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16. Abstract
When planning and programming a transportation project for delivery to the traveling public, Districts have historically relied on little more than the experience of their Right-of-Way (R/W) staff to establish the durations of R/W acquisition and utility adjustment processes, and subsequently, the timing of project letting. This lack of an established methodology exposes the department to risk relating to economics and negative public opinion. Research Project 0-4617 has developed "the Right of Way and Utility Adjustment Process Duration Information (RUDI) Tool" with significant potential for improving the department's ability to forecast the date of R/W and utility adjustment clearance. In order to provide the department with a decision-making instrument for enhancing project development and delivery processes, RUDI's ease of use, utility in highway project planning, and accuracy were evaluated. In addition, the application methods of RUDI in project development and planning processes were documented and a RUDI training guide was developed for tool implementation and evaluation. Moreover, 42 key drivers that may affect durations of R/W acquisition and utility adjustment were identified and assessed in terms of importance. Suggestions and recommendations for further research into improvements of the RUDI system were also gathered.

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FINDINGS ON DETERMINING DURATIONS OF RIGHT-OF-WAY ACQUISITION AND UTILITY ADJUSTMENT ON HIGHWAY PROJECTS

James T. O'Connor
William O'Brien
Taehong Sohn
Marcelo Azambuja

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Center for Transportation Research
The University of Texas at Austin
3208 Red River
Austin, TX 78705

www.utexas.edu/research/ctr

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Project Engineer: James T. O'Connor
Professional Engineer License State and Number: Texas No. 64532
P. E. Designation: Research Supervisor

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Chapter 1. Introduction

1.1 Background and Motivation

Constructing highway projects demands effective coordination among all disciplines involved in such projects. These projects require securing the approval of federal, state, and private agencies. There are various pre-construction activities including planning and designing that should be completed prior to the start of the actual construction of highway projects. Right-of-way (R/W) acquisition and utility adjustment are among the preconstruction tasks that occur on a highway project. Such tasks have been considered to be sensitive issues by most state Departments of Transportation. The Texas Department of Transportation (TxDOT) is no exception.

TxDOT has focused on the successful completion of R/W acquisition and utility adjustment processes because these can help ensure the timely delivery of highway projects. Accurately forecasting the amount of time required for R/W acquisition and utility adjustment in the planning phase in particular has been considered one of the necessary skills of R/W districts in TxDOT. However, making such forecasts for these processes is challenging and complex because it requires a sophisticated understanding of the numerous conditions involved in a highway project. Therefore, most R/W districts in TxDOT have relied heavily on the experience of their staff. This reliance has meant that these districts have suffered from risk relating to negative public opinion and adverse economic effects caused by the inaccuracy of duration estimation.

In order to establish an effective methodology for predicting the duration of R/W acquisition and utility adjustment processes, Research Project 0-4617 was initiated by TxDOT and was undertaken from 2005 to 2006. One of the accomplishments of this research project is the Right-of-Way Acquisition and Utility Adjustment Process Duration Information (RUDI) tool. This tool assists in decision-making by enhancing the department's capability to predict the duration of R/W acquisition and utility adjustment processes in a given highway construction process. Application of RUDI still requires team members' understanding of the key factors that determine the duration needed for acquiring R/W and adjusting utilities in a highway project. For R/W acquisition, four key drivers were identified, and for utility adjustment, eight drivers were identified.

An implementation study is a key step in identifying any additional needs and recommendations for improving a tool. Because RUDI was developed to assist TxDOT R/W personnel in improving the planning and designing of highway projects, it is critical to provide its department members with adequate training. It is also necessary to beta-test the tool in order to better understand needs for future RUDI enhancements.

To meet these demands, TxDOT initiated an implementation research project to evaluate the RUDI tool. This project was undertaken by a research team at the Center for Transportation Research (CTR) at The University of Texas at Austin. The team comprised Dr. James T. O'Connor, a professor at The University of Texas at Austin, Dr. William O'Brien, an assistant professor at The University of Texas at Austin, and Taehong Sohn and Marcelo Azambuja, graduate research assistants in the Construction Engineering and Project Management (CEPM) program in the Department of Civil, Architectural, and Environmental Engineering. In addition, Mr. John Campbell, the director of the TxDOT R/W division, served as the Program

Coordinator, and Mr. Tommy Jones, the administrator of Abilene R/W district, served as the Implementation Director, following Larry Black's retirement from TxDOT.

1.2 Study Objectives

Improving the RUDI tool is the ultimate goal of this implementation study. Therefore, the study's primary objectives were to identify additional recommendations and improvements for the tool. The specific objectives are the following:

- Beta-test RUDI for its ease of use, utility in highway project planning, and accuracy;
- Document the methods by which the R/W district staff apply RUDI in project development and planning processes;
- Develop a RUDI training guide for tool implementation and evaluation purposes;
- Provide RUDI training and related information to selected TxDOT practitioners; and
- Provide suggestions for further research into improvements of the RUDI system.

1.3 Scope Limitations

A previous Research Project, 0-4617, identified six durations including five key milestones in the development of RUDI. This study was limited to these same durations and milestones. Based on these parameters, this study included a comprehensive analysis of key drivers of the durations required for TxDOT R/W acquisition and utility adjustment processes. For duration prediction exercises, the manual estimation strategy depending on personal judgments and the RUDI-based estimations were undertaken. For the study, a single R/W project selected from the Right-of-Way Information System (ROWIS) in TxDOT was utilized as a model project for the purpose of analyzing the RUDI tool. In addition, a limited number of experts on R/W acquisition or utility adjustment in TxDOT R/W districts participated in this investigation.

1.4 Structure of the Report

This report includes nine chapters. Following this introduction, Chapter 2 describes the implementation of the research methodology regarding the procedure used to conduct this study. Chapter 3 reviews the development of the RUDI tool and introduces selected screen shots of the RUDI tool. Chapter 4 presents the steps taken to collect data for this study. Chapter 5 presents the procedure of a RUDI training session conducted to provide the relevant information for study participants. Chapter 6 describes the completed and recommended improvements for the RUDI tool. Chapter 7 presents the impact of the RUDI tool on the accuracy of duration estimations for the R/W acquisition and utility adjustment processes. Chapter 8 presents the statistical analysis of the key duration drivers characterizing R/W acquisition and utility adjustment in highway projects. Finally, Chapter 9 describes the conclusions and recommendations of the study.

Chapter 2. Implementation Research Methodology

2.1 Overview of Implementation Research Methodology

This chapter presents the methodology used to accomplish the study's objectives. Figure 2.1 illustrates the research process of the implementation study. First, the scope of this implementation study was defined using the results of the previous study. Based on this scope, a literature review and a brief review of the RUDI tool were conducted. Second, a list of duration drivers was identified using expert opinion. Third, a Generic Project Description Form characterizing a model highway project was developed, and the research team provided RUDI training sessions to selected districts in TxDOT. Fourth, for data collection, an assessment of the importance of duration drivers and estimation of durations were performed. Simultaneously, improvements for RUDI were collected. Fifth, data analysis was conducted. Finally, conclusions were drawn and recommendations set forth. The sections that follow Figure 2.1 address the implementation research process in more detail.

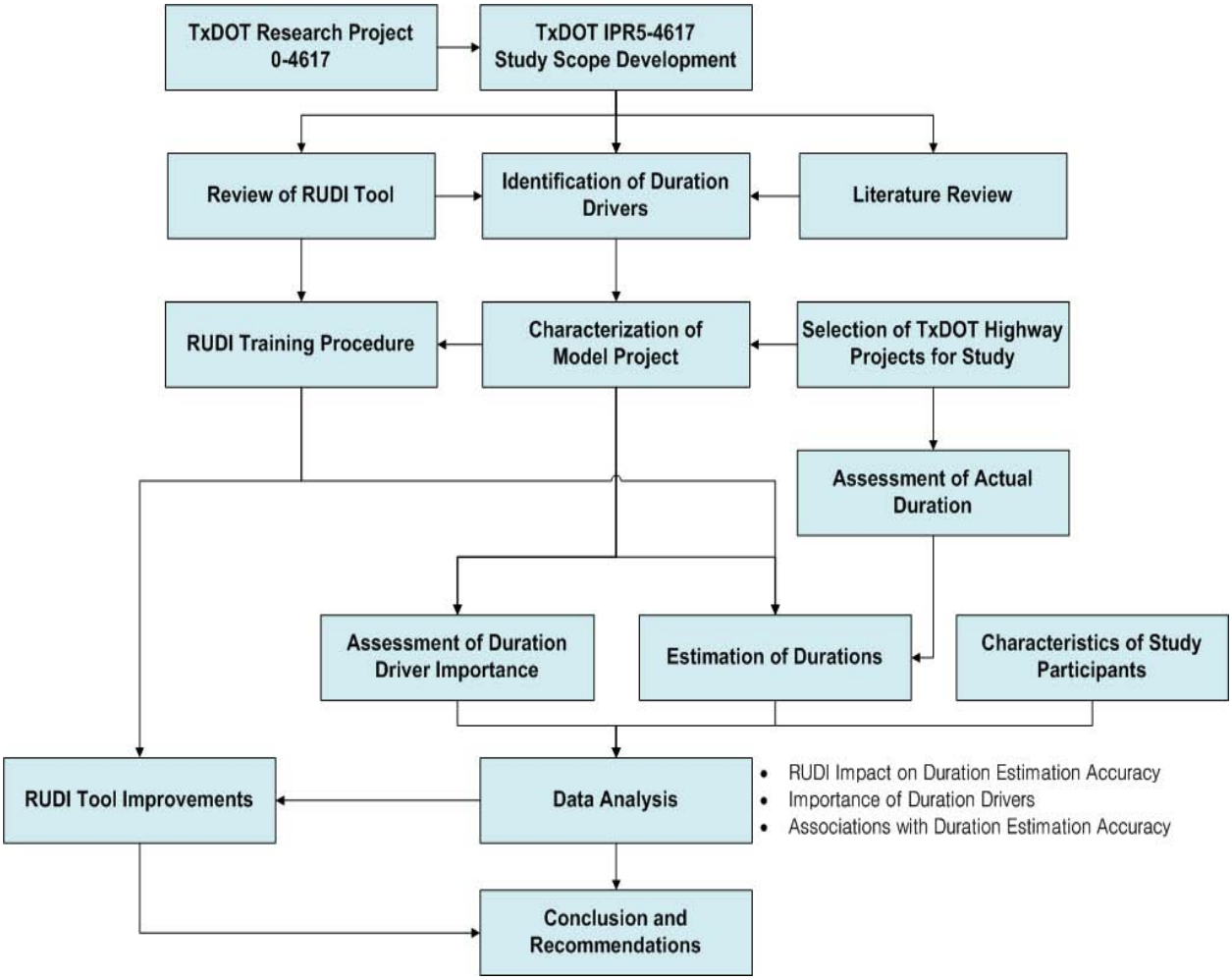

Figure 2.1: Overview of the Implementation Research Methodology

2.2 Review of the RUDI Tool

Key information about the RUDI tool was identified and used in the training sessions. A brief overview of the development of the RUDI tool was undertaken to provide TxDOT personnel with key information about it. In addition, selected screen shots of the improved RUDI tool were introduced to show its overall structure as well as its key components as described in Chapter 3.

2.3 Data Collection

The assessed data for this study were broken down into two categories: (1) the importance of duration drivers and (2) the estimation of a project's duration. These two types of data were collected by conducting RUDI workshops with TxDOT R/W district office staff. First, study participants were asked to assess the pre-application importance of duration drivers as illustrated in Figure 2.2. Second, their personal judgments regarding duration estimation were sought. After the non-RUDI-based duration estimation, the research team provided district staff with RUDI training, and the duration estimation using RUDI was conducted. Finally, study participants were asked to evaluate the post-application importance of the duration drivers. The detailed process of data collection is described in Chapter 4.

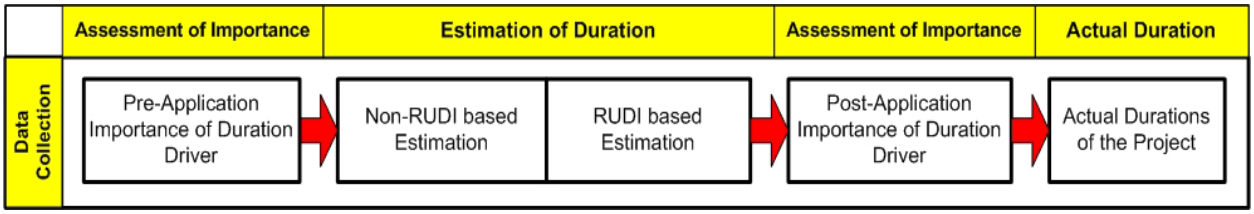

Figure 2.2: Overview of Data Collection

2.4 RUDI Training Procedure

After a one-hour presentation session for the RUDI tool had been conducted, study participants were asked to estimate durations of the model project selected from ROWIS based on the following steps: (1) Determine the degree of schedule urgency and uncertainty for the project; (2) Record the key drivers of the project on the Project Duration Record Forms embedded in RUDI; (3) Look up and document the durations provided by the RUDI tool; and (4) Analyze data and recommend the final durations for the project. The details of the RUDI training procedure are described in Chapter 5. In addition, the Project Duration Record Forms and the Percentile Range Matrix required for using RUDI are illustrated in Appendix B.

2.5 Tool Improvements

The study participants had opportunities to present their recommendations about and critiques of the RUDI tool. Those recommendations and critiques were divided into those involving short-term improvements and long-term ones to be taken into account in the development of the next version of RUDI. Short-term improvements were reflected in revising the previous version of RUDI, and a summary of long-term improvements is described in Chapter 6.

2.6 RUDI's Impact on the Duration Estimation Accuracy

A key objective of this study was to test the accuracy of RUDI. The approach used for testing the accuracy of RUDI was to compare the RUDI-based duration estimation and the non-RUDI-based duration estimation. Then, through a comparison, it was possible to see if the RUDI tool helped improve accuracies among estimators who otherwise rely on their personal judgments.

2.7 Lessons Learned about Determining Durations

The data analysis was divided into three sections: (1) The importance of duration drivers; (2) Associations between the importance of the drivers and the accuracy of their estimations; and (3) Relationships between the background factors of the experts and the accuracy of their duration estimations.

The analysis of the importance of duration drivers sought to identify which duration drivers are considered more important and less important in predicting the durations of R/W acquisition and utility adjustment processes. In addition, respondents' various perceptions of duration drivers were investigated based on different background factors such as area of expertise, years of experience, and district type. In analyzing associations among duration estimation accuracy, relationships between duration estimation accuracy and various personal backgrounds, the Chi-square test was used. The results of this step are summarized in Chapter 8.

2.8 Conclusions and Recommendations

Chapter 9 summarizes the conclusions of the study and recommendations on future research of the RUDI tool.

Chapter 3. Review of the RUDI Tool

3.1 Overview of RUDI Development

For R/W acquisition durations, the 0-4617 original research studied 45 projects selected from ROWIS with approximately 720 parcels. For the utility adjustment durations, 83 projects nominated by district officers were examined.

Key findings from the 0-4617 research project included the key durations for R/W acquisition and utility adjustment processes. The durations for R/W acquisition were divided into three key segments: R1, R2, and R3, which can be described as follows. R1 represents R/W Project Release to Initial Appraisal, R2 represents Initial Appraisal to Possession of Parcel, and R3 represents R/W Project Release to Possession of Parcel. For utility adjustment, there are also three segment durations which are divided in a similar way: U1, U2, and U3. U1 is defined as the duration from R/W Project Release to Final Project Utility Adjustment Agreement Execution. U2 represents Final Project Utility Adjustment Agreement Execution to Final Project Utility Adjustment Completion. U3 represents R/W Project Release to Final Project Utility Adjustment Completion.

There are four major factors for R/W acquisition and eight main factors for utility adjustment. For the R/W acquisition durations, "Number of Parcels," "Location Type," "District R/W Staff Size," and "District Annual R/W Budget" were identified. In contrast, the eight factors for utility adjustment included "TxDOT Highway Type," "TxDOT Project Type," "Utility Type," "Reimbursable or Non-Reimbursable," "LPA-Funded or Non-LPA-Funded," "Federally-Funded or Non-Federally-Funded," "Location Type," and "Quick or Slow." Cumulative plots and percentage tallies for each factor were developed. These plots and tables are included in RUDI. The following section describes major components of RUDI in more detail using selected screen shots of the improved RUDI tool.

3.2 Selected Screen Shots of the Improved RUDI

RUDI consists of six components, namely: advisory data (both R/W acquisition and utility adjustment durations), project duration record forms, an integrated process map, a key process milestone form, and the RUDI user guide. The user can access these components directly on the RUDI main interface page.

There are six primary buttons on this screen corresponding to each of the main components. In addition, there are two more buttons. The one in the bottom right corner allows the user to exit the system and the button beside it provides information about the research. The RUDI main interface is illustrated in Figure 3.1.

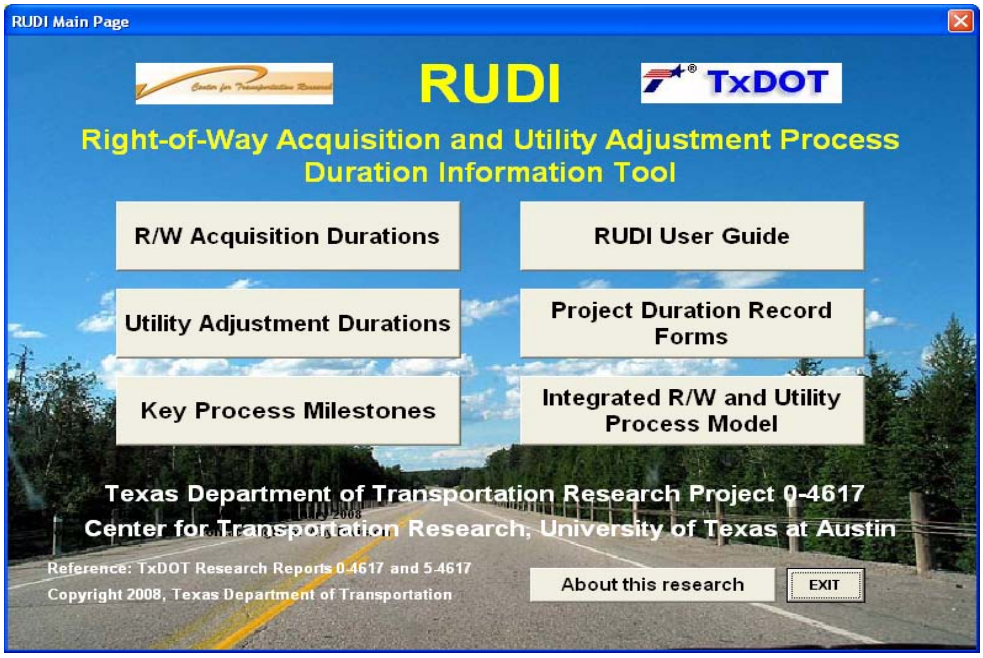

Figure 3.1: Main Interface of the Improved RUDI Tool

- **R/W Acquisition Durations**

The R/W Acquisition Durations button on the main interface takes the user to the R/W acquisition duration information. The R/W Acquisition Durations window displays three durations known as R1, R2, and R3, as described in Figure 3.2. R1, R2, and R3 correspond to various duration measurements in the R/W acquisition process as explained earlier. The user can use RUDI to find information about each of the durations that need to be estimated.

As depicted in Figure 3.3, by clicking on any duration button, the user will have access to another window showing the key factors for the chosen duration. The user will see a similar window when selecting the R2 or R3 duration. The user can use these key factors of each duration data set as a source for estimating the desired duration.

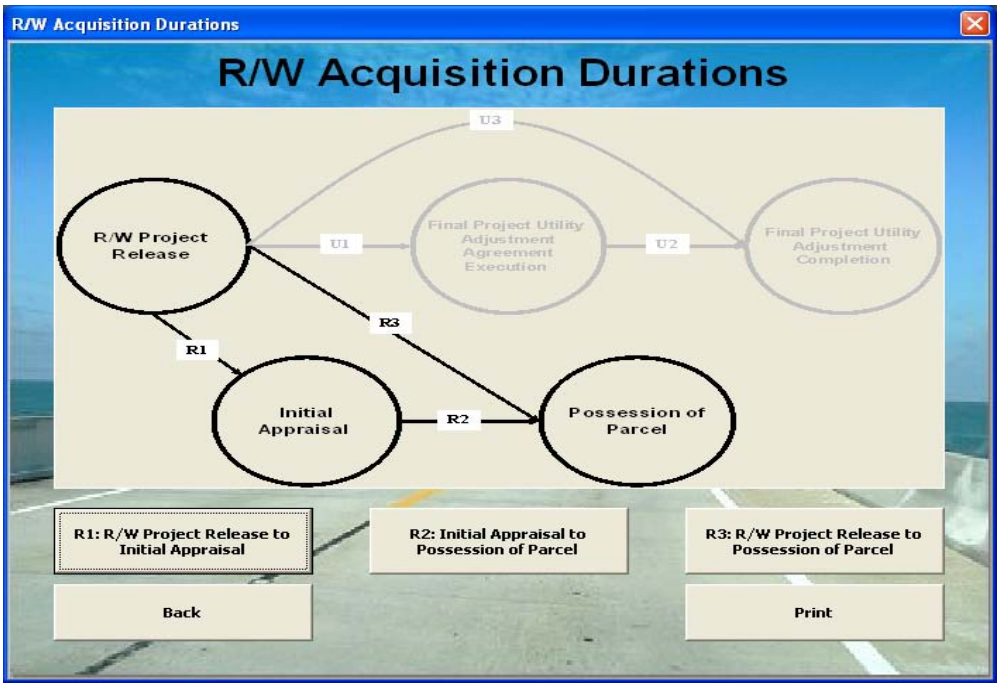

Figure 3.2: R/W Acquisition Process Durations

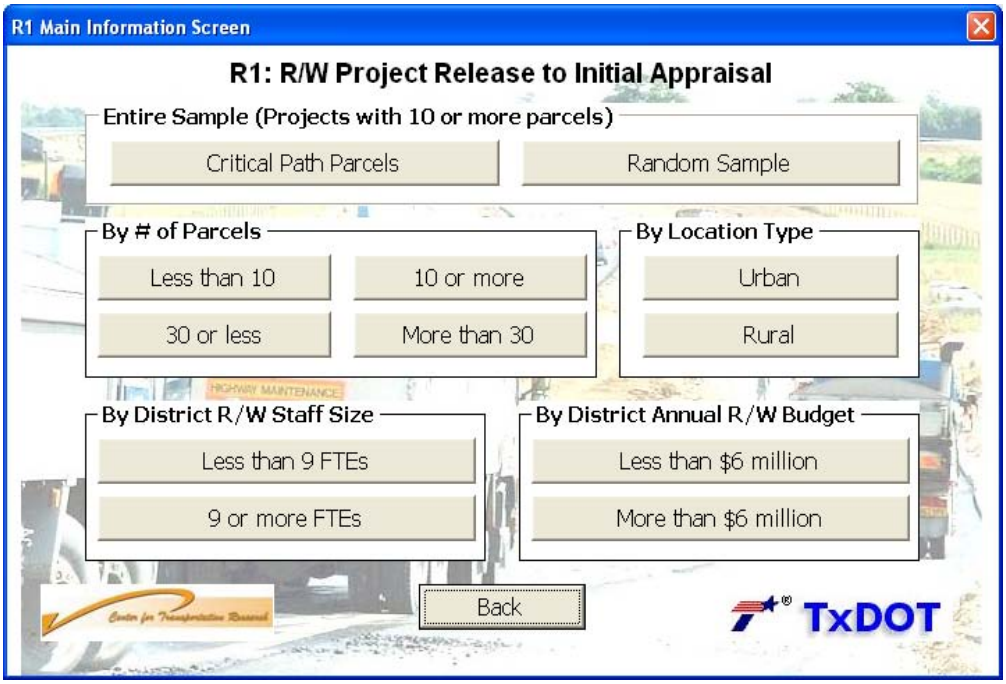

Figure 3.3: Key Duration Drivers of R/W Acquisition Process

- **Utility Adjustment Durations**

The Utility Adjustment Durations button on the main interface takes the user to the utility adjustment information. The Utility Adjustment Durations window is arranged like the R/W acquisition duration screen, as shown in Figure 3.4. As explained earlier, these durations include U1, U2, and U3.

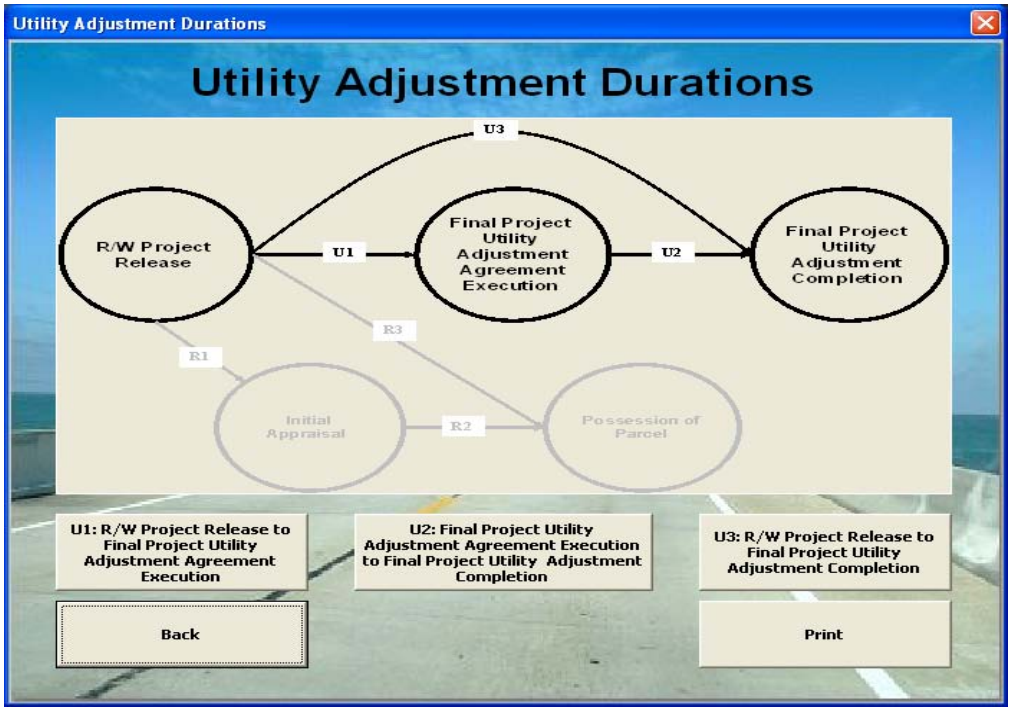

Figure 3.4: Utility Adjustment Process Durations

RUDI provides information about eight factors involved in the utility adjustment process. Figure 3.5 illustrates the window that is used to estimate the U2 duration. A similar window is presented for depicting the U1 and U3 duration factors. Similarly, users can choose the factors that are relevant to their projects. For example, if the project is not federally funded, the user can click on the "Non-Federally Funded" button to access information of interest for that kind of project, whether in either graphic or statistical format.

