right-of-way areas of each parcel are identified. The map shows other details relevant to the right-of-way such as, access points to the highway, the type of takings, and access rights that are needed for construction. A cost estimate map is a good tool that aids the right-of-way estimator in understanding the real estate requirements and in establishing a basis for the right-of-way estimate.

Parcel-by-Parcel Cost Estimate Approach

A parcel-by-parcel cost estimate approach is characterized by the feature that the cost of each parcel is estimated on an individual basis. By treating each parcel as a unique piece of real estate it is possible to capture site specific unique cost impacting conditions. The alternative approach is to complete the estimate on an overall basis (total acres) at a macro-level by considering only gross parcel area and land type (e.g., residential, commercial, etc.). When completing a parcel-by-parcel estimate, the cost estimator determines a cost for each individual parcel, capturing right-of-way quantities and parcel attributes in detail. This estimate approach is similar to completing an appraisal since parcels are appraised one by one. The interviews found that the parcel-by-parcel cost estimate approach is used by only one SHA for the programming estimate, at the same time the majority of SHAs interviewed utilized it for developing a preliminary design right-of-way cost estimate.

It appears that this approach to right-of-way cost estimating may produce a more accurate cost estimate because it incrementally captures the individual values in manner similar to property appraisals, and therefore more realistic acquisition values are used to develop the estimated. This causes the estimator to consider the required right-of-way real estate in more detail. For example, this is especially effective for estimating costs of damages because the cost impact must be considered for each individual parcel. It is difficult to accurately place a value on the damages from a partial taking unless one considers the impact on the particular business or residence located on the parcel.

Documented Cost Estimate Procedures

All SHAs interviewed have a published set of right-of-way procedures and these procedures are typically posted on the internet. The majority of these procedures focus on the agency's appraisal and acquisition processes. Very few of the documented procedures discussed right-of-way cost estimation or right-of-way cost estimate management processes. Caltrans is one agency that has a right-of-way manual which includes right-of-way cost estimation. Chapter 4 of the Caltrans right-of-way manual (www.dot.ca.gov/hq/row/rowman/manual/ch4.pdf) discusses right-of-way estimating. The chapter has four sections, the first of which outlines the general purpose and procedures behind the right-of-way cost estimation and management process. Section 2 discusses preparation of the actual estimate including all cost parameters. The chapter discusses in detail each aspect of right-of-way that may impact cost and provides specific guidance on each while the third section focuses on real estate inflation. The last section covers updating estimates which focuses on management of the cost estimates.

The Ohio Department of Transportation (ODOT) has a manual titled, "Cost Estimating Procedures for Acquiring Right of Way (2300 Cost Estimation...2007)". The ODOT

procedure focuses on right-of-way cost estimating for major projects and minor projects. This classification of projects is defined in ODOT project development process (PDP) procedures. Major projects have 14 steps. Right-of-way cost estimates are prepared at several of these steps. The first estimate is prepared to coincide with the first PDP step. Subsequent right-of-way estimates are updated based on the first estimate. The level of detail regarding right-of-way requirements increases as the PDP steps are performed. Multiple updates of the right-of-way estimate are prepared to support alternative selection, for example. On minor projects fewer right-of-way estimates are prepared as the alignment is not subject to alternative analysis. Similar estimating approaches are followed. In general, right-of-way cost estimating techniques are discussed and the use of supporting information is identified. Cost values are provided for many estimate elements. An estimate form is used to capture all costs and summarize costs for a total right-of-way estimate.

Due to the lack of published guidance, right-of-way estimators, managers, and supervisors rely heavily on their experience to guide them in developing estimates. Experienced estimators are critically important to creating good cost estimates, but the right-of-way process is a complex undertaking and an effective set of procedures is essential in providing a reference for right-of-way estimators. Moreover, as discussed in the critical issues earlier in Chapter 2, many experienced estimators are close to reaching retirement age. Therefore, the need for well defined and documented processes is becoming more important.

Right-of-Way/Design Tradeoffs

Right-of-way staff can provide valuable insight about the cost effects of design decisions. Using such information the project design team can actively control cost escalation problems and may even reduce overall project cost. However, very few of the SHAs interviewed maintain effective coordination mechanisms between the design team and right-of-way staff, specifically communication to discuss the impact of design decisions on right-of-way costs. Even minor design changes can have significant impacts on right-of-way cost, both increasing cost but just as importantly in reducing cost. One of the major factors in cost escalation is related to condemnation costs and awards greater than the appraised value following a court decision. Right-of-way/Design tradeoffs offer the advantage of potentially impacting fewer properties and fewer condemnations. Another advantage of such cooperation is the ability to reduce the overall cost of projects and potentially provide funds within the SHA budget for more projects. Additionally, project delays caused by delayed right-of-way acquisitions can be a large contributor to project cost escalation even greater than the increase in right-of-way cost. Involving right-of-way personnel in design analyses can help to avoid costly project delays resulting from delays in right-of-way acquisition.

Historical Data

Most SHAs do not use robust historical data when preparing a right-of-way cost estimate during programming and preliminary design of a project. With the exception of one SHA, no interviewed agency use historical data. A major reason that historical data plays only a minor role in cost estimates is the recognition that the real estate values are volatile. When determining real estate values for right-of-way, it is necessary to use the

most recent comparable sales in the area. Year-to-year inflation is not constant and can even differ by area; therefore, dated historical data is of little value when attempting to estimate real estate values. Historical data is only useful in areas where prices are relatively stable. However, when scope definition is not definitive (i.e., during planning), recent historical data may offer the best estimating methodology, but such data should not be the sole basis for the estimate. Whenever historical data is used, contingency should be applied for the uncertainty involved in predicting future values based upon past behavior, but even this is difficult.

Historical data is more useful in estimating demolition costs, relocation costs, and support costs (indirect costs). These items tend to correspond with historical data and lack the complexity associated with estimating real estate values, condemnations, and real estate inflation. Support costs include the work-hours and costs related to completing the cost estimates, appraisals, and acquisitions which must be charged to the project. These costs can be estimated relatively easily and accurately based upon the size of the project, number of parcels, and other project attributes.

It is difficult to predict cost estimate parameters such as condemnation or real estate inflation using historical data, but some insight may be gained by understanding the general trends and tendencies shown by historical data. Condemnation rates can be predicted with some accuracy since they are governed by state laws and SHA policies, but there is still uncertainty, especially related to the human factor. Historical data showing past real estate inflation rates may offer some insight into predicting the future inflation rate, but the historical relationship is tenuous as land values are volatile and dependent on many factors including government zoning decisions.

Estimate Documents

To ensure that all major cost items for right-of-way are included in the estimate several SHAs utilize standardized cost estimate sheets or data sheets. All aspects of the right-of-way estimate are listed as line items on these sheets. Such standardized sheets help the estimators track all cost items and serve to present the cost estimate data in an easy to understand format. Standard formatting is important for reviewing and updating estimates. Although most SHAs use some sort of estimating sheet, it is important to standardize these so that when reviews and communication of the estimates occur, the estimates are easy to read and understand. As discussed in previously, cost estimate sheets vary from one SHA to another, but the main elements of the estimate are typically: 1) land; 2) improvements; 3) relocation costs; 4) damages; and 5) condemnations. Other costs that may be included are support costs, demolition costs, and utility relocation. How these costs are documented depends on SHA policies and procedures. Figure 2 shows an example of a partial cost estimate sheet used by Caltrans.

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION		EXHIBIT	
RIGHT OF WAY DATA SHEET		4-EX-1 (REV 3/2004)	
(Form #)		Page 1 of 6	
To:	Date _____	Dist _____ Co _____ Rte _____	P/M (K/P) _____
Attention:	EA _____	Project Description _____	
Subject: Right of Way Data	Alternate No. _____		
This Alternate meets the criteria for a Design/Build project: Yes <input type="checkbox"/> No <input type="checkbox"/>			
1. Right of Way Cost Estimate: To be entered into PMCS COST RW1-5 Screens.			
	Current Value Future Use	Escalation Rate	Escalated Value
A. Total Acquisition Cost			\$ 1A1
Acquisition, including Excess Lands, Damages, and Goodwill.	\$ 1A2	1A3 %	\$ 1A4
Project Permit Fees.			\$ 1A5
B. Utility Relocation (State Share)	\$ 1B1	1B2 %	\$ 1B3
C. Relocation Assistance	\$ 1C1	1C2 %	\$ 1C3
D. Clearance/Demolition	\$ 1D1	1D2 %	\$ 1D3
E. Title and Escrow	\$ 1E1	1E2 %	\$ 1E3
F. Total Estimated Cost	\$ 1F1		\$ 1F2
G. Construction Contract Work	\$ 1G	<i>(These are construction costs that are to be included in the projects PS&E.)</i>	
2. Current Date of Right of Way Certification _____ 2 _____			
3. Parcel Data: To be entered into PMCS EVNT RW Screen.			
<u>Type</u> 3A	<u>Dual/Appr</u> 3C	<u>Utilities</u> 3D	<u>RR Involvements</u> 3E
X _____		U4-1 _____	None _____
A _____		-2 _____	C&M Agrmt _____
B _____		-3 _____	Svc Contract _____
C _____		-4 _____	Design _____
D _____		U5-7 _____	Const. _____
E XXXX		-8 _____	Lic/RE/Clauses _____
F XXXX		-9 _____	
Total 3B _____			<u>Misc. R/W Work</u>
			RAP Displ 3F _____
			Clear/Demo 3G _____
			Const Permits 3H _____
			Condemnation 3I _____
			Excess _____
Areas: R/W _____ No. Excess Parcels _____			
Entered PMCS Screens ___/___/___ by _____			
Entered AGRE Screen (Railroad data only) ___/___/___ by _____			

Figure 2. Right-of-way cost estimate sheet used by Caltrans

Appraisers Employed as Cost Estimators

The right-of-way cost estimators at one SHA are licensed and experienced appraisers. This does not seem to be a common agency practice. Employing appraisers as right-of-way estimators appears to be effective for this SHA as the appraiser turned estimator brings valuable knowledge and experience to the cost estimating process. These estimators can potentially produce better estimates because they understand the actual appraisal process and how the appraisers in the field derive a value for each parcel.

Risk Analysis

Right-of-way cost risks are associated with schedule, real estate inflation, condemnations, damages, and potential future development. This risk issue is critical when preparing estimates in general and can be particularly important to determining contingency amounts for a right-of-way cost estimate. Performing a risk analysis alerts the project participants of cost risks during the estimating process. Only two SHAs out of the nine interviewed complete a detailed or formal risk analysis for the right-of-way cost estimate. A formal risk analysis is one in which a systematic approach is used to identify major risks. The risk analysis completed for right-of-way cost consists of considering schedule risks, risks associated with real estate value inflation, and condemnation risks, plus others that are deemed critical to a particular project. Based on the risk analysis the estimator would add an appropriate contingency amount to the cost estimate.

The Washington State DOT (WSDOT) requires that projects follow its formal Cost Risk Assessment (CRA) or its Cost Estimate Validation Process (CEVP) in the case of projects of significant size (greater than \$20 million for CRA and greater than \$100 million for CEVP at the time of this report). Both of these processes focus on the total project cost estimate. As part of both the CRA and CEVP risk assessment processes, right-of-way personnel participate in risk workshops when the project involves purchase of right-of-way. This workshop first validates the cost of the project and its component parts (including right of way) and then assesses estimate uncertainty in terms of cost variation and potential risk events. Through this process, the right-of-way cost estimate is reviewed and then specific risks are identified. These risks are assessed in terms of probability of occurrence and the magnitude of impact. The cost impact of the right-of-way risks are then included with the overall project cost estimate as a form of contingency. The right-of-way risks are highlighted in the workshop report and managed by the project team, which includes right-of-way personnel.

Another SHA completes an in-depth look at all project risks, which begins with the field visit completed by the estimator. This field visit is used by the estimator to “size up” the project. It provides the opportunity to judge the complexity and severity of impacts that will result from takings. The estimator must make a judgment call of “high,” “medium,” or “low” in terms of invasiveness relative to the takings. This will later impact how parcel specific costs and risks are quantified such as damages and improvements. Also during the field visit, the estimator takes note on the geography of the land and current land use as well as trying to make assumptions for possible future development. It should be noted that analyzing the possible future development in an area can be difficult to predict, especially on vacant parcels, but the estimator has a better grounding for making a judgment to account for risk. Following the field visit, the estimator will complete the

risk analysis by identifying and evaluating all factors that may impact the project. Contingencies are applied based upon the risk analysis. Specifically related to condemnations, the estimator will estimate a percentage of parcels that go to condemnation versus a percentage that will settle. These percentages are a direct reflection the estimator's rating of "high," "medium," or "low" in terms of invasiveness as made during the field visit. A contingency is then applied for the costs of litigation. Risks are considered for environmental issues, title issues, or other miscellaneous issues where a dollar amount will be applied to the estimate based upon the probability of occurrence and severity. The potential risks of real estate inflation are considered in addition to considering any unknowns that have not been addressed throughout the risk analysis.

Application of Contingency

Contingency should be applied to cost estimates to account for the unknown or uncertain events (Anderson et al., 2007b). Only four of the SHAs interviewed confirmed the use of contingency amounts in their right-of-way estimates. Each SHA uses percentages for contingency values, except in the case of WSDOT which uses range estimates when conducting a CRA or CEVP risk analysis.

One of SHA is restricted by agency policy from applying contingency to anything but condemnation. A second SHA applies contingency as a rate that ranges from 20 to 25 percent depending on the judgment of the estimator. The third agency applies a set factor for three separate cost areas in the programming phase right-of-way estimate. These are: 1) schedule; 2) administrative; and court costs; and 3) market appreciation. These contingency rates are built into the agencies estimating sheets and therefore are applied to every right-of-way estimate. Although these contingency factors are not the product of a risk analysis, the agency reports that they appear to be basically accurate for most projects.

The issue of risk analysis and the setting of contingency were raised during the original Project 8-49 study and is a concern when considering right-of-way cost estimating. Contingency funds are typically applied in response to some project uncertainty or to account for inadequate scope definition (Anderson et al., 2007b). This should especially be the case for early estimates, particularly during Planning where there are many uncertainties and project scope is extremely broad. Condemnations should be one of the major areas looked at for risk and the application of an estimate contingency, but there are others including real estate inflation/appreciation, potential future development, and project schedule.

Estimate Accuracy Definition

In addition to a detailed risk analysis and the application of contingency, one SHA attempts to quantify estimate confidence for the benefit of those that use the estimate. This is not a formal risk analysis but only the estimator's personal assessment. After completion of the estimate, the right-of-way estimator assigns a rating of A, B, C, or D. A letter grade of 'A' indicates the highest level of confidence while 'D' is the lowest. This becomes important when an estimate must be updated as a result of SHA policy or a design change because it communicates to others the estimator opinion of the cost estimate's accuracy. Therefore, in the event of an update or change, the estimator (either

a new estimator or the original one) will have a general idea of where the estimate stands while giving them a point of reference to begin the update. For the same reason it is also important to note that limitations and assumptions should be recorded for each estimate.

Estimating Software

Standard right-of-way specific estimating software was not discovered to be in use by the seven SHAs and two cities interviewed. However, several SHAs have developed right-of-way cost estimating programs or spreadsheet workbooks. The Virginia DOT (VDOT) has developed an in-house estimating system called Project Cost Estimating System (PCES). This cost estimating program covers all project related costs including right-of-way. The system was initially developed by engineering as an early estimate tool. PCES appears to be somewhat cumbersome for right-of-way; however, it does address all areas of the right-of-way component. The system requires input for all of the cost areas of right-of-way to produce an estimate therefore it serves as a tool to insure that all cost aspects are considered. Estimators prepare an estimate in present dollars and the system automatically applies inflation. Screen captures of the estimating system are shown in Figure 3, Figure 4, and Figure 5.

In addition to the cost estimate system described above, individuals in several SHAs have developed detailed spreadsheet systems to complete their right-of-way cost estimates. In general, the workbooks cover all aspects of the right-of-way that are covered in the above screen captures and appear to be used for the same function. Estimating software and the use of estimating workbooks tend to structure the estimating process and provided consistency from estimate to estimate. This is especially favorable in large SHA organizations.

VDOT		Project Cost Estimating System RIGHT-OF-WAY ESTIMATE		VDOT	
Project & PPMS Numbers :					
VDOT Construction District :					
Select Project Area Real Estate Costs :		Average			
Define Project Land Use Characteristics :		Agricultural : _____ Residential : _____ Industrial : _____ Commercial : _____			
Instructions: Please fill-in all applicable White Boxes or make a choice from the Drop-down Lists					
Enter the Approximate Number of Parcels on the Project :		Select <u>Computed</u> or <u>User Defined</u> Costs :			
		Computed Costs			
1. LAND VALUE					
Prop. Right-of-Way	Total Right-of-Way Project Length (ML + Connections)	ft	Computed RW Cost per sq ft =	\$0.00	<
	Average width of Existing RW	ft	Enter Right-of-Way Estimator's Right-of-Way Cost per sq ft		<
	Average width of Proposed RW	ft			<
	Total area of all additional Prop. Right-of-Way	sf	0 sq ft =	0.000 Ac.	<
	Approx. % of Prop. CL within	ft of Exst. CL	(Total		<
	Approx. % of Prop. CL between	ft & ft of Exst. CL	Must =		<
	Approx. % of Prop. CL greater than	ft from Exst. CL	100%)		<
	Average Width of parallel Temporary Easements Left	ft	Comp. Temp. Eas. Cost / sq ft =	\$0.00	<
	Total Length of parallel Temporary Easements Left	ft	Enter Right-of-Way Estimator's Temp. Eas. Cost per sq ft		<
	Average Width of parallel Temporary Easements Right	ft			<
Total Length of parallel Temporary Easements Right	ft	0 sq ft =	0.000 Ac.	<	
Perm. & Util. Eas.	Total Area of All Replacement Utility Easements AND Select % of RW Cost for Util. Ease.	sf	Comp. Utility Eas. Cost / sq ft =	\$0.00	<
	OR		RW Est's. Utility Eas. Cost per sq ft		<
	Total Number of Replacement Easements Required	ea	0 sq ft =	0.000 Ac.	<
	Total area of All Permanent Easements	sf	Comp. Perm. Eas. Cost / sq ft =	\$0.00	<
			RW Est's. Perm. Eas. Cost per sq ft		<
			0 sq ft =	0.000 Ac.	<
COST OF LAND (Item # 1)		\$0	(Computed Costs)		
2. BUILDING VALUE					
Based upon comparison to similar, occupied Residential Dwellings in the Project Area, enter the Number of					
				Computed	
A.	Low Cost Residential Dwellings		\$0		<
B.	Moderately Low Cost Dwellings		\$0		<
C.	Average Cost Residential Dwellings		\$0		<
D.	Moderately High Cost Dwellings		\$0		<
E.	High Cost Residential Dwellings		\$0		<
Computed Total Residential Dwelling Costs :				\$0	<
Estimator's Total Residential Dwelling Costs :					<
Enter the total estimated cost of ALL COMMERCIAL & INDUSTRIAL BUILDINGS to be taken:					
Note: No Computed Costs Available. Use User Defined Costs Below:					
Estimator's Total Commercial / Industrial Buildings Costs :					<
3. OTHER IMPROVEMENTS					
Enter the estimated cost of ALL OTHER IMPROVEMENTS on the Project					
Computed Total Other Improvements Costs :				\$0	<
Estimator's Total Other Improvements Costs :					<
4. DAMAGES					
Anticipated % of Parcels Affected by Damages to Remainder					
Anticipated Relative Cost Impact of Damages to Remainder		Moderately High			
Approximate Number of Parcels Affected		0			
Computed Cost of Damages to Remainder :		\$0			
Estimator's Total Cost of Damages to Remainder :					
TOTAL ACQUISITIONS (Items # 1 - 4)		\$0	(Computed Costs)		

Figure 3. Screen capture of Virginia's cost estimating system (PCES)

5. ADMINISTRATIVE SETTLEMENTS		
Anticipated % of Parcels Affected by Administrative Settlements		
Anticipated Relative Cost Impact of Administrative Settlements		
Approximate Number of Parcels Affected	0	<
Computed Cost of Administrative Settlements	\$0	<
Estimator's Total Cost of Administrative Settlements		
6. CONDEMNATION INCREASES		
Anticipated % of Parcels Affected by Condemnation Increases		
Anticipated Relative Cost Impact of Condemnation Increases		
Approximate Number of Parcels Affected	0	<
Computed Cost of Condemnation Increases	\$0	<
Estimator's Total Cost of Condemnation Increases		
7. ADMINISTRATIVE COSTS & INCIDENTAL EXPENSES		
Anticipated Relative Cost Impact of Admin. Costs & Incidental Expenses		
Computed Administrative Costs & Incidental Expenses	\$0	<
Estimator's Total Administrative Costs & Incidental Expenses		
8. DEMOLITION CONTRACTS		
Anticipated Relative Cost Impact of Demolition Contracts		
Computed Costs of Demolition Contracts	\$0	<
Estimator's Total Cost of Demolition Contracts		
9. HAZARDOUS MATERIALS REMOVAL		
Anticipated Number of Demolished Buildings Requiring Asbestos Removal		
Anticipated Relative Cost of Asbestos Removal from Demolished Buildings		
Anticipated Number of Other Hazardous Materials Removal Sites		
Anticipated Relative Cost Impact of Other Hazardous Materials Removal		
Computed Cost of Hazardous Materials Removal	\$0	<
Estimator's Total Costs of Hazardous Materials Removal		
10. PROPERTY MANAGEMENT		
Anticipated Relative Cost Impact of Property Management		
Computed Costs of Property Management	\$0	<
Estimator's Total Cost of Property Management		
TOTAL OTHER ITEMS (Items # 5 - 10)	\$0	(Computed Costs)
11. RELOCATION ASSISTANCE		
Residential Relocation Costs:		
Anticipated Relative Cost Impact of Residential Relocation Expenses		
Computed Residential Relocation Costs	\$0	<
Estimator's Total Residential Relocation Costs		
Commercial Relocation Costs:		
<i>Note: No Computed Costs Available. Use User Defined Costs Below:</i>		
Estimator's Total Comm/Indust Relocation Costs		<<
Total Displacements:	<input type="text"/>	Farms: <input type="text"/>
Families:	<input type="text"/>	Non-Profit: <input type="text"/>
Businesses:	<input type="text"/>	Personal Property Only: <input type="text"/>
TOTAL RELOCATION ASSISTANCE (Item # 11)	\$0	(Computed Costs)

Figure 4. Screen capture of Virginia's cost estimating system (PCES)

12. YEAR OF RIGHT-OF-WAY AUTHORIZATION		<input type="text"/>	< Req'd.
13. MANUAL INFLATION RATE		<input type="text"/>	
SUB-TOTAL RIGHT-OF-WAY COSTS (Computed Costs)		\$0	
UTILITY COSTS TO RIGHT-OF-WAY PROJECT *		\$0	
TOTAL RIGHT-OF-WAY COSTS		\$0	
* Utility Data display requires completion of Utilities Estimate Worksheet (tab below)			
COMMENTS:			
<input type="text"/>			
RW-238 Data :		Right-of-Way Estimate Date:	<input type="text"/>
		Based on Approved / Unapproved Plans ?	<input type="text"/>
		Participating Cost / Non-Participating Cost ?	<input type="text"/>
		Today's Date:	10/18/04
© Virginia Department of Transportation 2003		Revised 10/08/04 RDW	Version 2.1

Figure 5. Screen capture of Virginia's cost estimating system (PCES)

Estimate Reviews

Review of right-of-way estimates is typically limited to an examination by the immediate supervisor of the estimator. The majority of SHAs require that a supervisor or right-of-way manager sign off on the estimate. In most cases the supervisor or manager will perform a quick review of the estimate to check whether major component costs seem reasonable. For the preliminary design estimate, one SHA reported performing a number of “mini estimate” checks on project parcels. A “mini estimate” is an estimate completed on several parcels within the project that may have a high impact on the right-of-way cost. High impact parcels are those where a large damage amount is expected or ones having many improvements. These mini estimates are checked against the corresponding parcels within the actual estimate. Based on the results of this comparison, the cost estimate is either: 1) approved and communicated to design, or 2) it is sent back to the right-of-way estimator for further work. Another SHA uses a weekly one-hour meeting involving program managers along with the director, assistant director, budget supervisor, and engineering supervisors to review “critical projects.” Critical projects are those in which budget, utility, or right-of-way problems exist. This allows all of the agency’s upper management to consider the projects and their estimates and to provide input.

Every right-of-way estimate should be reviewed by management. This research and previous NCHRP 8-49 research documented in Report 574 confirms this. However, it was found that the level of review at some agencies is minimal. Especially in cases of large projects, a higher level review which includes more of an effort by management to scrutinize and evaluate estimates should be undertaken.

Final Design

When a project transitions from preliminary design into final design, right-of-way requirements are not usually restated. In essence, the right-of-way process must be completed ahead of other design elements in the project development process to ensure that all right-of-way real estate is acquired prior to construction. Another estimate or estimate update is not typically required since appraisal and acquisition has begun. In the case of an ideal project, all parcels will be acquired before construction begins, but this is not always the case. When construction is scheduled to begin most states first require one of three things: 1) that all property be acquired, 2) a right of entry is granted to the SHA by the property owner; or 3) the parcel is in the condemnation process. Otherwise, construction may have to be delayed and that has the potential of impacting overall project costs and other aspects of the project. Cost estimating practices relative to final design were limited to the use of right-of-way tracking systems which are now discussed. The interviews did not identify any cost estimating practices that occurred during final design. At this point in project development the SHA has begun making appraisals and acquiring properties.

Right-of-Way Tracking Systems

Right-of-way tracking systems are currently in use by several of the SHAs interviewed. In general, a right-of-way tracking system is a data base containing information on individual parcels. They provide a means for assembling and retrieving parcel information easily. Out of the nine interviewed agencies, three SHAs have right-of-way tracking systems. These are: 1) the Virginia DOT's Right-of-Way and Utilities Management System (RUMS); 2) the Washington State DOT's Real Estate Information System (REIS); and 3) the Minnesota DOT's Right-of-Way Electronic Acquisition Land Management System (REALMS), which is the most advanced of the three identified. Following the approval of the right-of-way estimate at the preliminary design phase, the dollar value for right-of-way is input into the system. Further data is input after appraisal and acquisition. These systems serve as a database of past and up-to-date parcel data across the state and have the potential to be used for recent comparable sales, predicting possible inflation rates, predicting condemnation rates, or other right-of-way specific parameters or statistics. Instant access and availability of these forms, reports, and data is a major advantage of the systems, particularly when managing costs during appraisals and acquisitions, which is discussed in the next section under right-of-way management. The Minnesota system is mapped to the business structure of the SHA with approximately 150 forms and 90 reports that are used throughout the right-of-way division. This allows all employees of the SHA to access the forms and reports used in daily operations. Consultants are also being trained on the system to allow the SHA the versatility to contract out right-of-way appraisals and acquisition and still track the parcels.

RIGHT-OF-WAY ESTIMATE MANAGEMENT

This research considered right-of-way management practices in addition to cost estimation practices. This is reflected in the list of nine steps. Right-of-Way Cost Management uncovered through this research may be divided into two related but

separate categories: 1) cost estimation management; and 2) right-of-way cost management. Cost estimation management is defined by NCHRP Report 574 as “a process for evaluating changes in scope and other issues that affect project cost.” These evaluations should be performed for each cost estimate prepared during the project development process (Anderson et al., 2007a). In other words, the evaluation serves as a check and balance system for all estimates by checking each estimate for changes that impact cost and then evaluating those changes to determine whether the changes are necessary and/or acceptable. Although similar in many ways, *right-of-way cost management* can be described as the process in which the actual right-of-way costs reflected in appraisal and acquisition are managed to the dollar amount established as the baseline budget. Both of these right-of-way management processes are discussed in this section.

Right-of-Way Cost Estimation Management during Preliminary Design

Right-of-Way cost estimates prepared during programming become part of the project estimate that is approved for the construction program, consequently used for establishing the baseline cost estimate. Following the establishment of the baseline cost estimate and thus at the beginning of preliminary design, the basis for cost estimation management is established. Any future cost estimate updates should be checked and managed against this baseline. In particular, Report 574 defines two steps as falling within the realm of cost estimation management, which usually occur after an estimate is completed. These are:

- Obtain appropriate approvals and
- Determine estimate communication approach.

These two steps follow the review of an estimate. Appropriate approvals should be sought only after an estimate has been reviewed. By signing off on the estimate, management is agreeing that the cost estimate is completed to the best possible level of accuracy based upon project complexity, scope definition, availability of cost data, and other constraints. If the estimate is not approved and needs to be changed, it will be return to the estimator. In addition, project scope and project conditions should be constantly reviewed for any changes that impact estimated cost. As these changes are identified they should be evaluated for cost impacts and the cost estimate should be adjusted accordingly. After approval, the estimate communication approach used to communicate the estimate amount to design personnel should be chosen and should consider the degree of estimate uncertain and the intended use of the estimate.

Only a limited amount of evidence of cost estimation management surfaced during interviews, but every estimate completed at the preliminary design phase should go through some type of cost estimation management process. Cost estimation management should be practiced to control project cost, schedule, and scope (Anderson et al., 2007a). For example, in the event that a cost increase is identified in subsequent estimates following the baseline estimate, the reason for this should be examined and evaluated. The SHA should look at the change in cost and see if it is really necessary. If it is necessary and acceptable, other areas within the estimate should be examined to find areas where right-of-way dollars can be saved to bring the estimate back within the

budget set by the baseline estimate. This examination applies both to managing right-of-way cost and total project cost.

Right-of-Way Cost Management during Final Design

For right-of-way the final design phase of project development typically marks the point where cost estimation is phased out and appraisal and acquisition actions begin. As plans and specifications are nearing completion final right-of-way plans are usually released. Up to this point in project development, the cost management function of right-of-way should have consisted of managing cost estimate amounts against the baseline estimate (the baseline estimate is often used to program the project in the STIP). Beginning at final design, the cost management function should transition from managing subsequent estimates to managing the actual costs (or cost control). These costs are reflected in acquisitions and should be compared to the preliminary design cost estimate. In other words, parcel-specific cost estimate data should be compared to the parcel-specific acquisition costs to determine how actual costs compare with the estimated amounts. If a cost does not match the estimate, deviations should be evaluated and projections of total final cost made accordingly. NCHRP Report 574 identified three steps related to Cost Management. They are:

- Monitor project scope and project conditions;
- Evaluate potential impact of change; and
- Adjust cost estimate.

It is the goal of Right-of-Way Cost Management to complete acquisitions on budget with the estimates, but even if the management process cannot change the impact of the immediate cost escalation problem for that project, lessons can be learned by this process for future projects. The research team has defined this process of managing the actual costs to estimated costs as Right-of-Way Cost Management which will be extensively covered in the next chapter when describing the process flowchart.

SUMMARY OF NOTABLE PRACTICES

Although many of the SHAs interviewed for this research are struggling with project cost escalation, particularly with the impacts of right-of-way cost escalation, there were some successful practices identified during the interviews. Table 3 summarizes the noteworthy SHA practices identified through interviews. The table does not include all practices critically reviewed but only summarizes the most successful practices identified by this research.

Table 3. Summary of notable practices identified through SHA interviews

Project Development Phase	Best Practice	Description
Planning	Conceptual Cost Estimate Map	Aerial photo or map of each potential alignment showing approximate ROW boundaries.
	Early Scope Definition	A Planner and Project Manager (or Design Engineer) performs a field visit to discuss probable design parameters relative to ROW. Basic parameters such as the number of lanes, the number of retention basins, potential access issues, and expected ROW/Design tradeoff issues should be provided to the ROW estimator.
Programming and Preliminary Design	Cost Estimate Map	Aerial photo or detailed map consisting of overall ROW boundaries, parcel boundaries, and ROW areas. The map is provided by the Project Manager or Project Engineers to the ROW division when requesting a ROW cost estimate. Maps will most likely vary in detail between the Programming and Preliminary Design estimates.
	ROW/Design Tradeoff	ROW personnel provide input into design to discuss impacts of design decisions on ROW costs.
	Appraisers as Estimators	Employ experienced and knowledgeable ROW appraisers as ROW cost estimators for improved ROW cost estimates.
	Cost Estimate Sheet	A cost estimate document usually in spreadsheet form which includes line items for all cost items of the ROW estimate.
	Risk Analysis	A thorough risk analysis is completed for each cost estimate completed by the ROW division to include such risks such as time, property value inflation, and condemnations among others. In addition, ROW risks are captured through the WSDOT CRA and CEVP workshop process.
	Estimate Accuracy Definition	An approach to quantify confidence in each estimate that is completed throughout Project Development. After completion of the estimate, the ROW estimator assigns a rating of A, B, C, or D. A letter grade of 'A' indicates the highest level of confidence while 'D' is the lowest.
	Cost Estimating System	A cost estimating tool used throughout the agency's estimation process for all areas of the project. Particularly for right-of-way, it addresses all areas of right-of-way (e.g. land value, building value, other improvements, damages, etc.) and requires that a value for each of these areas must be input. This serves to account for all cost items affecting right-of-way cost.
Final Design	ROW Tracking Systems	The system has the ability of cost reporting and tracking of each parcel from appraisal through acquisition and can support forecasting of cost to complete the acquisition process (i.e., cost management). It is not used as cost estimation tool but may offer potential as a source of recent historical data and market trends for land values.
	ROW Cost Management	A technique of managing actual costs reflected by tracking appraisals and acquisition costs against the preliminary design cost estimate.

CHAPTER SUMMARY

Cost estimation and cost estimate management practices currently used by SHAs were reviewed during the research and analyzed in relation to the project development phases. This chapter discusses these SHA practices in reference to right-of-way estimates completed at the various phases of the project development process. The chapter also discussed right-of-way management in relation to both the management of the estimates completed during preliminary design and the management of actual costs during final design. Additionally, the chapter summarizes the successful practices discovered through agency interviews. Chapter 4 discusses the development of the process flowcharts in which process steps, inputs, and outputs for right-of-way cost estimation and cost estimate management are integrated in a structured process.

CHAPTER 4

RIGHT OF WAY PROCEDURE DEVELOPMENT

The goal of Task 4, *Develop Procedures on ROW Cost Estimation and Management* was to develop a “how to” Procedures Guide to support right-of-way cost estimating and management processes. The framework for the procedures guide is the series of process flowcharts that describe the right-of-way cost estimation and cost estimate management processes during project development phases. The individual right-of-way process flowcharts display process steps, inputs, and outputs in an easy to comprehend format. There are five flowcharts: 1) an agency-level flowchart that shows the interaction of right-of-way cost estimating with the project development process; 2) a conceptual right-of-way cost estimating flowchart that describes the required right-of-way estimate preparation steps during the planning stage of project development; 3) a baseline right-of-way cost estimating flowchart that depicts the required steps during programming; 4) an update right-of-way cost estimating flowchart that describes the required right-of-way estimate preparation steps during preliminary design to include a cost estimate management loop; and 5) a right-of-way cost management flowchart that describes the required steps comparing actual right-of-way costs with current estimated costs during the acquisition phase.

The methodology used to develop these flowcharts is discussed first. Following the methodology section, the agency-level flowchart is presented and discussed in the context of the project development phases. Then, the organizational-level flowcharts are presented with discussion of both: 1) Right-of-way Cost Estimating; and 2) Right-of-way Cost Management. The Right-of-way Cost Estimating section includes the estimates completed at planning, programming, and preliminary design while the Right-of-way Cost Management section discusses the cost control process at final design. In each of these sections, the rationale behind the process flowcharts, and process steps and inputs therein, is covered. The content and structure of the Right-of-Way Procedures Guidebook was developed around the flowcharts. Its development is discussed last.

DEVELOPMENT OF THE FLOWCHARTS

Development of the process flowcharts began during the SHA interviews. Draft flowcharts were developed early in the interview process with the intent of building and capturing detailed right-of-way cost estimating input information that could be verified during future interviews. The initial flowcharts were based on the literature review findings, information from SHA manuals (acquired from SHA websites), and the NCHRP Project 8-49 Phase 1 interviews. Charts developed during the 8-49 Phase 1 provided the basic process information for developing these flowcharts. In general, the flowcharts presented in the NCHRP Report 574 outline the critical steps necessary to create an accurate estimate (Anderson, et al., 2007a). These steps were discussed in previous chapters and are listed here, because they are equally applicable to the development of the right-of-way flowcharts. Recall that these steps are:

1. Determine Estimate Basis;
2. Prepare Estimate;
3. Determine Risk/Contingency;
4. Review Estimate;
5. Obtain Appropriate Approval;
6. Determine Estimate Communication Approach;
7. Monitor Project Scope/Project Conditions;
8. Communicate Estimate and Approval; and
9. Adjust Cost Estimate.

These general estimating and cost management steps are the foundation for the right-of-way flowcharts. It should be noted that although the right-of-way flowcharts are a result of this research effort, the literature reviewed, and SHA input, all the process steps and tools are not necessarily occurring in all SHAs. Rather, the flowcharts show what *should* be occurring, as established by this research. A good example of this is the issue of Right-of-way Cost Management during final design, which is not regularly performed by most of the SHAs interviewed. This step is critically important to completing right-of-way acquisition within the baseline cost estimate and thereby containing right-of-way cost within the amount budgeted and included in the STIP.

Refinement of the right-of-way cost estimating and cost management (CE/CM) process flowcharts continued with the SHA interviews. For the initial interviews, the inquiry protocol contained the project development flowcharts published in NCHRP Report 574 that depicted each project development phase (see Appendix A). These flowcharts were primarily strategic in nature and focused on the higher level cost estimation and cost estimate management process for projects. As SHA input accumulated with additional interviews the Report 574 flowcharts were replaced by draft right-of-way CE/CM process flowcharts. Compared to the Report 574 flowcharts, the right-of-way flowcharts take a more specific and detailed approach to the right-of-way cost issue. Instead of focusing on a strategic approach to right-of-way cost estimation and cost estimate management, a “how to” approach for the right-of-way flowcharts was adopted. More detail is provided using bulleted lists under each of the process steps within the flowcharts. In addition to the inclusion of these new flowcharts in the right-of-way inquiry protocol, the right-of-way process flowcharts were provided to a panel of SHA right-of-way experts. The right-of-way flowcharts were continually revised based upon comments from all of these sources.