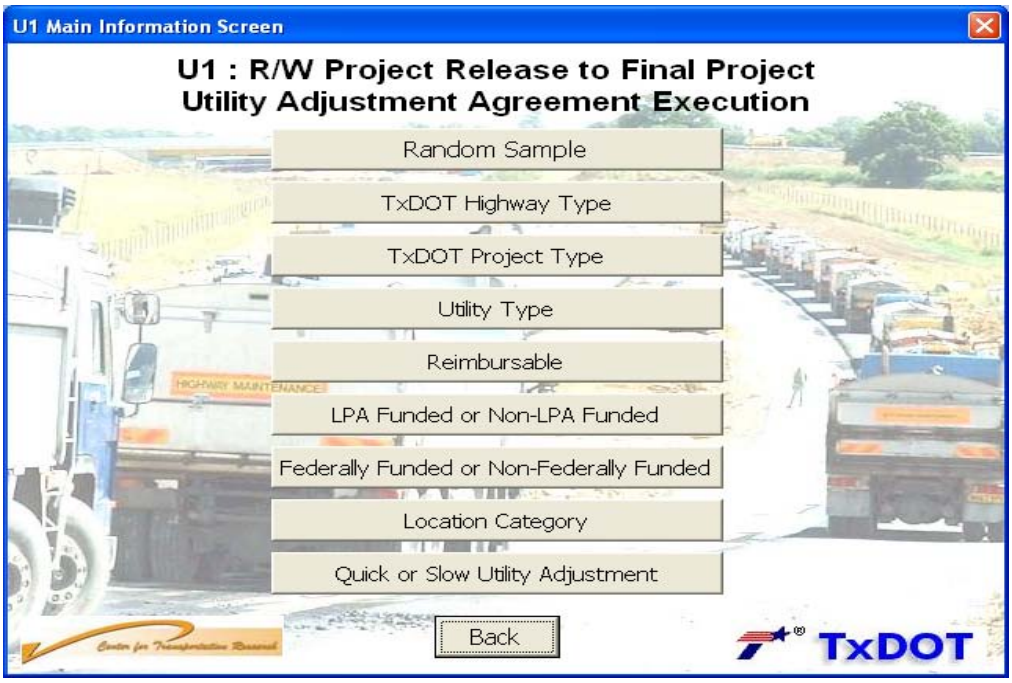

Figure 3.5: Key Duration Drivers of Utility Adjustment Process

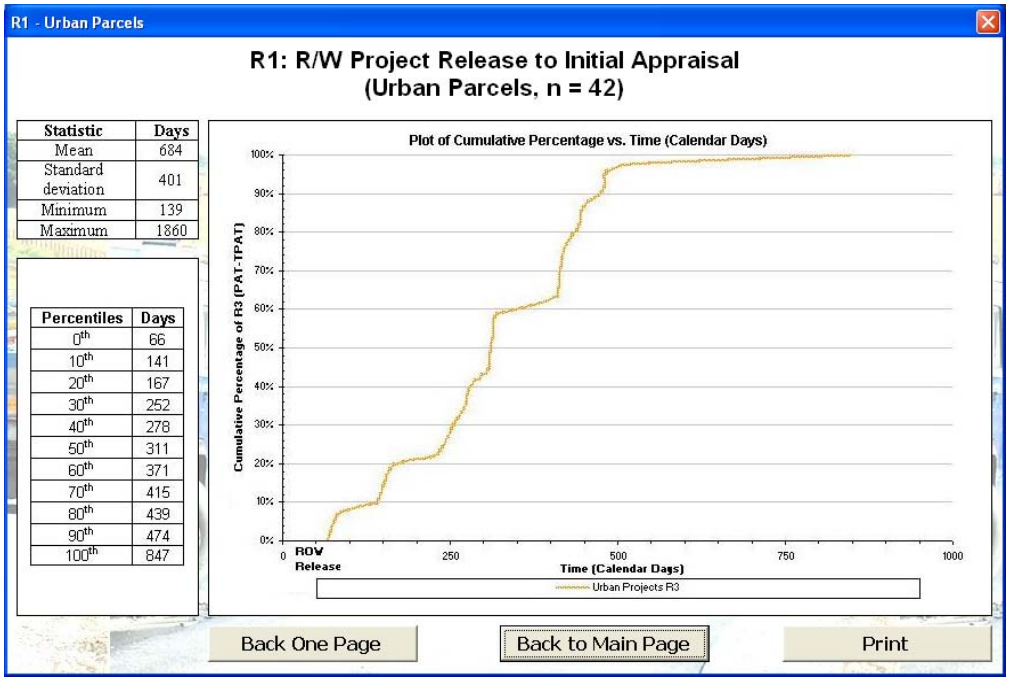

Figure 3.6: Output of the RUDI Tool

The user also has access to the duration data, which are presented in two different formats: graphical plots and statistical information, as depicted in Figure 3.6. Each graph is a plot presenting cumulative percentiles of project time (calendar days) for each of the durations in R/W acquisition. The descriptive statistics describe the plot information in detail. These data are presented in both a statistical summary table and a percentile table. The first table shows the mean, the standard deviation, and the minimum and maximum values of the past durations, while the second table shows the percentiles of these data.

- **Key Process Milestones**

The Key Process Milestones button takes the user to a plot of the process milestones that are the project's target dates for R/W acquisitions and utility adjustments, as described in Figure 3.7. This milestone information can help the user to understand what each duration means in this tool. Moreover, it is a tool that may serve to visualize the critical paths of the R/W and utility adjustment processes.

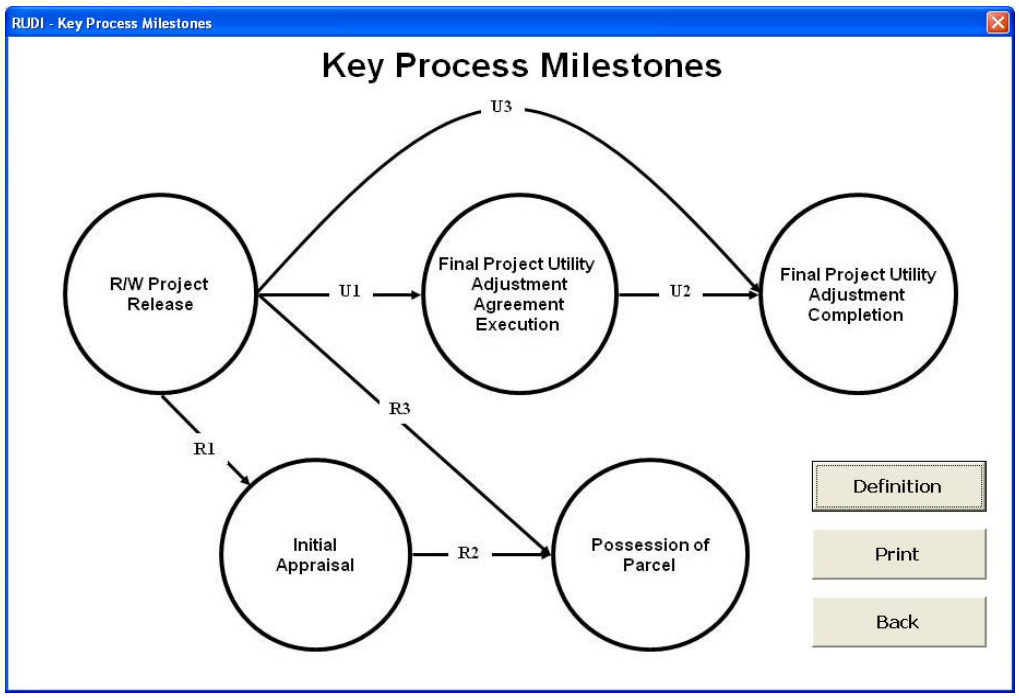

Figure 3.7: RUDI Key Process Milestones

- **Percentile Range Matrix**

A key decision for the user to make with RUDI involves selecting a percentile range. To help the user, a percentile range matrix developed by the research team is provided as a guide. The matrix provides the user with appropriate percentile ranges based on two variables: the degree of uncertainty and degree of schedule urgency.

Both variables have three categories that represent three levels of urgency and uncertainty: low, moderate and high. Schedule urgency is determined by the conditions affecting the project schedule and other duration factors. As shown in Figure 3.8, the higher the level of schedule urgency, the lower the recommended values of the percentile range. The uncertainty

levels are determined by factors that affect the R/W acquisition and utility adjustment durations. As presented in the matrix, the higher the degree of uncertainty, the higher the values of the percentile range. Whether to select schedule urgency or uncertainty is left to the user for the project in question. The Project Duration Record Forms button on the main interface page takes the user to this matrix.

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

Figure 3.8: Percentile Range Matrix

Chapter 4. Data Collection

4.1 Identification of Duration Drivers

Even though the key duration drivers in RUDI have strong associations with R/W acquisition and utility adjustment processes, these drivers cannot represent all duration drivers for these processes. Some factors related to these processes can be identified through analyzing organizational resources of R/W districts or better understanding stakeholders involved in projects. Therefore, it was a key step to investigate other characteristics of a highway project in order to identify other key drivers affecting the durations of R/W acquisition and utility adjustment. The research team conducted a comprehensive review of relevant literature and utilized expert opinion in order to identify these other key drivers. The identified duration drivers are categorized into three groups: (1) Project Basic Facts-related; (2) R/W Acquisition-related; and (3) Utility Adjustment-related.

As illustrated in Table 4.1, there are 18 duration drivers related to a project's basic facts. Specifically, drivers #1 to #3 present project or location types and #5 to #8 present the status of the preliminary design phase of highway projects. In addition, there are drivers for project funds (drivers #11 to #14) and conditions regarding R/W district (#8 and #9). Drivers #15 to #17 present external factors affecting both R/W acquisition and utility adjustment. These drivers were identified as common ones that may have an influence on the durations of both R/W acquisition and utility adjustment. In other words, theses drivers are often considered in forecasting both the durations of R/W acquisition and utility adjustment of a highway project.

For R/W acquisition-related drivers, 15 drivers were identified. These drivers can be divided into external and internal drivers because some information can be obtained through investigating external conditions of the project or district, while others are determined by the nature of the project itself. So, external drivers include #21, #26, #32, and #33 because information can be obtained as the project proceeds. Drivers #19, #20, #22, #23, #24, #25, #27, #28, #29, #30, and #31 can be considered internal drivers because information can be gathered about them before the project begins.

There are nine drivers for utility adjustments as illustrated in Table 4.1. All these drivers can be considered external drivers because specific information about them can be identified by checking the physical conditions surrounding a highway project and the TxDOT district.

Table 4.1: List of 42 Duration Drivers

Project Basic Facts-related Drivers	1. TxDOT Project Type 2. TxDOT Highway Type 3. Project Location Type 4. Right-of-Way and Utility Scope 5. Status of Schematic Design 6. Status of Boundary Surveying 7. Status of Environmental Clearance 8. Status of Right-of-Way Map 9. Internal R/W Staff Size of a District 10. District R/W Annual Budget	11. Dedication of Funds to the Project (R/W and Construction) 12. LPA Funded or Non-LPA Funded 13. Federally Funded or Non-Federally Funded 14. Funding Limitations for the Project 15. Level of Acceptance of the Project by the Public 16. Level of Political Pressure 17. Common Concerns of Property Owners 18. Current Status of the R/W Project
R/W Acquisition-related Drivers	19. Number of Parcels for Acquisition 20. Different Types of Parcel Usages 21. Frequency of Eminent Domain 22. Source of Personnel to be used for R/W Acquisition 23. Availability of District R/W Appraisers (District Staff and Outsourced) 24. Is Funding Available for Outsourcing Staff Assistance? 25. Type of Property Owners 26. Level of Familiarity with Key Landowners	27. Are There Any Property Tenants to Consider? 28. Need for Residential Relocation 29. Level of Local Availability of Replacement Housing Facilities 30. Need for Business Relocation 31. Level of Local Availability of Replacement Business Facilities 32. Likelihood of Title Curative Actions 33. Responsiveness of Local Title Companies to TxDOT
Utility Adjustment-related Drivers	34. Have SUE Investigations been performed? 35. Will SUE Investigations be performed? (If no or unknown in the driver #34) 36. Utility Type 37. Number of Utilities Located in Public R/W 38. Number of Utilities Located in Private Easement	39. Number of Utilities for Adjustments or Relocations 40. Is there any Utility Adjustment to be Included in the Highway Construction Contract? 41. Responsiveness of Utility Companies to TxDOT Needs 42. Adjustment is Reimbursable Utility or Non-Reimbursable Utility

All 42 duration drivers were assessed by R/W and utility experts in order to determine their levels of importance in duration estimation and to investigate their associations with duration estimation accuracy. Based on these drivers the research team developed a form that can be used to characterize a highway project. That form is described in the following section.

4.2 Development of Model Project Description Form

In order to effectively present the identified 42 duration drivers and make them more useful, the form depicted in Figure 4.1 was developed. This form is called a Model Project Description Form (MPDF). This form was designed to characterize an actual TxDOT project for non-RUDI-based and RUDI-based duration estimation practice. In addition, MPDF can be used by TxDOT project planners and R/W personnel in collecting information needed to understand R/W acquisitions and utility adjustments on a highway project. As illustrated in Figure 4.1, the form includes two columns for the title of drivers and their values. Each driver includes a possible list of values, which mean specific information on drivers. The full version of the form is described in Appendix D.

Project Basic Facts	
Driver	**Value**
1. ☐ TxDOT Project Type	☐ RER (Rehabilitation of Existing Road) ☐ UGN (Upgrade to Standards Non-Freeway) ☐ NNF (New Location Non-Freeway) ☐ INC (Interchange - New or Reconstructed) ☐ WF (Widen Freeway) ☐ WNF (Widen Non-Freeway) ☐ BR (Bridge Replacement) ☐ CNF (Convert Non-Freeway to Freeway) ☐ HES (Hazard Elimination/Safety) ☐ MSC (Miscellaneous) ☐ NLF (New Location Freeway) ☐ OV (Overlay) ☐ UPG (Upgrade to Standards ☐ BWR (Bridge Widening/Repair)
2. ☐ TxDOT Highway Type	☐ IH (Interstate) ☐ SH (State Highway) ☐ FM (Farm to Market road) ☐ CS (City Street) ☐ US (US highway) ☐ RM (Ranch to Market road)

Figure 4.1: Partial Model Project Description Form

4.3 Selection of TxDOT Highway Projects

For the data collection, three recently completed TxDOT highway projects were selected from the Right-of-Way Information System (ROWIS). Three projects were chosen based on estimated construction letting dates and differences among them in major characteristics such as project location, highway type, and numbers of parcels. The major characteristics of the selected projects are described in Table 4.2.

Table 4.2: Selected TxDOT Highway Projects for Study

Model Project	Major Characteristics				
	Project Location	Highway Type	Project Scope	# of Parcels	Utility Type
A	Metropolitan	Interstate Highway	R/W & Utility	10 to 30	Water and Gas
B	Rural	Farm to Market Road	R/W & Utility	More than 30	Waste water, & Gas
C	Rural	US Highway	R/W & Utility	More than 30	Oil and Pipelines

Figure 4.2 presents the actual durations of the six durations in R/W acquisition and utility adjustment for Project B. For R/W acquisition, the R1 and R2 took 34 days and 762 days respectively. The sum of these durations is R3, which is 796 days. Projects A and C have not been completed due to the lack of funding. Therefore, these projects were not included in the analysis of the study.

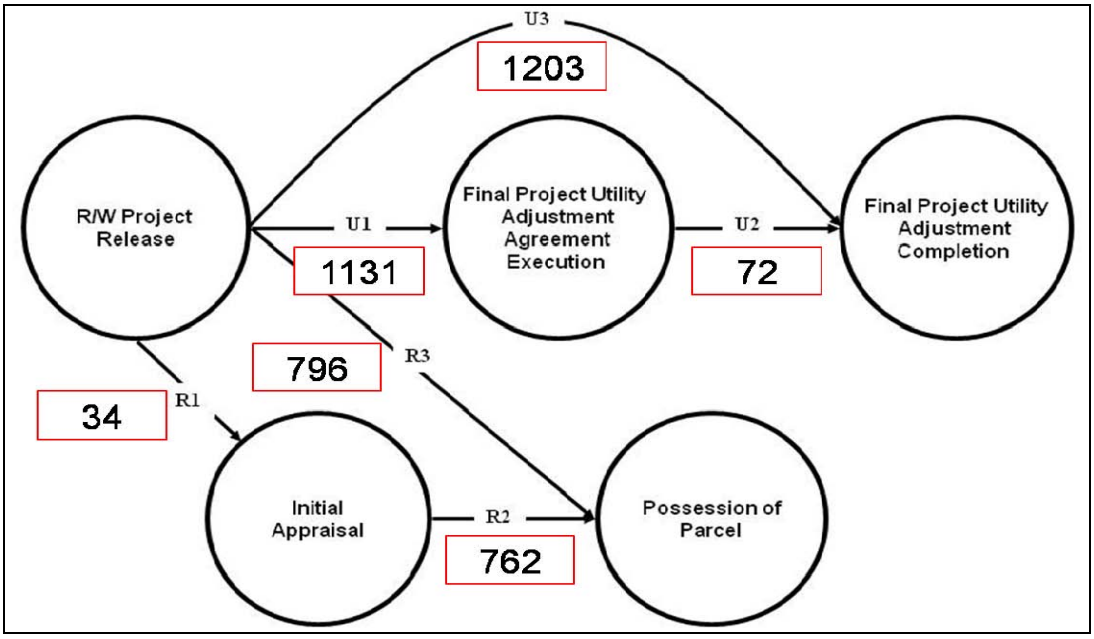

Figure 4.2: Actual Durations of Project B

4.4 Characteristics of Study Participants

For this study, the research team provided seven workshops including RUDI training sessions to participants from 17 districts in Texas. These districts included Abilene, Amarillo, Austin, Beaumont, Brownwood, Bryan, Childress, El Paso, Dallas, Fort Worth, Houston, Laredo, Lubbock, Lufkin, Paris, San Angelo, and Wichita Falls. As presented in Table 4.3, the total number of workshop attendees was 73; 43 out of the 73 experts provided data for analyzing the importance of the duration drivers and the duration estimation for Project B. Twenty-five out of 43 experts were working on R/W acquisition-related fields, and 18 experts were responsible for utility adjustments in their districts. Fifteen experts from urban or metropolitan districts (such as Austin, El Paso, Fort Worth, and Dallas districts) participated. In addition, 28 experts were from rural districts, such as Lubbock, Abilene, Paris, Childress, and so forth.

Table 4.3: Profile of Study Participants – Area of Expertise and District Type

Workshop	Workshop Attendees (n)	Study Participants (n)	Area of Expertise		District Type of Study Participants		
			R/W	Utility	Rural	Urban	Metropolitan
#1	7	6	5	1	6	0	0
#2	3	2	1	1	2	0	0
#3	9	8	5	3	3	5	0
#4	10	2	0	2	0	2	0
#5	8	5	3	2	0	0	5
#6	20	11	6	5	9	2	0
#7	16	9	5	4	8	1	0
Total	**73**	**43**	**25**	**18**	**28**	**10**	**5**

Experts' years of experience was used as one of the independent variables for data analysis. Therefore, it was necessary to profile the participants' experience. Table 4.4 offers a description of the experts' years of experience based on their areas of expertise. As described in Table 4.4, the average years the participants' experience were 16 and 11 for R/W acquisition and utility adjustment experts, respectively. Among the 43 experts, there were eight R/W ones with less than 13 years of experience and 17 R/W ones with more than 13 years of experience. Moreover, 13 out of 18 utility experts have less than 13 years of experience while 5 experts have more than 13 years of experience.

Table 4.4: Profile of Study Participants – Years of Experience

Workshop	Study Participants (n)	Area of Expertise		Mean (years)		R/W		Utility	
		R/W	Utility	R/W	Utility	<13 (years)	>13 (years)	<13 (years)	>13 (years)
#1	6	5	1	19.5	6.5	1	4	1	0
#2	2	1	1	15.0	13.0	0	1	0	1
#3	8	5	3	15.6	10.0	1	4	3	0
#4	2	0	2	0	2.0	0	0	1	1
#5	5	3	2	13.3	13.6	1	2	2	0
#6	11	6	5	16.5	12.5	4	2	4	1
#7	9	5	4	15.6	18.5	1	4	2	2
Total	**43**	**25**	**18**	**16**	**11**	**8**	**17**	**13**	**5**

Figure 4.3 is a scatter plot of the experts' years of experience. As presented in Figure 4.3, more than half of the study's participants have over 10 years of experience, though there are experts with less than 5 years of experience.

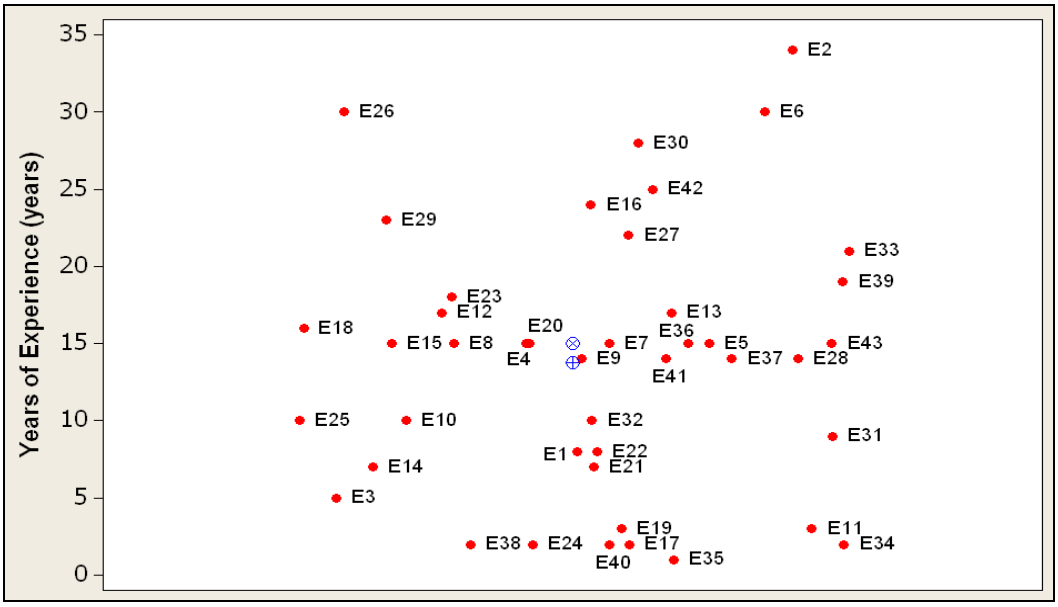

Figure 4.3: Scatter Plot of Study Participants' Years of Experience

Chapter 5. RUDI Training Procedure

5.1 RUDI Training Procedure

RUDI training sessions were provided after study participants had estimated the durations of Project B manually and assessed the importance of the drivers without having been given their project-specific values. Through a one-hour training session, the users learned about how to use the RUDI tool. The brief procedure is as follows:

- First, the user should print the Project Duration Record Form (Appendix C) that allows the user to record information as they use RUDI. The Project Duration Record Form then becomes part of the project documentation.
- Second, the user needs to characterize the project's parameters that the user is preparing for the duration estimation. More specifically, characterizing the project for R/W acquisition means that the user identifies the following items: number of parcels, location type, district R/W staff size, and district annual R/W budget for R/W acquisition. For utility adjustment, the following items need to be identified: TxDOT highway type, TxDOT project type, utility type, reimbursable or non-reimbursable, LPA-funded or non-LPA-funded, federally funded or non-federally funded, location type, and adjustment speed.
- Third, the user also needs to judge both the project's degree of schedule urgency and degree of uncertainty. These judgments are mostly based on the user's experience with and evaluation of previous TxDOT projects' performance. These degrees should be expressed as percentile ranges.
- Fourth, after the selection of the percentile range, the user needs to find more detailed information for each of the three durations: R1, R2, and R3. The user has access to the duration data, which are presented in two different formats: graphical plots and statistical information. Each graph is a plot presenting cumulative percentile versus time (calendar days) for a certain duration. The user needs to record durations for each driver.
- As a final procedure, the user should select the most reasonable duration within the range obtained from completing the duration record forms. This selection depends considerably on personal judgment based on the user's knowledge of previous projects.

5.2 Project Duration Record Forms

The Project Duration Record Forms embedded in the RUDI tool consist of the following documents:

- A form for recording the project title, its current status, any unusual circumstances, and so on.
- A duration record form for the R/W acquisition process

- A duration record form for the utility adjustment process
- A form of key process milestones
- A form for recording the final recommended duration and a justification for the recommendation

Table 5.1 partially depicts the form for recording R/W acquisition durations. Users can gain access to the full duration record forms by clicking a button on the main interface of RUDI. The full version of this form is described in Appendix C.

Table 5.1: Partial RUDI Project Duration Record Form

			R1				R2			
			From R/W Project Release To Initial Appraisal				From Initial Appraisal To Possession of Parcel			
			Degree of Schedule Urgency L □ M □ H □				Degree of Schedule Urgency L □ M □ H □			
			Degree of Uncertainty L □ M □ H □				Degree of Uncertainty L □ M □ H □			
			Percentiles		Duration		Percentiles		Duration	
			Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	□								
	10 or greater	□								
	30 or less	□								
	More than 30	□								

5.3 Assessing Uncertainty and Schedule Urgency

In order to select reasonable percentile ranges from the percentile range matrix, users need to assess the degree of schedule urgency and uncertainty of a project. Users should take a close look at the list of 42 duration drivers and consider other factors to determine the degree of schedule uncertainty and urgency. The drivers suggested by the research team are as follows, divided into two lists. The first is of the drivers affecting uncertainty, while the second includes those affecting schedule urgency.

- Uncertainty drivers:
  - Project funding limitations (relative to cost)
  - Project scope
  - Familiarity with local landowners

- Knowledge of existing utility facilities
- Level of cooperation between DOT and local utilities
- Property title-related uncertainties

- Schedule Urgency drivers:
  - Level of political pressure
  - Relative highway user costs involving traffic delays
  - Level of district R/W support resources available
  - Contact letting pressure

5.4 Recommended Percentile Ranges

One of the outcomes from this implementation study was the development of a Percentile Range Matrix. As described in Table 5.2, the degree of uncertainty or schedule urgency is divided into three groups: (1) Low; (2) Moderate; and (3) High. Users can select one percentile range for R/W acquisition and utility adjustment or choose two different percentile ranges for each process. However, users should rely on their own personal judgments when they select these ranges. Because personal judgment plays a role in percentile selection, differences among experts can cause variability in the estimated durations of the recommended percentile ranges.

Table 5.2: Percentile Range Matrix

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

Chapter 6. RUDI Tool Improvements

6.1 Completed Improvements

This section summarizes a list of improvements for RUDI that have been completed. During the RUDI training sessions, study participants had opportunities to present various recommendations and critiques regarding the RUDI tool. Based on the recommendations, the following improvements were made.

- Developed a self-performing PowerPoint-formatted module for briefing about RUDI to help users understand the tool
- Replaced the screen background for increasing the readability of the interface
- Replaced the previous documents with the newest documents, including the following:
  - A user guide
  - Project Duration Record Forms
- Added the webpage providing definitions of the key process milestones
- Added the webpage including a RUDI glossary (as an appendix in RUDI user guide)
- Reorganized the R1 and R3 durations for consistency with the utility adjustment durations
- Calibrated the definitions of the six key durations:
  - R1: R/W Project Release to Initial Appraisal
  - R2: Initial Appraisal to Possession of Parcel
  - R3: R/W Project Release to Possession of Parcel
  - U1: R/W Project Release to Final Project Utility Agreement Execution
  - U2: Final Project Utility Agreement Execution to Final Project Utility Adjustment Completion
  - U3: R/W Project Release to Final Project Utility Adjustment Completion
- Eliminated unused “Exit” buttons
- Adjusted the size of the tables and figures in RUDI

6.2 Improvements for the Next Version

The following comments include suggested improvements that need to be completed for future RUDI system development. Most of these improvements can be characterized as long-term goals of studies following this implementation research study.

- Collect data from recent and actual projects and add them to the RUDI database. This data should include the following:
  - Collect Right-of-Way (R/W) acquisition data mainly from urban and metropolitan districts because RUDI currently presents more information regarding rural projects.

- Collect data on utility adjustment data.

- Collect data related to highly important variables used in estimates: RUDI presents the user with few important variables to guide their estimate (e.g., number of parcels, location, and district annual budget for R/W durations). Even though these variables are important, this study has shown that users consider many other variables when estimating durations. Data about such variables should be included in the future, because some of them seem to play a very important role in the duration estimation process (e.g., eminent domain and environmental analysis).
- Include highways projects with unusual circumstances like a large number of parcels (more than 100 parcels) or railroads. Data about highway projects with these unusual conditions can be useful in improving the RUDI tool for better duration estimations.
- Enable RUDI to consider two or more duration factors at the same time: currently RUDI displays the data concerning one variable at a time.
  - Users can only display right-of-way durations by selecting the number of parcels or any of the other variables. Instead, RUDI should allow users to select multiple variables at the same time to provide them with a more precise match of data according to their project characteristics. For example, RUDI should allow users to select both the number of parcels and the project's location simultaneously.
- Analyze similar TxDOT projects: the inclusion of a function allowing parallel analysis would enable users to search and filter data that are similar to their projects. If they had the specific information about their project characteristics, users could find a sample of other past and current projects with characteristics that match those of their own project. RUDI would become a database where all knowledge about durations is stored in the same place and where such knowledge could be quickly recovered.
- Real time analysis of ROWIS: TxDOT already documents much of the needed data in ROWIS. In the future, some of these data could be integrated with a dynamic database or tool enabling users to have real time access to projects durations. This effort would require developing the database and then keeping it updated on a weekly or monthly basis, but if done well the benefits for the estimation process would be invaluable.