Following completion of the interviews, the research team developed a handout for further validation of the flowcharts. The handout consists of the five process flowcharts and a one and a half page summary of the research progress, a summary of the methodology behind development of the process flowcharts, and instructions for providing input (see Appendix D). This handout was distributed to selected SHAs and conference calls were initiated to acquire additional feedback on the processes depicted in the flowcharts. The process flowcharts were then further revised to reflect comments received from these SHAs. A panel of experts again reviewed the flowcharts in late

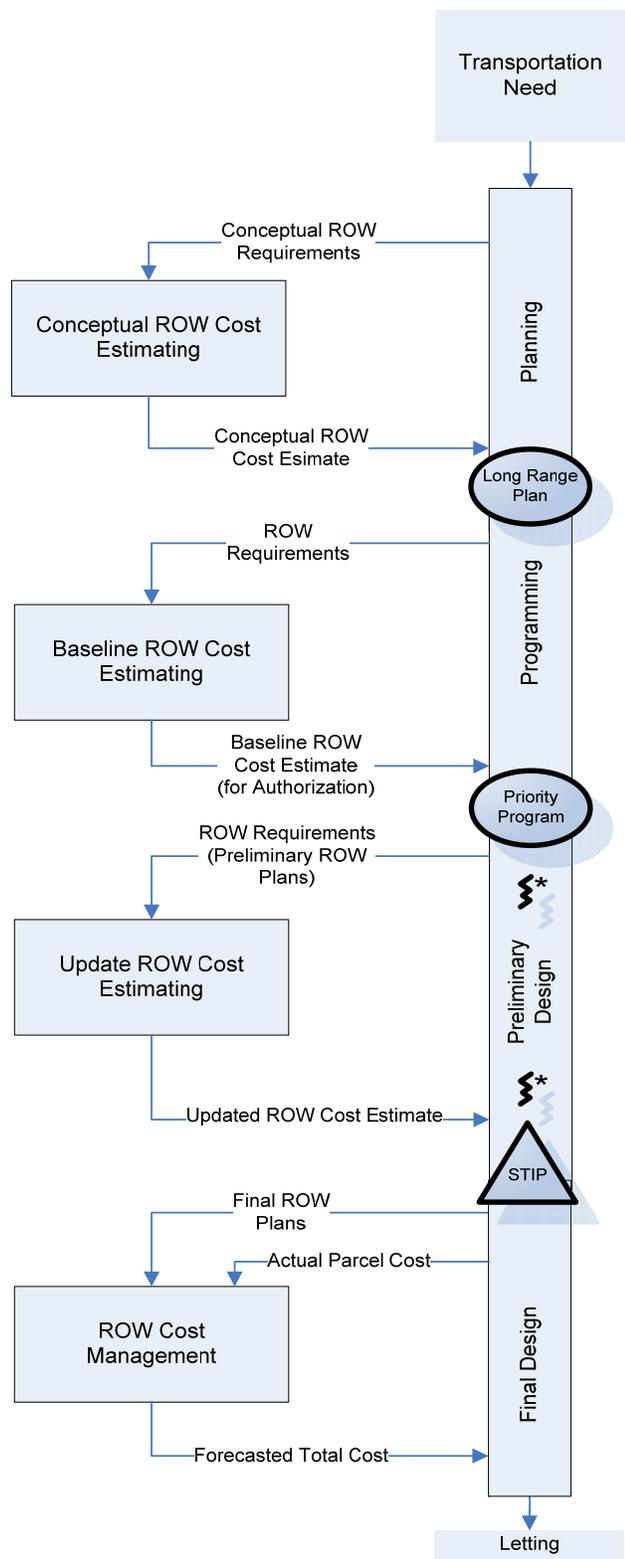
September 2007 although no major changes or revisions to the flowcharts were suggested. The panel was interested in how the inputs might change from one cost estimate to another. Therefore, this is addressed here as the flowcharts are presented and discussed.

RIGHT-OF-WAY PROCESS AT THE AGENCY LEVEL

Following the approach used during the initial NCHRP 8-49 work an agency level focus was adopted for this research. Consequently, the primary flowchart presents the overall right-of-way cost estimation and cost estimate management process from the identification of a transportation need, at the planning phase, through the acquisition of right-of-way during the final design phase of project development. Each of the major right-of-way cost estimates are shown corresponding to its project development phase. Figure 6 is the agency-level right-of-way estimating process flowchart.

A major challenge to developing the flowcharts resulted from the fact that there is not a clear distinction from one SHA to another relative to when a project development phase starts and when it ends and how right-of-way cost estimates are integrated with these phases. Further, the number of years that comprise a priority program varies across SHAs. Some SHAs have programs with projects that are 10 years from their projected letting date. Alternatively, other SHAs only include projects that are six years from the projected letting date. The number of years prior to the projected letting when a project is initially considered for the priority program impacts the timing of preparing the baseline right-of-way estimate as well as the number of estimate updates needed prior to including a project in the STIP (State Transportation Improvement Program). Project complexity with impact the number of right-of-way estimates prepared during these years.

Some SHAs include right-of-way cost in their programs for each project that has a right of way requirement. Other SHAs use a right-of-way “set aside” fund or “pot of money” approach to provide funds for purchasing right-of-way. These variations are represented on the flowcharts with a “spring” to denote that the timing of when projects are included in plans and programs is dynamic and varies with individual SHAs. As can be seen in Figure 6, the point at which a SHA’s priority program begins and the point at which a project is incorporated into the STIP may vary. These milestones and differences in project phase definition and timing can also vary from project to project, depending on project complexity such as size, project elements, and the area of right-of-way required.



* Represents the dynamic nature of the milestone dependant on the practices of the State highway agency.

Figure 6. Agency-level right-of-way cost estimating and cost management flowchart

The intent of displaying the project development phases linked to right-of-way cost estimating and cost estimate management is to communicate the critical relationship that exist between the two activities. Moreover, it stresses the relationship that should exist between the personnel who estimate and procure right-of-way and the project development team. Right-of-way requirements that are defined when the project scope is developed constitutes the major input into right-of-way cost estimation and cost estimate management. As the project moves through the development process the project design team refines the project's scope and hence the right-of-way requirements. Following the completion of a right-of-way cost estimate and its review and approval, a dollar value is communicated to the project development team.

The findings of this research support the recommendation that a right-of-way cost estimate be completed during each of the first three project development phases. Additionally, the research supports the recommendation that as a minimum there be a structured Right-of-way Cost Management process. The Right-of-way Cost Management process should track costs based on the appraisals and then based on the actual acquisition actions. It should even allow tracking of any later acquisitions required because of construction issues. The right-of-way cost estimates completed during planning, programming, and preliminary design have been defined through this research as: 1) Conceptual Right-of-way Cost Estimating, 2) the Baseline Right-of-way Cost Estimating, and the 3) Update Right-of-way Cost Estimating, respectively (Figure 6, agency level flowchart). The fourth process in the Figure 6 flowchart is Right-of-way Cost Management. Further, cost estimates are not usually completed during final design as the emphasis has already moved to real estate appraisals and acquisition of properties with Right-of-way Cost Management tracking expenditures and forecasting funds needed to complete right-of-way acquisition based on trends from actual purchases and other impacts (e.g., damages, etc.).

RIGHT-OF-WAY PROCESS AT THE ORGANIZATIONAL LEVEL

The agency-level right-of-way cost estimating and cost management process flowchart provides the framework for right-of-way cost estimating and right-of-way cost management within the project development process. Following the development of the agency wide flowchart, the specific phase level cost estimate and cost management process flowcharts were developed. These flowcharts provide detail about right-of-way cost estimation and management processes specific to each project development phase. They include inputs, outputs, and process steps. Process steps are shown in the flowcharts as rectangles while inputs are denoted by parallelograms. The boxes showing the process steps within the flowcharts contain bulleted actions for completing each step. This section is divided into two key parts: 1) Right-of-way Cost Estimating and estimation management to include the Conceptual Right-of-way Cost Estimate, the Baseline Right-of-way Cost Estimate, and the Updated Right-of-way Cost Estimates that occur during the first three phases of project development; and 2) the Right-of-way Cost Management process that occurs primarily during the final design phase of project development.

Right-of-way Cost Estimating and Estimation Management

The flowcharts documenting Conceptual Right-of-way Cost Estimating, Baseline right-of-way Cost Estimating, and Update Right-of-way Cost Estimating are shown in Figure 7, Figure 8, and Figure 9, respectively. These flowcharts are discussed in combination here due to similarities in the process steps. Differences between the charts are the result of the level of scope definition during a phase and by the applicability of cost related inputs. The basis by which estimates are completed during the three phases provides an example of differences in cost estimate approaches due to the level of scope definition. The Conceptual right-of-way Cost Estimate is often completed on an overall cost basis where the cumulative right-of-way characteristics of all of the property to be acquired is taken into account. The Baseline Right-of-way Cost Estimate is often prepared based upon potential parcel costs. The Updated Right-of-way Cost Estimate should always be prepared based upon parcel-specific costs. Additionally, one attribute that sets apart the Updated Right-of-way Cost Estimate from the other two is a more rigorous estimation management loop that should be probing the new right-of-way cost estimate and gauging it against the baseline right-of-way estimate. The differences between the estimates will be highlighted throughout this section.

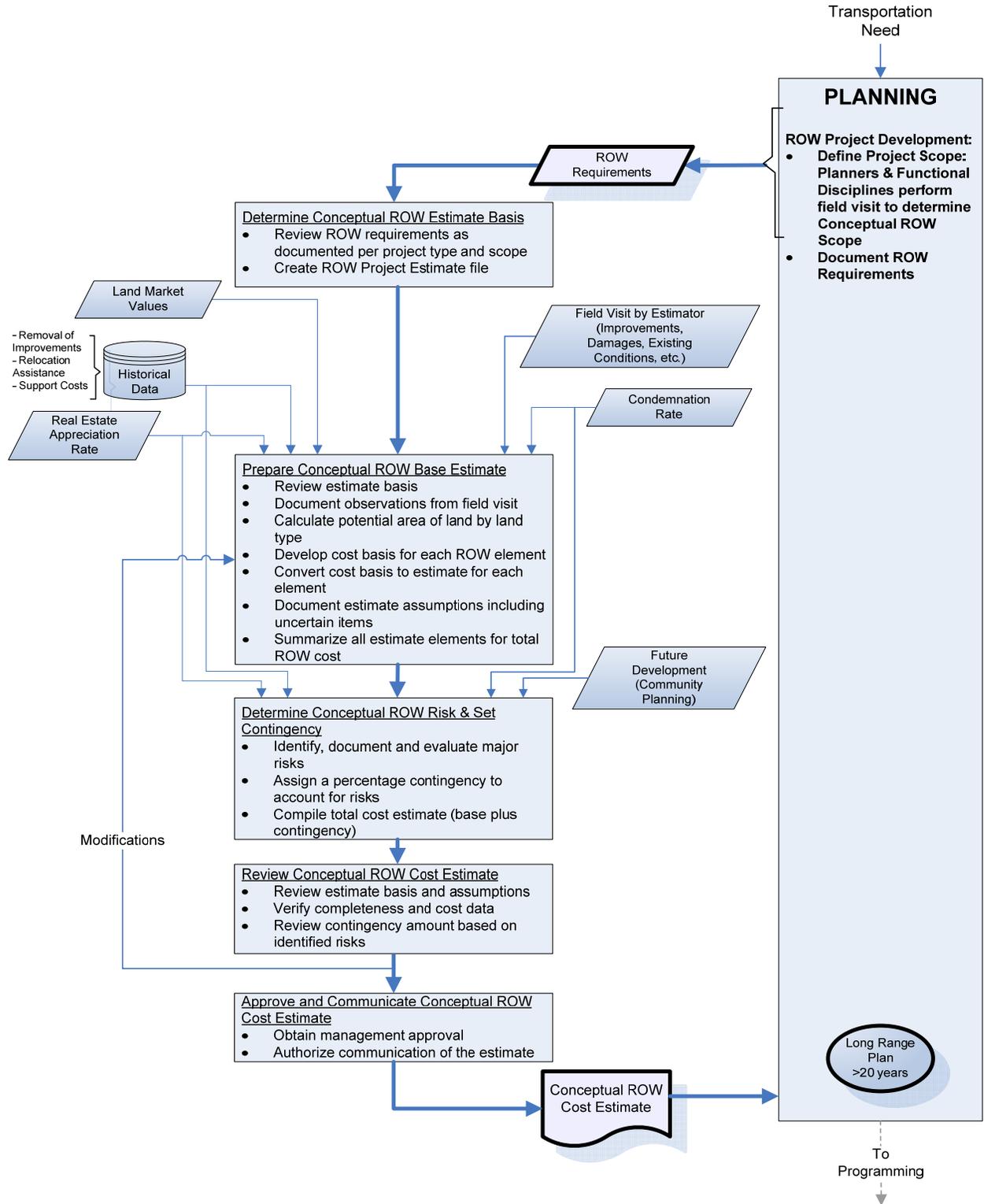


Figure 7. Conceptual Right-of-way cost estimating process flowchart

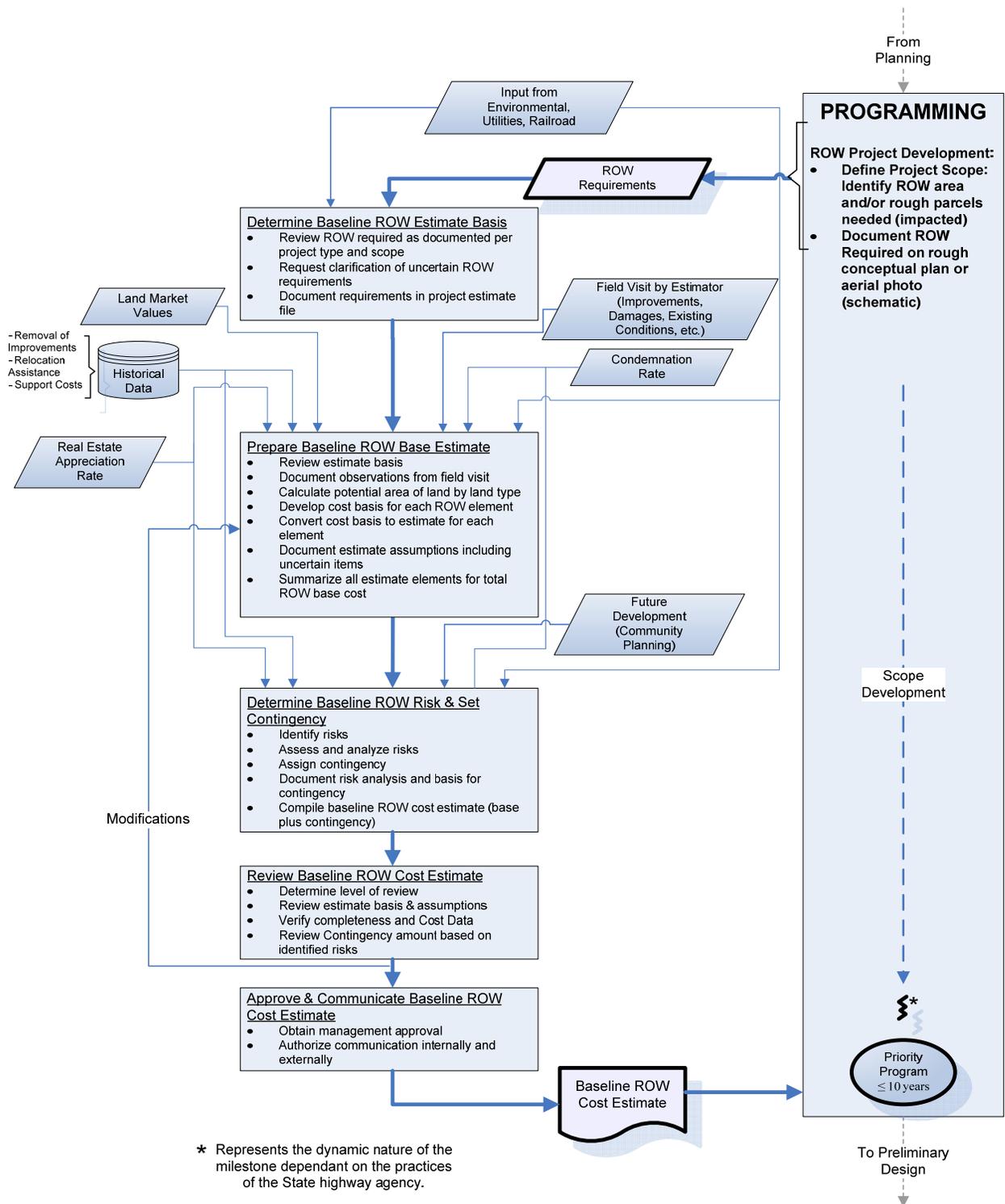


Figure 8. Baseline Right-of-way cost estimating process flowchart

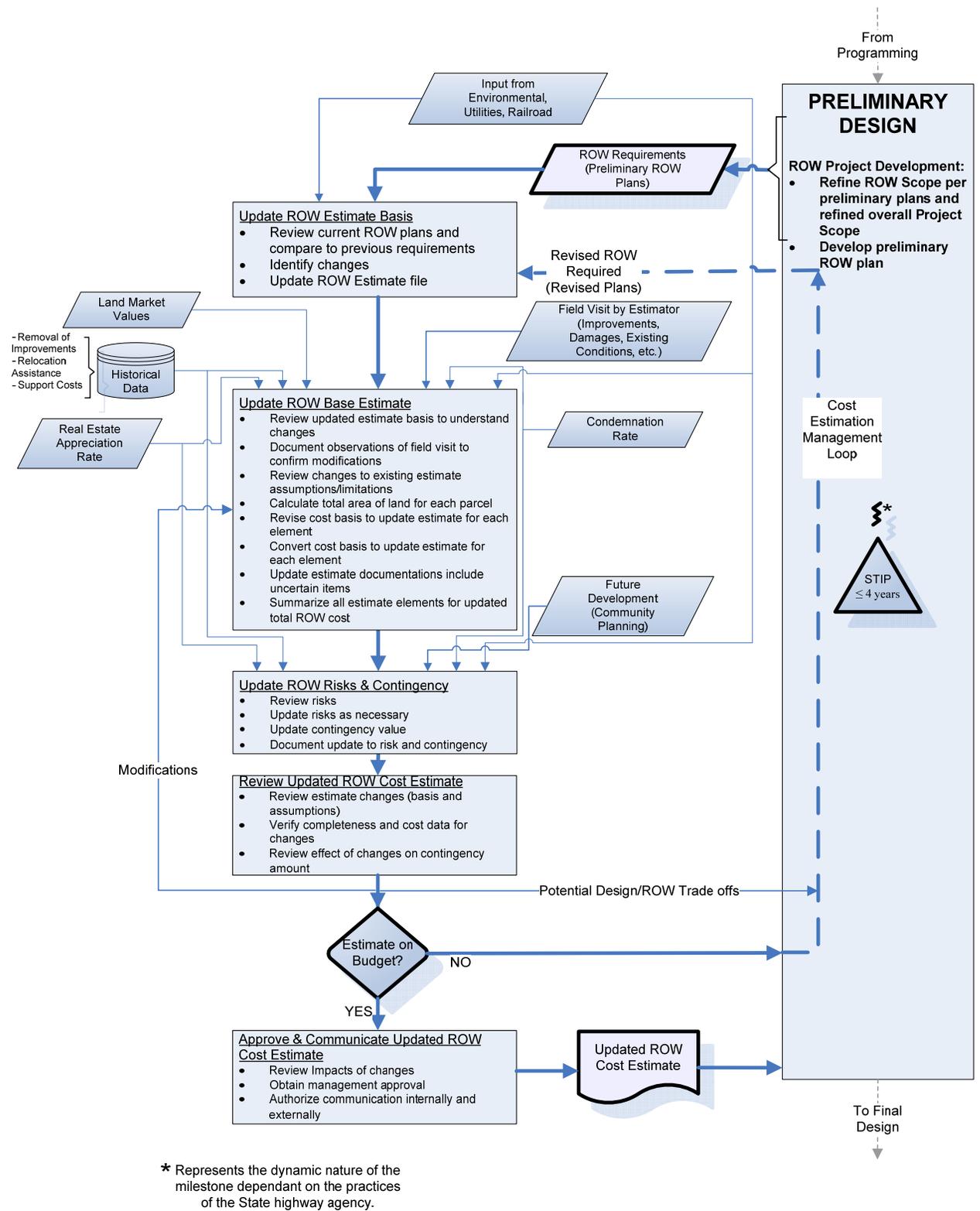


Figure 9. Update Right-of-way cost estimating process flowchart

The Conceptual Right-of-way Cost Estimate process flowchart, Figure 7, is so named because it is based on a conceptual definition of project scope. The conceptual scope sets the general right-of-way requirements. This estimate is typically prepared 10 or more years before the project will be let for construction.

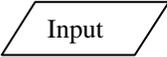
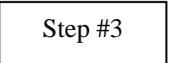
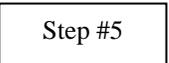
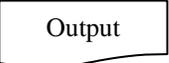
The Baseline Right-of-way Cost Estimate, Figure 8, is used to set a baseline cost for the project and therefore is so named. The research led to the recommendation that this estimate be completed at the end of the programming phase. At this point in project development a preferred alternative has been selected. This estimate establishes the right-of-way baseline project cost that management uses to evaluate future right-of-way cost estimates during preliminary design and during right-of-way acquisition. It is prepared at a point in the project development process that is typically within 10 years or less from the construction letting.

The Updated Right-of-way Cost Estimate, Figure 9, is completed during preliminary design and is usually the budget used to program the project in the STIP. The term “updated” is used for this right-of-way cost estimate because it should be an update (or refinement) of the baseline estimate. This flow chart, Figure 9, shows a cost management loop which indicates that discrepancies identified between the baseline estimate and the updated estimate should be examined and adjustments made accordingly. If the cost difference is the result of an amended scope then it may be necessary to establish an amended baseline estimate and amend the STIP. Updated estimates will probably be produced more than once, depending on project complexity and other circumstances. Another action that may be taken is that of performing analyses for Right of Way/Design tradeoffs throughout the right-of-way cost estimation process. Right of Way/Design tradeoffs have the potential to reduce right-of-way requirements and positively impact overall construction cost.

General Right-of-way Cost Estimating Steps

The process flowcharts follow the cost estimation and management steps described in NCHRP Report 574 only modified based on information captured during the SHA right-of-way interviews. They document the cost estimate steps for planning, programming, and preliminary design estimates, and follow a global set of process steps. Table 4 provides descriptions for those global process steps. The major input for a right-of-way estimate is a quantification of the right-of-way requirements and the output of the process flowcharts is the estimated right-of-way cost amount.

Table 4. General process steps and descriptions for right-of-way cost estimating

Process Step	Activity	Description
 Input	ROW Requirements from Development Team	Development team communicates ROW requirements to ROW personnel.
 Step #1	Determine ROW Estimate Basis	Review ROW requirements and create an estimate file that documents requirements and assumptions.
 Step #2	Prepare ROW Base Estimate	Complete cost estimate activities, which include: gathering data, quantifying estimate parameters, computing costs by applying values to the estimate parameters, and adjusting the estimate.
 Step #3	Determine Risk and Set Contingency	Document and evaluate all major risks that affect cost, assess the impact of the risks, and apply contingency values per risk analysis. Communicate risk mitigation opportunities.
 Step #4	Review ROW Cost Estimate	Review major aspects of the ROW cost estimate including: estimate basis, assumptions, and high impact (\$) areas of the estimate.
 Decision Milestone*	Estimate on Budget?	(YES) If Update \$ is less than or equal to Baseline \$, proceed to <i>Approve & Release ROW Cost Estimate</i> (NO) If Update \$ is greater than the Baseline \$, complete <i>Cost Estimate Management</i>
 Step #5	Approve and Release ROW Cost Estimate	Based on the estimate review: approve & release estimate OR disapprove & return to ROW estimator for corrections.
 Output	Estimate Amount (\$) to Development Team	Communicate cost estimate amount (\$) to Development.

* Denotes a step unique to the Updated Right-of-Way Cost Estimate (not included in the Conceptual and Baseline Cost Estimates)

Input: Right-of-way Requirements from Development Team

The primary input to the cost estimating flowcharts is the set of right-of-way requirements as defined by the development team and communicated to right-of-way section. The major difference between right-of-way estimates is the varying amount of certainty (or uncertainty) as to real estate requirements. The degree to which right-of-way requirements are certain is directly dependent on the level of project scope definition and design definition. Therefore, there is greater uncertainty as to right-of-way requirements for the Conceptual Right-of-way Cost Estimate than for the Baseline Right-of-way Cost Estimate. Uncertainty should diminish with each Updated Right-of-way Cost Estimate. SHAs should make a significant effort to definitively describe project scope and hence right-of-way requirements. Early scope definition, prior to the Conceptual Right-of-way Cost Estimate, will allow the right-of-way estimators to provide a right-of-way cost estimate with better precision. When project scope is nebulous the right-of-way estimate must be based on percentages and there will consequently be a lack of precision. This is a project development process issue and can only be corrected at that level. The effort must be made to better define scope and communicate right-of-way requirements to right-of-way staff at the baseline stage and when updated estimates are requested. Scope definition is a critical issue that SHAs should address since that information establishes the basis for the estimate and has a significant impact on the accuracy of both the right-of-way cost estimate and the construction estimate.

There are noticeable differences relative to how the right-of-way requirements should be communicated to right-of-way staff. This research identified the cost estimate map as an effective tool to communicate right-of-way requirements. This entails the use of a map or aerial photo with specific right-of-way information drawn/indicated upon it. The level of information on the map varies with each estimate and the amount of detail on the cost estimate map should increase drastically from the Conceptual Right-of-way Estimate through the Updated Right-of-way Cost Estimates. At the Conceptual Right-of-way Cost Estimate the cost estimate map will typically show the location of the project in addition to the approximate right-of-way boundaries, this may be inferred by stating a width or number of lanes. The cost estimate map for an Updated Right-of-way estimate should identify specific parcels, show expected right-of-way limits based upon preliminary plans, and identify the type of take, if applicable.

Step #1: Determine ROW Estimate Basis

The estimate basis is determined directly from the right-of-way requirements and involves reviewing the real estate requirement on the schematic (aerial photograph or map) or other method of communicating the project boundaries. This includes documenting land use, location, topography, general project data, and any other data that may impact or be pertinent in determining the right-of-way cost. Determining the estimate basis varies only minimally between each of the estimates. The major difference is in the level of detail provided by the development team for each estimate. Consequently, the estimate basis for the Conceptual Right-of-way cost estimate will be less than that for the Baseline Right-of-way Cost Estimate and for later Updated estimates.

A robust effort must be made by the right-of-way estimator to define the estimate basis in as much detail as possible so that a deterministic cost value can be produced. If the estimate basis is not defined accurately the estimator has little solid data on which to base the projected cost. An estimate file is created to document the estimate basis. The estimate file should be created prior to developing the Conceptual Right-of-way Estimate and it should be updated when new scope information and right-of-way requirements become available. The estimate file is important for tracking project requirements and to identify changes in scope and project design between each of the estimates, particularly if the changes impact cost.

Step #2: Prepare ROW Base Estimate

Preparing the right-of-way cost estimate involves the following general activities: gathering project specific data, quantifying estimate parameters, performing research to establish real estate values, applying the values to the estimate parameters, and adjusting the estimate for real estate inflation. These estimating activities vary little between each of the estimates, but the time and effort to complete these activities will likely increase as the project develops. All of the activities are discussed as estimate inputs.

The estimate approach typically differs between each of the three estimates. Two primary approaches are used to complete a right-of-way estimate. The estimate is either completed using: 1) the overall approach which estimates a value for the whole project based upon cumulative values for real estate, improvements, damages, and other cost parameters; and 2) the parcel-by-parcel approach which estimates and assigns a cost value to each parcel. Conceptual Right-of-way Cost Estimates are usually developed using the overall estimate approach. Typically, the overall estimate approach is used for the Baseline Right-of-way Cost Estimate, but the findings of this research seem to indicate that a parcel-by-parcel approach has the greatest potential to provide an accurate estimate, although this has not been proven by a comparative analysis of estimates and experienced cost. A parcel-by-parcel costing takes into account parcel specific data such as the potential impact of damages on the actual parcel that may impact overall cost. The Updated Right-of-way Cost Estimate should always be completed on a parcel-by-parcel basis. In addition to having the potential benefit of greater accuracy, a parcel-by-parcel estimate is necessary to complete cost management (or cost control) activities during final design, which will be discussed later.

Step #3: Determine Risk and Set Contingency

A systematic risk analysis to identify major risks affecting the estimated cost and schedule should be performed for each cost estimate. As a result of the risk analysis, realistic contingency values can be applied to estimate. Additionally, contingency values should also cover project unknowns. Risk analysis and the application of contingency play a major role in adjusting the cost estimate to represent the most probable cost for the necessary right-of-way real estate. The use of a risk analysis and the application of contingency are particularly critical for the Conceptual Right-of-way Cost Estimate due to the large degree of uncertainty associated with the duration of time between estimate creation and the expected construction letting. This may include uncertainty in right-of-way requirements as scope is refined or the effect of other estimate parameters such as real estate inflation or condemnation rates. As a project develops, uncertainty typically

lessens, therefore, the amount of contingency that is applied to subsequent estimates should be less, but risk analysis and the application of contingency should still be performed as there are always cost and schedule risks.

The amount of detail involved in the Conceptual Right-of-way Cost Estimate is usually minimal when compared to later estimates, but it is critical for the right-of-way estimator to identify the major risks to project cost and schedule. Based upon these major risks a percentage amount for contingency should be applied to the estimate. The risk analysis becomes more detailed when the Baseline Right-of-way Cost Estimate is prepared as all risks, large and small, should be identified. These risks are then evaluated for cost and schedule impact and contingency amounts incorporated into the estimate. Each risk analysis should be appropriately documented to include assumptions, limitations, and the overall basis of the risk analysis. This becomes especially important when an estimate is updated. A good practice is to assign a confidence level to the estimate or to make detailed notes that communicate to users the estimator's confidence in the estimate. This confidence level could be similar to the confidence score presented in the previous chapter. With an Updated Right-of-way Cost Estimate, the risk analysis involves reviewing the risks identified for the baseline estimate. If the risks have changed between the two estimates, these changes should be reconciled or updated as necessary and the contingency amounts revised accordingly. A confidence level should be assigned for this estimate to communicate to users the estimator's confidence in the estimate.

Step #4: Review ROW Cost Estimate

Each estimate should be reviewed by knowledgeable staff and management. In general, reviews should minimally consist of reviewing the estimate basis and assumptions, the validity of the cost data, and verifying the completeness of the estimate. In the case of the Conceptual Right-of-way Cost Estimate management should pay close attention to: 1) the real estate inflation rate used; and 2) the risk analysis together with assigned contingencies. The inflation rate has a large impact on the estimated cost since the project is 10 or even 20 years from construction letting. The risk analysis and breakdown of the contingencies should be examined closely as there is significant uncertainty and unknowns inherent with these estimates. The Baseline Right-of-way Cost Estimate should be reviewed closely because it sets the cost value against which all later estimates will be compared. Special care should be taken to compare the Updated Right-of-way Cost Estimate to the Baseline particularly to identify any changes that have occurred or discrepancies. A review process is essential throughout project development in order to control project cost and control cost escalation. The process should be systematic and should clearly document estimating procedures in an easy-to-follow manner.

Documentation of the review is important. Reviewers should take notes on the level of review detail, what portions of the estimate were examined, and issues that surfaced during the review. Modifications to the estimate may be requested.

Decision Milestone: Estimate on Budget?

This decision milestone is unique to the Update Right-of-way Cost Estimating process and can be defined as part of cost estimation management discussed in the latter parts of Chapter 4. This should be occurring as updated cost estimates are completed to compare the estimated value against the baseline cost estimate. It is shown in the flowchart,

Figure 9, as a decision milestone following “Review Updated ROW Cost Estimate” and denoted by a diamond.

If the estimate is within the Baseline Right-of-way Cost Estimate budget, then the estimate should be approved for release back to the development team. If it is not within budget, it should be further examined and recommendations made to accept the increased cost or to make project changes that will bring the cost within budget. If discrepancies are identified between the Baseline and the Updated Right-of-way Cost Estimates, the estimate is sent back through the estimation process as shown in the “Cost Estimation Management Loop.” The suggested changes may include changes in the project’s design to reduce right-of-way cost. ROW/design tradeoff analysis can be utilized to determine what type of changes should be made. Value engineering or some similar method can be used to evaluate the proposed changes. An example would be consideration of the cost of a retaining wall versus the right-of-way cost increase resulting from a decision to build a slope requiring more land area. The decision can be considered from both points of view. A retaining wall may be the right choice if the slope creates a high cost of damages to an existing business. A slope typically requires acquiring a larger portion of an impacted piece of property but is less costly to construct. Contrastingly, this issue can be considered in reverse if the wall is extremely expensive compared to the piece of property that would be necessary for the slope.

Examination and evaluation of differences between the baseline estimate and the updated estimate does not regularly occur in most SHAs. Instead, the higher cost estimate amount is accepted and becomes a source of project cost escalation. The cyclical cost estimation management process should occur for every updated estimate (see Figure 9). This process should be documented by the estimator and management. All discrepancies and resulting changes to the project design or right-of-way should be documented in the estimate file. Even if a discrepancy is found and no major change is made, the discrepancy should be documented as this issue may resurface during subsequent estimate updates or become a later cost management question.

Step #5: Approve and Release ROW Cost Estimate

The approval and release step is the first true cost estimation management step included in each of the cost estimate processes. Appropriate approvals should be required for all cost estimates before they are released to the development team and others in the agency. This step ensures that management is aware of project cost and by their signature confirms their acceptance and their Section’s accountability for the estimate.

Output: Estimate Amount to Development Team

Following approval and release of the cost estimate a value is communicated back to the project manager and the development team. Care must be taken to communicate the cost estimate value and management must recognize that the value is just one of the many probable right-of-way costs (Anderson et al., 2007b). This is also an estimation management step completed by right-of-way staff.

Cost Estimating Inputs

In addition to the right-of-way requirement input and estimate output shown in the Table 4, there are other keys inputs needed to perform the process steps. As previously discussed, the major input into the process flowcharts are the right-of-way requirements which are used to establish the estimate basis for right-of-way cost estimates and to determine whether changes have occurred in Right-of-way Cost Management. Research has shown that other inputs are necessary throughout the process to create an accurate estimate. The nature of these inputs will vary with each of the estimates and discussed herein.

Inputs to Determining the Cost Estimate Basis

Discipline input from environmental, railroads, and utilities is important when determining the estimate basis because input from these disciplines can impact right-of-way requirements and they may not have been considered by the project manager or the development team. Environmental needs may include supplementary lands for retention basins or ponds to control storm water runoff or for lands to replace sensitive parcels impacted environmentally. Railroads and utilities may require additional land for relocation. Input from these three discipline areas is primarily included for the Baseline Cost Estimate and the Updated Cost Estimate. This input is not always directly considered in the Conceptual Right-of-way Cost Estimate since project scope and right-of-way requirements are not well defined. When the estimator makes the field visit potential environmental, utility, and railroad issues must be considered. It is best if field visits are made jointly by all members of the project development team. This avails project members the opportunity to hear and understand the concerns of other team members in a visual context. If requirements related to issues are unclear, advice from the other disciplines should be considered. If there is a potential cost impact, then the requirements should be noted as part of the cost estimate basis.

Inputs to Preparing the ROW Cost Estimate

There are various inputs necessary to prepare the Right-of-way Cost Estimate. These include:

- Data from a field visit performed by the ROW estimator;
- Land Market Values;
- Historical Data;
- Condemnation Rates; and
- Real Estate Inflation Rates.

These inputs will vary depending on the particular right-of-way cost estimate being prepared and the data available at the specific point in project development.

A *Field Visit* by the right-of-way estimator should be performed to gather data relevant to the cost estimate. Many times this is completed as a drive through (a windshield survey) or by walking the project corridor(s). It should be performed for all cost estimates throughout the project development process because it is important for the cost estimator to comprehend the complex attributes specific to the project location. The field visit

should include documenting existing conditions and making notes of potential damages and improvements or other issues that may impact the cost of acquiring the right-of-way. Although the field visit gathers the same information for each of the estimates, the level of detail and certainty varies. The field visit completed at the Conceptual Right-of-way Cost Estimate which is typically completed 10 to 20 years before the construction letting date will pose the most difficulty to the estimator in establishing information on existing conditions and extrapolating those conditions to future acquisition cost. For example, it is difficult to guess what the highest and best use a piece of vacant agricultural land will be in 10 to 20 years. Potential damages and improvements are likely to change in that 10 to 20 year span. The field visit completed for later estimates provide more solid information to the estimator. The estimator must take into account information gathered at the field visit in the risk analysis and when setting contingency values.

Land Market Values can be established by the method of comparable sales or a similar approach. This is a major portion of, and input into, estimate preparation in which fair market value must be determined for the right-of-way. The source of real estate market values will usually vary between the cost estimates. For the conceptual cost estimate, the land market values may be aggregated to a cost per acre value. This matches with the fact that this estimate is usually prepared based upon a total area to be acquired as opposed to considering each parcel. The land market values are likely established using tax assessor records or through comparable sales from realtor listings other similar sources during the preparation of Baseline and Updated Right-of-way Cost Estimates.

Historical Data is utilized to determine the cost for removal of improvements, relocation assistance, and support costs. Support costs are defined as all costs the SHA is expected to incur to complete the estimate, appraisals, and acquisitions. Historical data can provide an understanding of real estate inflation trends and condemnation cost. Real estate inflation and condemnation rate data may provide the estimator average rates over past years to be used as an indicator of a probable future behavior. Caution is recommended, though, in assuming these values for future values since the past is not always the best indicator of the future. In the absence of definitive scope definition, historical data from a similar project is sometimes used to establish the right-of-way cost for the Conceptual Right-of-way Cost Estimate, but this practice is not always recommended. An effort to definitively and accurately define scope early in the project development process supports development of accurate estimates.