Chapter 7. RUDI's Impact on the Duration Estimation Accuracy

7.1 Accuracy of Estimators

As mentioned in the introductory section of this report, one of the objectives of this implementation study was to test the accuracy of the RUDI tool for improvements. This objective was achieved by comparing accuracies of both the non-RUDI-based and RUDI-based duration estimations. Moreover, this comparison was used to see if the amount RUDI improved the accuracy of duration estimation depended upon experts' personal judgments. The results of this comparative analysis are described in the following sections.

The following figure illustrates the categorization of estimators based on their estimates' accuracy. As illustrated in Figure 7.1, quartile rankings in a boxplot were utilized as a fundamental differentiator. Boxplots in statistical analysis are useful in presenting the range and the quartile of the data as well as in identifying some outliers because they allow one to quickly process the information. The central portion of boxplots consists of 50 percent of the data, from the highest range of the first quartile (25^{th} percentile) to the highest range of the third quartile (75^{th} percentile). This portion is called the interquartile range (IQR). Based on this concept, boxplots using differences between actual durations and estimated durations for R/W acquisition and utility adjustment were produced. Estimators with differences in the first quartile range were defined as "More Accurate" estimators. Moderate accuracy was designated for the estimators with differences in percentile 50 of the interquartile range. Finally, estimators with differences in the third quartile range were considered to be less accurate. This determination concept was utilized only for R2 and R3 as well as U1 and U3. The reason for not considering R1 and U2 was that these durations are the shortest ones in R/W acquisition and utility adjustment. Therefore, these durations' impacts on the accuracy of duration estimation were disregarded.

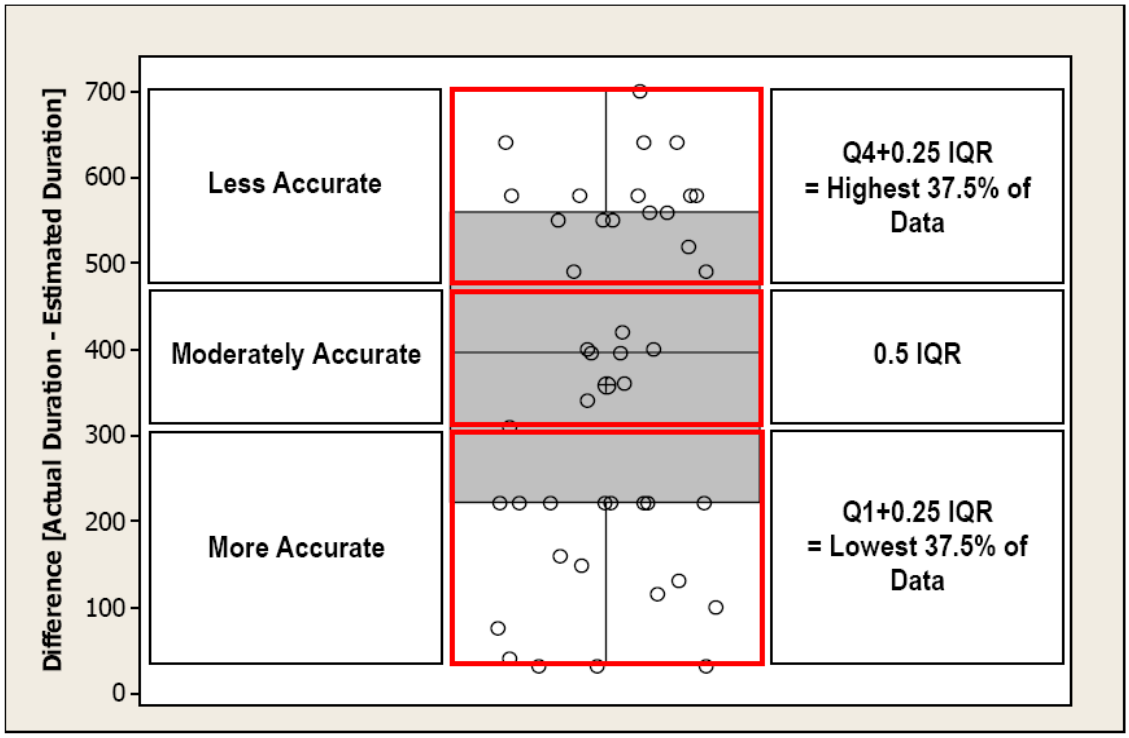

Figure 7.1: Determination of Duration Estimation Accuracy

7.2 Accuracy of Non-RUDI-based Duration Estimation

Table 7.1 describes the accuracy of the non-RUDI-based estimation of R2 (from Initial Appraisal to Possession of Parcel) and R3 (from R/W Project Release to Possession of Parcel) durations in the R/W acquisition process. The sample size was 43, which includes all the respondents in this study. As illustrated by Table 7.1, for R2, there are 18 More Accurate and 17 Less Accurate estimators. For R3, 19 More Accurate and 16 Less Accurate estimators were identified. However, only 14 estimators showed consistent accuracies that could be called More Accurate in predicting durations of R2 and R3. In addition, there were 12 estimators who were considered Less Accurate in both R2 and R3. The remaining 15 estimators did not predict numbers with an equal level of accuracy in these two durations.

Table 7.1: Accuracy of Non-RUDI-based Duration Estimation – R/W Acquisition

# of Estimator	Right-of-Way Acquisition (n=43)		# of Estimator	Right-of-Way Acquisition (n=43)	
	R2	R3		R2	R3
Estimator #1	Less	Less	Estimator #23	More	More
Estimator #2	Moderate	Less	Estimator #24	Less	Less
Estimator #3	More	More	Estimator #25	Less	Moderate
Estimator #4	More	More	Estimator #26	More	More
Estimator #5	More	More	Estimator #27	More	More
Estimator #6	Less	More	Estimator #28	More	More
Estimator #7	Moderate	Less	Estimator #29	Moderate	More
Estimator #8	More	More	Estimator #30	Less	Less
Estimator #9	Less	Less	Estimator #31	Moderate	Less
Estimator #10	Less	Less	Estimator #32	Less	Less
Estimator #11	Less	Moderate	Estimator #33	Less	Less
Estimator #12	More	More	Estimator #34	More	More
Estimator #13	Less	Moderate	Estimator #35	Less	Less
Estimator #14	Moderate	Less	Estimator #36	More	Moderate
Estimator #15	Less	Less	Estimator #37	Less	Less
Estimator #16	Moderate	More	Estimator #38	Less	Less
Estimator #17	More	Moderate	Estimator #39	More	More
Estimator #18	More	More	Estimator #40	Less	More
Estimator #19	More	Moderate	Estimator #41	Less	Less
Estimator #20	More	More	Estimator #42	Moderate	More
Estimator #21	More	Moderate	Estimator #43	Moderate	Moderate
Estimator #22	More	More			

Table 7.2 illustrates the accuracy of the non-RUDI-based duration estimation of utility adjustment process. There were 19 and 17 estimators categorized as More Accurate for U1 (R/W Project Release to Final Project Utility Adjustment Agreement Execution) and U3 (from R/W Project Release to Final Project Utility Adjustment Completion), respectively. Conversely, there were 16 Less Accurate estimators for both U1 and U3. When considering More Accurate estimators for U1 and U3, 14 respondents presented consistent accuracy for both U1 and U3. In addition, there were 11 Less Accurate estimators for both U1 and U3. The remaining 18 estimators were considered Moderately Accurate estimators because of their inconsistent displays of accuracy.

Table 7.2: Accuracy of Non-RUDI-based Duration Estimation – Utility Adjustment Process

# of Estimator	Utility Adjustment (n=43)		# of Estimator	Utility Adjustment (n=43)	
	U1	U3		U1	U3
Estimator #1	Less	Less	Estimator #23	More	More
Estimator #2	More	Less	Estimator #24	Less	Less
Estimator #3	More	Moderate	Estimator #25	More	Moderate
Estimator #4	Moderate	Moderate	Estimator #26	More	Moderate
Estimator #5	Less	More	Estimator #27	Moderate	More
Estimator #6	More	Less	Estimator #28	Less	More
Estimator #7	Less	Less	Estimator #29	Less	Moderate
Estimator #8	Moderate	Moderate	Estimator #30	Less	Less
Estimator #9	Less	Less	Estimator #31	Less	Less
Estimator #10	Less	Moderate	Estimator #32	More	More
Estimator #11	Less	Moderate	Estimator #33	More	More
Estimator #12	Moderate	Moderate	Estimator #34	More	More
Estimator #13	Moderate	Less	Estimator #35	More	More
Estimator #14	Moderate	Less	Estimator #36	More	More
Estimator #15	Less	Less	Estimator #37	More	More
Estimator #16	More	More	Estimator #38	Less	Less
Estimator #17	More	More	Estimator #39	Less	Less
Estimator #18	More	More	Estimator #40	Less	Less
Estimator #19	More	More	Estimator #41	More	More
Estimator #20	Moderate	Less	Estimator #42	More	More
Estimator #21	Less	Less	Estimator #43	Moderate	Moderate
Estimator #22	More	More			

7.3 Accuracy of RUDI-based Duration Estimation

This section describes the accuracy of RUDI-based duration estimation for R/W acquisition and utility adjustment. The same study participants reported on earlier were asked to estimate the six durations in R/W acquisition and utility adjustment of Project B using the RUDI tool. Using the concept addressed earlier, the durations for R2 and R3 were analyzed.

As illustrated in Table 7.3, there were 16 More Accurate estimators for R2 or R3 when using RUDI as compared to not, respectively. For Less Accurate estimators, 17 experts were identified for both R2 and R3. However, there were only 10 estimators in the More Accurate

category in boxplots of *both* R2 and R3. In contrast, 13 Less Accurate estimators were identified for both R/W durations.

Table 7.3: Accuracy of RUDI-based Duration Estimation – R/W Acquisition Process

# of Estimator	Right-of-Way Acquisition (n=43)		# of Estimator	Right-of-Way Acquisition (n=43)	
	R2	R3		R2	R3
Estimator #1	Less	Less	Estimator #23	Moderate	Less
Estimator #2	Less	Less	Estimator #24	More	Moderate
Estimator #3	More	More	Estimator #25	Moderate	Moderate
Estimator #4	More	More	Estimator #26	More	Moderate
Estimator #5	More	More	Estimator #27	More	More
Estimator #6	Less	Moderate	Estimator #28	Moderate	Moderate
Estimator #7	Less	Less	Estimator #29	More	Less
Estimator #8	More	Less	Estimator #30	More	More
Estimator #9	Less	Less	Estimator #31	More	More
Estimator #10	Less	Less	Estimator #32	Moderate	More
Estimator #11	More	Moderate	Estimator #33	More	More
Estimator #12	Moderate	More	Estimator #34	Moderate	Moderate
Estimator #13	More	Moderate	Estimator #35	More	More
Estimator #14	Less	More	Estimator #36	Less	Less
Estimator #15	Less	Less	Estimator #37	Less	Less
Estimator #16	Less	Less	Estimator #38	Less	Less
Estimator #17	Less	Moderate	Estimator #39	More	More
Estimator #18	Less	Less	Estimator #40	Moderate	Less
Estimator #19	Moderate	More	Estimator #41	Less	Less
Estimator #20	Moderate	More	Estimator #42	Less	Less
Estimator #21	More	Moderate	Estimator #43	More	More
Estimator #22	Less	More			

As depicted in Table7.4, there were 17 and 18 More Accurate estimators in U1 and U3, respectively. In addition, 16 out of 43 estimators were identified as Less Accurate estimators in U1 and U3, respectively. When considering accuracy in both U1 and U3, 14 More Accurate estimators and 13 Less Accurate estimators were identified. The remaining 16 were Moderately Accurate estimators who did not show a consistent level of accuracy in duration estimation in both U1 and U3.

Table 7.4: Accuracy of RUDI-based Duration Estimation – Utility Adjustment Process

# of Estimator	Utility Adjustment (n=43)		# of Estimator	Utility Adjustment (n=43)	
	U1	U3		U1	U3
Estimator #1	More	More	Estimator #23	Less	Less
Estimator #2	Less	Less	Estimator #24	More	More
Estimator #3	More	More	Estimator #25	More	Moderate
Estimator #4	More	More	Estimator #26	More	More
Estimator #5	More	More	Estimator #27	More	More
Estimator #6	More	More	Estimator #28	More	More
Estimator #7	Less	Less	Estimator #29	More	More
Estimator #8	Less	Less	Estimator #30	More	More
Estimator #9	Moderate	More	Estimator #31	More	More
Estimator #10	Less	Less	Estimator #32	Moderate	Less
Estimator #11	Moderate	More	Estimator #33	Moderate	Moderate
Estimator #12	Moderate	Moderate	Estimator #34	More	More
Estimator #13	Moderate	Moderate	Estimator #35	Less	Less
Estimator #14	More	Moderate	Estimator #36	Less	Less
Estimator #15	Less	Less	Estimator #37	Less	Less
Estimator #16	More	Moderate	Estimator #38	Moderate	More
Estimator #17	Less	Less	Estimator #39	Moderate	Less
Estimator #18	Moderate	Less	Estimator #40	Less	Less
Estimator #19	Less	More	Estimator #41	Less	Less
Estimator #20	Less	Less	Estimator #42	More	More
Estimator #21	Less	Moderate	Estimator #43	Less	Moderate
Estimator #22	Moderate	Moderate			

In summary, one of the findings that can be observed in this analysis was that study participants' estimates did not have recognizable or specific patterns in their predictions of the durations of R2 and R3 for R/W acquisition as well as the durations of U1 and U3 for utility adjustment. In other words, although some estimators produced accurate numbers in R/W acquisition and utility adjustment, most experts did not show consistent accuracy in their estimates. The following section describes details related to estimators' fluctuation in estimating durations through the comparison of RUDI-based duration estimation and non-RUDI-based duration estimation.

7.4 Comparison between Non-RUDI-based Durations and RUDI-based Durations

This section describes a comparison of the accuracy of non-RUDI-based and RUDI-based duration estimations. Through this comparative analysis, it was possible to see if, and how much, RUDI improved the accuracy of non-RUDI-based duration estimations.

First, for R2, non-RUDI-based durations are more accurate than RUDI-based durations as depicted in Figure 7.2. That is, while some individual data points in the boxplot for NR2 are close to zero, most data points in the boxplot for RR2 are far from zero. This means that the non-RUDI-based R2 durations were relatively accurate compared to the RUDI-based durations.

RUDI-based durations were derived from recommended percentile ranges using degree of schedule urgency and uncertainty. This parameter may have introduced large differences in the accuracy of predictions. In other words, different and unreasonable judgments about the degree of uncertainty and schedule urgency of the project may have caused inaccurate estimates. Another possible reason for the discrepancy is that the data analyzed for R2 were not as applicable as expected in real-life circumstances.

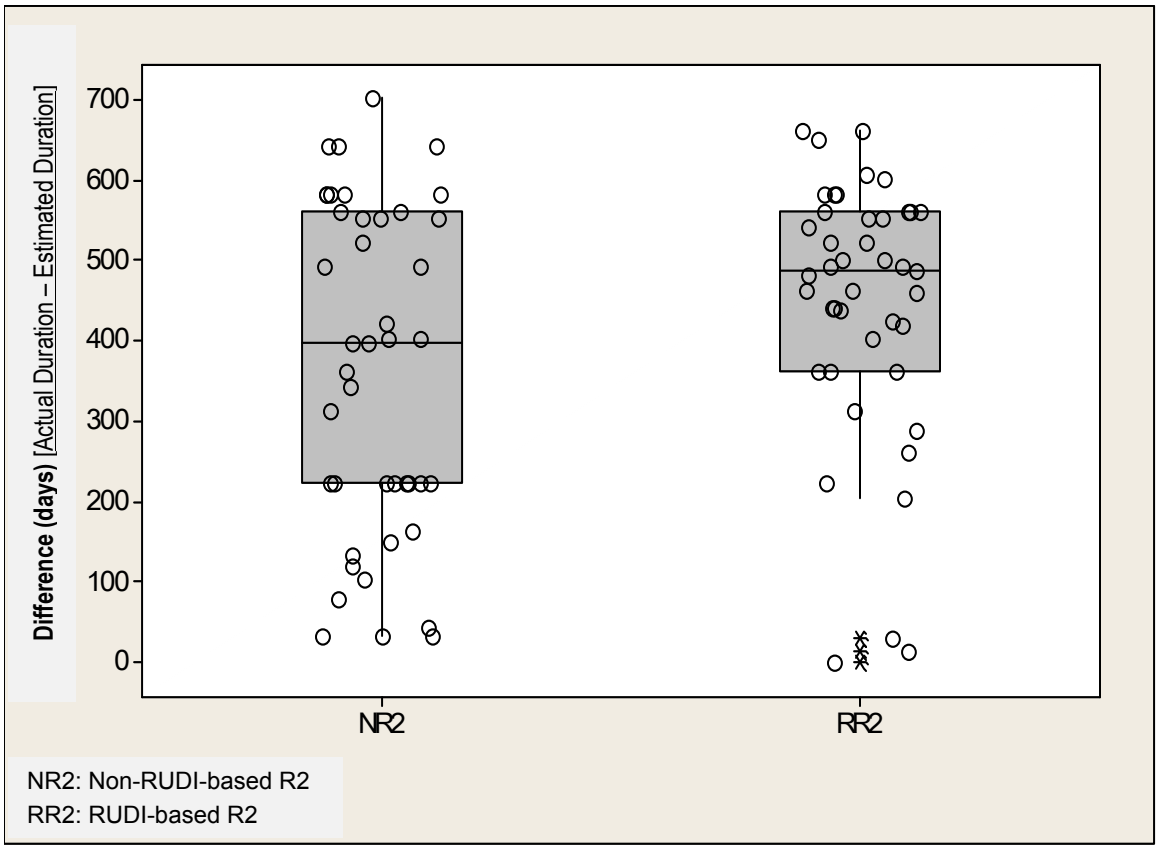

Figure 7.2: Boxplot of Non-RUDI-based R2 and RUDI-based R2

Table 7.5 illustrates RUDI's utility in improving the accuracy of non-RUDI-based duration estimations of R2. Although RUDI was helpful for 12 estimators in predicting the duration of R2, the accuracy of 15 estimators' estimation was negatively impacted by using

RUDI. As mentioned in the description of Figure 7.2, because RUDI-based estimates were not as accurate for R2 compared to non-RUDI-based duration estimation, RUDI was not helpful in improving accuracy.

Table 7.5: Comparison between Non-RUDI and RUDI-based Durations – R/W Acquisition: R2

Estr.	R/W Acquisition: R2		Improved Accuracy? (Y/N)	Estr.	R/W Acquisition: R2		Improved Accuracy? (Y/N)
	Non-RUDI	RUDI			Non-RUDI	RUDI	
E#1	Less	Less	Same	E#23	More	Moderate	No
E#2	Moderate	Less	No	E#24	Less	More	Yes
E#3	More	More	Same	E#25	Less	Moderate	Yes
E#4	More	More	Same	E#26	More	More	Same
E#5	More	More	Same	E#27	More	More	Same
E#6	Less	Less	Same	E#28	More	Moderate	No
E#7	Moderate	Less	No	E#29	Moderate	More	Yes
E#8	More	More	Same	E#30	Less	More	Yes
E#9	Less	Less	Same	E#31	Moderate	More	Yes
E#10	Less	Less	Same	E#32	Less	Moderate	Yes
E#11	Less	More	Yes	E#33	Less	More	Yes
E#12	More	Moderate	No	E#34	More	Moderate	No
E#13	Less	More	Yes	E#35	Less	More	Yes
E#14	Moderate	Less	No	E#36	More	Less	No
E#15	Less	Less	Same	E#37	Less	Less	Same
E#16	Moderate	Less	No	E#38	Less	Less	Same
E#17	More	Less	No	E#39	More	More	Same
E#18	More	Less	No	E#40	Less	Moderate	Yes
E#19	More	Moderate	No	E#41	Less	Less	Same
E#20	More	Moderate	No	E#42	Moderate	Less	No
E#21	More	More	Same	E#43	Moderate	More	Yes
E#22	More	Less	No				

For R3, RUDI-based duration estimations were more accurate than non-RUDI-based duration estimations, as presented in Figure 7.3. The data in the boxplot for NR3 spread widely, but the data based on RUDI showed a more narrow degree of dispersion in the boxplot. This

means that most estimators benefited from using RUDI when estimating the durations for R3. Moreover, because R3 covers the entire R/W acquisition process (from R/W Project Release to Possession of Parcel), the negative impact of inaccurate numbers for R2 can be offset by the more accurate R3 durations. R3 is the more significant estimation for R/W acquisition of highway projects overall.

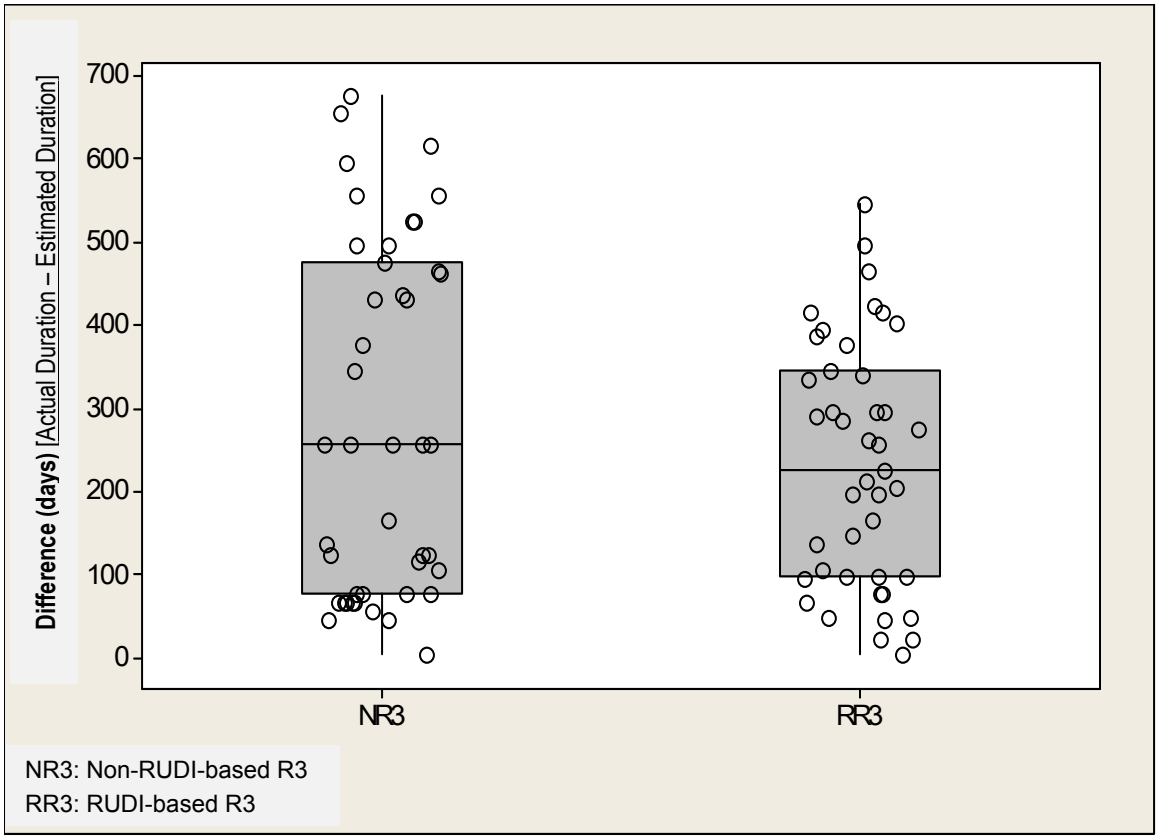

Figure 7.3: Boxplot of Non-RUDI-based R3 and RUDI-based R3

There were 9 estimators with improved accuracy for R3 when using RUDI, and there were 12 estimators with worse accuracy. The remaining 22 estimators did not show significant changes in the accuracy of their duration estimation. However, as described in Figure 7.3, the accuracy of RUDI-based R3 duration estimation was much better than non-RUDI-based R3 duration estimation.

Table 7.6: Comparison between Non-RUDI and RUDI-based Durations – R/W Acquisition: R3

Estr.	R/W Acquisition: R3		Improved Accuracy? (Y/N)	Estr.	R/W Acquisition: R3		Improved Accuracy? (Y/N)
	Non-RUDI	RUDI			Non-RUDI	RUDI	
E#1	Less	Less	Same	E#23	More	Less	No
E#2	Less	Less	Same	E#24	Less	Moderate	Yes
E#3	More	More	Same	E#25	Moderate	Moderate	Same
E#4	More	More	Same	E#26	More	Moderate	No
E#5	More	More	Same	E#27	More	More	Same
E#6	More	Moderate	No	E#28	More	Moderate	No
E#7	Less	Less	Same	E#29	More	Less	No
E#8	More	Less	No	E#30	Less	More	Yes
E#9	Less	Less	Same	E#31	Less	More	Yes
E#10	Less	Less	Same	E#32	Less	More	Yes
E#11	Moderate	Moderate	Same	E#33	Less	More	Yes
E#12	More	More	Same	E#34	More	Moderate	No
E#13	Moderate	Moderate	Same	E#35	Less	More	Yes
E#14	Less	More	Yes	E#36	Moderate	Less	No
E#15	Less	Less	Same	E#37	Less	Less	Same
E#16	More	Less	No	E#38	Less	Less	Same
E#17	Moderate	Moderate	Same	E#39	More	More	Same
E#18	More	Less	No	E#40	More	Less	No
E#19	Moderate	More	Yes	E#41	Less	Less	Same
E#20	More	More	Same	E#42	More	Less	No
E#21	Moderate	Moderate	Same	E#43	Moderate	More	Yes
E#22	More	More	Same				

An additional finding was that for U1, RUDI-based durations are more accurate than non-RUDI-based durations, as depicted in Figure 7.4. The dispersion of the RUDI-based U1 durations was tighter than that of the non-RUDI based durations. The data for NU1 were roughly divided into two groups by whether their estimations deviated from the actual duration by greater or less than 500 days. That is, more than half of the estimators produced numbers with more than 500 days difference from the actual duration. Although RUDI did not include a large sample for

utility adjustment, the collected sample for RUDI provided a reasonable amount of duration information to the users.

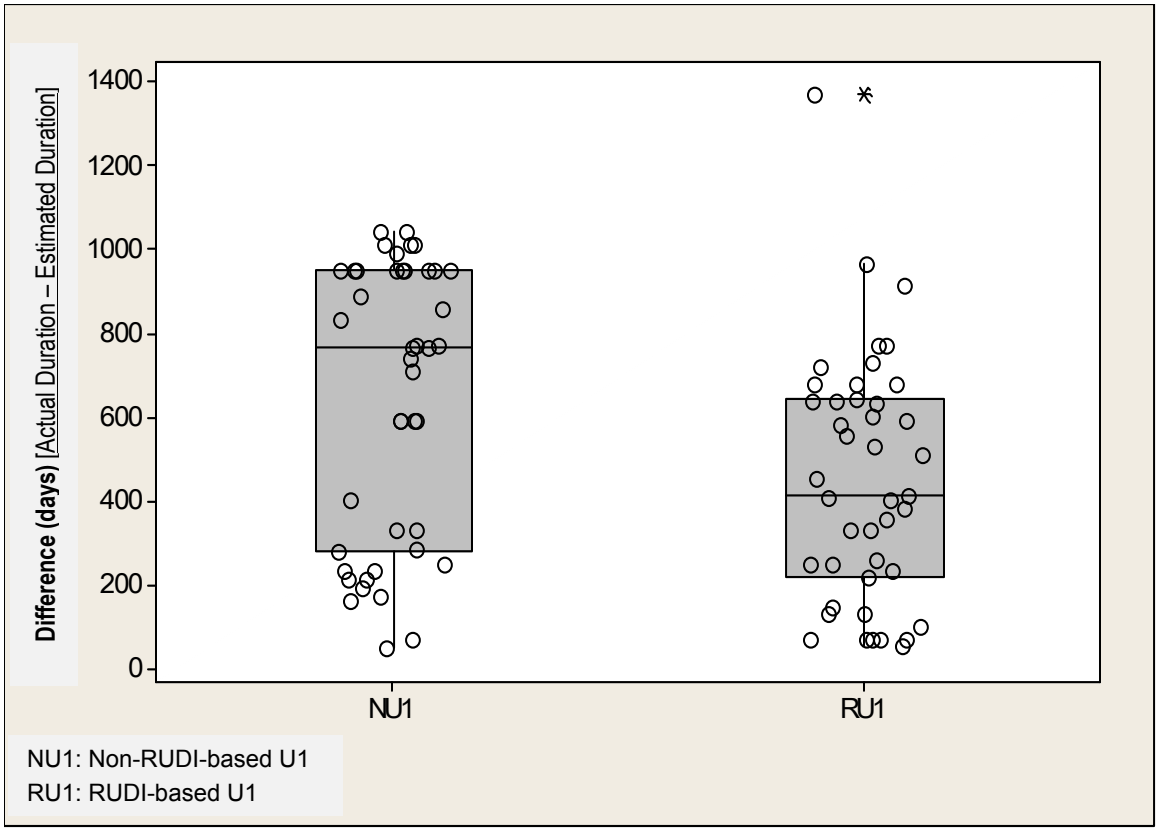

Figure 7.4: Boxplot of Non-RUDI-based U1 and RUDI-based U1

As illustrated in Table 7.7, there were 14 estimators who demonstrated improvements in accuracy when using RUDI. On the other hand, RUDI decreased the accuracy of 15 estimators from more to less accurate or from moderate to less accurate.