Condemnation Rates must be estimated for the project as the number of condemnations will impact the cost of right-of-way acquisition. This rate is typically expressed as the percentage of properties that proceed to the eminent domain process. The rate of condemnation is location specific and significant research should be completed to establish this rate and its cost impact on the estimate. Barring any change in state laws that govern the eminent domain process, condemnation rates should not vary significantly from estimate to estimate.

Real Estate Inflation Rates are used to adjust current property market values to cost at the time of acquisition. This is an important factor in cost estimate preparation since property values are extremely volatile and difficult to predict. This is especially the case for the Conceptual Right-of-way Cost Estimate where there is a high amount of uncertainty inherent in predicting the inflation rates for an acquisition 10 to 20 years in

the future. The inflation rate becomes somewhat less uncertain with a shorter duration between the estimate and acquisition but the rate can still be volatile. It should be noted that real estate inflation is not the same as construction cost inflation, therefore a different rate than that used for construction purposes is necessary.

Inputs to Risk Analysis and Setting Contingency

A risk analysis should be performed to identify and evaluate all major risks to the project and for determining the contingency amount that is added to the base cost amount of the estimate. Inputs into this process step are:

- Future Development;
- Historical Data;
- Condemnation Rates; and
- Real Estate Inflation Rates.

Generally the amount of risk inherent in an estimate typically decreases as the project scope becomes better defined and project design proceeds. Therefore, the major difference between the Conceptual Right-of-way Cost Estimate and later estimates is that the predicted values become more certain and the amount of contingency assigned to the estimate decreases. The base estimate amount may correspondingly decrease.

Future Development input is utilized to capture the cost effect of future improvements to the properties that will have to be purchased or the cost effect of land use changes. Future improvements impact property value and hence right-of-way cost. The possibility that a piece property which is vacant when the planning estimate is produced could be developed into a shopping center later must be factored into the right-of-way estimate. Consequently, it is necessary to identify this risk and consider assigning a contingency amount. There is a large difference between the risk and uncertainty associated with predicting future development at the Conceptual Right-of-way Cost Estimate and the Baseline and Updated Right-of-way Cost Estimates. This is due to the ability of the estimator to be able to predict the future highest and best use of the right-of-way. One resource that may be utilized by the right-of-way estimator at the Conceptual Right-of-way Cost Estimate is a strategic community plan which usually consists of a 15 to 20 year growth plan for a city or town. The estimator can make a prediction for the future development of an area based upon this community planning document. It may also be utilized for later estimates for examining growth trends throughout the area. Private developers may be a resource for predicting the future development of an area. There is also the possibility of using early acquisition options to reduce cost risk.

Historical Data can be used to support the risk analysis. As the project approaches the point of right-of-way acquisition uncertainty decreases, and recent historical data may offer better insight into the probable support costs, costs of relocation assistance, and cost of removing improvements than in earlier phases of the project.

Condemnation Rates are a large component of the risk analysis due to their potential for significantly impacting costs and schedule. Costs associated with condemnations have been shown by the literature to have a large impact on the cost estimate and hence, cost escalation. Some states have laws requiring the SHA to pay the property owner's court

fees, appraisals, and other costs. Moreover, condemnation is a risk to the project schedule. In some states, the condemnation process can lengthen and delay acquisition of the property, which may delay construction.

Real Estate Inflation Rates have been shown by the literature and this research to be highly volatile and dependent on many market factors. The impact on overall right-of-way costs must be taken into account as land values make up a large portion of the total costs. Real estate inflation is exceptionally difficult to predict any time during the estimating process but more so at Conceptual Right-of-way Cost Estimate stage since the estimator is trying to look so far in the future. Contingency amounts should always be applied for real estate inflation to reflect hard to predict market changes and other external factors that drive prices.

Right-of-way Cost Management

The process of *Right-of-way Cost Management* was generally defined to be primarily the management of actual costs reflected in appraisals and acquisitions against the estimated parcel costs in the Updated Right-of-way Cost Estimate. This process does not involve cost estimation; it is the control of right-of-way acquisition cost. Acquisitions should be tracked on a parcel-by-parcel basis against the estimated cost. The Right-of-way Cost Management process is presented in Figure 10.

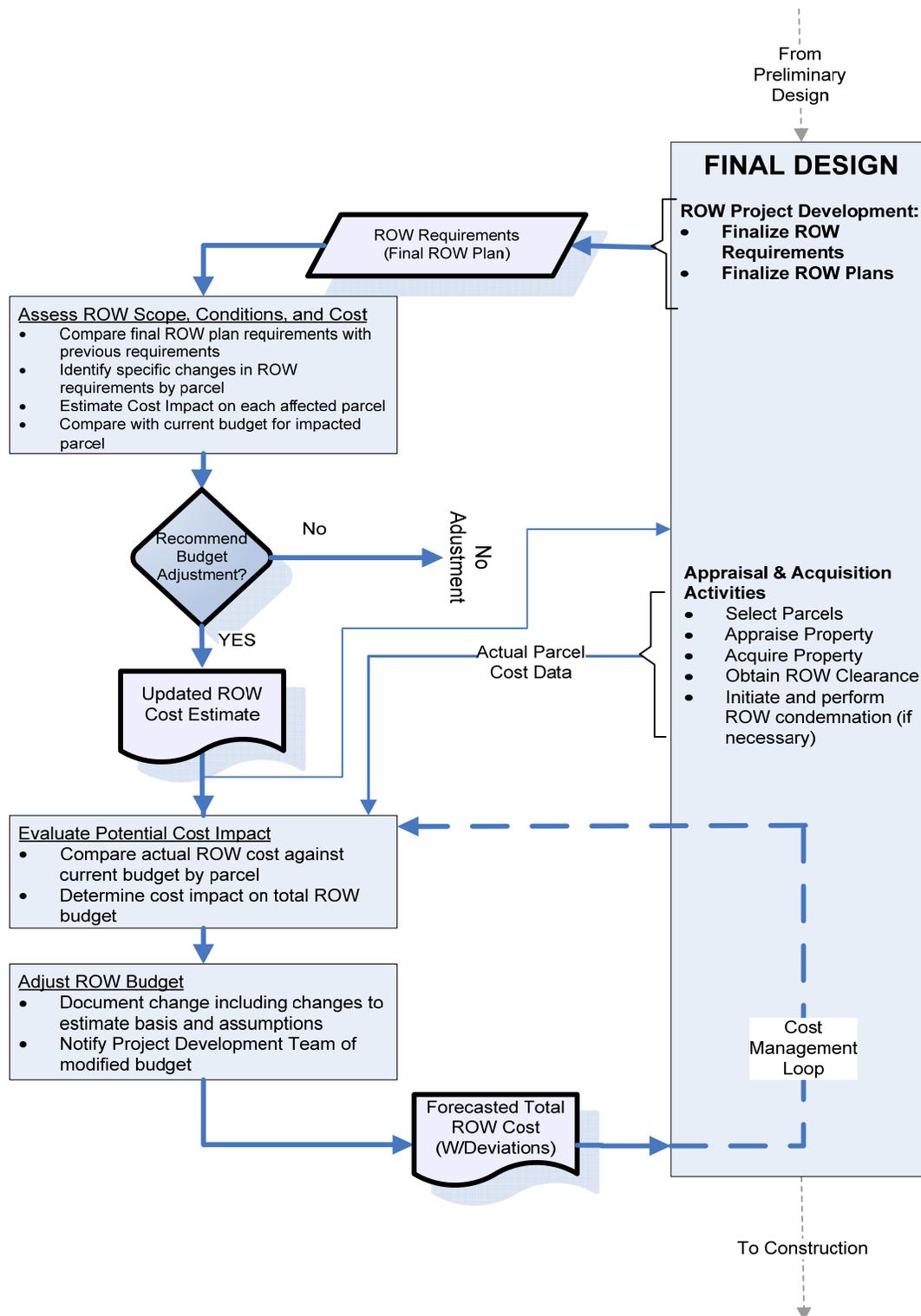
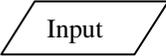
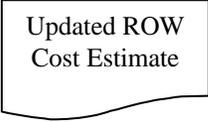
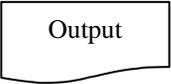


Figure 10. Right-of-way cost management process flowchart

Right-of-way Cost Management Process Steps

The process flowchart documenting right-of-way activities during final design is primarily describing the Right-of-way Cost Management steps during real estate acquisition. The process steps used in the Right-of-way Cost Management Flowchart are presented and explained in Table 5.

Table 5. General process steps and descriptions for final design Right-of-way cost management

Process Step	Activity	Description
	ROW Requirements from Development Team	Development team communicates ROW requirements as Final ROW Plans to ROW personnel.
	Assess ROW Scope, Conditions, and Cost	Review ROW requirements and document changes, if present. In the event that changes are discovered, evaluate the cost impact on the overall ROW Budget.
	Recommend Budget Adjustment?	If the changes are expected to increase the final ROW project cost, an adjustment to the budget should be recommended. If no impact on the budget or a decrease in cost is expected then no adjustment is necessary.
	Update Current ROW Budget	An adjustment should be made to the ROW budget if changes are recommended.
	Evaluate Potential Cost Impact	Compare actual costs as reflected in appraisals and acquisitions to estimated costs. Determine whether overall budget cost may be impacted and document.
	Adjust ROW Budget	Adjust the ROW budget if the cost of acquisitions reflect an increase in overall cost and take appropriate steps to request additional funds.
	Forecasted Total ROW Cost (w/deviations)	Communicate total forecasted cost to Development Team and continue cost management (return to Step #2) until all ROW is acquired.

Input: ROW Requirements from Design

The final right-of-way plans (requirements) are the major input into the Right-of-way Cost Management process. These plans document the right-of-way requirement based upon the final design of the project. The exact location and area of each parcel to be acquired is shown.

Step #1: Assess ROW Scope, Conditions, and Cost

Before appraisals begin, each parcel in the final right-of-way plan should be examined and compared to the most recent right-of-way requirements used to complete the latest updated right-of-way cost estimate. Right-of-way personnel must identify whether there are potential changes in scope, conditions, or cost that will impact the project's real estate acquisition cost. For example, design changes that occurred since the last Updated Right-of-way Cost Estimate was completed qualify as potential changes that may impact final project right-of-way cost. This cost management step may also identify errors or omissions in previous estimates.

Decision Milestone: Recommend Budget Adjustment

The decision milestone represents the decision making process that must occur based on the output of Step #1. If changes are discovered, the impact of the changes should be evaluated based upon the right-of-way budget and a decision made to recommend adjustment of the budget or possibly even design changes to control cost. Additionally, a change might be considered if there is a potential for a reduction in cost. Although in most cases adjustments should be made to reduce cost, necessary adjustments can increase cost.

Step #2: Evaluate Potential Cost Impact

As appraisals and acquisitions are executed, cost data should be recorded for each parcel. This step of Right-of-way Cost Management involves checking the appraisal amounts and acquisition cost against the estimate values in the right-of-way budget. Throughout appraisal and acquisition activities, costs should be tracked in a system which provides up-to-date parcel expenditure information and a detailed cost summary. Right-of-way acquisition cost tracking enables the SHA to check expenditures and forecast the expected final project cost at the completion of acquisitions. The right-of-way tracking systems in Virginia, Minnesota, and Washington are good examples of this capability. This step should reoccur regularly throughout the appraisal and acquisition process. The "Cost Management Loop" shown in Figure 10 indicates the need for this management process to be cyclical. Reports should be generated at milestones such as at the 30 percent, 60 percent, and 90 percent points of land acquisition or when the right-of-way manager deems an update is pertinent. The cost management loop denotes this cyclical reporting and comparison between the actual expenditures and the estimated.

Step #3: Adjust ROW Budget

If the forecasted project cost calculated in Step #2 is expected to be greater than the ROW budget management must either institute a budget adjustment with the appropriate steps for requesting additional funds or develop a proposal for reducing right-of-way cost. The project manager should be notified immediately, and the basis for the budget adjustment and any supporting assumptions and calculations must be documented.

Output: Forecasted Total ROW Cost

Following adjustment of the budget and notification to the project manager of expected right-of-way cost, the adjusted budget should be communicated to the project development team. The Right-of-way Cost management process continues until all right-of-way is acquired. Following the completion of all acquisition, the project is ready to be let for construction. This management process has the potential to reduce right-of-way cost escalation problems during acquisitions and provides opportunities for lessons learned by evaluating the cost impacts which can be applied to estimates for future projects.

PROCEDURES GUIDE: STRUCTURE, LAYOUT, AND CONTENT

The right-of-way estimating Procedures Guide is structured around the information shown on the right-of-way process flowcharts presented in this chapter. The guide presents a structured right-of-way cost estimation and cost estimate management process. It describes in further detail the process steps, inputs, and outputs of each of the flowchart steps by providing more detailed discussions. These discussions include the use of tools, the impact of project complexity and tips for successful application of the steps. Additionally, a tool appendix highlighting tools discovered during this research is included. This appendix includes relevant tools from NCHRP Report 574 as many of those tools bear on the process of cost estimating right of way.

The Procedures Guide consists of eight chapters and a tools appendix. The first chapter introduces the Procedures Guide by summarizing the problem, discussing the need for a solution to the problem, and explaining the overall approach to achieving accurate right-of-way estimates. Chapter 2 argues for an integrated and structure approach to right-of-way cost estimating and cost management. Successful implementation begins with a strategic approach that can translate into a tactical application. Management support is necessary to ensure implementation. Chapter 3 provides an agency level perspective of the right-of-way cost estimation and cost estimate management processes as related to the generic project development process. The chapter outlines the objectives of each of the estimates prepared throughout project development. Further, this chapter discusses the impact of project complexity on right-of-way estimating. It outlines the basic elements that comprise a right-of-way cost estimate. The next four chapters, Chapters 4 to 7, describe in greater detail each of the process flowcharts corresponding to Figures 7, 8, 9, and 10, respectively. A typical layout for each chapter is as follows:

Introduction – objective and benefit

Flowchart – general description

Flowchart Step (e.g., Determine ROW Estimate Basis)

Project Complexity – impact on how the process is applied

Phase Inputs – expanded discussion from the flowchart

Process Step Description – expanding on bullets shown on the flowcharts

Tools – illustrations and references to the Tool Appendix

Tips for Success – important points to remember

Outputs – main deliverable(s) of the step

Flowchart Step (e.g., Prepare Base Estimate) – repeat same layout

Summary

The text focuses on differences in application in relation to the project development phase associated with the particular cost estimating approach and then cost management.

Chapter 8 concludes the ROW Guidebook with overall conclusions and recommendations. The Tool Appendix provides detailed information on each of the tools discussed in the Procedures Guide. The tool description is consistent with that used in NCHRP Report 574. Thus, for each tool the format is as follows: what is it; why it is used; how it is used; where it may be applicable within the right-of-way cost estimation and cost estimate management process; example applications; tips on use of the tools; and references for more information.

CHAPTER SUMMARY

Process flowcharts for the cost estimation and cost estimate management process were developed based upon conversation with multiple SHAs. Those flowcharts were presented in this chapter in addition to the methodology behind their development and rationale for the process steps and inputs within the flowcharts. There are five flowcharts: 1) an agency-level flowchart showing all cost estimates and the interaction of right-of-way with the project development process; 2) a conceptual right-of-way cost estimating flowchart which depicts the process during planning; 3) a baseline right-of-way cost estimating flowchart which depicts the process during programming; 4) an update right-of-way cost estimating flowchart which depicts the process during preliminary design to include a cost estimate management loop; and 5) a right-of-way cost management flowchart which depicts the cost management process during final design. The steps and information depicted on these flowcharts were explained. A short description of the Procedures Guide structure, layout, and content was presented. Chapter 5 of this report presents the conclusions and recommendations related to the research.

CHAPTER 5

CONCLUSIONS

NCHRP Project 8-49 identified right-of-way cost as a significant contributor to project cost escalation. It was found that: 1) Right-of-way cost estimation and cost estimate management processes lack structure; and 2) there is a lack of integration and communication between those responsible for right-of-way cost estimating and those responsible for project development. Therefore, this research addressed cost escalation issues relative to the right-of-way cost estimation and management through a process-focused approach.

SUMMARY

The research effort examined right-of-way the cost estimation and cost estimate management process in detail. Specific problems investigated were:

- Cost escalation;
- The lack of a structured approach to cost estimating; and
- The lack of communication with development personnel.

Critical issues that impact the right-of-way cost estimation process were identified. Through interviews with SHAs and local government agencies, the research team reviewed current right-of-way estimating practices, methods and tools. The inputs, outputs, and process steps for right-of-way estimating were documented using flowchart techniques. The resulting information formed the basis for developing five right-of-way estimating process flowcharts. These flowcharts integrate with the general cost estimation and cost estimate management steps presented in NCHRP Project 8-49.

This report documents the right-of-way flowcharts which are the framework for the right-of-way cost estimation and cost estimate management processes. The structured processes depicted by the flowcharts are the basis of the right-of-way Procedures Guide developed during this research. The flowcharts encompass the first four phases of project development. Right-of-way cost estimates are typically prepared during phases of project development, corresponding with the first three project development phases. These are: 1) the Conceptual Right-of-way Cost Estimate which is produced during the planning phase; 2) the Baseline Right-of-way Cost Estimate which is produced during the programming phase; and 3) Updated Right-of-way Cost Estimates which are produced during preliminary design. A fourth process, defined as right-of-way Cost Management which occurs during final design is also presented as a flowchart. Additionally, the cost estimate management process is integrated into the Update Right-of-way Cost Estimating process. This management process ensures that when subsequent estimates are produced following the Baseline Right-of-way Cost Estimate there is management acknowledgement of cost changes and management has the opportunity to control cost.

CONCLUSIONS

The conclusions of this research were derived from a literature review, interviewing individuals engaged in right-of-way estimating and developing the procedures guide. Data from both sources was collected and analyzed. General conclusions are:

- Systematic and structured processes for right-of-way estimating and cost management are lacking in many state highway agencies. The lack of defined processes impacts the agency's ability to consistently produce accurate right-of-way cost estimates. This lack of structure is compounded when a state highway agency is decentralized and each region/district completes estimates using different processes.
- Communication and coordination between right-of-way sections and development teams is generally lacking throughout the project development process.
- There are a small number of tools available to aid agencies estimate right-of-way cost. There are right-of-way database programs and programs for capturing right-of-way information that can support right-of-way estimate development.
- Typically, right-of-way estimating personnel are not involved in preparing planning right-of-way cost estimates. It was found that planning right-of-way cost estimates are often prepared by the planning section and the right-of-way section is not contacted for guidance.
- There is only limited or no connection between the right-of-way planning estimate and later estimates. The basis and documentation supporting the planning estimate is often not forwarded to those responsible for later right-of-way estimates.
- Cost estimation management is minimal throughout the cost estimation process and especially during the Preliminary Design project development phase.
- State highway agency right-of-way manuals tend to concentrate on the appraisal and acquisition process with little information documenting right-of-way cost estimation and cost management activities.
- Utilization of systematic risk analysis techniques are lacking and contingency, when assigned, is based in most cases on gross percentages.
- Clear and effective scope definition and communication of right-of-way requirements is critical to preparing an accurate right-of-way estimate.
- Right-of-way estimator experience and knowledge play a significant role in producing accurate right-of-way cost estimates.
- Right-of-way Cost Management (cost control) is used only to a minimum extent during the appraisal and acquisition process.

The *Procedures Guide* is a stand alone document that addresses each of these issues.

RECOMMENDATIONS FOR FUTURE RESEARCH

This research focused on developing a framework for the right-of-way cost estimation and cost estimate management processes that would support the creation of accurate

right-of-way cost estimates. A more in-depth look at specific tools that support right-of-way cost estimation could be beneficial. This research presented tools discovered through interviews, but did not focus on development of tools, nor did it evaluate the effectiveness of any of the identified tools.

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APPENDIX A
PROJECT DEVELOPMENT PHASES

(Anderson et al., 2007a)

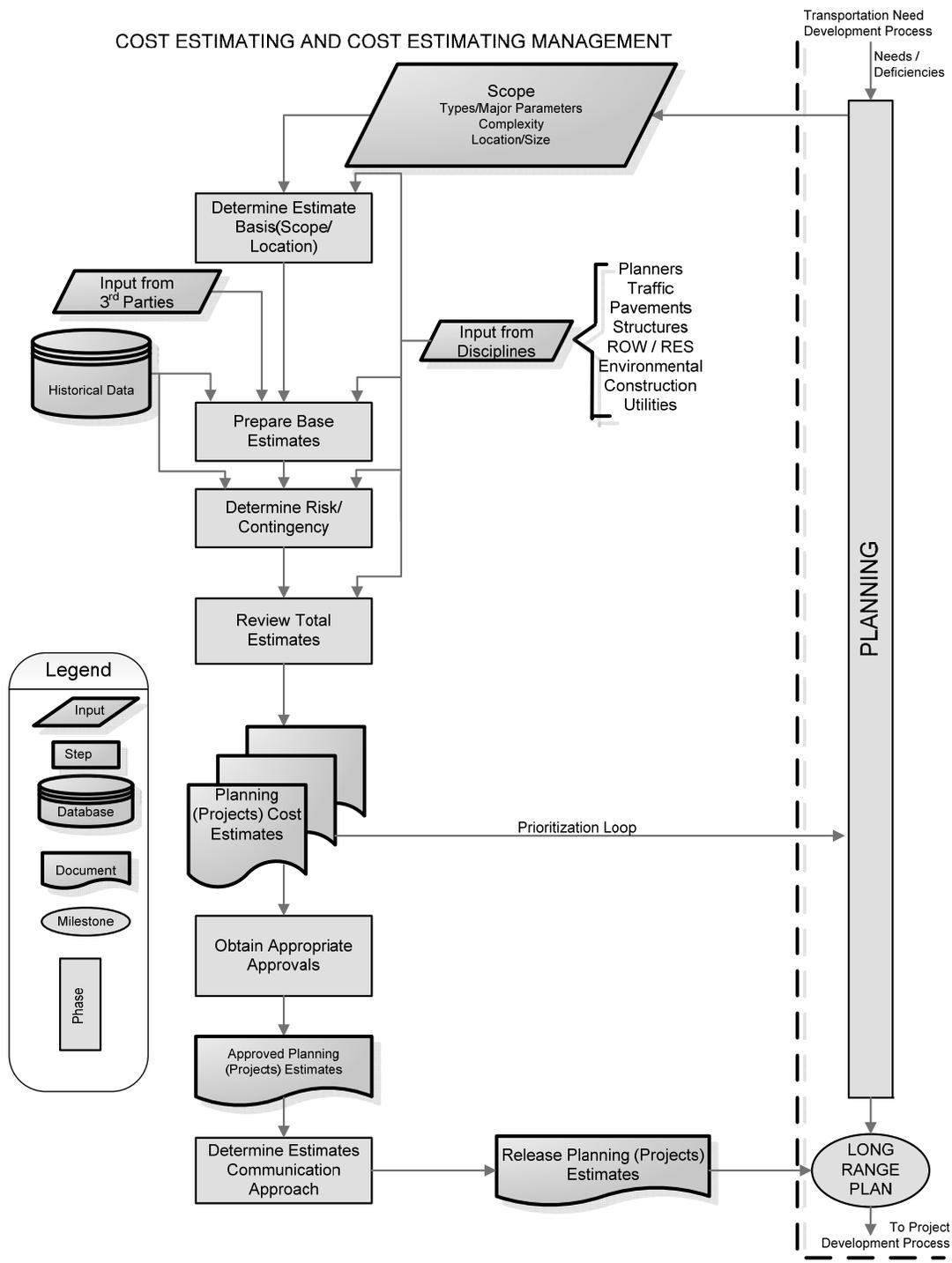


Figure A-1: Cost estimation practice and cost estimation management during planning (NCHRP 8-49, Phase I).

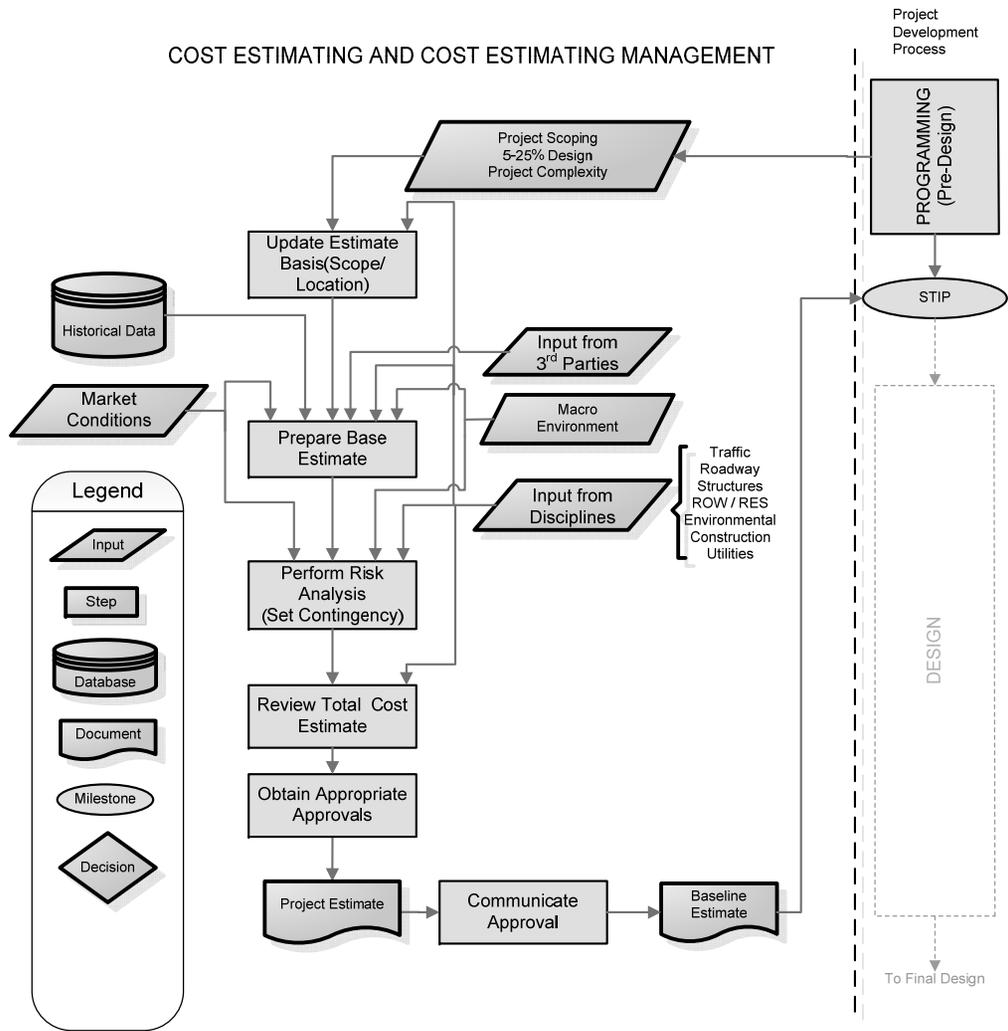


Figure 11: Cost estimation practice and cost estimation management during programming (NCHRP 8-49, Phase I).

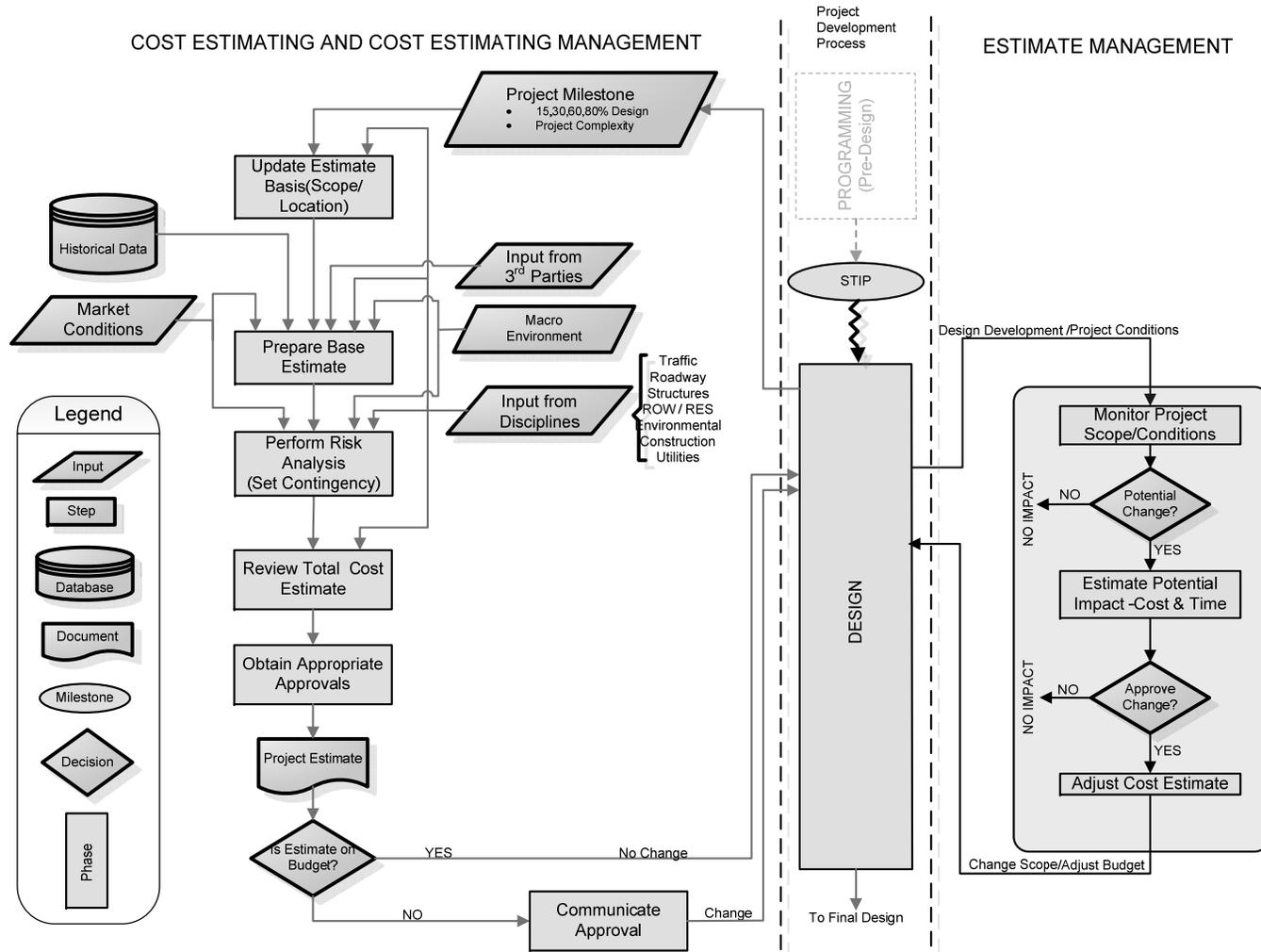


Figure A-3: Cost estimation practice and cost estimate management during preliminary design (NCHRP 8-49, Phase I).

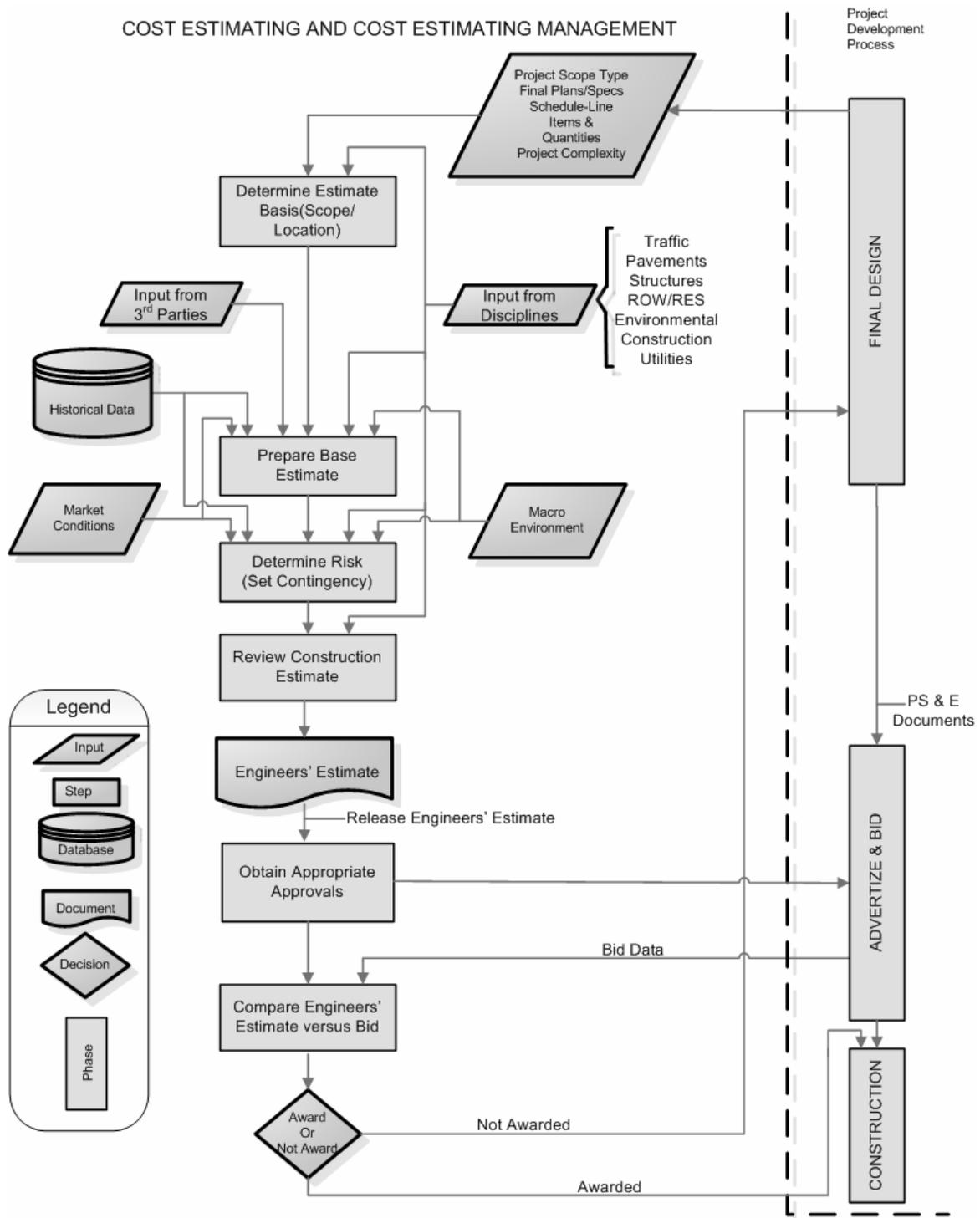


Figure A-4: Cost estimating and cost estimation management during final design (NCHRP 8-49, Phase I).

APPENDIX B
INTERVIEW PROTOCOL



MEMORANDUM
February 6, 2009

TO: Survey Participant

FROM: Stuart Anderson
Principal Investigator

SUBJECT: NCHRP 8-49 Phase II Interview Questionnaire

Thank you for participating in the NCHRP 8-49 Research Project concerning methods and tools to control cost escalation related to Right-of-Way. We have enclosed some brief background information about the research project along with the questionnaire we plan to discuss with you during our interview on *(insert day/month)* at *(insert time)*. Please review the questionnaire prior to the interview to become acquainted with the nature of the questions that we will be discussing.

If you have any questions, please contact me by telephone at 979-845-2407 or by email at s-anderson5@tamu.edu.

Background

The Texas Transportation Institute (TTI) is conducting an NCHRP project (8-49, Phase II) entitled “Right of Way Methods and Tools to Control Project Cost Escalation.” The research team consists of Dr. Stuart Anderson (Principal Investigator), Dr. Keith Molenaar (Co-Principal Investigator), Dr. Cliff Schexnayder (Consultant), as well as an industry review and implementation team. Phase I of NCHRP 8-49 documented the problems manifested in cost management approaches and cost estimate processes that often do not promote consistency and accuracy of costs over the entire project development process. NCHRP 8-49 Phase II will focus on the cost escalation problem that most state highway agencies, transit agencies, and metropolitan planning organizations face dealing specifically with *right-of-way*. Phase I findings, which are based on a critical review of literature, recent research, and current estimating practice, suggests that there are numerous factors influencing project cost escalation. These factors manifest themselves in increased costs in a number of project areas. The 8-49, Phase I research found that:

1. Actual cost of project right of way is frequently greater than the estimates of such cost that were produced during early stages of project development;
2. Management of the right-of-way estimating process has the potential to contribute significantly to addressing cost estimate consistency and accuracy throughout the entire project development process;
3. There is an opportunity to develop more right-of-way estimating methods and tools from successful practices around the country; and
4. There is a need to provide more specific guidance on how to implement strategies, methods, and tools such that improved right-of-way estimates can be achieved.

Because the study scope requires the research team to consider right-of-way estimating procedures and management methods during various phases of project development, particularly early stages, we have developed the following interview instrument that addresses various cost estimation and cost estimation management tools and methods that are in use in practice today. The team will assemble “state of practice” estimating information by project development phase so that the final guidelines will present tools to develop, track (manage), and document realistic right-of-way cost estimates during each phase of a project. The findings of 8-49, Phase I defined the different project phases shown in Figure 1 and further described in Table 1. A more detailed breakdown of the planning, programming, and preliminary design phases can be found as Attachment A following the questionnaire (NCHRP 8-49, Phase I).

Instructions

We have enclosed a questionnaire with sections relevant to the first four project phases shown in Figure 1. The interview will be based on the enclosed interview questionnaire. During the interview, all persons representing your state agency may be present for a group interview, or each person can be interviewed individually. The interview will last approximately two hours depending on the number of individuals involved in the discussion. The questionnaire to be discussed has been attached for review prior to the interview. Please note that not all the questions will apply to every individual and some of the questions are repetitive from phase to phase. The research team would also appreciate receiving any supplemental information regarding the DOT's R/W estimating methods and tools such as information about computer programs you use or published guidelines.