Table 7.7: Comparison between Non-RUDI and RUDI-based Durations – Utility Adjustment: U1

Estr.	Utility Adjustment: U1		Improved Accuracy? (Y/N)	Estr.	Utility Adjustment: U1		Improved Accuracy? (Y/N)
	Non-RUDI	RUDI			Non-RUDI	RUDI	
E#1	Less	More	Yes	E#23	More	Less	No
E#2	More	Less	No	E#24	Less	More	Yes
E#3	More	More	Same	E#25	More	More	Same
E#4	Moderate	More	Yes	E#26	More	More	Same
E#5	Less	More	Yes	E#27	Moderate	More	Yes
E#6	More	More	Same	E#28	Less	More	Yes
E#7	Less	Less	Same	E#29	Less	More	Yes
E#8	Moderate	Less	No	E#30	Less	More	Yes
E#9	Less	Moderate	Yes	E#31	Less	More	Yes
E#10	Less	Less	Same	E#32	More	Moderate	No
E#11	Less	Moderate	Yes	E#33	More	Moderate	No
E#12	Moderate	Moderate	Same	E#34	More	More	Same
E#13	Moderate	Moderate	Same	E#35	More	Less	No
E#14	Moderate	More	Yes	E#36	More	Less	No
E#15	Less	Less	Same	E#37	More	Less	No
E#16	More	More	Same	E#38	Less	Moderate	Yes
E#17	More	Less	No	E#39	Less	Moderate	Yes
E#18	More	Moderate	No	E#40	Less	Less	Same
E#19	More	Less	No	E#41	More	Less	No
E#20	Moderate	Less	No	E#42	More	More	Same
E#21	Less	Less	Same	E#43	Moderate	Less	No
E#22	More	Moderate	No				

Finally, for U3, RUDI-based durations were also more accurate than non-RUDI-based durations, even though there were some extreme outliers in the boxplot for RU3 as described in Figure 7.5. There were 15 estimators with improved accuracy in using RUDI for U3, and there were 13 estimators who did not benefit from RUDI application for their estimates, as illustrated in Table 7.8.

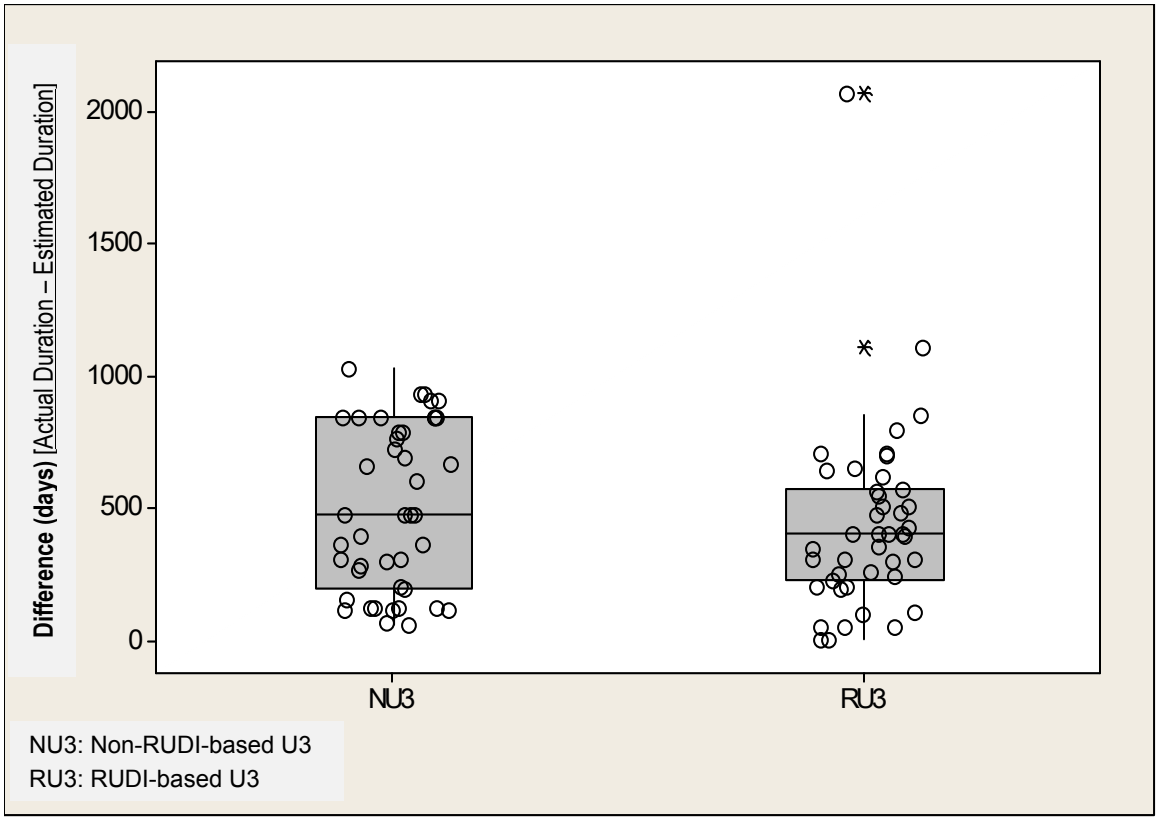

Figure 7.5: Boxplot of Non-RUDI-based U3 and RUDI-based U3

Table 7.8: Comparison between Non-RUDI and RUDI-based Durations – Utility Adjustment: U3

Estr.	Utility Adjustment: U3		Improved Accuracy? (Y/N)	Estr.	Utility Adjustment: U3		Improved Accuracy? (Y/N)
	Non-RUDI	RUDI			Non-RUDI	RUDI	
E#1	Less	More	Yes	E#23	More	Less	No
E#2	Less	Less	Same	E#24	Less	More	Yes
E#3	Moderate	More	Yes	E#25	Moderate	Moderate	Same
E#4	Moderate	More	Yes	E#26	Moderate	More	Yes
E#5	More	More	Same	E#27	More	More	Same
E#6	Less	More	Yes	E#28	More	More	Same
E#7	Less	Less	Same	E#29	Moderate	More	Yes
E#8	Moderate	Less	No	E#30	Less	More	Yes
E#9	Less	More	Yes	E#31	Less	More	Yes
E#10	Moderate	Less	No	E#32	More	Less	No
E#11	Moderate	More	Yes	E#33	More	Moderate	No
E#12	Moderate	Moderate	Same	E#34	More	More	Same
E#13	Less	Moderate	Yes	E#35	More	Less	No
E#14	Less	Moderate	Yes	E#36	More	Less	No
E#15	Less	Less	Same	E#37	More	Less	No
E#16	More	Moderate	No	E#38	Less	More	Yes
E#17	More	Less	No	E#39	Less	Less	Same
E#18	More	Less	No	E#40	Less	Less	Same
E#19	More	More	Same	E#41	More	Less	No
E#20	Less	Less	Same	E#42	More	More	Same
E#21	Less	Moderate	Yes	E#43	Moderate	Moderate	Same
E#22	More	Moderate	No				

Chapter 8. Findings on Determining Durations

8.1 Importance of Duration Drivers

8.1.1 All Respondents

8.1.1.1. PRE-Application Importance

While the previous chapter discussed the accuracy of duration estimations, this section describes the results of the assessments of the importance of duration drivers affecting R/W acquisition and utility adjustment processes. As mentioned in the introduction, there were two types of driver importance: PRE-application and POST-application importance of drivers. Using three independent variables such as years of experience, district type, and area of expertise, the level of importance of these drivers was analyzed.

First, the results of the PRE-application importance assessments are described in Table 8.1. Before estimating the durations of R/W acquisition and utility adjustment of Project B, all respondents were asked to assess the PRE-application importance level of 42 duration drivers using a 4-point Likert scale. The scale's points were labeled "not important" (0), "low importance" (0.33), "moderate importance" (0.67), and "high importance" (1).

As illustrated in Table 8.1, drivers #7 (Status of Environmental Clearance) and #8 (Status of Right-of-Way Map) which are related to the Project Basic Facts category were evaluated as having relatively high importance. They ranked among the top ten most highly rated drivers. Driver #7 in particular was perceived by most respondents to be the most important driver. Among R/W acquisition-related drivers, drivers #19 (Number of Parcels for Acquisition) and #21 (Frequency of Eminent Domain) ranked in the top ten. For utility adjustment, there were four drivers ranked in the top ten. These include Number of Utilities Located in Public R/W (D37), Number of Utilities Located in Private Easement (D38), Number of Utilities for Adjustments or Relocations (D39), and Responsiveness of Utility Companies to TxDOT Needs (D41).

Table 8.1: Descriptive Statistics of PRE-Application Importance Assessments

Category	Driver	Description	Mean (n=43)	Rank
Project Basic Facts	D1	TxDOT Project Type	0.767	18
	D2	TxDOT Highway Type	0.690	31
	D3	Project Location Type	0.674	35
	D4	Right-of-Way and Utility Scope	0.822	9
	D5	Status of Schematic Design	0.651	37
	D6	Status of Boundary Surveying	0.705	27
	D7	Status of Environmental Clearance	0.891	1
	D8	Status of Right-of-Way Map	0.860	4
	D9	Internal R/W Staff Size of a District	0.690	31
	D10	District R/W Annual Budget	0.721	24
	D11	Dedication of Funds to the Project (R/W and Construction)	0.783	14
	D12	LPA Funded or Non-LPA Funded	0.674	34
	D13	Federally Funded or Non-Federally Funded	0.659	36
	D14	Funding Limitations for the Project	0.775	16
	D15	Level of Acceptance of the Project by the Public	0.705	26
	D16	Level of Political Pressure	0.636	41
	D17	Common Concerns of Property Owners	0.729	23
	D18	Current Status of the R/W Project	0.791	12
R/W Acquisition	D19	Number of Parcels for Acquisition	0.845	7
	D20	Different Types of Parcel Usages	0.705	27
	D21	Frequency of Eminent Domain	0.860	5
	D22	Source of Personnel to be used for R/W Acquisition	0.690	33
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.713	25
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.698	30
	D25	Type of Property Owners	0.643	40
	D26	Level of Familiarity with Key Landowners	0.597	42
	D27	Are There Any Property Tenants to Consider?	0.736	22
	D28	Need for Residential Relocation	0.814	10
	D29	Level of Local Availability of Replacement Housing Facilities	0.760	19
	D30	Need for Business Relocation	0.760	19
	D31	Level of Local Availability of Replacement Business Facilities	0.783	14
	D32	Likelihood of Title Curative Actions	0.791	12
	D33	Responsiveness of Local Title Companies to TxDOT	0.760	19
Utility Adjustment	D34	Have SUE Investigations been Performed	0.643	39
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.651	37
	D36	Utility Type	0.806	11
	D37	Number of Utilities Located in Public R/W	0.829	8
	D38	Number of Utilities Located in Private Easement	0.876	3
	D39	Number of Utilities for Adjustments or Relocations	0.860	6
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.698	29
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.884	2
	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.775	16

8.1.1.2. POST-Application Importance

Table 8.2 describes the results of POST-application importance assessments. POST-application importance of duration drivers was evaluated on a 2-point scale. The scale points were labeled “not important” (0) and “important” (1). The reason for using the different scale for this assessment was in order to present whether drivers are critical and considered in estimating the durations of both processes. This assessment was conducted after the RUDI-based duration

estimation had been completed. Therefore, respondents had specific information on drivers to use in evaluating the importance of each duration driver. This is how POST-application importance differed from PRE-application importance.

As depicted in Table 8.2, driver #4 (R/W and Utility Scope) and driver #18 (Current Status of the Right-of-Way Project) that were related to the project basic facts ranked in the top ten of POST-Application factors. Among R/W acquisition-related drivers, the drivers ranked as highly important are as follows:

- Number of Parcels for Acquisition (D19)
- Frequency of Eminent Domain (D21)
- Need for Residential Relocation (D28)
- Level of Local Availability of Replacement Housing Facilities (D29)
- Need for Business Relocation (D30)

Among utility adjustment-related duration drivers, the following drivers ranked in the top ten:

- Utility Type (D36)
- Number of Utilities Located in Public R/W (D37)
- Number of Utilities Located in Private Easement (D38)
- Responsiveness of Utility Companies to TxDOT Needs (D41)

Table 8.2: Descriptive Statistics of POST-Application Importance Assessments

Category	Driver	Description	Mean (n=43)	Rank
Project Basic Facts	D1	TxDOT Project Type	0.465	35
	D2	TxDOT Highway Type	0.442	38
	D3	Project Location Type	0.698	12
	D4	Right-of-Way and Utility Scope	0.860	3
	D5	Status of Schematic Design	0.488	32
	D6	Status of Boundary Surveying	0.535	25
	D7	Status of Environmental Clearance	0.674	15
	D8	Status of Right-of-Way Map	0.674	16
	D9	Internal R/W Staff Size of a District	0.535	23
	D10	District R/W Annual Budget	0.535	24
	D11	Dedication of Funds to the Project (R/W and Construction)	0.651	17
	D12	LPA Funded or Non-LPA Funded	0.465	35
	D13	Federally Funded or Non-Federally Funded	0.372	40
	D14	Funding Limitations for the Project	0.488	31
	D15	Level of Acceptance of the Project by the Public	0.372	39
	D16	Level of Political Pressure	0.302	41
	D17	Common Concerns of Property Owners	0.442	37
	D18	Current Status of the R/W Project	0.744	7
R/W Acquisition	D19	Number of Parcels for Acquisition	0.907	1
	D20	Different Types of Parcel Usages	0.535	25
	D21	Frequency of Eminent Domain	0.721	10
	D22	Source of Personnel to be used for R/W Acquisition	0.465	34
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.488	33
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.651	17
	D25	Type of Property Owners	0.512	27
	D26	Level of Familiarity with Key Landowners	0.512	28
	D27	Are There Any Property Tenants to Consider?	0.512	30
	D28	Need for Residential Relocation	0.744	7
	D29	Level of Local Availability of Replacement Housing Facilities	0.791	6
	D30	Need for Business Relocation	0.791	5
	D31	Level of Local Availability of Replacement Business Facilities	0.605	22
	D32	Likelihood of Title Curative Actions	0.698	12
	D33	Responsiveness of Local Title Companies to TxDOT	0.651	17
Utility Adjustment	D34	Have SUE Investigations been Performed	0.605	21
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.465	36
	D36	Utility Type	0.721	10
	D37	Number of Utilities Located in Public R/W	0.744	9
	D38	Number of Utilities Located in Private Easement	0.814	4
	D39	Number of Utilities for Adjustments or Relocations	0.628	20
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.512	28
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.884	2
	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.698	12

8.1.1.3. Comparison between PRE-Application and POST-Application Importance

Table 8.3 describes the comparison of PRE-application and POST-application importance. There were two findings that should be emphasized.

First, as presented in Table 8.3, some differences have negative signs, indicating a shift between PRE-application importance and POST-application importance. This result may have arisen because a driver's importance level had increased after respondents learned specific information about that driver. These drivers are as follows:

- Project Location Type (D3)
- Right-of-Way and Utility Scope (D4)
- Number of Parcels for Acquisition (D19)
- Level of Local Availability of Replacement Housing Facilities (D29)
- Number of Business Relocation (D30)

Second, the mean values of the PRE-application importance are relatively higher than the mean values of the POST-application importance as illustrated in Table 8.3. This pattern may have been caused by the fact that participating respondents recognized the list of 42 drivers as major characteristics of highway projects without considering their pertinent values in real-life conditions. The rankings were based on differences between PRE-application and POST-application mean values. In order to focus on drivers with large differences, the research team used a value of a 0.2 differential as a cut-off point. There were 13 drivers with mean differences over 0.2. In addition, the values of Model Project (B) were presented as possible causes for these differences. The thirteen drivers with such differences are the following:

- Project basic facts-related drivers:
  - TxDOT Project Type (D1)
  - TxDOT Highway Type (D2)
  - Status of Environmental Clearance (D7)
  - LPA Funded or Non-LPA Funded (D12)
  - Federally Funded or Non-Federally Funded (D13)
  - Funding Limitations for the Project (D14)
  - Level of Acceptance of the Project by the Public (D15)
  - Level of Political Pressure (D16)
  - Common Concerns of Property Owners (D17)

- R/W acquisition-related drivers:
  - Source of Personnel to be used for R/W Acquisition (D22)
  - Availability of District R/W Appraisers (D23)
  - Are There Any Property Tenants to Consider? (D27)

- Utility adjustment-related drivers:
  - Number of Utilities for Adjustments or Relocations (D39)

Table 8.3: Comparison between PRE-Application and POST-Application Importance

Cate.	Driver	Description	Mean (n=43)		Difference (Pre-Post)	Rank	Model Project Value
			PRE	POST			
Project Basic Facts	D1	TxDOT Project Type	0.767	0.465	0.302	3	RER
	D2	TxDOT Highway Type	0.690	0.442	0.248	7	FM
	D3	Project Location Type	0.674	0.698	– 0.024		
	D4	Right-of-Way and Utility Scope	0.822	0.860	– 0.038		
	D5	Status of Schematic Design	0.651	0.488	0.163		
	D6	Status of Boundary Surveying	0.705	0.535	0.170		
	D7	Status of Environmental Clearance	0.891	0.674	0.217	12	Completed
	D8	Status of Right-of-Way Map	0.860	0.674	0.186		
	D9	Internal R/W Staff Size of a District	0.690	0.535	0.155		
	D10	District R/W Annual Budget	0.721	0.535	0.186		
	D11	Dedication of Funds to the Project (R/W and Construction)	0.783	0.651	0.132		
	D12	LPA Funded or Non-LPA Funded	0.674	0.465	0.209	13	LPA funded
	D13	Federally Funded or Non-Federally Funded	0.659	0.372	0.287	4	Federally funded
	D14	Funding Limitations for the Project	0.775	0.488	0.287	4	None
	D15	Level of Acceptance of the Project by the Public	0.705	0.372	0.333	2	Extensive supportive
	D16	Level of Political Pressure	0.636	0.302	0.334	1	Moderate
	D17	Common Concerns of Property Owners	0.729	0.442	0.287	6	Access
	D18	Current Status of the R/W Project	0.791	0.744	0.047		
R/W Acquisition	D19	Number of Parcels for Acquisition	0.845	0.907	– 0.062		
	D20	Different Types of Parcel Usages	0.705	0.535	0.170		
	D21	Frequency of Eminent Domain	0.860	0.721	0.139		
	D22	Source of Personnel to be used for R/W Acquisition	0.690	0.465	0.225	10	District staff
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.713	0.488	0.225	9	Marginally adequate
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.698	0.651	0.047		
	D25	Type of Property Owners	0.643	0.512	0.131		
	D26	Level of Familiarity with Key Landowners	0.597	0.512	0.085		
	D27	Are There Any Property Tenants to Consider?	0.736	0.512	0.224	11	No
	D28	Need for Residential Relocation	0.814	0.744	0.070		
	D29	Level of Local Availability of Replacement Housing Facilities	0.760	0.791	– 0.031		
	D30	Need for Business Relocation	0.760	0.791	– 0.031		
	D31	Level of Local Availability of Replacement Business Facilities	0.783	0.605	0.178		
	D32	Likelihood of Title Curative Actions	0.791	0.698	0.093		
	D33	Responsiveness of Local Title Companies to TxDOT	0.760	0.651	0.109		
Utility Adjustment	D34	Have SUE Investigations been Performed?	0.643	0.605	0.038		
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.651	0.465	0.186		
	D36	Utility Type	0.806	0.721	0.085		
	D37	Number of Utilities Located in Public R/W	0.829	0.744	0.085		
	D38	Number of Utilities Located in Private R/W	0.876	0.814	0.062		
	D39	Number of Utilities for Adjustments or Relocations	0.860	0.628	0.232	8	More than 7
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.698	0.512	0.186		
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.884	0.884	0.000		
	D42	Adjustment is Reimbursable or Non-Reimbursable Utility	0.775	0.698	0.077		

8.1.2 MORE Accurate vs. LESS Accurate Estimators

This section describes the differences between More Accurate and Less Accurate estimators in perceiving the PRE-application importance of duration drivers related to project basic facts and R/W acquisition. As described in Table 8.4, there were 14 More Accurate and 12 Less Accurate estimators. The 14 More accurate Estimators were respondents that showed consistent accuracy in both R2 and R3 durations. That is, these estimators were equally more accurate with their group for both R2 and R3 compared to 12 Less Accurate estimators. There were eight drivers with more than 0.2 differences, and their relevant values are described in Table 8.4. The drivers related to project basic factors with large differences (> 0.2) include:

- TxDOT Project Type (D1)
- District R/W Annual Budget (D10)
- Dedication of Funds to the Project (R/W and Construction (D11)
- Funding Limitations for the Project (D14)
- Level of Political Pressure (D16)

The drivers related to R/W acquisition with large differences (> 0.2) are as follows:

- Need for Residential Relocation (D28)
- Level of Local Availability of Replacement Housing Facilities (D29)
- Likelihood of Title Curative Actions (D32)

As described in Table 8.4, there were duration drivers with differences showing negative signs, indicating a shift between PRE-application importance and POST-application importance. These drivers were evaluated as having relatively high importance by estimators with less accuracy in R/W acquisition duration estimation. Moreover, More Accurate estimators did not consider these drivers to be as highly important as Less Accurate estimators perceived them to be. Therefore, these drivers may be considered items that reveal perceptual differences among estimators with different levels of accuracy. Further study would be needed to determine whether there is a strong correlation between such differences and accuracy in estimation. These drivers include:

- Project Location Type (D3)
- Right-of-Way and Utility Scope (D4)
- Status of Schematic Design (D5)
- Status of Boundary Surveying (D6)
- Status of Right-of-Way Map (D8)
- Internal R/W Staff Size of a District (D9)
- District R/W Annual Budget (D10)
- Common Concerns of Property Owners (D17)
- Different Types of Parcel Usages (D20)
- Availability of District R/W Appraisers (District Staff and Outsourced) (D23)
- Level of Familiarity with Key Landowners (D26)
- Are There Any Property Tenants to Consider? (D27)
- Need for Business Relocation (D30)

Table 8.4: PRE-Application Importance of Project Basic Facts and R/W Acquisition-related Drivers – Comparison MORE Accurate and Less Accurate Estimators

B: Project Basic Facts-related, **R**: R/W Acquisition-related

Cate.	Driver	Description	Mean		Difference (M-L)	Rank	Model Project Value
			MORE Accurate (n=14)	LESS Accurate (n=12)			
B	D14	Funding Limitations for the Project	0.952	0.611	0.341	4	
R	D28	Need for Residential Relocation	0.929	0.583	0.345	3	
B	D7	Status of Environmental Clearance	0.929	0.833	0.095		
R	D21	Frequency of Eminent Domain	0.929	0.806	0.123		
B	D11	Dedication of Funds to the Project (R/W and Construction)	0.929	0.500	0.429	1	
R	D29	Level of Local Availability of Replacement Housing Facilities	0.905	0.528	0.377	2	
R	D32	Likelihood of Title Curative Actions	0.905	0.639	0.266	5	
R	D19	Number of Parcels for Acquisition	0.857	0.806	0.052		
B	D1	TxDOT Project Type	0.857	0.611	0.246	6	
B	D8	Status of Right-of-Way Map	0.857	0.889	– 0.032		
R	D31	Level of Local Availability of Replacement Business Facilities	0.810	0.750	0.060		
B	D4	Right-of-Way and Utility Scope	0.810	0.861	– 0.052		
R	D33	Responsiveness of Local Title Companies to TxDOT	0.810	0.667	0.143		
B	D18	Current Status of the R/W Project	0.762	0.722	0.040		
R	D24	Is Funding Available for Outsourcing Staff Assistance?	0.738	0.722	0.016		
R	D27	Are There Any Property Tenants to Consider?	0.738	0.750	– 0.012		
B	D15	Level of Acceptance of the Project by the Public	0.714	0.694	0.020		
B	D12	LPA Funded or Non-LPA Funded	0.714	0.556	0.159		
B	D17	Common Concerns of Property Owners	0.690	0.806	– 0.115		
B	D2	TxDOT Highway Type	0.690	0.667	0.024		
B	D13	Federally Funded or Non-Federally Funded	0.667	0.611	0.056		
R	D22	Source of Personnel to be used for R/W Acquisition	0.667	0.667	0.000		
R	D20	Different Types of Parcel Usages	0.667	0.694	– 0.028		
B	D3	Project Location Type	0.667	0.694	– 0.028		
R	D25	Type of Property Owners	0.643	0.639	0.004		
R	D30	Need for Business Relocation	0.643	0.833	– 0.190		
B	D16	Level of Political Pressure	0.643	0.417	0.226	8	
R	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.619	0.750	– 0.131		
B	D6	Status of Boundary Surveying	0.619	0.806	– 0.187		
B	D10	District R/W Annual Budget	0.595	0.833	– 0.238	7	
B	D9	Internal R/W Staff Size of a District	0.571	0.750	– 0.179		
R	D26	Level of Familiarity with Key Landowners	0.571	0.583	– 0.012		
B	D5	Status of Schematic Design	0.524	0.722	– 0.198		

Table 8.5 describes the results of the PRE-application importance assessments of project basic facts-related and utility adjustment-related drivers by More Accurate and Less Accurate estimators who were equally accurate within their group in both U1 and U3, respectively. As illustrated in Table 8.5, most drivers were evaluated as having relatively high importance by Less Accurate estimators. This finding may have arisen because Less Accurate estimators may have different perceptions of driver importance compared to the perceptions of More Accurate estimators in predicting the durations of the utility adjustment process. These drivers are as follows:

- TxDOT Highway Type (D2)
- Project Location Type (D3)
- Right-of-Way and Utility Scope (D4)
- Status of Schematic Design (D5)
- Status of Boundary Surveying (D6)
- Internal R/W Staff Size of a District (D9)
- LPA Funded or Non-LPA Funded (D12)
- Level of Acceptance of the Project by the Public (D15)
- Common Concerns of Property Owners (D17)
- Have SUE Investigations been performed? (D34)
- Will SUE Investigations be performed? (D35)
- Utility Type (D36)
- Number of Utilities Located in Public R/W (D37)
- Number of Utilities Located in Private Easement (D38)
- Number of Utilities for Adjustments or Relocations (D39)
- Responsiveness of Utility Companies to TxDOT Needs (D41)
- Adjustment is Reimbursable Utility or Non-Reimbursable Utility (D42)

Drivers with large differences greater than the cut-off point (>0.2) include D14 (Funding Limitations for the Project), D11 (Dedication of Funds to the Project), D42 (Adjustment is Reimbursable Utility or Non-Reimbursable Utility), and D34 (Have SUE Investigations Been Performed?). Drivers #11 and #14 were evaluated as highly important by More Accurate estimators, while Less Accurate estimators did not consider these drivers to be highly important. In contrast, Less Accurate estimators recognized drivers #34 and #42 as highly important drivers, but More Accurate estimators did not perceive them in that way. Different personal backgrounds may have an impact on the differences in importance rankings. However, it is necessary to collect more data using additional projects to increase the reliability of these results. This study analyzed this possible relationship in the sections that follow.