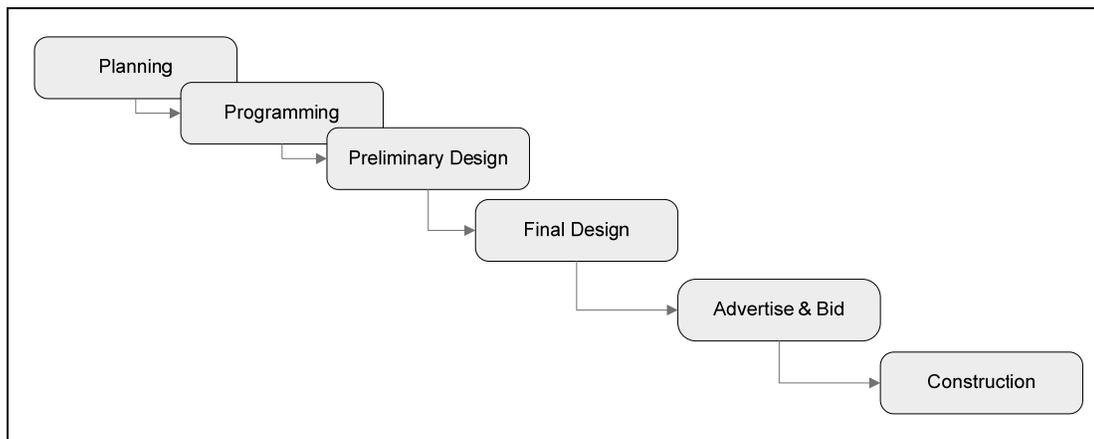


Figure 1 Typical Project Development Phases for Highway Projects (NCHRP 8-49, Phase I)

Table 1: Development Phases and Activities (Anderson and Blaschke 2004¹; NCHRP 8-49, Phase I)

Development Phases	Typical Activities
Planning	Purpose and need; improvement or requirement studies; environmental considerations; right of way considerations; public involvement/participation; interagency conditions.
Programming	Environmental analysis; schematic development; public hearings; right of way impact; project economic feasibility and funding authorization.
Preliminary Design	Right of way development; environmental clearance; design criteria and parameters; surveys/utility locations/drainage; preliminary plans such as alternative selections; geometric alignments; bridge layouts.
Final Design	Right of way acquisitions; PS&E development – final pavement and bridge design, traffic control plans, utility drawings, hydraulics studies/drainage design, final cost estimates.
Advertise and Bid	Prepare contract documents, advertise for bid, pre-bid conference; receive and analyze bids.
Construction	Determine lowest responsive bidder, initiate contract, mobilization; inspection and materials testing; contract administration; traffic control, bridge, pavement, drainage construction.

1. Anderson, Stuart D. and Blaschke, Byron C. (2004). NCHRP Synthesis 33-09 “Statewide Highway Letting Program Management”

Right-of-Way Interview

The following list of questions has been developed to target specific areas of right-of-way cost estimation, estimate management, and other aspects of the right-of-way process. As mentioned previously, the project team is particularly interested in the right-of-way process as it parallels with the phases of project development. We are primarily concerned with the first four phases which include: ***Planning; Programming; Preliminary Design;*** and ***Final Design.*** Therefore, as the interview progresses, each question will be discussed in reference to each of the first four phases of project development. In other words, each question will be asked 4 times. The first time a question will be asked as related to the *planning phase*. The second time it will be asked as related to *programming* and so on for *preliminary design* and *detailed design*. This line or type of questioning will help the team to identify similarities and differences of the right-of-way process as related to the project development process. Additionally, we acknowledge that some questions may not apply to a particular phase; if this is the case, please respond as such. Recall that detailed figures documenting the project development phases referenced above are shown in Attachment A.

Contact(s):

Determining Right-of-Way requirements

1. How is right-of-way requirements quantified for a particular project during each phase of project development? What sources of data are used in determining right-of-way dimensions at each point in project development (e.g. alignments, ROW maps, topographical maps, typical cross sections, land surveys, etc.)?

Estimate Preparation

2. Describe policies, procedures, techniques, and/or standards used in preparing right-of-way cost estimates during each phase of project development? If these policies, procedures, techniques, and/or standards are formally documented (written), can you provide us with a copy or a website location where we can obtain a copy?
3. Is historical data (or other data) used as a basis for preparing right-of-way estimates during each phase of project development? How is this data adjusted for time (schedule), location, and other project specific conditions?

4. What elements (e.g. utility adjustments, land use, damages, improvements, relocation assistance, eminent domain proceedings, etc.) are included in a right-of-way estimate prepared during each phase of project development? At each phase, which one element is most difficult to quantify accurately? Which one is the least difficult? What methods and tools are used to quantify each?
5. How does the DOT address potential environmental issues (e.g. hazardous materials, wetlands, etc.) in right-of-way cost estimates during each phase of project development?
6. How do you insure that estimates completed during each phase of project development reflect all elements of the required right-of-way (e.g. utility adjustments, land use, damages, improvements, relocation assistance, eminent domain proceedings, etc.)?
7. During each phase of project development, is risk considered in the right-of-way estimate? If so, how is risk quantified and applied to the cost estimate?

Estimate Reviews

8. Is a formal review conducted within the DOT at each phase of project development to verify the right-of-way estimate? If yes, go to 8a, otherwise go to 8b.
 - 8a. Do the reviews follow a set of formalized and institutionalized procedures? Does the magnitude of right-of-way cost or right-of-way complexity trigger the review or additional reviews? Please identify these trigger values. What personnel outside of those responsible for preparing the estimate are involved in the review and approval of the estimate?
 - 8b. How does your DOT verify a right-of-way estimate?

Estimate Communication

9. Is there a systematic program that is used to standardize right-of-way estimating procedures and train those responsible for assembling the estimates during each phase of project development? What formal mechanisms are used for capturing and transferring knowledge about right-of-way cost estimating techniques?
10. Is contact made with the property owners during each phase of project development? If so, what information is communicated to the property owners? Is there an effort to discover potential problems or possible excessive damages that are unforeseen or unknown to the acquiring agency through communication with land owners at this time?

Cost Estimating Management

11. Are differences in right-of-way cost estimates between each phase reconciled? If so, how is the reconciliation performed?
12. What triggers an update of a right-of-way estimate during each phase of project development? Are estimates updated on a periodic basis, when major design changes occur, or through some other triggering mechanism?
13. Is the right-of-way cost estimate updated based upon continuing experience throughout the acquisition process or at each phase of the project development process? For example, the cost of parcels which are acquired early in the acquisition process exceed the estimated values may indicate the same for the remainder of the parcels.
14. If project requirements change and there is a requirement for additional right-of-way, how are these changes and requirements communicated to the personnel responsible for right-of-way cost estimating and acquisition during each phase of project development? Please explain how these changes are implemented by the right-of-way officials?

State Laws & Other Factors

15. Are there specific state laws or statutes that affect the ROW process during each phase of project development? If so, please identify such laws and describe each including background and effect on the ROW process.
16. Are there any other factors that affect the ROW process during each phase of project development (e.g. environmental, social, political; such parameters may apply to the whole state or a particular district or metropolitan area)? If so, please name these and describe each including background and effect on the ROW process.
17. Do state laws allow for the use of acquisition techniques such as advanced acquisition, land consolidation, land exchange, incentives, or other non-standard techniques? If so, are these used and how effective are such techniques? Please include the particular phase of project development where these techniques are applicable.

(General cost estimating and estimate management flowcharts from Phase I of NCHRP 8-49 which are displayed in Appendix A were included in the interview protocol here)

APPENDIX C
EXAMPLE OF STATE DOT INTERVIEW REPORT

State Highway Agency
@State Office
@District Office

The following list of questions has been developed to target specific areas of right-of-way cost estimation, estimate management, and other aspects of the right-of-way process. As mentioned previously, the project team is particularly interested in the right-of-way process as it parallels with the phases of project development. We are primarily concerned with the first four phases which include: ***Planning; Programming; Preliminary Design; and Final Design***. Therefore, as the interview progresses, each question will be discussed in reference to each of the first four phases of project development. In other words, each question will be asked 4 times. The first time a question will be asked as related to the *planning phase*. The second time it will be asked as related to *programming* and so on for *preliminary design* and *detailed design*. This line or type of questioning will help the team to identify similarities and differences of the right-of-way process as related to the project development process. Additionally, we acknowledge that some questions may not apply to a particular phase; if this is the case, please respond as such. Recall that detailed figures documenting the project development phases referenced above are shown in Attachment A.

Contact(s):

Senior ROW Agent

Senior ROW Agent (North Region)

Senior ROW Agent (North Region)

Senior ROW Agent (North Region)

Overview: ROW Process

***refer to figure provided showing the ROW process in relation to the overall project development process

- There are only 3 phases in the ROW process: Project Initiation (Planning, Programming), Permits and Studies (Preliminary Design), PS&E (Final Design)
- Planning (with Programming) - Programming is not considered a phase by itself in the process. It takes place at the end of planning and before preliminary design occurs. Multiple alternatives exist during the planning phase. The ROW cost estimate completed at this point usually sets the ROW baseline for the project.
- Preliminary Design – a preferred alternative is chosen here based upon cost estimates of design, construction, and ROW per each alternative. After a preferred alternative is chosen the cost estimate is usually updated.

- Final Design – appraisals and acquisition occur during this phase. In the perfect world, all acquisition is complete before construction begins.

*** Marysville provided the following:

- 2 copies of completed ROW cost estimates which includes cost data sheets
- A ROW cost data sheet request with a cost estimate map
- the excel template for their cost estimation process

Determining Right-of-Way requirements

1. How are right-of-way requirements quantified for a particular project during each phase of project development? What sources of data are used in determining right-of-way dimensions at each point in project development (e.g. alignments, ROW maps, topographical maps, typical cross sections, land surveys, etc.)?

- A cost estimate map is typically provided by the ROW engineers. The cost estimate map consists of an aerial photo of the project area in which each parcel is labeled and ROW boundaries are drawn in. The level of detail shown on the cost estimate map is crucial to producing an accurate cost estimate.
- On a parcel by parcel basis, structures (improvements) are identified along with any problems and the market value is applied as determined by the ROW agent.
 - o Market trends are the prime source of assigning value to a property. The ROW agent will contact the tax assessor, realtors in the area, and any other sources.
 - o Field visits and maps such as provided by Google Earth also are used by agents to identify structures, damages, and other potential problems by parcel.
 - o Experience and knowledge of the area is a large indicator for an accurate cost estimate. The best estimators are those that are experienced because they have a feel for property values and other aspects of ROW.
 - o This portion of the estimate is restricted by the amount of time available.
 - o When partial takings, damages must be assessed.
- The level of detail of the Cost Estimate Map was emphasized by Marysville to affect the quality and ease of the cost estimate.

Estimate Preparation

2. Describe policies, procedures, techniques, and/or standards used in preparing right-of-way cost estimates during each phase of project development? If these policies, procedures, techniques, and/or standards are formally documented (written), can you provide us with a copy or a website location where we can obtain a copy?

- Policies and procedures related to cost estimates of ROW can be found in **Chapter 4 of the ROW manual**. These policies and procedures provide information to the districts but these are only guides by which they estimate ROW. The manual does not provide actual tools for the districts to use. The actual tools and methods are not consistent throughout the districts.

- early collaboration of ROW with the PM and Design is encouraged to identify problems at early stages in project development
 - All the above confirmed by Marysville. They follow the general outline set in the ROW manual.
3. Is historical data (or other data) used as a basis for preparing right-of-way estimates during each phase of project development? How is this data adjusted for time (schedule), location, and other project specific conditions?
- historical data is used for support costs which are the man-hours used to complete the estimates
 - demolition of existing buildings is also estimated by recent historical data
 - capital costs are based on recent sales in the area (market value)
 - all the above confirmed by Marysville
4. What elements (e.g. utility adjustments, land use, damages, improvements, relocation assistance, eminent domain proceedings, etc.) are included in a right-of-way estimate prepared during each phase of project development? At each phase, which one element is most difficult to quantify accurately? Which one is the least difficult? What methods and tools are used to quantify each?
- All elements above are included in the ROW estimate beginning with Planning. This estimate is updated after programming, during preliminary design and may be updated during Final Design dependent on appraisals. Appraisals are considered more accurate than early estimates and if there is enough increase over the cost estimate the budget may be adjusted through communication with the Project Manager.
 - Additional elements in ROW estimate: permit costs, support costs
 - The number of parcels that will go to eminent domain proceedings are also estimated.
 - Most difficult: highest and best use, damages in partial takings.
 - Least difficult: relocation assistance program, demolition costs,
 - each district is responsible for tools and methods to estimate costs
 - A minimum of two estimates are prepared for a project: Planning and Preliminary Design.
 - Most difficult: damages, environmental mitigation
 - o there are many unknowns at the estimate level which aren't realized until the appraisal stage of the project
 - Least difficult: relocation costs
5. How does the DOT address potential environmental issues (e.g. hazardous materials, wetlands, etc.) in right-of-way cost estimates during each phase of project development?
- Environmental issues are addressed before a project can be programmed. This is especially the case for projects in the STIP.
 - There is a division in each district that handles environmental issues for the projects. It seemed that the environmental impacts are not specified until the preliminary design phase; therefore it is not captured in the planning phase estimate. There is a need for

environmental impacts to be identified earlier so that mitigation lands can be acquired if necessary and also included in the cost estimate.

- Impacts of possible hazardous materials on parcels are usually estimated by the ROW agent doing the estimate to the best of their ability based on the limited information at hand and other indicators.
6. How do you insure that estimates completed during each phase of project development reflect all elements of the required right-of-way (e.g. utility adjustments, land use, damages, improvements, relocation assistance, eminent domain proceedings, etc.)?
- The use of a cost data sheet which has an itemized list of costs that apply to the project. Also included in the data sheet is a list of questions pertaining to the ROW including assumptions and limitations. There is a section that summarizes types of parcels to be acquired and types of utility relocations.
 - Cost areas include:
 - o total acquisition cost (includes acquisition, excess lands, damages, and Goodwill (??))
 - o utility relocation
 - o relocation assistance
 - o clearance/demolition
 - o title and escrow
 - There is an example cost data sheet that is in the exhibits portion of Chapter 4 of the ROW manual.
 - The Marysville district uses an excel spreadsheet that has 3 parts to it and then is summarized by the cost data sheet similar to the one provided by the ROW manual, Ch. 4:
 - o Capital cost estimate which estimates the cost of acquisition by each parcel
 - includes the complexity of each parcel, damages, utilities, relocation costs, etc.
 - an escalation rate and contingency factor (usually 20 to 25%) is also applied to the estimate
 - each involved party signs off on their area of expertise within the cost estimate
 - o Support allocation request which estimates the cost in man-hours to complete the work on the cost estimate(s) and any updates required throughout the project. This is done by a standard WBS that denotes the level of all individuals that may be involved in the cost estimate.
 - o Timeline needed for acquisition which is the time necessary for all appraisals and acquisition beginning from the last map provided.
7. During each phase of project development, is risk considered in the right-of-way estimate? If so, how is risk quantified and applied to the cost estimate?
- there is no formal risk analysis done
 - Contingency of approximately 20-25% is applied to cover cost escalation.

- Contingency does not vary from estimate to estimate. It is usually applied by percentage to the aggregate project. There is no methodology for assigning this contingency amount, but early communication with land owners may increase the contingency amount being applied.

Estimate Reviews

8. Is a formal review conducted within the DOT at each phase of project development to verify the right-of-way estimate? If yes, go to 8a, otherwise go to 8b.

8a. Do the reviews follow a set of formalized and institutionalized procedures? Does the magnitude of right-of-way cost or right-of-way complexity trigger the review or additional reviews? Please identify these trigger values. What personnel outside of those responsible for preparing the estimate are involved in the review and approval of the estimate?

8b. How does your DOT verify a right-of-way estimate?

- The ROW data sheet has a place for a supervisor of ROW, Railroad, and Utilities to sign off on the estimate.
- The Deputy District Chief of ROW eventually signs off on the ROW estimate.
- Reviews are done on ROW appraisals, but there is not much of a review for cost estimates during early stages of project development.
- Following the completion of the ROW data sheet it is circulated to all parties involved in the cost estimate. Each of the parties must sign off that the portion of the estimate completed that affects their department is correct.

Estimate Communication

9. Is there a systematic program that is used to standardize right-of-way estimating procedures and train those responsible for assembling the estimates during each phase of project development? What formal mechanisms are used for capturing and transferring knowledge about right-of-way cost estimating techniques?

- No, there is no program in place to standardize estimating procedures and train estimators.
- There is not systematic program but training is facilitated by those individuals that have the most experience in ROW. The excel spreadsheet serves as a systematic tool that attempts to streamline the ROW estimation process; the general procedure used for cost estimation is outlined within the spreadsheet.

10. Is contact made with the property owners during each phase of project development? If so, what information is communicated to the property owners? Is there an effort to discover potential problems or possible excessive damages that are unforeseen or unknown to the acquiring agency through communication with land owners at this time?

- Formal contact is not made with property owners until the appraisal stage during final design.
- Public hearings during the Permits & Studies phase (Planning) take place according to state law.
- All the above confirmed by Marysville

Cost Estimating Management

11. Are differences in right-of-way cost estimates between each phase reconciled? If so, how is the reconciliation performed?

- At minimum, two estimates are completed (planning and preliminary design).
- The Planning cost estimate is updated during the Preliminary Design phase after a preferred alternative is chosen. The estimate is updated by review of the cost data sheet and supporting estimate information.
- All the above confirmed by Marysville. The planning estimate is reviewed based on market conditions, design details, improvements completed since planning estimate, etc.

12. What triggers an update of a right-of-way estimate during each phase of project development? Are estimates updated on a periodic basis, when major design changes occur, or through some other triggering mechanism?

- major changes in design trigger an update of the ROW estimate
- Review of cost estimates is completed once a year if time and work loads permit.
- At minimum, the planning estimate is updated during preliminary design when a preferred alternative is chosen and when any major design changes take place.

13. Is the right-of-way cost estimate updated based upon continuing experience throughout the acquisition process or at each phase of the project development process? For example, the cost of parcels which are acquired early in the acquisition process exceed the estimated values may indicate the same for the remainder of the parcels.

- an update occurs during preliminary design after a preferred alignment is selected
- yes, an update of the cost estimate (or budget) may occur during final design based on appraisal values if there are significant differences from the cost estimate
- All the above confirmed by Marysville

14. If project requirements change and there is a requirement for additional right-of-way, how are these changes and requirements communicated to the personnel responsible for right-of-way cost estimating and acquisition during each phase of project development? Please explain how these changes are implemented by the right-of-way officials?

- these changes are communicated through the project manager to ROW, but no formal process for communicating these changes were discussed in the interview

- All the above confirmed by Marysville

State Laws & Other Factors

15. Are there specific state laws or statutes that affect the ROW process during each phase of project development? If so, please identify such laws and describe each including background and effect on the ROW process.

- following the Kelo case decision by the Supreme Court, each land owner is allowed up to \$5000 reimbursement towards an independent appraisal. The Kelo case statute may be a source of delay in the acquisition process. Previously, it was easy to predict when a property's acquisition would be complete even if it would go to condemnation because there was a more systematic timeline associated.
- state dollars can not be spent towards ROW until environmental clearance has been obtained
- laws seem to favor property owners
- All the above confirmed by Marysville

16. Are there any other factors that affect the ROW process during each phase of project development (e.g. environmental, social, political; such parameters may apply to the whole state or a particular district or metropolitan area)? If so, please name these and describe each including background and effect on the ROW process.