Table 8.5: PRE-Application Importance of Project Basic Facts and UTILITY Adjustment-related Drivers – Comparison between MORE Accurate and Less Accurate Estimators

B: Project Basic Facts-related, **U**: Utility Adjustment-related

Cate.	Driver	Description	Mean		Difference (M-L)	Rank	Model Project Value
			MORE Accurate (n=14)	LESS Accurate (n=11)			
B	D8	Status of Right-of-Way Map	0.952	0.818	0.134		
B	D7	Status of Environmental Clearance	0.929	0.848	0.080		
B	D14	Funding Limitations for the Project	0.929	0.576	0.353	2	
U	D41	Responsiveness of Utility Companies to TxDOT Needs	0.905	0.909	– 0.004		
U	D38	Number of Utilities Located in Private Easement	0.857	0.879	– 0.022		
B	D11	Dedication of Funds to the Project (R/W and Construction)	0.833	0.576	0.258	4	
B	D4	Right-of-Way and Utility Scope	0.833	0.879	– 0.045		
B	D18	Current Status of the R/W Project	0.810	0.788	0.022		
B	D17	Common Concerns of Property Owners	0.786	0.818	– 0.032		
B	D10	District R/W Annual Budget	0.786	0.758	0.028		
U	D39	Number of Utilities for Adjustments or Relocations	0.786	0.939	– 0.154		
U	D37	Number of Utilities Located in Public R/W	0.762	0.939	– 0.177		
U	D36	Utility Type	0.762	0.788	– 0.026		
B	D6	Status of Boundary Surveying	0.738	0.788	– 0.050		
B	D1	TxDOT Project Type	0.714	0.636	0.078		
B	D15	Level of Acceptance of the Project by the Public	0.714	0.727	– 0.013		
U	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.690	0.667	0.024		
B	D16	Level of Political Pressure	0.667	0.485	0.182		
B	D5	Status of Schematic Design	0.643	0.727	– 0.084		
B	D9	Internal R/W Staff Size of a District	0.643	0.788	– 0.145		
U	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.619	0.939	– 0.320	3	
B	D12	LPA Funded or Non-LPA Funded	0.595	0.667	– 0.071		
B	D3	Project Location Type	0.595	0.667	– 0.071		
B	D13	Federally Funded or Non-Federally Funded	0.571	0.697	– 0.126		
B	D2	TxDOT Highway Type	0.571	0.758	– 0.186		
U	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.571	0.727	– 0.156		
U	D34	Have SUE Investigations been Performed	0.476	0.879	– 0.403	1	

In Table 8.6, the results of POST-application importance assessments of duration drivers related to project basic facts and R/W acquisition by More Accurate and Less Accurate estimators in predicting the durations of R/W acquisition are shown. There were 11 drivers with large differences exceeding the cut-off (0.2). These differences may have been caused by specific values attaching to the model project used in this study. The five drivers that related to project basic facts include:

- TxDOT Project Type (D1)
- Project Location Type (D3)
- Right-of-Way and Utility Scope (D4)
- District R/W Annual Budget (D10)
- Dedication of Funds to the Project (R/W and Construction) (D11)

The six drivers related to R/W acquisition are as follows:

- Different Types of Parcel Usages (D20)
- Frequency of Eminent Domain (D21)
- Type of Property Owners (D25)
- Level of Familiarity with Key Landowners (D26)
- Are There Any Property Tenants to Consider? (D27)
- Level of Local Availability of Replacement Business Facilities (D31)

Among these drivers, drivers #4, #20, and #27 were evaluated as highly important by Less Accurate estimators. Their values are "R/W and Utility," "Residential and Commercial," and "No," respectively. These values of the model project may have caused the Less Accurate estimators to have different perceptions of the drivers' POST-application importance compared to the More Accurate estimators. There were other drivers evaluated as having relatively high importance by Less Accurate estimators. These drivers include the following:

- TxDOT Highway Type (D2)
- Status of Boundary Surveying (D6)
- Status of Environmental Clearance (D7)
- Status of Right-of-Way Map (D8)
- LPA Funded or Non-LPA Funded (D12)
- Level of Acceptance of the Project by the Public (D15)
- Level of Political Pressure (D16)
- Common Concerns of Property Owners (D17)
- Current Status of the R/W Project (D18)
- Is Funding Available for Outsourcing Staff Assistance? (D24)
- Need for Residential Relocation (D28)
- Need for Business Relocation (D30)
- Responsiveness of Local Title Companies to TxDOT (D33)

Table 8.6: POST-Application Importance of Project Basic Facts and R/W Acquisition-related Drivers – Comparison between MORE Accurate and LESS Accurate Estimators

B: Project Basic Facts-related, **R**: R/W Acquisition-related

Cate.	Driver	Description	Mean		Difference (M-L)	Rank	Model Project Value
			MORE Accurate (n=14)	LESS Accurate (n=12)			
R	D21	Frequency of Eminent Domain	1.000	0.250	0.750	2	Several
R	D19	Number of Parcels for Acquisition	0.929	0.833	0.095		
B	D3	Project Location Type	0.929	0.583	0.345	6	Rural
R	D32	Likelihood of Title Curative Actions	0.857	0.750	0.107		
R	D31	Level of Local Availability of Replacement Business Facilities	0.857	0.083	0.774	1	Low
R	D26	Level of Familiarity with Key Landowners	0.786	0.250	0.536	3	High
B	D11	Dedication of Funds to the Project (R/W and Construction)	0.786	0.500	0.286	9	Yes
R	D28	Need for Residential Relocation	0.714	0.750	– 0.036		
B	D4	Right-of-Way and Utility Scope	0.714	1.000	– 0.286	8	R/W and Utility
B	D1	TxDOT Project Type	0.714	0.250	0.464	4	RER
R	D30	Need for Business Relocation	0.714	0.750	– 0.036		
R	D29	Level of Local Availability of Replacement Housing Facilities	0.714	0.833	– 0.119		
B	D10	District R/W Annual Budget	0.714	0.417	0.298	7	Less than $6M
R	D25	Type of Property Owners	0.643	0.417	0.226	10	Some out-of-state
B	D18	Current Status of the R/W Project	0.643	0.750	– 0.107		
B	D7	Status of Environmental Clearance	0.643	0.667	– 0.024		
R	D33	Responsiveness of Local Title Companies to TxDOT	0.571	0.583	– 0.012		
R	D24	Is Funding Available for Outsourcing Staff Assistance?	0.571	0.583	– 0.012		
B	D6	Status of Boundary Surveying	0.571	0.583	– 0.012		
B	D5	Status of Schematic Design	0.571	0.500	0.071		
R	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.500	0.500	0.000		
R	D22	Source of Personnel to be used for R/W Acquisition	0.500	0.417	0.083		
B	D14	Funding Limitations for the Project	0.500	0.500	0.000		
B	D9	Internal R/W Staff Size of a District	0.500	0.417	0.083		
B	D8	Status of Right-of-Way Map	0.500	0.667	– 0.167		
B	D2	TxDOT Highway Type	0.429	0.500	– 0.071		
B	D13	Federally Funded or Non-Federally Funded	0.429	0.250	0.179		
R	D20	Different Types of Parcel Usages	0.357	0.583	– 0.226	10	Residential and Commercial
R	D27	Are There Any Property Tenants to Consider?	0.357	0.750	– 0.393	5	No
B	D15	Level of Acceptance of the Project by the Public	0.357	0.417	– 0.060		
B	D12	LPA Funded or Non-LPA Funded	0.357	0.500	– 0.143		
B	D17	Common Concerns of Property Owners	0.357	0.417	– 0.060		
B	D16	Level of Political Pressure	0.286	0.333	– 0.048		

Table 8.7 describes the results of the POST-application importance assessments of the duration drivers related to project basic facts and utility adjustment. More Accurate and Less Accurate estimators in this assessment showed equal accuracy in predicting the durations of U1

and U3 within their respective groups. As presented in Table 8.7, 15 out of 27 duration drivers showed large differences (>0.2). These differences reveal that there were significant perceptual differences between More Accurate and Less Accurate estimators in assessing POST-application importance of drivers. In addition, some specific values of these drivers may have caused these results.

The project basic facts-related drivers among the 15 drivers with largely divergent results include:

- TxDOT Project Type (D1)
- Status of Schematic Design (D5)
- Status of Boundary Surveying (D6)
- Status of Right-of-Way Map (D8)
- District R/W Annual Budget (D10)
- Dedication of Funds to the Project (R/W and Construction) (D11)
- Federally Funded or Non-Federally Funded
- Funding Limitations for the Project (D14)
- Level of Political Pressure (D16)
- Common Concerns of Property Owners (D17)

The remaining five drivers related to utility adjustment are as follows:

- Will SUE Investigations to be performed? (D35)
- Utility Type (D36)
- Number of Utilities for Adjustments or Relocations (D39)
- Is There Any Utility Adjustment to be Included in the Highway Construction Contract? (D40)
- Adjustment is Reimbursable Utility or Non-Reimbursable Utility (D42)

Table 8.7: POST-Application Importance of Project Basic Facts and UTILITY Adjustment-related Drivers – Comparison between MORE Accurate and LESS Accurate Estimators

B: Project Basic Facts-related, **U**: Utility Adjustment-related

Cate.	Driver	Description	Mean		Difference (M-L)	Rank	Model Project Value
			MORE Accurate (n=14)	LESS Accurate (n=11)			
U	D41	Responsiveness of Utility Companies to TxDOT Needs	0.929	1.000	– 0.071		
U	D38	Number of Utilities Located in Private Easement	0.929	0.818	0.110		
B	D4	Right-of-Way and Utility Scope	0.929	1.000	– 0.071		
B	D11	Dedication of Funds to the Project (R/W and Construction)	0.857	0.455	0.403	9	Yes
U	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.786	0.182	0.604	2	Yes
B	D18	Current Status of the R/W Project	0.786	0.636	0.149		
B	D8	Status of Right-of-Way Map	0.786	0.545	0.240	14	Completed
U	D37	Number of Utilities Located in Public R/W	0.714	0.545	0.169		
U	D34	Have SUE Investigations been Performed	0.714	0.545	0.169		
B	D10	District R/W Annual Budget	0.714	0.273	0.442	6	Less than $6M
B	D6	Status of Boundary Surveying	0.714	0.182	0.532	4	Completed
B	D7	Status of Environmental Clearance	0.714	0.545	0.169		
B	D3	Project Location Type	0.714	0.545	0.169		
B	D14	Funding Limitations for the Project	0.571	0.364	0.208	15	None
U	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.571	0.818	– 0.247	13	Reimbursable and Non-reimbursable
B	D12	LPA Funded or Non-LPA Funded	0.571	0.455	0.117		
B	D5	Status of Schematic Design	0.571	0.273	0.299	12	Completed
B	D13	Federally Funded or Non-Federally Funded	0.500	0.182	0.318	11	Federally funded
B	D9	Internal R/W Staff Size of a District	0.500	0.545	– 0.045		
B	D1	TxDOT Project Type	0.500	1.000	– 0.500	5	RER
B	D16	Level of Political Pressure	0.429	0.091	0.338	10	Moderate
B	D15	Level of Acceptance of the Project by the Public	0.429	0.273	0.156		
B	D2	TxDOT Highway Type	0.429	0.364	0.065		
U	D36	Utility Type	0.357	0.909	– 0.552	3	Water, Gas, Overhead /Underground communication, Electric pipes
U	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.286	0.727	– 0.442	7	No
U	D39	Number of Utilities for Adjustments or Relocations	0.143	0.909	– 0.766	1	More than 7
B	D17	Common Concerns of Property Owners	0.143	0.545	– 0.403	8	Access

8.1.3 Most Experienced vs. Moderately Experienced vs. Least Experienced Estimators

The following tables describe results of PRE-application and POST-application assessments of the importance of 42 duration drivers on the basis of the years of experience of all the respondents. Three groups for categorizing years of experience were used: (1) Most Experienced; (2) Moderately Experienced; and (3) Least Experienced. Estimators with less than 4 years of experience were defined as "Least Experienced." Respondents with from 4 to 12 years of experience were grouped as "Moderately Experienced." Finally, "Most Experienced" included estimators with more than 12 years of experience. This analysis aimed at investigating the impact of years of experience on assessing importance of duration drives in R/W acquisition and utility adjustment. As depicted in Table 8.8, two comparative analyses were conducted. The rankings were based on the differences between two groups. The first analysis was to compare results of the Most Experienced and Moderately Experienced estimators. As depicted in Table 8.8, 21 out of the 42 drivers were evaluated as having relatively high importance by estimators with 4-12 years of experience as compared to the Most Experienced estimators. The column on the right in the table describes the model project values of these drivers. The impact of these values on importance of these drivers can be validated by analyzing additional projects. The following drivers ranked in the top ten:

- TxDOT Highway Type (D2)
- Internal R/W Staff Size of a District (D9)
- District R/W Annual Budget (D10)
- Federally Funded or Non-Federally Funded (D13)
- Funding Limitations for the Project (D14)
- Different Types of Parcel Usages (D20)
- Type of Property Owners (D25)
- Level of Local Availability of Replacement Business Facilities (D31)
- Is There Any Utility Adjustment to be Included in the Highway Construction Contract? (D40)
- Responsiveness of Utility Companies to TxDOT Needs (D41)

The second comparison was between the Most Experienced and Least Experienced estimators. As presented in Table 8.8, among drivers ranked in the top ten by these groups, some of the drivers did not appear in the comparison between the Most Experienced and Moderately Experienced estimators. These drivers include:

- TxDOT Highway Type (D2)
- Status of Schematic Design (D5)
- Status of Boundary Surveying (D6)
- LPA Funded or Non-LPA Funded (D12)
- Federally Funded or Non-Federally Funded (D13)
- Level of Political Pressure (D16)
- Different Types of Parcel Usages (D20)
- Source of Personnel to be used for R/W Acquisition (D22)
- Level of Local Availability of Replacement Housing Facilities (D29)
- Responsiveness of Local Title Companies to TxDOT (D33)

Table 8.8: PRE-Application Importance of Duration Drivers – MOST vs. MODERATELY vs. LEAST Experienced

Cate.	Driver	Description	Mean			Difference (Most-Moderately)	Rank	Difference (Most-Least)	Rank	Model Project Value
			MOST Experienced (n=27)	MODERATELY Experienced (n=8)	LEAST Experienced (n=8)					
Project Basic Facts	D1	TxDOT Project Type	0.778	0.750	0.750	0.028		0.028		
	D2	TxDOT Highway Type	0.753	0.583	0.583	0.170	3	0.170	5	
	D3	Project Location Type	0.691	0.583	0.708	0.108		– 0.017		
	D4	Right-of-Way and Utility Scope	0.827	0.875	0.750	– 0.048		0.077		
	D5	Status of Schematic Design	0.630	0.542	0.833	0.088		– 0.204	3	
	D6	Status of Boundary Surveying	0.667	0.750	0.792	– 0.083		– 0.125	9	
	D7	Status of Environmental Clearance	0.901	0.875	0.875	0.026		0.026		
	D8	Status of Right-of-Way Map	0.852	0.875	0.875	– 0.023		– 0.023		
	D9	Internal R/W Staff Size of a District	0.642	0.792	0.750	– 0.150	4	– 0.108		
	D10	District R/W Annual Budget	0.654	0.917	0.750	– 0.262	1	– 0.096		
	D11	Dedication of Funds to the Project (R/W and Construction)	0.802	0.792	0.708	0.011		0.094		
	D12	LPA Funded or Non-LPA Funded	0.716	0.750	0.458	– 0.034		0.258	2	
	D13	Federally Funded or Non-Federally Funded	0.753	0.583	0.417	0.170	2	0.336	1	
	D14	Funding Limitations for the Project	0.790	0.667	0.833	0.123	7	– 0.043		
	D15	Level of Acceptance of the Project by the Public	0.704	0.708	0.708	– 0.005		– 0.005		
	D16	Level of Political Pressure	0.605	0.625	0.750	– 0.020		– 0.145	7	
	D17	Common Concerns of Property Owners	0.716	0.792	0.708	– 0.076		0.008		
	D18	Current Status of the R/W Project	0.778	0.875	0.750	– 0.097		0.028		
R/W Acquisition	D19	Number of Parcels for Acquisition	0.852	0.833	0.833	0.019		0.019		
	D20	Different Types of Parcel Usages	0.753	0.625	0.625	0.128	6	0.128	8	
	D21	Frequency of Eminent Domain	0.864	0.833	0.875	0.031		– 0.011		
	D22	Source of Personnel to be used for R/W Acquisition	0.704	0.792	0.542	– 0.088		0.162	6	
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.741	0.667	0.667	0.074		0.074		
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.704	0.750	0.625	– 0.046		0.079		
	D25	Type of Property Owners	0.630	0.750	0.583	– 0.120	9	0.046		
	D26	Level of Familiarity with Key Landowners	0.593	0.542	0.667	0.051		– 0.074		
	D27	Are There Any Property Tenants to Consider?	0.741	0.708	0.750	0.032		– 0.009		
	D28	Need for Residential Relocation	0.815	0.833	0.792	– 0.019		0.023		
	D29	Level of Local Availability of Replacement Housing Facilities	0.778	0.792	0.667	– 0.014		0.111	10	
	D30	Need for Business Relocation	0.753	0.750	0.792	0.003		– 0.039		
	D31	Level of Local Availability of Replacement Business Facilities	0.753	0.875	0.792	– 0.122	8	– 0.039		
	D32	Likelihood of Title Curative Actions	0.802	0.792	0.750	0.011		0.052		
	D33	Responsiveness of Local Title Companies to TxDOT	0.778	0.875	0.583	-0.097		0.194	4	

Cate.	Driver	Description	Mean			Difference (Most-Moderately)	Rank	Difference (Most-Least)	Rank	Model Project Value
			MOST Experienced (n=27)	MODERATELY Experienced (n=8)	LEAST Experienced (n=8)					
Utility Adjustment	D34	Have SUE Investigations been Performed	0.642	0.667	0.625	– 0.025		0.017		
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.642	0.750	0.583	– 0.108		0.059		
	D36	Utility Type	0.802	0.792	0.833	0.011		– 0.031		
	D37	Number of Utilities Located in Public R/W	0.827	0.833	0.833	– 0.006		– 0.006		
	D38	Number of Utilities Located in Private Easement	0.877	0.875	0.875	0.002		0.002		
	D39	Number of Utilities for Adjustments or Relocations	0.877	0.833	0.833	0.043		0.043		
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.728	0.583	0.708	0.145	5	0.020		
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.901	0.792	0.917	0.110	10	– 0.015		
	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.778	0.833	0.708	– 0.056		0.069		

Table 8.9 describes the results of the POST-application importance assessments of 42 duration drivers on the basis of years of experience of all the respondents. The first analysis aimed to compare the results of the Most Experienced and Moderately Experienced estimators. The following drivers ranked in the top ten among these groups:

- TxDOT Highway Type (D2)
- Status of Boundary Surveying (D6)
- Funding Limitations for the Project (D14)
- Level of Political Pressure (D16)
- Current Status of the R/W Project (D18)
- Different Types of Parcel Usages (D20)
- Availability of District R/W Appraisers (District Staff and Outsourced) (D23)
- Are There Any Property Tenants to Consider? (D27)
- Likelihood of Title Curative Actions (D32)
- Responsiveness of Local Title Companies to TxDOT (D33)

Conversely, in the comparison between the Most Experienced and Least Experienced estimators, the following drivers ranked in the top ten:

- Status of Boundary Surveying (D6)
- Internal R/W Staff Size of a District (D9)
- Dedication of Funds to the Project (R/W and Construction) (D11)
- Funding Limitations for the Project (D14)
- Source of Personnel to be used for R/W Acquisition (D22)
- Availability of District R/W Appraisers (District Staff and Outsourced) (D23)
- Level of Familiarity with Key Landowners (D26)
- Likelihood of Title Curative Actions (D32)
- Responsiveness of Local Title Companies to TxDOT (D33)
- Have SUE Investigations been performed? (D34)

Table 8.9: POST-Application Importance of Duration Drivers – MOST vs. MODERATELY vs. LEAST Experienced

Cate.	Driver	Description	Mean			Difference (Most-Moderately)	Rank	Difference (Most-Least)	Rank	Model Project Value
			MOST Experienced (n=27)	MODERATELY Experienced (n=8)	LEAST Experienced (n=8)					
Project Basic Facts	D1	TxDOT Project Type	0.444	0.500	0.500	– 0.056		– 0.056		
	D2	TxDOT Highway Type	0.481	0.250	0.500	0.231	7	– 0.019		FM
	D3	Project Location Type	0.741	0.625	0.625	0.116		0.116		
	D4	Right-of-Way and Utility Scope	0.852	0.750	1.000	0.102		– 0.148		
	D5	Status of Schematic Design	0.519	0.500	0.375	0.019		0.144		
	D6	Status of Boundary Surveying	0.667	0.250	0.375	0.417	1	0.292	4	Completed
	D7	Status of Environmental Clearance	0.667	0.625	0.750	0.042		– 0.083		
	D8	Status of Right-of-Way Map	0.667	0.625	0.750	0.042		– 0.083		
	D9	Internal R/W Staff Size of a District	0.593	0.500	0.375	0.093		0.218	8	Less than 9 FTEs
	D10	District R/W Annual Budget	0.556	0.500	0.500	0.056		0.056		
	D11	Dedication of Funds to the Project (R/W and Construction)	0.630	0.500	0.875	0.130		– 0.245	6	Yes
	D12	LPA Funded or Non-LPA Funded	0.444	0.375	0.625	0.069		– 0.181		
	D13	Federally Funded or Non-Federally Funded	0.296	0.500	0.500	– 0.204		– 0.204		
	D14	Funding Limitations for the Project	0.407	0.625	0.625	– 0.218	8	– 0.218	9	None
	D15	Level of Acceptance of the Project by the Public	0.333	0.375	0.500	– 0.042		– 0.167		
	D16	Level of Political Pressure	0.333	0.125	0.375	0.208	9	– 0.042		Moderate
	D17	Common Concerns of Property Owners	0.407	0.375	0.625	0.032		– 0.218		
	D18	Current Status of the R/W Project	0.667	0.875	0.875	– 0.208	10	– 0.208		R/W full release
R/W Acquisition	D19	Number of Parcels for Acquisition	0.926	0.750	1.000	0.176		– 0.074		
	D20	Different Types of Parcel Usages	0.556	0.250	0.750	0.306	4	– 0.194		Residential and Commercial
	D21	Frequency of Eminent Domain	0.704	0.625	0.875	0.079		– 0.171		
	D22	Source of Personnel to be used for R/W Acquisition	0.556	0.375	0.250	0.181		0.306	3	District staff
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.593	0.250	0.375	0.343	3	0.218	10	Marginally adequate
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.630	0.625	0.750	0.005		– 0.120		
	D25	Type of Property Owners	0.519	0.625	0.375	– 0.106		0.144		
	D26	Level of Familiarity with Key Landowners	0.481	0.375	0.750	0.106		– 0.269	5	High
	D27	Are There Any Property Tenants to Consider?	0.556	0.250	0.625	0.306	4	– 0.069		No
	D28	Need for Residential Relocation	0.741	0.750	0.750	– 0.009		– 0.009		
	D29	Level of Local Availability of Replacement Housing Facilities	0.815	0.750	0.750	0.065		0.065		
	D30	Need for Business Relocation	0.778	0.875	0.750	– 0.097		0.028		
	D31	Level of Local Availability of Replacement Business Facilities	0.667	0.500	0.500	0.167		0.167		
	D32	Likelihood of Title Curative Actions	0.852	0.500	0.375	0.352	2	0.477	1	High
	D33	Responsiveness of Local Title Companies to TxDOT	0.741	0.500	0.500	0.241	6	0.241	7	High

Cate.	Driver	Description	Mean			Difference (Most-Moderately)	Rank	Difference (Most-Least)	Rank	Model Project Value
			MOST Experienced (n=27)	MODERATELY Experienced (n=8)	LEAST Experienced (n=8)					
Utility Adjustment	D34	Have SUE Investigations been Performed	0.556	0.500	0.875	0.056		– 0.319	2	No
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.481	0.375	0.500	0.106		– 0.019		
	D36	Utility Type	0.704	0.750	0.750	– 0.046		– 0.046		
	D37	Number of Utilities Located in Public R/W	0.741	0.750	0.750	– 0.009		– 0.009		
	D38	Number of Utilities Located in Private Easement	0.852	0.750	0.750	0.102		0.102		
	D39	Number of Utilities for Adjustments or Relocations	0.630	0.750	0.500	– 0.120		0.130		
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.481	0.625	0.500	– 0.144		– 0.019		
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.926	0.750	0.875	0.176		0.051		
	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.741	0.625	0.625	0.116		0.116		

8.1.4 R/W Acquisition vs. Utility Adjustment Expertise

Along with accuracy of duration estimation and respondents' amount of experience, another independent variable used in analyzing PRE-application and POST-application importance rankings of duration drivers was respondents' areas of expertise. This study's participants were grouped into two categories such as whether they specialized in R/W acquisition or Utility adjustment.