- Environmental mitigation directly affects ROW. Lands may need to be purchased to replace wetlands or other environmentally sensitive lands that are destroyed by highway projects.
 - o A lot of emphasis was placed on environmental by Marysville. The need to know environmental impacts early in the ROW process so that mitigation lands can be included in the cost estimate is essential. Marysville is constantly trying to get numbers from the environmental group earlier.
 - o There are 2 options for environmental mitigation:
 - Purchase lands, develop land, and maintain perpetually
 - buy credits from others (this is preferred so that they do not have to develop and maintain the land)
- Political influences may affect how funds are prioritized for each project.
- Non-traditional project delivery methods, particularly Design Sequencing, make it more difficult to estimate ROW costs.

17. Do state laws allow for the use of acquisition techniques such as advanced acquisition, land consolidation, land exchange, incentives, or other non-standard techniques? If so, are these used and how effective are such techniques? Please include the particular phase of project development where these techniques are applicable.

- Advanced Acquisition is limited to hardships or protection buying.
- Some projects may meet certain conditions for early acquisition, but all public hearings must still take place and environmental documents must be circulated. This may be a

stretch due to the state law pertaining to spending state dollars only after environmental clearance has been obtained.

- not discussed with Marysville

Other notes:

- ROW capital costs and support costs are based on projects, but a lump sum is given to the districts by the CTC by fiscal year.
 - o This lump sum approach offers the districts some flexibility in spending funds. This is the case when a project is delayed, the districts may choose to spend the money allotted to that project on more pressing projects that were not actually programmed at the time budget was submitted to the CTC.
 - o The lump sum is favored over a project by project approach because of changes in design and construction. Lump sum avoids the adjustments required by project to project approach and also avoids further escalation of market values.
- Delays to projects include:
 - o environmental
 - o political
 - o community opposition
- Market values, even within the district, will vary from area to area.
- project managers have come to expect the cost escalation involved in ROW, but man-hours estimated to complete the cost estimates have become more crucial
- In order to know the estimating process and the market values across the district the job of cost estimator at the Marysville office is a full-time job that has no other responsibilities.
- Cost estimates are completed by market value. This differs from appraisals which may be done by the cost or income methods of valuation.
- ROW has a huge human factor involved with it. Regardless of the accuracy of your estimate, it is difficult to predict the property owner and what actions they may take and the resources they may have to back up those actions.

APPENDIX D

ROW FLOWCHART HANDOUT

(August 15, 2007 version)

Thank you for participating in the NCHRP 8-49 (Phase II) Research Project concerning procedures, methods, and tools to account cost escalation related to Right-of-Way. The main objective of NCHRP Project 8-49(II) is to:

Develop an all-inclusive set of ROW cost estimation and cost estimate management procedures based upon literature and current SHA practice, which integrates cost estimate steps documented in NCHRP Report 574 to support the right-of-way process.

To date, the research team has completed all nine interviews in all. This includes seven State highway agencies and two local public agencies. Following these interviews process flowcharts were created to synthesize ROW practices of these agencies. The flowcharts document the process steps, inputs, and outputs related to the ROW process throughout the project development process.

As defined by Phase I of NCHRP Project 8-49, the project development process consists of: Planning, Programming, Preliminary Design, Final Design, and Construction. Since Phase I established this general project timeline, the process flowcharts have been developed relative to these phases. These phases are outlined in Table 1, below.

Table 1: Development Phases and Activities (Anderson and Blaschke 2004¹; NCHRP 8-49, Phase I)

Development Phases	Typical Activities
Planning	Purpose and need; improvement or requirement studies; environmental considerations; right of way considerations; public involvement/participation; interagency conditions.
Programming	Environmental analysis; schematic development; public hearings; right of way impact; project economic feasibility and funding authorization.
Preliminary Design	Right of way development; environmental clearance; design criteria and parameters; surveys/utility locations/drainage; preliminary plans such as alternative selections; geometric alignments; bridge layouts.
Final Design	Right of way acquisitions; PS&E development – final pavement and bridge design, traffic control plans, utility drawings, hydraulics studies/drainage design, final cost estimates.

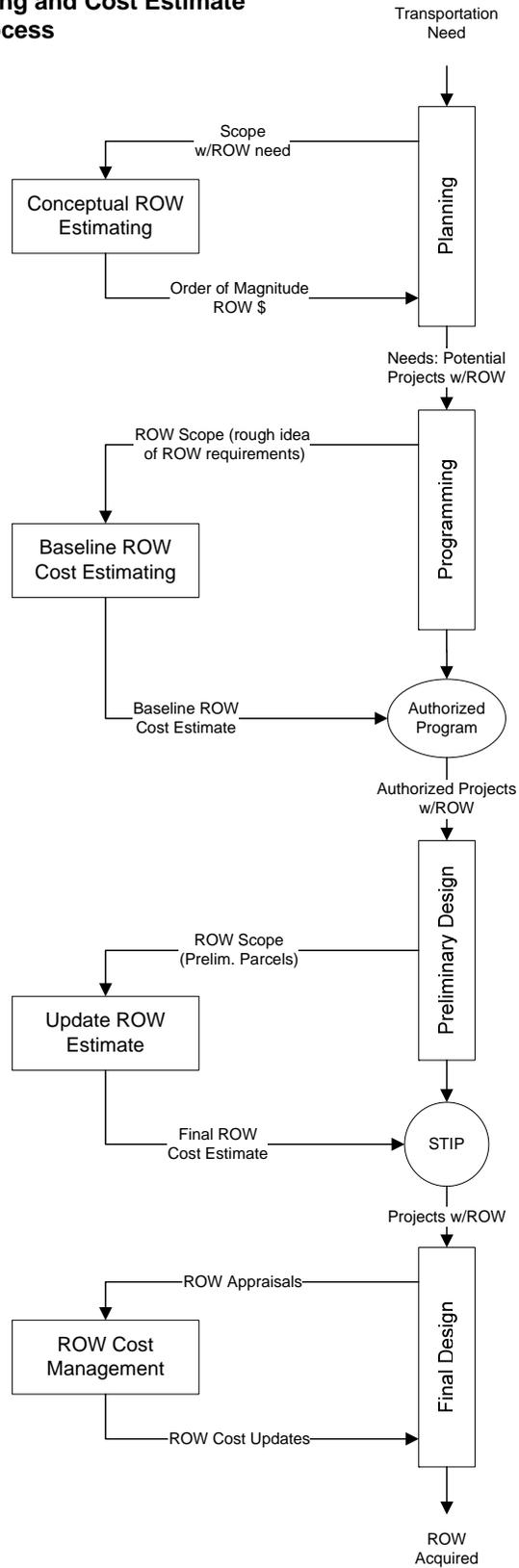
Five flowcharts have been developed which are attached below. The first outlines the process at the agency level. The following four diagrams document the ROW process at the four stages of project development shown above. Table 2 quickly outlines the ROW processes that occur during each of the phases.

Table 2: Development Phases and Purpose of each of the process flowcharts

Flowchart	Development Phases	Purpose
Agency Level ROW Process	All Phases	Display the overall ROW cost estimation and cost management process at the Agency Level
Conceptual ROW Cost Estimating	Planning	Estimate a ROW cost 10-20 years from the start of construction for planning purposes.
Baseline ROW Cost Estimating	Programming	Establish the Baseline ROW Cost Estimate
Update ROW Cost Estimating	Preliminary Design	Update the Baseline ROW Cost Estimate per changes/revisions since last cost estimate
ROW Cost Management	Final Design	Manage appraised values and actual acquisition costs versus the Update ROW Cost Estimate

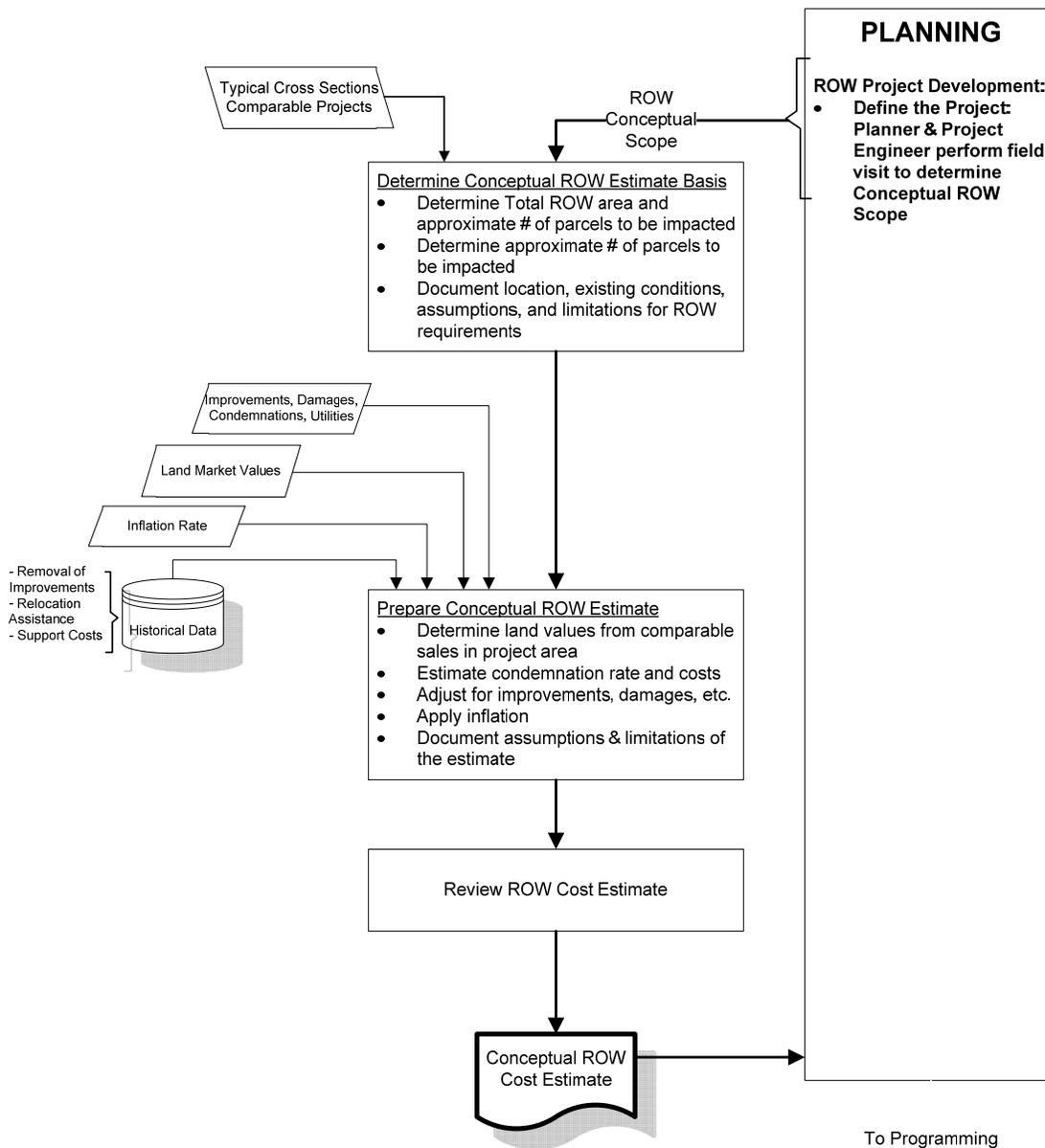
It is the intention of the research team to continue to develop these process flowcharts through validation and revisions by input provided by officials of each of the acquiring agencies interviewed. The research team would like to complete this through the method of a conference call which will last 30 to 45 minutes. Please review the enclosed ROW process flowcharts and be prepared to provide input on these flowcharts. Thank you, once again, for your time and contribution to this research.

Agency Level ROW Cost Estimating and Cost Estimate Management Process



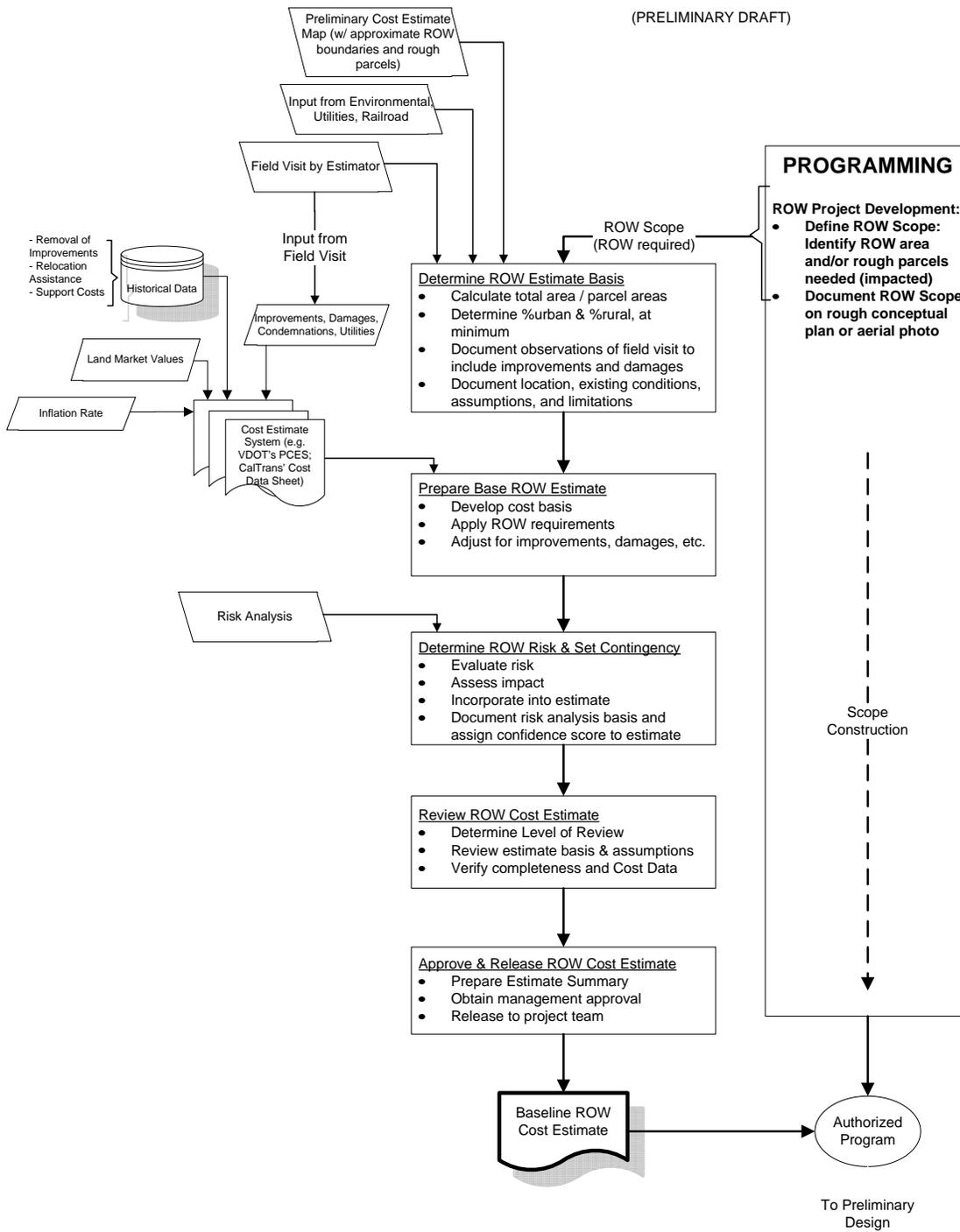
Conceptual ROW Cost Estimating

(PRELIMINARY DRAFT)



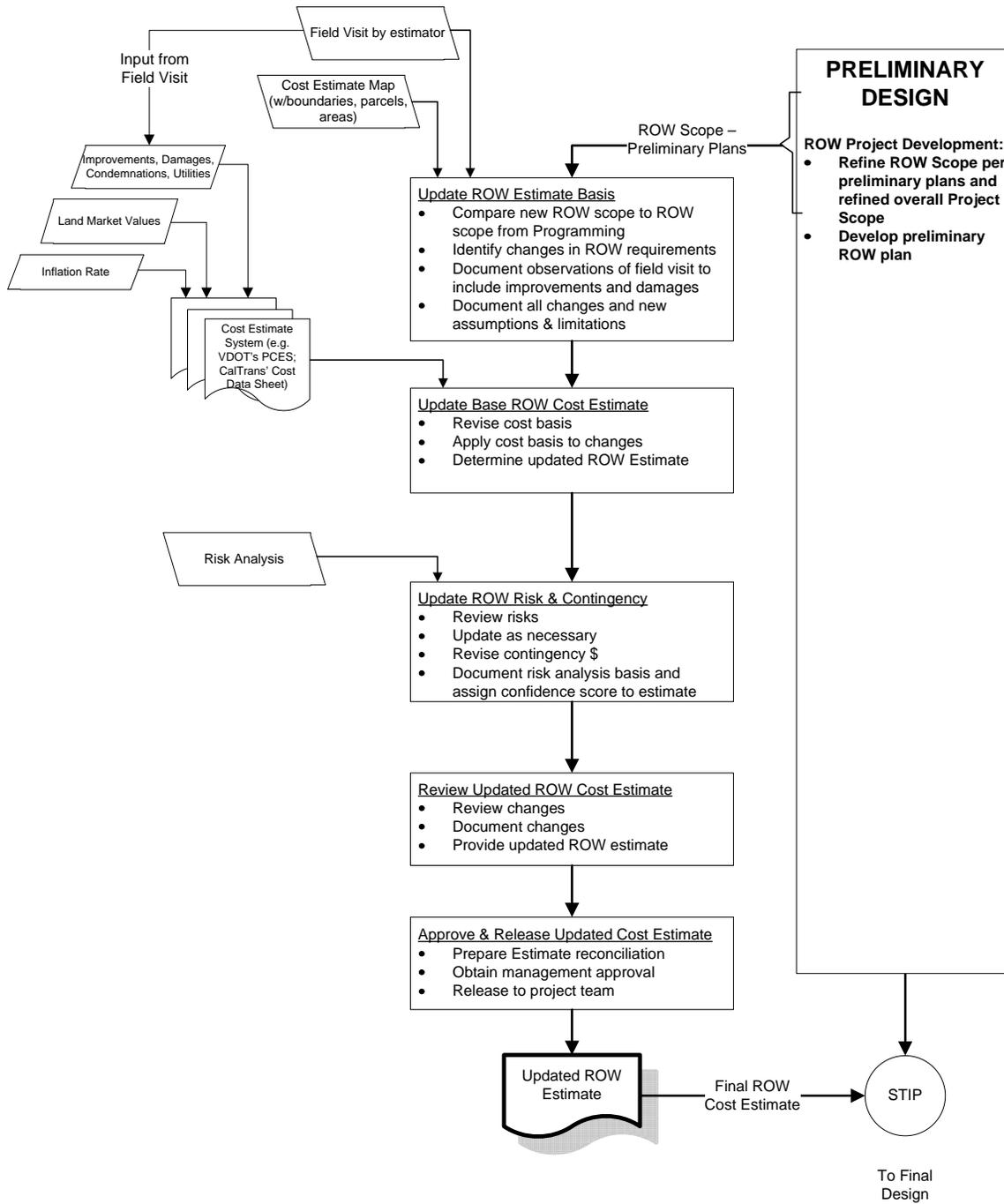
Baseline ROW Cost Estimating

(PRELIMINARY DRAFT)



Update ROW Cost Estimate

(PRELIMINARY DRAFT)



ROW Cost Management

(PRELIMINARY DRAFT)