There were not any drivers showing large differences in importance rankings, with large again defined as differences exceeding the cut-off point (>0.2) as described in Table 8.10. Therefore, model project values were not presented. One of the findings from this table is that area of expertise is not a factor that can bring about significant differences between R/W experts and Utility experts in assessing the PRE-application importance of duration drivers. However, some drivers were considered as having relatively high importance in the assessment of Utility experts, as compared to the R/W experts' assessments. These drivers are as follows:

- Right-of-Way and Utility Scope (D4)
- Status of Boundary Surveying (D6)
- Status of Right-of-Way Map (D8)
- Internal R/W Staff Size of a District (D9)
- District R/W Annual Budget (D10)
- Level of Acceptance of the Project by the Public (D15)
- Common Concerns of Property Owners (D17)
- Current Status of the R/W Project (D18)
- Number of Parcels for Acquisition (D19)
- Different Types of Parcel Usages (D20)
- Frequency of Eminent Domain (D21)
- Type of Property Owners (D25)
- Are There Any Property Tenants to Consider? (D27)
- Likelihood of Title Curative Actions (D32)
- Utility Type (D36)
- Number of Utilities Located in Private Easement (D38)

Table 8.10: PRE-Application Importance of Duration Drivers – Comparison between R/W Experts and UTILITY Experts

Cate.	Driver	Description	Mean		Difference (R-U)	Rank	Model Project Value
			R/W Experts (n=25)	Utility Experts (n=18)			
Project Basic Facts	D1	TxDOT Project Type	0.813	0.704	0.109		
	D2	TxDOT Highway Type	0.720	0.648	0.072		
	D3	Project Location Type	0.693	0.648	0.045		
	D4	Right-of-Way and Utility Scope	0.813	0.833	– 0.020		
	D5	Status of Schematic Design	0.680	0.611	0.069		
	D6	Status of Boundary Surveying	0.693	0.722	– 0.029		
	D7	Status of Environmental Clearance	0.920	0.852	0.068		
	D8	Status of Right-of-Way Map	0.853	0.870	– 0.017		
	D9	Internal R/W Staff Size of a District	0.667	0.722	– 0.055		
	D10	District R/W Annual Budget	0.667	0.796	– 0.129		
	D11	Dedication of Funds to the Project (R/W and Construction)	0.813	0.741	0.072		
	D12	LPA Funded or Non-LPA Funded	0.747	0.574	0.173		
	D13	Federally Funded or Non-Federally Funded	0.693	0.611	0.082		
	D14	Funding Limitations for the Project	0.800	0.741	0.059		
	D15	Level of Acceptance of the Project by the Public	0.693	0.722	– 0.029		
	D16	Level of Political Pressure	0.667	0.593	0.074		
	D17	Common Concerns of Property Owners	0.720	0.741	– 0.021		
	D18	Current Status of the R/W Project	0.760	0.833	– 0.073		
R/W Acquisition	D19	Number of Parcels for Acquisition	0.827	0.870	– 0.043		
	D20	Different Types of Parcel Usages	0.693	0.722	– 0.029		
	D21	Frequency of Eminent Domain	0.853	0.870	– 0.017		
	D22	Source of Personnel to be used for R/W Acquisition	0.720	0.648	0.072		
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.733	0.685	0.048		
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.747	0.630	0.117		
	D25	Type of Property Owners	0.640	0.648	– 0.008		
	D26	Level of Familiarity with Key Landowners	0.613	0.574	0.039		
	D27	Are There Any Property Tenants to Consider?	0.733	0.741	– 0.008		
	D28	Need for Residential Relocation	0.880	0.722	0.158		
	D29	Level of Local Availability of Replacement Housing Facilities	0.840	0.648	0.192		
	D30	Need for Business Relocation	0.787	0.722	0.065		
	D31	Level of Local Availability of Replacement Business Facilities	0.813	0.741	0.072		
	D32	Likelihood of Title Curative Actions	0.787	0.796	– 0.009		
	D33	Responsiveness of Local Title Companies to TxDOT	0.800	0.704	0.096		
Utility Adjustment	D34	Have SUE Investigations been Performed	0.653	0.630	0.023		
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.693	0.593	0.100		
	D36	Utility Type	0.800	0.815	– 0.015		
	D37	Number of Utilities Located in Public R/W	0.853	0.796	0.057		
	D38	Number of Utilities Located in Private Easement	0.867	0.889	– 0.022		
	D39	Number of Utilities for Adjustments or Relocations	0.893	0.815	0.078		
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.733	0.648	0.085		
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.893	0.870	0.023		
	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.800	0.741	0.059		

Table 8.11 describes the comparison of R/W experts and Utility experts in assessing the POST-application importance of duration drivers. Even though drivers did not show large differences in PRE-application importance, eight drivers in the assessments of POST-application importance showed differences that were more than the cut-off point (>0.2). These drivers include:

- TxDOT Project Type (D1)
- Project Location Type (D3)
- Status of Schematic Design (D5)
- Level of Local Availability of Replacement Business Facilities (D31)
- Responsiveness of Local Title Companies to TxDOT (D33)
- Will SUE Investigations be performed? (D35)
- Number of Utilities Located in Public R/W (D37)
- Number of Utilities for Adjustments or Relocations (D39)

As depicted in Table 8.11, R/W experts considered these drivers as having relatively high importance more often than Utility experts did when R/W experts knew specific information about the drivers. However, there were also some drivers that were evaluated as having more significance by Utility experts. These drivers are as follows:

- Right-of-Way and Utility Scope (D4)
- Internal R/W Staff Size of a District (D9)
- District R/W Annual Budget (D10)
- Different Types of Parcel Usages (D20)
- Need for Business Relocation (D30)
- Utility Type (D36)
- Number of Utilities in Located in Private Easement (D38)
- Responsiveness of Utility Companies to TxDOT Needs (D41)

Table 8.11: POST-Application Importance of Duration Drivers – Comparison between R/W Experts and UTILITY Experts

Cate.	Driver	Description	Mean		Difference (R-U)	Rank	Model Project Value
			R/W Experts (n=25)	Utility Experts (n=18)			
Project Basic Facts	D1	TxDOT Project Type	0.560	0.333	0.227	6	RER
	D2	TxDOT Highway Type	0.480	0.389	0.091		
	D3	Project Location Type	0.800	0.556	0.244	4	Rural
	D4	Right-of-Way and Utility Scope	0.800	0.944	– 0.144		
	D5	Status of Schematic Design	0.600	0.333	0.267	2	Completed
	D6	Status of Boundary Surveying	0.600	0.444	0.156		
	D7	Status of Environmental Clearance	0.680	0.667	0.013		
	D8	Status of Right-of-Way Map	0.680	0.667	0.013		
	D9	Internal R/W Staff Size of a District	0.520	0.556	– 0.036		
	D10	District R/W Annual Budget	0.520	0.556	– 0.036		
	D11	Dedication of Funds to the Project (R/W and Construction)	0.720	0.556	0.164		
	D12	LPA Funded or Non-LPA Funded	0.480	0.444	0.036		
	D13	Federally Funded or Non-Federally Funded	0.400	0.333	0.067		
	D14	Funding Limitations for the Project	0.560	0.389	0.171		
	D15	Level of Acceptance of the Project by the Public	0.400	0.333	0.067		
	D16	Level of Political Pressure	0.360	0.222	0.138		
	D17	Common Concerns of Property Owners	0.480	0.389	0.091		
	D18	Current Status of the R/W Project	0.760	0.722	0.038		
R/W Acquisition	D19	Number of Parcels for Acquisition	0.920	0.889	0.031		
	D20	Different Types of Parcel Usages	0.520	0.556	– 0.036		
	D21	Frequency of Eminent Domain	0.800	0.611	0.189		
	D22	Source of Personnel to be used for R/W Acquisition	0.480	0.444	0.036		
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.520	0.444	0.076		
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.680	0.611	0.069		
	D25	Type of Property Owners	0.520	0.500	0.020		
	D26	Level of Familiarity with Key Landowners	0.520	0.500	0.020		
	D27	Are There Any Property Tenants to Consider?	0.560	0.444	0.116		
	D28	Need for Residential Relocation	0.760	0.722	0.038		
	D29	Level of Local Availability of Replacement Housing Facilities	0.800	0.778	0.022		
	D30	Need for Business Relocation	0.760	0.833	– 0.073		
	D31	Level of Local Availability of Replacement Business Facilities	0.720	0.444	0.276	1	Low
	D32	Likelihood of Title Curative Actions	0.760	0.611	0.149		
	D33	Responsiveness of Local Title Companies to TxDOT	0.760	0.500	0.260	3	High
Utility Adjustment	D34	Have SUE Investigations been Performed	0.640	0.556	0.084		
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.560	0.333	0.227	6	Yes
	D36	Utility Type	0.720	0.722	– 0.002		
	D37	Number of Utilities Located in Public R/W	0.840	0.611	0.229	5	4 to 7
	D38	Number of Utilities Located in Private Easement	0.800	0.833	– 0.033		
	D39	Number of Utilities for Adjustments or Relocations	0.720	0.500	0.220	8	More than 7
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.520	0.500	0.020		
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.840	0.944	– 0.104		
	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.720	0.667	0.053		

8.1.5 Rural District vs. Urban / Metropolitan District Estimators

The final independent variable used to analyze the relationship between experts' backgrounds and the importance of assessments of drivers was "District Type." These types were grouped based on whether they were Rural or Urban/Metropolitan. Because of a lack of participants from Metropolitan districts, Urban district and Metropolitan district were combined into one group.

Table 8.12 describes the results of PRE-application importance assessments. The experts from rural districts evaluated 20 out of 42 duration drivers as having relatively high importance compared to the experts from Urban and Metropolitan districts. In contrast, 22 drivers were considered to have relatively high importance by the experts from Urban and Metropolitan districts. However, there were not significant differences (>0.2) between these two groups in assessing the PRE-application importance of drivers.

Conversely, in the assessments of the POST-application importance of drivers, there were nine drivers that showed large differences exceeding the cut-off point (0.2). These drivers include:

- Level of Political Pressure (D16)
- Common Concerns of Property Owners (D17)
- Frequency of Eminent Domain (D21)
- Source of Personnel to be used for R/W Acquisition (D22)
- Are There Any Property Tenants to Consider? (D27)
- Responsiveness of Local Title Companies to TxDOT (D33)
- Will SUE Investigations be performed? (D35)
- Number of Utilities for Adjustments or Relocations (D39)
- Adjustment is Reimbursable Utility or Non-Reimbursable Utility (D42)

Table 8.12: PRE-Application Importance of Duration Drivers – Comparison between RURAL District and URBAN/METROPOLITAN District Estimators

Cate.	Driver	Description	Mean		Difference (R-U/M)	Rank	Model Project Value
			Rural (n=28)	Urban/ Metro (n=15)			
Project Basic Facts	D1	TxDOT Project Type	0.750	0.800	– 0.050		
	D2	TxDOT Highway Type	0.679	0.711	– 0.032		
	D3	Project Location Type	0.702	0.622	0.080		
	D4	Right-of-Way and Utility Scope	0.845	0.778	0.067		
	D5	Status of Schematic Design	0.667	0.622	0.045		
	D6	Status of Boundary Surveying	0.726	0.667	0.059		
	D7	Status of Environmental Clearance	0.833	1.000	– 0.167		
	D8	Status of Right-of-Way Map	0.833	0.911	– 0.078		
	D9	Internal R/W Staff Size of a District	0.679	0.711	– 0.032		
	D10	District R/W Annual Budget	0.726	0.711	0.015		
	D11	Dedication of Funds to the Project (R/W and Construction)	0.738	0.867	– 0.129		
	D12	LPA Funded or Non-LPA Funded	0.643	0.733	– 0.090		
	D13	Federally Funded or Non-Federally Funded	0.619	0.733	– 0.114		
	D14	Funding Limitations for the Project	0.738	0.844	– 0.106		
	D15	Level of Acceptance of the Project by the Public	0.690	0.733	– 0.043		
	D16	Level of Political Pressure	0.619	0.667	– 0.048		
	D17	Common Concerns of Property Owners	0.702	0.778	– 0.076		
	D18	Current Status of the R/W Project	0.786	0.800	– 0.014		
R/W Acquisition	D19	Number of Parcels for Acquisition	0.845	0.844	0.001		
	D20	Different Types of Parcel Usages	0.738	0.644	0.094		
	D21	Frequency of Eminent Domain	0.845	0.889	– 0.044		
	D22	Source of Personnel to be used for R/W Acquisition	0.726	0.622	0.104		
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.738	0.667	0.071		
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.702	0.689	0.013		
	D25	Type of Property Owners	0.631	0.667	– 0.036		
	D26	Level of Familiarity with Key Landowners	0.619	0.556	0.063		
	D27	Are There Any Property Tenants to Consider?	0.726	0.756	– 0.030		
	D28	Need for Residential Relocation	0.810	0.822	– 0.012		
	D29	Level of Local Availability of Replacement Housing Facilities	0.762	0.756	0.006		
	D30	Need for Business Relocation	0.798	0.689	0.109		
	D31	Level of Local Availability of Replacement Business Facilities	0.798	0.756	0.042		
	D32	Likelihood of Title Curative Actions	0.762	0.844	– 0.082		
	D33	Responsiveness of Local Title Companies to TxDOT	0.726	0.822	– 0.096		
Utility Adjustment	D34	Have SUE Investigations been Performed	0.655	0.622	0.033		
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.619	0.711	– 0.092		
	D36	Utility Type	0.798	0.822	– 0.024		
	D37	Number of Utilities Located in Public R/W	0.857	0.778	0.079		
	D38	Number of Utilities Located in Private Easement	0.905	0.822	0.083		
	D39	Number of Utilities for Adjustments or Relocations	0.905	0.778	0.127		
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.655	0.778	– 0.123		
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.893	0.867	0.026		
	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.833	0.667	0.166		

Table 8.13: POST-Application Importance of Duration Drivers – Comparison between RURAL District and URBAN/METROPOLITAN District Estimators

Cate.	Driver	Description	Mean		Difference (R-U/M)	Rank	Model Project Value
			Rural (n=28)	Urban/ Metro (n=15)			
Project Basic Facts	D1	TxDOT Project Type	0.429	0.533	– 0.104		
	D2	TxDOT Highway Type	0.393	0.533	– 0.140		
	D3	Project Location Type	0.750	0.600	0.150		
	D4	Right-of-Way and Utility Scope	0.857	0.867	– 0.010		
	D5	Status of Schematic Design	0.500	0.467	0.033		
	D6	Status of Boundary Surveying	0.571	0.467	0.104		
	D7	Status of Environmental Clearance	0.714	0.600	0.114		
	D8	Status of Right-of-Way Map	0.679	0.667	0.012		
	D9	Internal R/W Staff Size of a District	0.536	0.533	0.003		
	D10	District R/W Annual Budget	0.536	0.533	0.003		
	D11	Dedication of Funds to the Project (R/W and Construction)	0.679	0.600	0.079		
	D12	LPA Funded or Non-LPA Funded	0.464	0.467	– 0.003		
	D13	Federally Funded or Non-Federally Funded	0.321	0.467	– 0.146		
	D14	Funding Limitations for the Project	0.429	0.600	– 0.171		
	D15	Level of Acceptance of the Project by the Public	0.393	0.333	0.060		
	D16	Level of Political Pressure	0.393	0.133	0.260	6	Moderate
	D17	Common Concerns of Property Owners	0.571	0.200	0.371	2	Access
	D18	Current Status of the R/W Project	0.750	0.733	0.017		
R/W Acquisition	D19	Number of Parcels for Acquisition	0.929	0.867	0.062		
	D20	Different Types of Parcel Usages	0.536	0.533	0.003		
	D21	Frequency of Eminent Domain	0.643	0.867	– 0.224	8	Several
	D22	Source of Personnel to be used for R/W Acquisition	0.536	0.333	0.203	9	District staff
	D23	Availability of District R/W Appraisers (District Staff and Outsourced)	0.500	0.467	0.033		
	D24	Is Funding Available for Outsourcing Staff Assistance?	0.679	0.600	0.079		
	D25	Type of Property Owners	0.536	0.467	0.069		
	D26	Level of Familiarity with Key Landowners	0.500	0.533	– 0.033		
	D27	Are There Any Property Tenants to Consider?	0.607	0.333	0.274	5	No
	D28	Need for Residential Relocation	0.786	0.667	0.119		
	D29	Level of Local Availability of Replacement Housing Facilities	0.821	0.733	0.088		
	D30	Need for Business Relocation	0.786	0.800	– 0.014		
	D31	Level of Local Availability of Replacement Business Facilities	0.643	0.533	0.110		
	D32	Likelihood of Title Curative Actions	0.750	0.600	0.150		
	D33	Responsiveness of Local Title Companies to TxDOT	0.750	0.467	0.283	4	High
Utility Adjustment	D34	Have SUE Investigations been Performed	0.607	0.600	0.007		
	D35	Will SUE Investigations be performed? (If no or unknown in the duration driver # 34)	0.357	0.667	– 0.310	3	Yes
	D36	Utility Type	0.714	0.733	– 0.019		
	D37	Number of Utilities Located in Public R/W	0.714	0.800	– 0.086		
	D38	Number of Utilities Located in Private Easement	0.821	0.800	0.021		
	D39	Number of Utilities for Adjustments or Relocations	0.786	0.333	0.453	1	More than 7
	D40	Is there any Utility Adjustment to be Included in the Highway Construction Contract?	0.536	0.467	0.069		
	D41	Responsiveness of Utility Companies to TxDOT Needs	0.893	0.867	0.026		
	D42	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	0.786	0.533	0.253	7	Reimbursable/ Non-reimbursable

8.2 Associations with Duration Estimation Accuracy

8.2.1 Estimators' Years of Experience

Associations between the estimators' backgrounds and the duration estimation accuracy were analyzed. Through this analysis, it was possible to identify what backgrounds influenced the accuracy of duration estimation based on personal judgments.

The chi-square test was used for this analysis. The chi-square test is a statistical method that can be used to decide if observed data differ from those expected under a particular hypothesis. In this study, the hypothesis to test was that there is no significant relationship between duration estimation accuracy and estimators' backgrounds.

First, the chi-square test was conducted on Years of Experience and it produced a significant p-value (0.018). This small value means that there is a significant relationship between the two factors contrary to the hypothesis, what was that "Years of Experience" may have played an important role producing differences in R/W duration estimation accuracy. As depicted in Table 8.14, experts with less than 13 years of experience display less accuracy in determining the durations of R/W acquisition than experts with more than 13 years of experience.

Table 8.14: Chi-square Test of Association between Years of Experience and Accuracy of Duration Estimation in R/W Acquisition

			Years of Experience		Total
			Less than 13 years	More than 13 years	
Accuracy in R/W acquisition durations	Less accurate	Count	9	3	12
	More accurate	Count	4	10	14
Total		Count	13	13	26
Pearson Chi-Square			Value	df	Sig. (2-sided)
			5.57142	1	0.01825

However, for predicting the durations of the utility adjustment process, the *p*-value was not statistically significant (0.743). "Years of Experience" appears to be not strongly associated with the accuracy of duration estimation for the utility adjustment process.

Table 8.15: Chi-square Test of Association between Years of Experience and Accuracy of Duration Estimation in UTILITY Adjustment

			Years of Experience		Total
			Less than 13 years	More than 13 years	
Accuracy in Utility adjustment durations	Less accurate	Count	7	4	11
	More accurate	Count	8	6	14
Total		Count	15	10	25
Pearson Chi-Square			Value	df	Sig. (2-sided)
			0.10815	1	0.74235

8.2.2 Area of Expertise

The chi-square test for analyzing the relationship between Area of Expertise and accuracy of duration estimation for the R/W acquisition process provided a significant *p*-value (0.006). Therefore, it can be said that an expert's "Area of Expertise" has a strong association with the accuracy of duration estimation for R/W acquisition. As depicted in Table 8.16, R/W experts were more accurate than Utility experts in determining durations of R/W acquisition.

Table 8.16: Chi-square Test of Association between Area of Expertise and Accuracy of Duration Estimation in R/W Acquisition

			Area of Expertise		Total
			R/W Acquisition	Utility Adjustment	
Accuracy in R/W acquisition durations	Less accurate	Count	3	9	12
	More accurate	Count	11	3	14
Total		Count	14	12	26
Pearson Chi-Square			Value	df	Sig. (2-sided)
			7.46173	1	0.00630

The *p*-value was not statistically significant (0.897) in the chi-square test for the relationship between the Area of Expertise and the accuracy of the duration estimation for utility adjustment, as described in Table 8.17. That is, the strength of the association between the Area of Expertise and the accuracy of the utility adjustment durations is negligible. This finding was also shown in determining the accuracy of estimators for the utility adjustment process in Chapter 7.

Table 8.17: Chi-square Test of Association between Area of Expertise and Accuracy of Duration Estimation in UTILITY Adjustment

			Area of Expertise		Total
			R/W Acquisition	Utility Adjustment	
Accuracy in Utility adjustment durations	Less accurate	Count	5	6	11
	More accurate	Count	6	8	14
Total		Count	11	14	25
Pearson Chi-Square			Value	df	Sig. (2-sided)
			0.01765	1	0.89730

8.2.3 District Type

The final factor to test was "District Type." As mentioned earlier, the district types were divided into two groups: Rural and Urban/Metropolitan due to the lack of sample data of Metropolitan districts. As presented in Table 8.18, the *p*-value provided by the chi-square test is not statistically significant (0.555) and this insignificance means that there was a weak relationship between the District Type and accuracy in estimating durations of R/W acquisition process.

Table 8.18: Chi-square Test of Association between District Type and Accuracy of Duration Estimation in R/W Acquisition

			District Type		Total
			Rural	Urban/Metro	
Accuracy in R/W acquisition durations	Less accurate	Count	9	3	12
	More accurate	Count	9	5	14
Total		Count	18	8	26
Pearson Chi-Square			Value	df	Sig. (2-sided)
			0.34806	1	0.55501

Table 8.19 describes the results of the chi-square test to determine any association between District Type and the accuracy of duration estimation for utility adjustment. The *p*-value was statistically significant (0.021), meaning that the District Type was strongly associated with accuracy differences in estimations of the durations of the utility adjustment process. Experts from urban/metropolitan districts were more accurate than experts from rural districts. This means that the experts from rural districts were not as accurate as experts from Urban and Metropolitan districts even when the project they needed to estimate was located in a rural area.

Table 8.19: Chi-square Test of Association between District Type and Accuracy of Duration Estimation in UTILITY Adjustment

			District Type		Total
			Rural	Urban /Metro	
Accuracy in Utility adjustment durations	Less accurate	Count	9	2	11
	More accurate	Count	5	9	14
Total		Count	14	11	25
Pearson Chi-Square			Value	df	Sig. (2-sided)
			5.31409	1	0.021125

8.2.4 PRE-Application Perception of Duration Driver Importance

In Chapter 7, the comparative analysis was conducted in order to investigate differences between More Accurate and Less Accurate estimators in assessing the importance of duration drivers. That analysis showed whether More Accurate and Less Accurate estimators evaluated the importance of drivers differently. However, the following two sections, 8.2.4 and 8.2.5, describe the drivers in which More Accurate and Less Accurate estimators showed differences in their assessments of drivers' importance.

Table 8.20 describes different perceptions among More Accurate and Less Accurate experts in R/W acquisition in the PRE-application evaluation of the importance of duration drivers. There were four drivers related to project basic facts. Specifically, More Accurate estimators evaluated driver #11 (Dedication of Funds to the Project) and #14 (Funding Limitations for the ProjectD14) as having high importance, but these drivers were considered as having low importance by Less Accurate estimators. In addition, although driver #16 (Level of Political Pressure) was considered moderately important by More Accurate estimators, for Less Accurate estimators, that driver was evaluated as not important. Conversely, Less Accurate estimators considered driver #17 (Common Concerns of Property Owners) as having high importance.

Among R/W acquisition-related drivers, drivers #28 (Need for Residential Relocation), #29 (Level of Local Availability of Replacement Housing Facilities), and #32 (Likelihood of Title Curative Actions) were considered as having high importance by More Accurate estimators, but Less Accurate estimators had different perceptions of these drivers' importance. Driver #30 (Need for Business Relocation) was evaluated as having high importance by Less Accurate estimators.

Table 8.20: Chi-square Test of Association between PRE-Application Importance of Duration Drivers and Accuracy of Duration Estimation in R/W Acquisition

Category	Driver	P value (P <0.05)	Description	Level of Importance	
				More Accurate (n=14)	Less Accurate (n=12)
Project Basic Facts	D11	0.002	Dedication of Funds to the Project (R/W and Construction)	High	Low
	D14	0.007	Funding Limitations for the Project	High	Low
	D16	0.003	Level of Political Pressure	Moderate	Not Important
	D17	0.023	Common Concerns of Property Owners	Moderate	High
R/W Acquisition	D28	0.002	Need for Residential Relocation	High	Low
	D29	0.004	Level of Local Availability of Replacement Housing Facilities	High	Low
	D30	0.018	Need for Business Relocation	Moderate	High
	D32	0.001	Likelihood of Title Curative Actions	High	Moderate

Table 8.21 shows the different perceptions among More Accurate and Less Accurate estimators in utility adjustment in the POST-application evaluation of the importance of duration drivers. Two project basic facts-related drivers were evaluated differently by both estimator groups, as is depicted by Table 8.21.

Conversely, the following four utility adjustment-related drivers were considered to be highly important by Less Accurate estimators.

- Have SUE Investigations Been Performed? (D34)
- Adjustment is Reimbursable Utility or Non-Reimbursable Utility (D42)
- Number of Utilities Located in Public R/W (D37)
- Number of Utilities for Adjustments or Relocations (D39)

Table 8.21: Chi-square Test of Association between PRE-Application Importance of Duration Drivers and Accuracy of Duration Estimation in UTILITY Adjustment

Category	Driver	P value (P <0.05)	Description	Level of Importance	
				More Accurate (n=14)	Less Accurate (n=11)
Project Basic Facts	D6	0.049	Status of Boundary Surveying	High	Moderate
	D14	0.005	Funding Limitations for the Project	High	Not Important
Utility Adjustment	D34	0.005	Have SUE Investigation been Performed	Low	High
	D37	0.008	Number of Utilities Located in Public R/W	Moderate	High
	D39	0.021	Number of Utilities for Adjustments or Relocations	Moderate	High
	D42	0.019	Adjustment is Reimbursable Utility or Non-Reimbursable Utility	Low	High

8.2.5 POST-Application Perception of Duration Driver Importance

More Accurate and Less Accurate estimators for R/W acquisition had different opinions of the PRE-application importance of two project basic facts-related drivers such as driver #1 (TxDOT Project Type) and driver #3 (Project Location Type). While these drivers were not evaluated as important by Less Accurate evaluators, More Accurate ones recognized these drivers as important ones, as depicted by Table 8.22.

For R/W acquisition-related drivers, More Accurate estimators evaluated driver # 21 (Frequency of Eminent Domain), #26 (Level of Familiarity with Key Landowners), and #31 (Level of Local Availability of Replacement Business Facilities) to be important, while Less Accurate estimators considered these drivers to not be important. In addition, driver #27 (Are There Property Tenants to Consider) was considered to be important by Less Accurate estimators.

The possible reason for these differences between More Accurate and Less Accurate estimators is that these estimators may have perceived the specific values of these drivers differently in assessing the driver importance.

Table 8.22: Chi-square Test of Association between POST-Application Importance of Duration Driers and Accuracy of Duration Estimation in R/W Acquisition

Cate.	Driver	P value (P <0.05)	Description	Important Driver?		Model Project Value
				More Accurate (n=14)	Less Accurate (n=12)	
B	D1	0.018	TxDOT Project Type	Important	Not Important	RER
B	D3	0.037	Project Location Type	Important	Not Important	Rural
R	D21	0.000	Frequency of Eminent Domain	Important	Not Important	Several
R	D26	0.006	Level of Familiarity with Key Landowners	Important	Not Important	Yes
R	D27	0.045	Are There Any Property Tenants to Consider?	Not Important	Important	No
R	D31	0.000	Level of Local Availability of Replacement Business Facilities	Important	Not Important	Low

B: Project Basic Facts-related, **R**: R/W Acquisition-related

Table 8.23 describes the different perceptions of More Accurate and Less Accurate estimators in utility adjustment in POST-application importance of duration drivers related to project basic facts-related drivers or utility adjustment. More Accurate estimators admitted the importance of the drivers such as "Status of Boundary Surveying," "District R/W Annual Budget," and "Dedication of Funds to the Project." However, these drivers were not assessed as important by Less Accurate estimators. There was one driver related to project basic facts that was considered important by Less Accurate estimators. That was driver #17 "Common Concerns of Property Owners." Conversely, driver #35 (Will SUE Investigations Be Performed?) was considered not important by More Accurate estimators. However, More Accurate estimators evaluated driver #36 (Utility Type), #39 (Number of Utilities for Adjustments or Relocations), and #40 (Is There any Utility Adjustment to be Included in the Highway Construction Contract?) as not important.

Table 8.23: Chi-square Test of Association between POST-Application Importance of Duration Drivers and Accuracy of Duration Estimation in UTILITY Adjustment

Cate.	Driver	P value (P <0.05)	Description	Important Driver?		Model Project Value
				More Accurate (n=14)	Less Accurate (n=11)	
B	D6	0.008	Status of Boundary Surveying	Important	Not Important	Completed
B	D10	0.028	District R/W Annual Budget	Important	Not Important	Less than $6 million
B	D11	0.032	Dedication of Funds to the Project (R/W and Construction)	Important	Not Important	Yes
B	D17	0.032	Common Concerns of Property Owners	Not Important	Important	Access
U	D35	0.003	Will SUE Investigation be Performed	Important	Not Important	Yes
U	D36	0.005	Utility Type	Not Important	Important	Water, Overhead and underground communications, etc.
U	D39	0.000	Number of Utilities for Adjustments or Relocations	Not Important	Important	More than 7
U	D40	0.028	Is There any Utility Adjustment to be included in the Highway Construction Contract?	Not Important	Important	No

B: Project Basic Facts-related, **U**: Utility Adjustment-related

In summary, estimators who exhibited different accuracy levels of duration estimations have assessed POST-importance of the duration drivers differently. One of the possible causes for these differences may be a different perception of the specific values of the drivers. As depicted in Tables 8.22 and 8.23, while More Accurate estimators considered some drivers important after knowing their specific values, Less Accurate estimators evaluated some drivers as not important. In order to increase the reliability of this finding, it is necessary to conduct additional studies using more data samples.

Chapter 9. Conclusions and Recommendations

9.1 Conclusions

This section presents the conclusions from the results of this implementation study and offers recommendations for enhancing the accuracy and effectiveness of RUDI. The following conclusions also relate to the objectives of this study: to identify key duration drivers for R/W acquisition and utility adjustment processes in highway projects for improved duration prediction.

- Based on the information collected from interactive RUDI training sessions at selected TxDOT districts, it is apparent that RUDI can be useful to TxDOT project planners and other relevant stakeholders in forecasting the necessary durations for acquiring right-of-way and adjusting utilities.
- The accuracy of RUDI in predicting the durations of R/W acquisition and utility adjustment is relatively high compared to the manual estimation methods that are based on personal judgments, even though RUDI was based on limited sample data.
- The percentile range matrix developed by the research team is an effective guide in selecting reasonable percentile ranges that allow predictors to use statistical information provided by the RUDI tool. Reasonableness in determining the degree of uncertainty and schedule urgency of a project is critical to obtaining the full benefits of RUDI.
- Forty-two duration drivers of R/W acquisition and utility adjustment have been identified based on experts' opinions, and their importance was evaluated by 43 R/W and utility experts who are currently working in various TxDOT districts. The assessment results of the duration drivers' importance reveal that there are perceptual differences among experts in their evaluations of the importance of various duration drivers. One apparent reason for such discrepancies is that estimators with more accurate duration estimates do not overestimate the importance of many duration drivers in R/W acquisition and utility adjustment processes.
- For better R/W acquisition duration estimates, the most important and relevant drivers identified by the study are as follows:
  - TxDOT Project Type (D1)
  - Project Location Type (D3)
  - Right-of-Way and Utility Scope (D4)
  - District R/W Annual Budget (D10)
  - Dedication of Funds to the Project (R/W and Construction) (D11)
  - Number of Parcels for Acquisition (D19)
  - Frequency of Eminent Domain (D21)
  - Level of Familiarity with Key Landowners (D26)
  - Need for Residential Relocation (D28)
  - Level of Local Availability of Replacement Housing Facilities (D29)
  - Need for Business Relocation (D30)

- Level of Local Availability of Replacement Business Facilities (D31)
- Likelihood of Title Curative Actions (D32)

These drivers have been rated as highly important in assessing POST-application importance by the more accurate estimators in R/W acquisition duration estimation. Several of these drivers are not included in the RUDI tool and may not be supported by the ROWIS database. Therefore, these drivers should be analyzed further for accuracy influence on R/W duration estimation in future studies.

- For utility adjustment duration estimation, the following drivers have been rated as the most relevant and significant:
  - Project Location Type (D3)
  - Right-of-Way and Utility Scope (D4)
  - Status of Boundary Surveying (D6)
  - Status of Environmental Clearance (D7)
  - Status of Right-of-Way Map (D8)
  - District R/W Annual Budget (D10)
  - Dedication of Funds to the Project (R/W and Construction (D11)
  - Current Status of the R/W Project (D18)
  - Have SUE Investigations Been Performed? (D34)
  - Will SUE Investigations Be Performed? (D35)
  - Number of Utilities Located in Public R/W (D37)
  - Number of Utilities Located in Private Easement (D38)
  - Responsiveness of Utility Companies to TxDOT Needs (D41)

  These drivers have been also evaluated as having high importance in assessing POST-application importance by the more accurate estimators in utility adjustment duration estimation. Whether SUE investigations have been performed is a sensitive issue to estimators and there are Project Basic Facts-related drivers that have not been considered to be highly important in R/W acquisition duration estimation. This observation may mean that forecasting durations of utility adjustment requires different factors from the prediction of R/W acquisition even though both pre-construction activities are correlated and should be well coordinated.

- In investigating the associations among accuracy of duration estimation and experts' backgrounds, the estimators with more than 13 years of experience in R/W acquisition produced more accurate duration estimates when compared to the less experienced experts. Estimators specializing in R/W acquisition showed more accurate duration estimations for R/W acquisition process than did utility adjustment experts. Experts working in urban and metropolitan districts were more accurate than experts from rural districts in predicting durations even though the model project that they needed to estimate was located in a rural area in Texas. It is necessary to analyze kinds of highway projects, whether urban, metropolitan, or rural, in order to increase the reliability of the results through analyzing these projects' associations with estimators' backgrounds.

9.2 Recommendations

The following recommendations may be made to TxDOT based on the findings about and improvements of the RUDI tool in this study:

- It is necessary to conduct additional similar studies using a larger number of real TxDOT projects to better understand the accurate determination of durations. Specifically, recently completed TxDOT projects should be analyzed in order to expand, enrich, and update data upon which RUDI is based.
- As mentioned in the conclusion, although RUDI is an effective informational tool in estimating durations of R/W acquisition and utility adjustment processes, it does not cover many key drivers that may affect both preconstruction processes as mentioned in the conclusions. Therefore, the identified drivers from this implementation study may be used as important data points that need to be identified and recorded for the TxDOT database ROWIS.
- TxDOT may wish to develop a spreadsheet model to act simultaneously with ROWIS. It would be very beneficial to enable parallel analysis that would enable users to search and filter recent data that are similar to their projects. In addition, RUDI should be further developed as a database in which all knowledge about durations is stored in the same place and from which such knowledge could be quickly recovered. These efforts could make RUDI more dynamic and beneficial.

Appendix A: Improved RUDI Tool (v2.0)

The improved RUDI tool (version 2.0) is provided in a CD.

Appendix B: RUDI Training Tutorial

Content

1. RUDI Purpose and Definition
2. Using RUDI: Percentiles
3. RUDI Examples
4. Completing RUDI Project Duration Record Form

TxDOT

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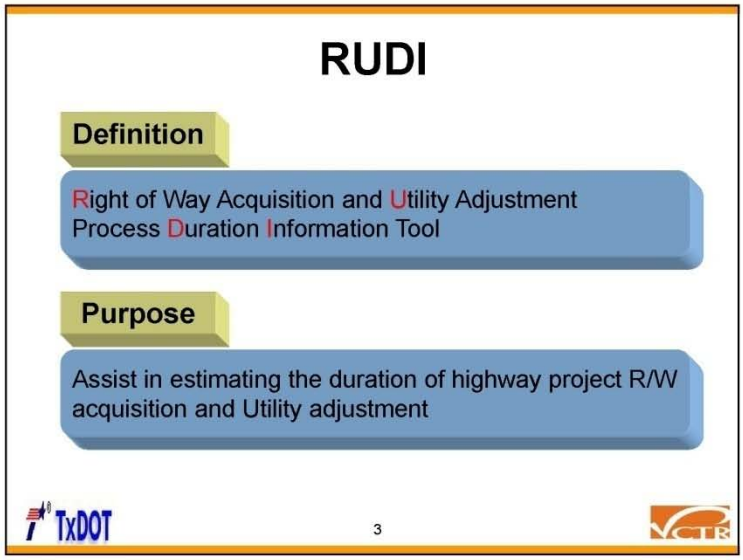
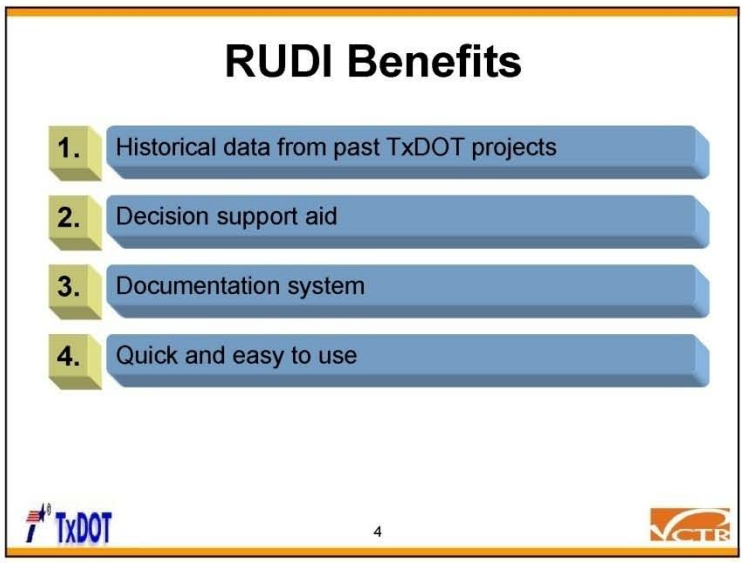
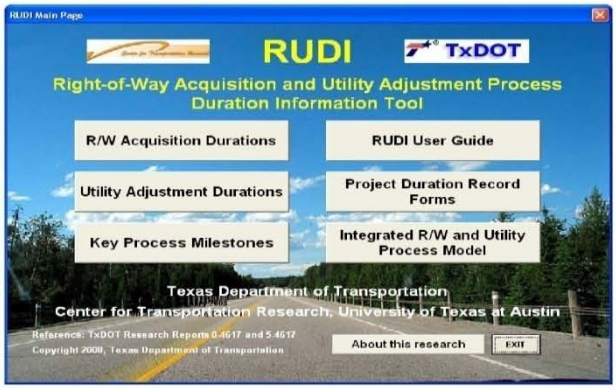

RUDI
Definition
Right of Way Acquisition and Utility Adjustment Process Duration Information Tool
Purpose
Assist in estimating the duration of highway project R/W acquisition and Utility adjustment
TxDOT
3

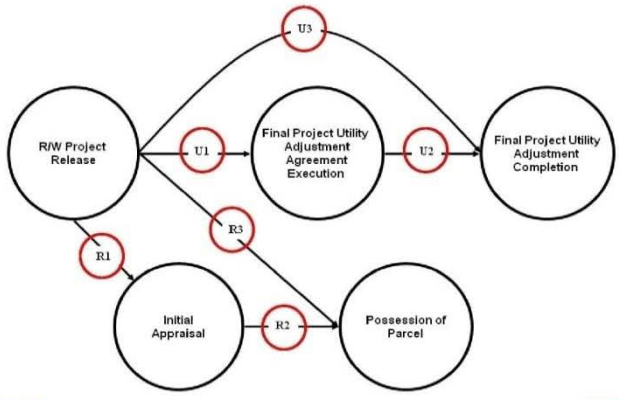

RUDI Benefits
1. Historical data from past TxDOT projects
2. Decision support aid
3. Documentation system
4. Quick and easy to use
TxDOT
4

RUDI Main Interface



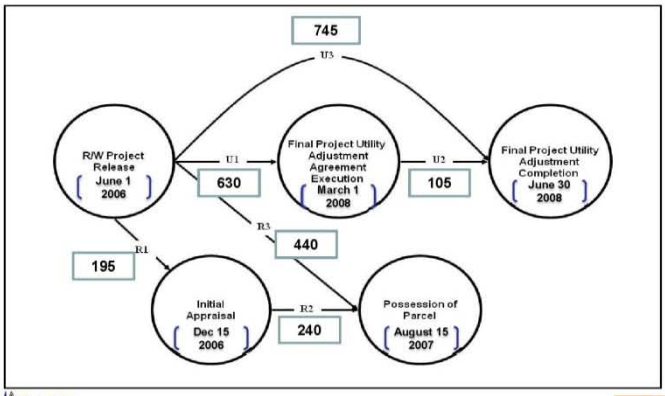
TxDOT 5 CTR

What Durations are Provided?



TxDOT 6 CTR

RUDI Milestone Record Form



TxDOT 7 VCTR

RUDI Source Data for R/W Acquisition

- ROWIS Database
  - 384 projects with 5932 parcels completed (as of 6/7/04)
  - Average number of parcels per project: 15
  - Median: 5
  - ¾ of 384 projects have 16 parcels or fewer per project
- 45 projects were studied among 384 projects
  - Not random but convenience sampling
  - Average number of parcels: 36

TxDOT 8 VCTR

RUDI Source Data for Utility Adjustment

- TxDOT Databases
  - R/W Division's utility database
  - DCIS database
- 83 projects were examined from district nominees (non-random sampling)
  - "Quick" and "Slow" categorization by District
  - "Quick" projects: 34 and "Slow" projects: 49
- 67 projects with complete duration data
  - "Quick" projects: 25
  - "Slow" projects: 42

TxDOT 9 CTR

RUDI Procedure

1. Print the Project Duration Record Form
2. Characterize project on the Record Form
3. Set target percentile range
4. Look up & document durations
5. Analyze data & recommend durations

TxDOT 10 CTR

USING RUDI: Percentiles

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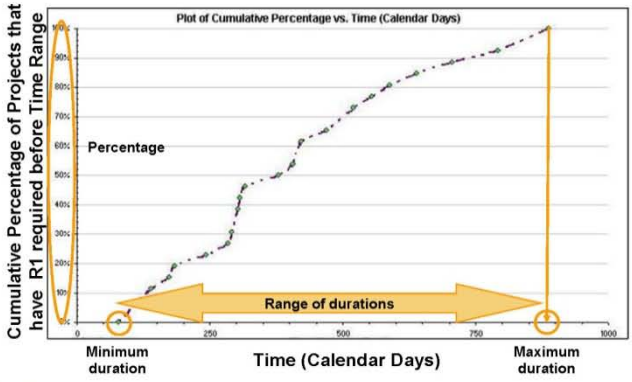
RUDI Output



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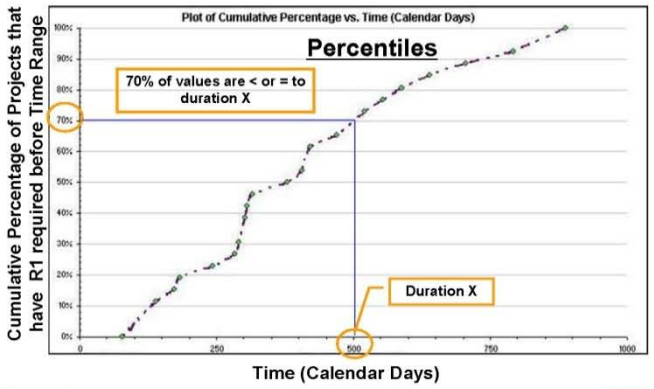
RUDI: Percentiles



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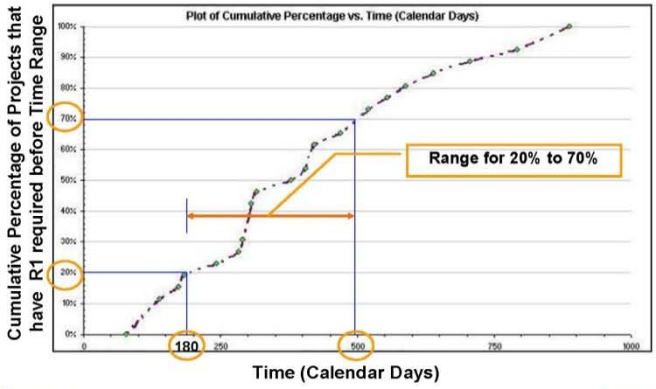
RUDI: Percentile Range



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What Percentile Range to Use?

PERCENTILE RANGE MATRIX

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

TxDOT 15

Drivers for Schedule Urgency

1. Level of political pressure
2. Relative highway user costs (of delay in travel)
3. Level of district R/W support resources available
4. Contract letting pressure

TxDOT 16

Drivers for Uncertainty

1. Project funding limitations (relative to cost)
2. Project scope
3. Familiarity with local landowners
4. Knowledge of existing utility facilities
5. Level of cooperation between DOT and local utilities
6. Property title – related uncertainties

TxDOT 17 VCTR

What % Range is Right?

PERCENTILE RANGE MATRIX

		Percentile Ranges: Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate			
	Low			

Schedule:
- High level of political pressure
- High user costs of delay in travel
- High R/W district support resource availability

Uncertainty:
- Known project scope
- High familiarity with local landowners
- High level of cooperation between DOT and local utilities

TxDOT 18 VCTR

What % Range is Right?

PERCENTILE RANGE MATRIX

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate			
	Low			

Schedule:
- High level of political pressure
- High user costs of delay in travel
- High R/W district support resource availability

Uncertainty:
- Unknown project scope
- Low familiarity with local landowners
- Low level of cooperation between DOT and local utilities

TxDOT

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VCTR

What % Range is Right?

PERCENTILE RANGE MATRIX

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate			
	Low	50-70	50-80	50-90

Schedule:
- Low level of political pressure
- Low user costs of delay in travel
- Low R/W district support resource availability

Uncertainty:
- Known project scope
- High familiarity with local landowners
- High level of cooperation between DOT and local utilities

TxDOT

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VCTR

10

What % Range is Right?

PERCENTILE RANGE MATRIX

Percentile Ranges			
	Degree of Uncertainty		
Degree of Schedule Urgency	Low	Moderate	High
High	10-30	10-40	10-50
Moderate			
Low	50-70	50-80	50-90

Schedule:
- Low level of political pressure
- Low user costs of delay in travel
- Low R/W district support resource availability

Uncertainty:
- Unknown project scope
- Low familiarity with local landowners
- Low level of cooperation between DOT and local utilities

TxDOT 21 VCTR

R/W Acquisition Duration Drivers in RUDI

Number of Parcels	Less than 10	☐
	10 or greater	☐
	30 or less	☐
	More than 30	☐
Location Type	Urban	☐
	Rural	☐
District ROW Staff Size	Less than 9 FTEs	☐
	9 or more FTEs	☐
District Annual ROW Budget	Less than $6 million	☐
	More than $6 million	☐

TxDOT 22 VCTR

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Utility Adjustment Duration Drivers in RUDI

TxDOT Highway Type		
TxDOT Project Type		
Utility Type		
Reimbursable	Reimbursable	☐
	Non-Reimbursable	☐
LPA Funding	LPA Funded	☐
	Non-Funded	☐
Federal Funding	Federally Funded	☐
	Non-Federally Funded	☐
Location Category	Urban	☐
	Rural	☐
	Metropolitan	☐
Utility Adjustment Speed	Quick	☐
	Slow	☐

TxDOT

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VCTR

RUDI Examples

TxDOT

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VCTR

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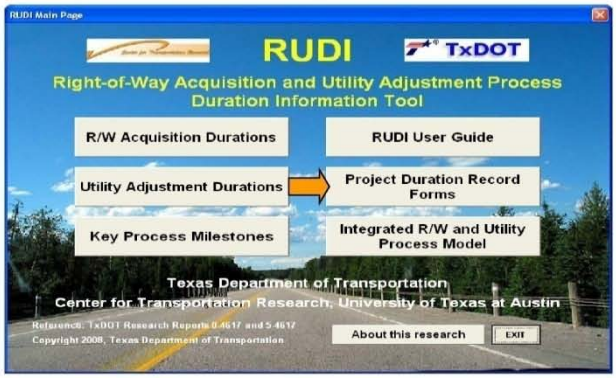
RUDI



TxDOT 25 CTR

Sample Duration Record Form

Characterizing your project

Recording percentiles and durations from RUDI

RIGHT OF WAY ACQUISITION PROCESS DURATIONS

			R1 From R/W Project Release To Initial Appraisal			
Degree of Schedule Urgency			L ☐ M ☐ H ☐			
Degree of Uncertainty			L ☐ M ☐ H ☐			
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐				
	10 or greater	☐				
	30 or less	☐				
	More than 30	☐				
Location Type	Urban	☐				
	Rural	☐				
Average						
Range						
Recommended duration						

TxDOT 26 CTR

R/W Acquisition Example

R1 Duration: R/W Project Release to Initial Appraisal

Location Type: Rural area

# of Parcels: 15

Low degree of uncertainty

Moderate schedule urgency

Percentile Ranges			
	Degree of Uncertainty		
Degree of Schedule Urgency	Low	Moderate	High
High	10-30	10-40	10-50
Moderate	30-50	30-60	30-70
Low	50-70	50-80	50-90

RIGHT OF WAY ACQUISITION PROCESS DURATIONS						
Choices			R1 From R/W Project Release To Initial Appraisal			
			Degree of Schedule Urgency	L ☐ M X H ☐		
			Degree of Uncertainty	L X M ☐ H ☐		
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐				
	10 or greater	X	30	50		
	30 or less	☐				
	More than 30	☐				
Location Type	Urban	☐				
	Rural	X	30	50		
Average						
Range						
Recommended duration						

TxDOT

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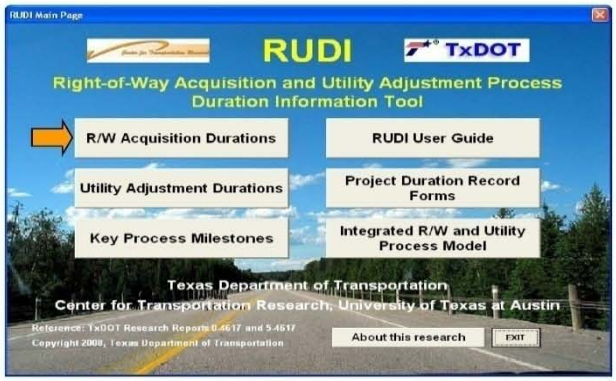
VCTR

R/W Acquisition Example



TxDOT

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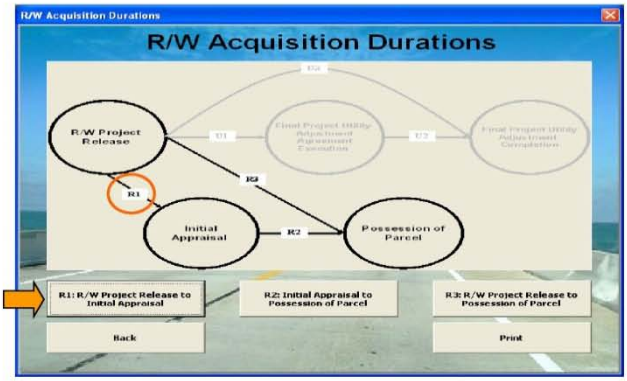
VCTR

Example: R1 Duration



TxDOT

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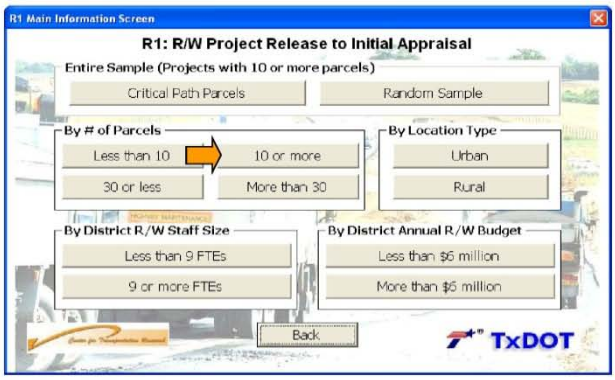
Example: R1 Duration



TxDOT

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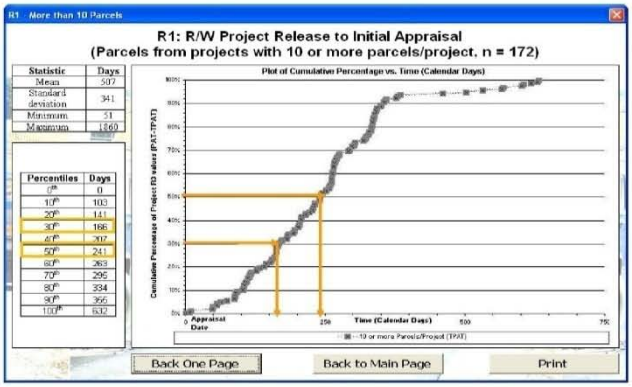
R1 with 15 Parcels



TxDOT

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CTR

Example: R1 Duration

RIGHT OF WAY ACQUISITION PROCESS DURATIONS						
Choices			R1 From R/W Project Release To Initial Appraisal			
			Degree of Schedule Urgency: L ☐ M ☒ H ☐			
			Degree of Uncertainty: L ☒ M ☐ H ☐			
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐				
	10 or greater	☒	30	50	166	241
	30 or less	☐				
	More than 30	☐				
Location Type	Urban	☐				
	Rural	☐				
Average						
Range						
Recommended duration						

TxDOT

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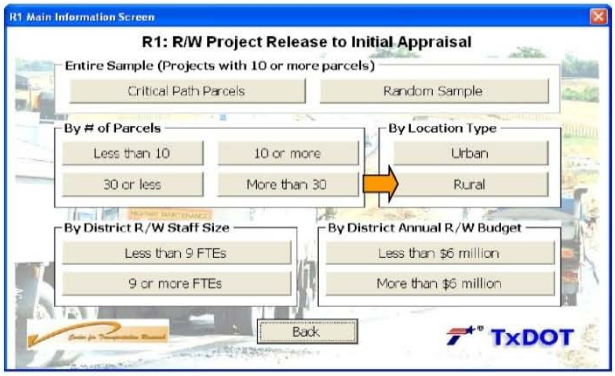
CTR

Example: R1 Duration



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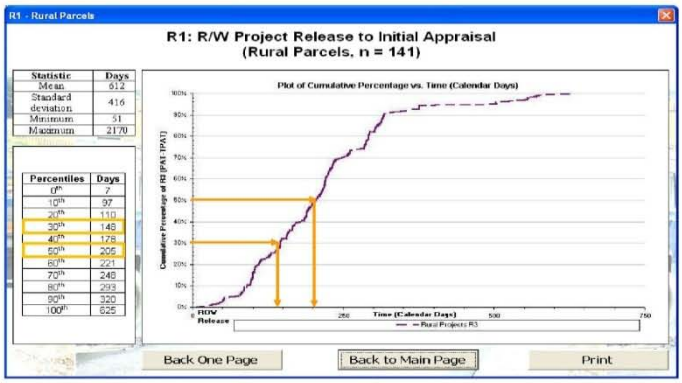
R1 in Rural Area



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Example: R1 Duration

RIGHT OF WAY ACQUISITION PROCESS DURATIONS						
Choices			R1 From R/W Project Release To Initial Appraisal			
			Degree of Schedule Urgency: L □ M X H □			
			Degree of Uncertainty: L X M □ H □			
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	□				
	10 or greater	X	30	50	166	241
	30 or less	□				
	More than 30	□				
Location Type	Urban	□				
	Rural	X	30	50	148	205
Average						
Range						
Recommended duration						

TxDOT

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VCTR

Example: R1 Duration

RIGHT OF WAY ACQUISITION PROCESS DURATIONS						
Choices			R1 From R/W Project Release To Initial Appraisal			
			Degree of Schedule Urgency: L □ M X H □			
			Degree of Uncertainty: L X M □ H □			
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	□				
	10 or greater	X	30	50	166	241
	30 or less	□				
	More than 30	□				
Location Type	Urban	□				
	Rural	X	30	50	148	205
Average			30	50	157	223
Range			30-50		166-205	
Recommended duration						

TxDOT

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VCTR

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How do you Determine the Recommended Duration?

- Stay within the RANGE
- Consider OTHER factors
- Use your JUDGEMENT

TxDOT 37 CTR

Utility Adjustment Example

U2 Duration: Final Project Utility Adjustment Agreement Execution to Final Project Utility Adjustment Completion

- Utility Type: Overhead Power
- Utility Adjustment Speed: Slow
- High degree of uncertainty
- Moderate schedule urgency

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

UTILITY ADJUSTMENT PROCESS DURATIONS

Choices			U2: From Final Project Utility Adjustment Agreement Execution To Final Project Utility Adjustment Completion			
			Degree of Schedule Urgency	L □	M X	H □
			Degree of Uncertainty	L □	M □	H X
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Utility Type	*Overhead Power*		30	70		
Utility Adjustment Speed	Quick	□				
	Slow	X	30	70		
Average						
Range						
Recommended duration						

TxDOT 38 CTR

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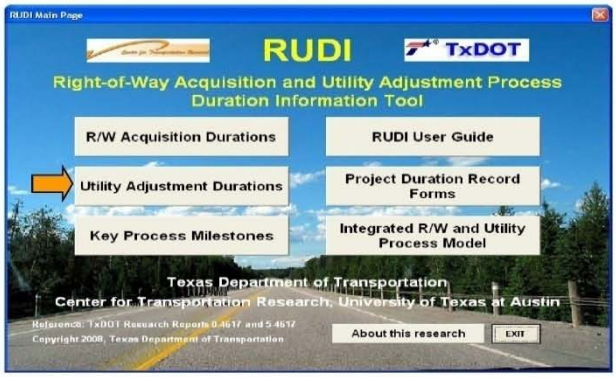
Utility Adjustment Example



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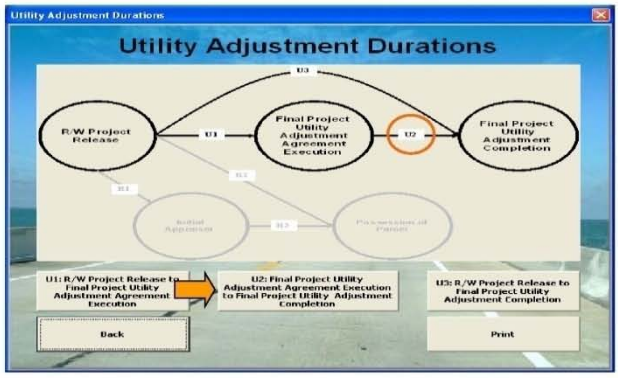
Example: U2 Duration



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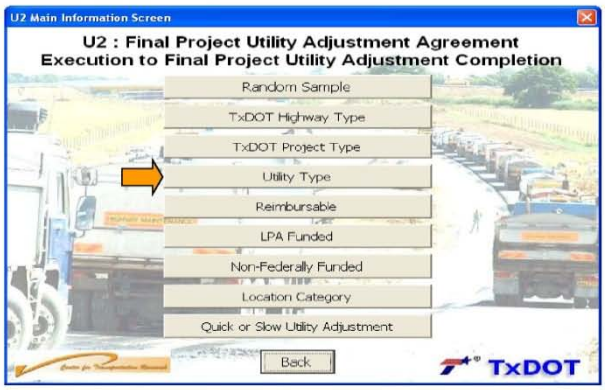
Example: U2 Duration



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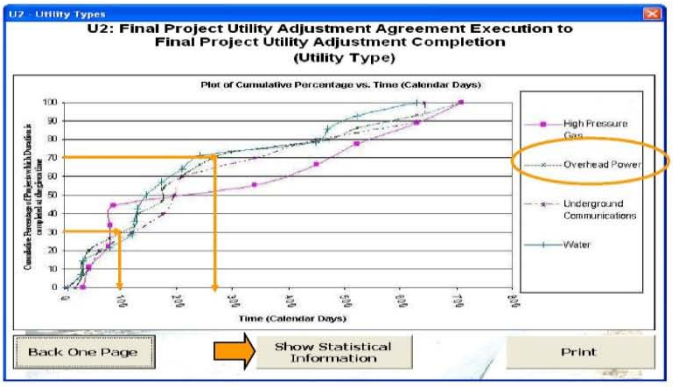
Example: U2 Duration



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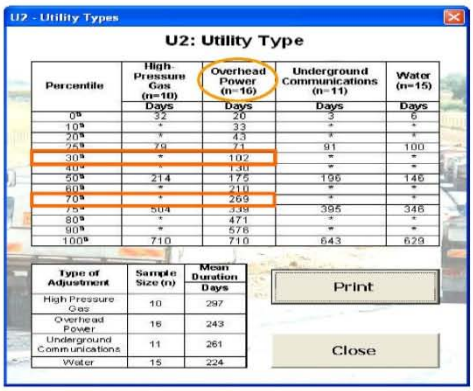
Example: U2 Duration



Percentile	High-Pressure Gas (n=10)	Overhead Power (n=16)	Underground Communications (n=11)	Water (n=15)
	Days	Days	Days	Days
0%	32	20	3	6
10%	*	33	*	*
20%	*	43	*	*
25%	79	71	91	100
30%	*	102	*	*
40%	*	130	*	*
50%	214	175	196	146
60%	*	210	*	*
70%	*	269	*	*
75%	504	339	395	346
80%	*	471	*	*
90%	*	576	*	*
100%	710	710	643	629

Type of Adjustment	Sample Size (n)	Mean Duration (Days)
High Pressure Gas	10	297
Overhead Power	16	243
Underground Communications	11	261
Water	15	224

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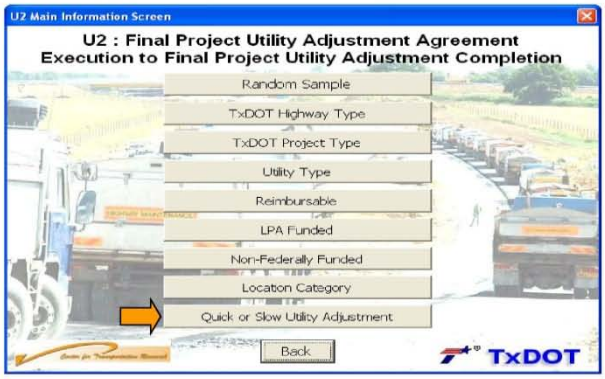
Example: U2 Duration



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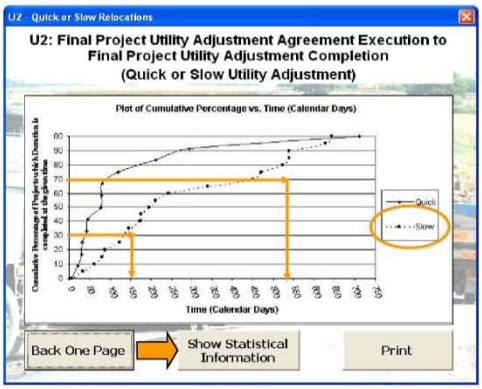
Example: U2 Duration



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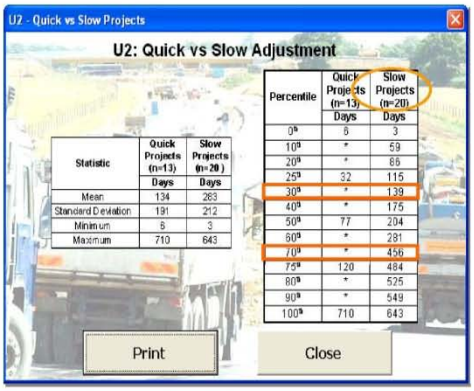
Example: U2 Duration



Statistic	Quick Projects (n=13) Days	Slow Projects (n=20) Days
Mean	134	269
Standard Deviation	191	212
Minimum	6	3
Maximum	710	643

Percentile	Quick Projects (n=13) Days	Slow Projects (n=20) Days
0th	6	3
10th	*	59
20th	*	86
25th	32	115
30th	*	139
40th	*	175
50th	77	204
60th	*	281
70th	*	456
75th	120	484
80th	*	525
90th	*	549
100th	710	643

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Example: U2 Duration

UTILITY ADJUSTMENT PROCESS DURATIONS						
Choices			U2 From Final Project Utility Adjustment Agreement Execution To Final Project Utility Adjustment Completion			
			Degree of Schedule Urgency	L □	M X	H □
			Degree of Uncertainty	L □	M □	H X
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Utility Type	*Overhead Power*		30	70	102	269
Utility Adjustment Speed	Quick	□				
	Slow	X	30	70	139	456
Average			30	70	121	363
Range			30 -70		139 - 269	
Recommended duration						

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RUDI Limitations

1. Provides a RANGE of durations not a single number
2. Does NOT include ALL factors affecting durations
3. Based on limited historical data
4. Still requires user JUDGEMENT

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RUDI Duration Record Form

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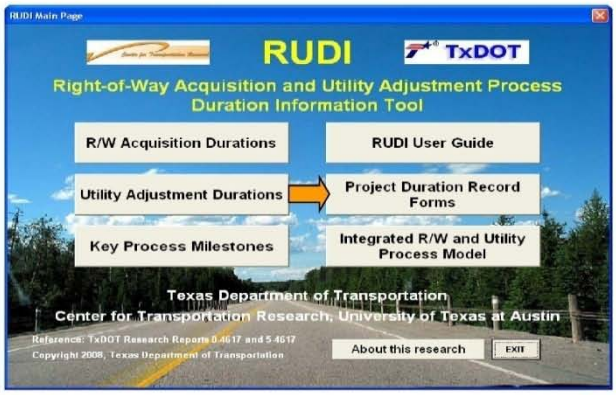
RUDI



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R/W ACQUISITION AND UTILITY ADJUSTMENT PROCESS DURATION RECORD FORM

Project CSJ	
Project Title	
Date of Analysis	
Name of Analyst	
Project Description	
Unusual Circumstances (i.e. congested corridor, wetlands, lawyer activity, etc., if known)	
Project Current Status	

TxDOT 51 CTR

PERCENTILE RANGE MATRIX

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

TxDOT 52 CTR

RIGHT OF WAY ACQUISITION PROCESS DURATIONS

Choices			R1 From R/W Project Release To Initial Appraisal				R2 From Initial Appraisal To Possession of Parcel				R3 From R/W Project Release To Possession of Parcel			
			Degree of Schedule Urgency L☐ M☐ H☐				Degree of Schedule Urgency L☐ M☐ H☐				Degree of Schedule Urgency L☐ M☐ H☐			
			Degree of Uncertainty L☐ M☐ H☐				Degree of Uncertainty L☐ M☐ H☐				Degree of Uncertainty L☐ M☐ H☐			
			Percentiles		Duration		Percentiles		Duration		Percentiles		Duration	
			Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐												
	10 or greater	☐												
	30 or less	☐												
	More than 30	☐												
Location Type	Urban	☐												
	Rural	☐												
District ROW Staff Size	Less than 9 FTEs	☐												
	9 or more FTEs	☐												
District Annual ROW Budget	Less than $6 million	☐												
	More than $6 million	☐												
Average														
Range														
Recommended duration														

TxDOT 53 VCTR

UTILITY ADJUSTMENT PROCESS DURATIONS

Choices			U1 From R/W Project Release To Final Project Utility Adjustment Agreement Execution				U2 From Final Project Utility Adjustment Agreement Execution To Final Project Utility Adjustment Completion				U3 From R/W Project Release To Final Project Utility Adjustment Completion			
			Degree of Schedule Urgency L☐ M☐ H☐				Degree of Schedule Urgency L☐ M☐ H☐				Degree of Schedule Urgency L☐ M☐ H☐			
			Degree of Uncertainty L☐ M☐ H☐				Degree of Uncertainty L☐ M☐ H☐				Degree of Uncertainty L☐ M☐ H☐			
			Percentiles		Duration		Percentiles		Duration		Percentiles		Duration	
			Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
TxDOT Highway Type														
TxDOT Project Type														
Utility Type														
Reimbursable	Reimbursable	☐												
	Non-Reimbursable	☐												
LPA Funding	LPA Funded	☐												
	Non-Funded	☐												
Federal Funding	Federally Funded	☐												
	Non-Federally Funded	☐												
Location Category	Urban	☐												
	Rural	☐												
	Metropolitan	☐												
Utility Adjustment Speed	Quick	☐												
	Slow	☐												
Average														
Range														
Recommended duration														

TxDOT 54 VCTR

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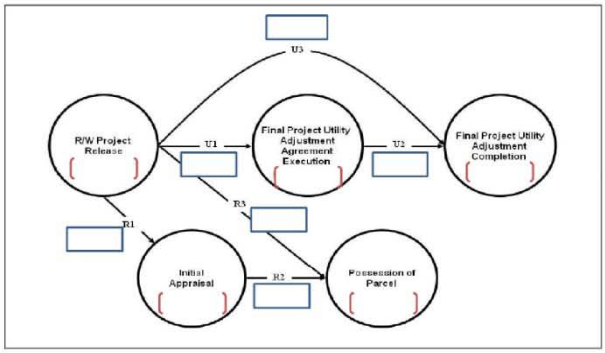
Key Process Milestone Form



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RECOMMENDED DURATIONS AND MILESTONE DATES

Right Of Way Acquisition	Utility Adjustment
Justifications	

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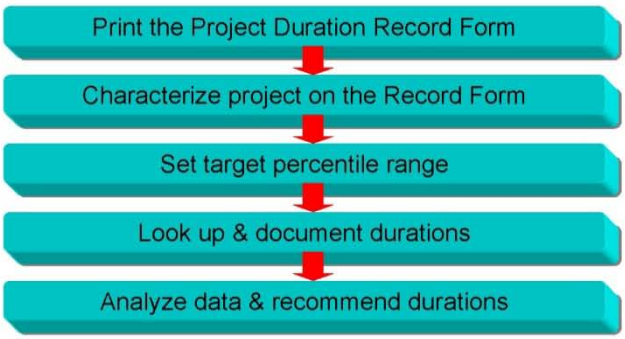
RUDI Practice

TxDOT 57 CTR

Review of RUDI Steps



TxDOT 58 CTR

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What Percentile Range to Use?

PERCENTILE RANGE MATRIX

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

TxDOT 59 VCTR

Critical Issues for Your Judgment

1. What are the factors affecting your duration judgments?
2. How do you factor-in uncertainty?
3. What steps do you use for estimating durations?

TxDOT 60 VCTR

Appendix C: RUDI User Guide

RUDI

Right-of-Way Acquisition and Utility Adjustment Process Duration Information Tool

User Guide

Texas Department of Transportation

TxDOT

Preface

Ever since right of way acquisition has been an organized business activity in Texas, involved and affected parties both sides of the R/W line have asked the question "How long does it take to acquire right of way? And, "When will this new highway be completed?" For over 40 years there has not been a reasonable answer to these questions. Predicting the duration of R/W acquisition processes has historically been a problematic issue without a definitive and reliable means of forecasting the successful delivery of clear right of way for highway construction. The Texas Department of Transportation's inability to consistently predict the completion of this activity causes project delays, cost overruns and negative economic impact to commerce in general.

Knowing of these negative economic repercussions, numerous investigations, process reviews and retooling efforts have been conducted in an attempt to understand and streamline R/W process durations and address unrealistic letting dates. However, none of these efforts produced a framework and tool that could suggest a date of R/W delivery.

Then early in 2003 at the prompting of John Campbell, ROW Division Director, and under the direction of the Research and Technology Implementation Office, a research project was authorized and commissioned to research delays in right of way and utility processes. The Center for Transportation Research at the University of Texas at Austin has scientifically measured right of way and utility historical data and developed a tool to assist the right of way practitioner when providing an advance indication of R/W delivery for construction.

This tool is called the "Right of Way and Utility Adjustment Duration Information System" (RUDI). It is an innovative tool that reviews a historical data directory to make intelligent predictions of time to acquire R/W and adjust utilities. RUDI is the first functional model of this type of decision assistance tool. RUDI is believed to be a wise first step toward providing a knowledgeable advisory of R/W project completion thereby supporting the mission of TxDOT to work cooperatively to provide safe, effective and efficient movement of people and goods. We trust this tool will be a benefit to your operations.

Larry Black

District Right of Way Administrator
Amarillo District Office
Texas Department of Transportation

Table of Contents

Table of Figures

Chapter I: Introduction to RUDI

Part 1: Introducing RUDI

- **Definition**

RUDI is a **R**ight of Way Acquisition and **U**tility Adjustment Process **D**uration **I**nformation Tool.

- **Purpose**

RUDI was developed to assist project planning by supporting estimates of Right-of-Way (R/W) and utility adjustment durations for new TxDOT projects and by validating assumptions on existing projects.

- **Benefits**

RUDI is quick and easy to use. It provides a historical basis for R/W acquisition and utility adjustment duration estimates as well as supporting users' judgment for decision making about duration estimates.

Part 2: Getting Started

RUDI runs within the Microsoft Excel platform. In order to properly run RUDI, the user should set Excel to enable macros as a preparation step. If the user's computer is set to "enable macros," one will see RUDI's main interface page immediately after clicking on the file. However, if the user's computer is not set to "enable macros," the computer will give a security warning and give notice to enable or disable macros, as illustrated in Figure 1.1 below. The user should enable macros.

Figure 1.1 Dialog Box for Enabling Macros

Part 3: Navigating RUDI

RUDI consists of six components, namely: advisory data (both R/W acquisition and Utility adjustment durations), a project duration record form, an integrated process map, a key process milestone form, and the RUDI user guide. The user can directly access these components on the RUDI main interface page. There are six primary buttons on this screen corresponding to the main components. In addition, there are two additional buttons. The one on the bottom right hand corner allows the user to exit the system and the other one beside it provides information about the research. The RUDI main interface (Figure 1.2) is illustrated below.

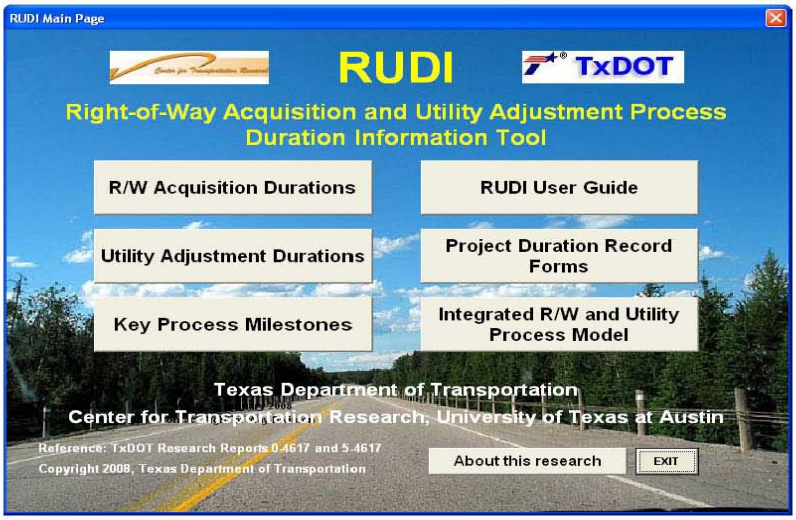


Figure 1.2 RUDI Main Interface

- **R/W Acquisition Durations**

The *R/W Acquisition Durations* button takes the user to the R/W acquisition duration information. The *R/W Acquisition Durations* window displays three durations known as R1, R2, and R3 (Figure 1.3). R1, R2 and R3 correspond to various duration measurements in the R/W acquisition process. The user can use RUDI to find information about each of the durations that need to be estimated.

By clicking on any duration button, the user will have access to another window showing the key factors of the chosen duration. The interface regarding the key factors for the R1 duration is shown below. The user will see the same window when selecting R2 or R3 duration. R1 indicates the duration from the R/W project release to the initial appraisal. R2 represents the duration from the initial appraisal to the possession of parcel. U3 indicates the duration from the R/W project release to possession of parcel. The user can use these key factors of each duration data set as a

source for estimating the desired duration (Figure 1.4). A more detailed explanation and examples are presented in the Chapter II of this user guide.

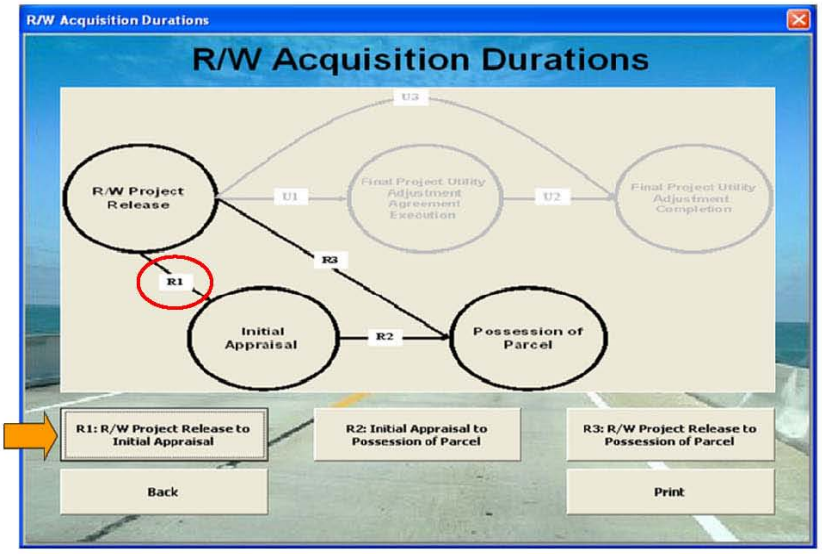


Figure 1.3 R/W Acquisition Process Durations

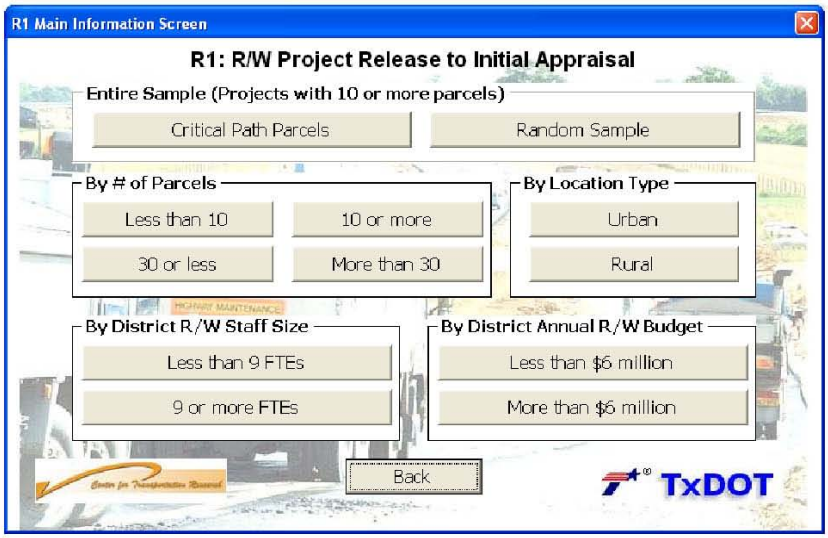


Figure 1.4 R1: R/W Project Release to Initial Appraisal

- **Utility Adjustment Durations**

The *Utility Adjustment Durations* button takes the user to utility adjustment information. The *Utility Adjustment Durations* window is arranged like the R/W acquisition durations screen, as shown in Figure 1.5 below. U1 indicates the duration from the R/W project release to the final project utility adjustment agreement execution. U2 represents the duration from the final project utility adjustment agreement execution to the final project utility adjustment completion. U3 indicates the duration from the R/W project release date to the final project utility adjustment completion.

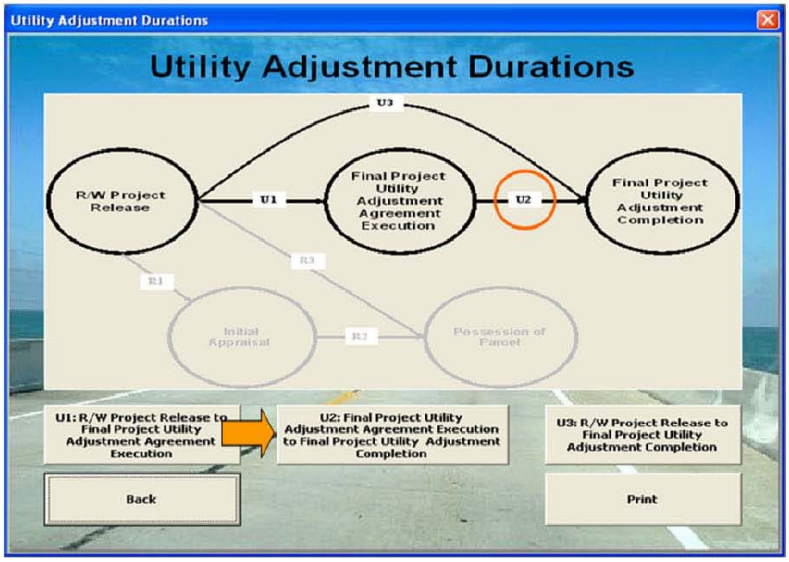


Figure 1.5 Utility Adjustment Durations

RUDI provides information about eight factors characterizing the utility adjustment process. The picture below illustrates the window that is used to estimate the U2 duration (Figure1.6). The same window is presented for depicting U1 and U3 duration factors. Similarly, users can choose the factors that are relevant to their projects. For example, if the project is not federally funded, the user can click on the "Non-Federally Funded" button to access information of interest (either graphic or statistical format).

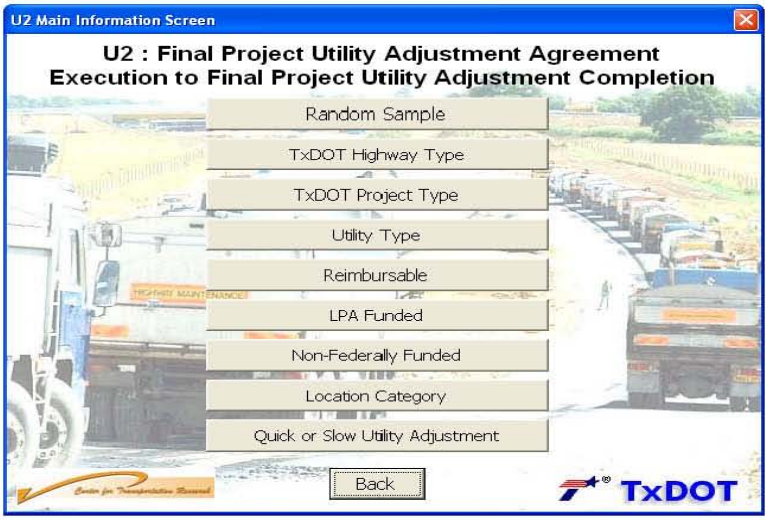


Figure 1.6 U2: Final Project Utility Adjustment Agreement Execution to Final Project Utility Adjustment Completion

- **Project Duration Record Form**

The *Project Duration Record Form* contains a form for manually recording information from RUDI. In general, bringing up and printing out a project record form is the first step in the duration estimate process.

RIGHT OF WAY ACQUISITION PROCESS DURATIONS						
Choices			R1 From R/W Project Release To Initial Appraisal			
			Degree of Schedule Urgency L ☐ M ☐ H ☐			
			Degree of Uncertainty L ☐ M ☐ H ☐			
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐				
	10 or greater	☐				
	30 or less	☐				
	More than 30	☐				
Location Type	Urban	☐				
	Rural	☐				
Average						
Range						
Recommended duration						

Figure 1.7 Simplified Project Duration Record Form

This form is specifically designed to allow users to describe project characteristics, to write down and to compare durations as they access data within the system (Figure1.7). The complete Project Record Form can be seen in Appendix B.

- **RUDI Key Process Milestones**

The *Key Process Milestones* button takes the user to a plot of process milestones for R/W acquisition and utility adjustment (Figure 1.8). This milestone information can help the user to understand what each duration means in this tool. Moreover, it is a tool that may serve to visualize the critical path for the R/W and utility adjustment processes. The *Definition* button explains each of the five milestones, as presented in Figure 1.9.

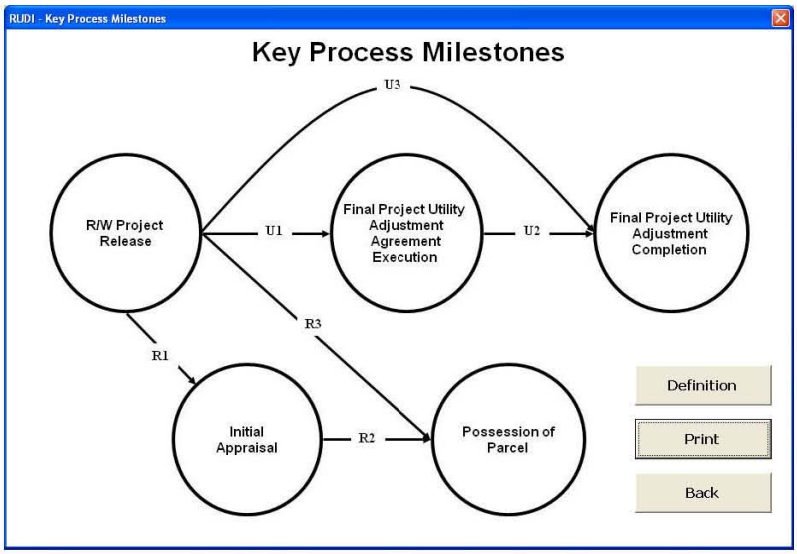


Figure 1.8 Key Process Milestones

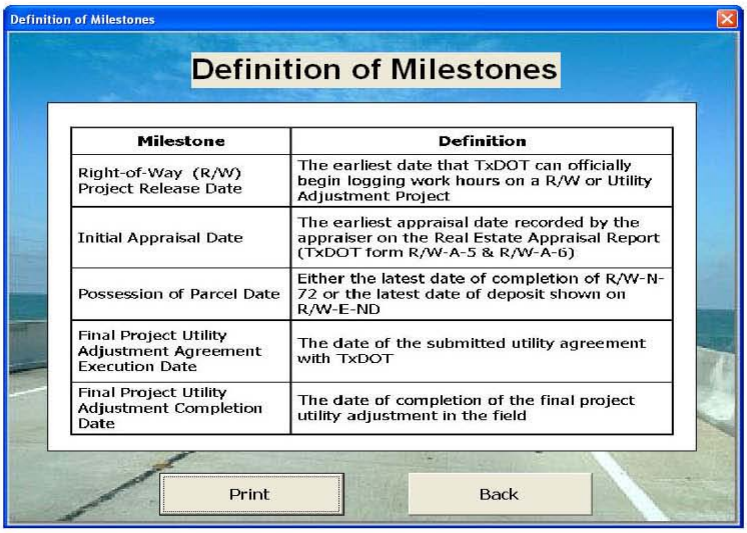


Figure 1.9 Definitions of the Key Process Milestones

- **Integrated R/W acquisition and Utility adjustment process map**

The *Integrated R/W & Utility Process Model* button allows the user to visualize a complete process map of how R/W acquisition and utility adjustment usually occur for Texas Department of Transportation projects. The map also shows the integrated interaction between different involved organizations. The process model is presented in Adobe Acrobat format (pdf).

- **RUDI User Guide**

The *RUDI User Guide* button takes the user to the summarized instructions pertaining to the usage of RUDI.

Chapter II: Using RUDI

Part 1: Major Concepts for RUDI

In this part, the user guide describes the following key RUDI concepts:

a) The major duration categories
b) The statistical concepts for using information provided by RUDI
c) The method for using the percentile range matrix

- **Duration Categories**

Data concerning R/W acquisition durations are broken down into three subcategories (Figure 2.1):

a) **R1** represents the duration between the R/W Project Release and the Initial Appraisal.
b) **R2** represents the duration between the Initial Appraisal and the Possession of Parcel.
c) **R3** represents the duration between the R/W Project Release and the Possession of Parcel.

Utility adjustment duration data are broken down into three subcategories (Figure 2.1):

a) **U1** represents the duration between the R/W Project Release and the Final Project Utility Adjustment Agreement Execution.
b) **U2** represents the duration between the Final Project Utility Adjustment Agreement Execution and the Final Project Utility Adjustment Completion.
c) **U3** represents the duration between the R/W Project Release and the Final Project Utility Adjustment Completion.

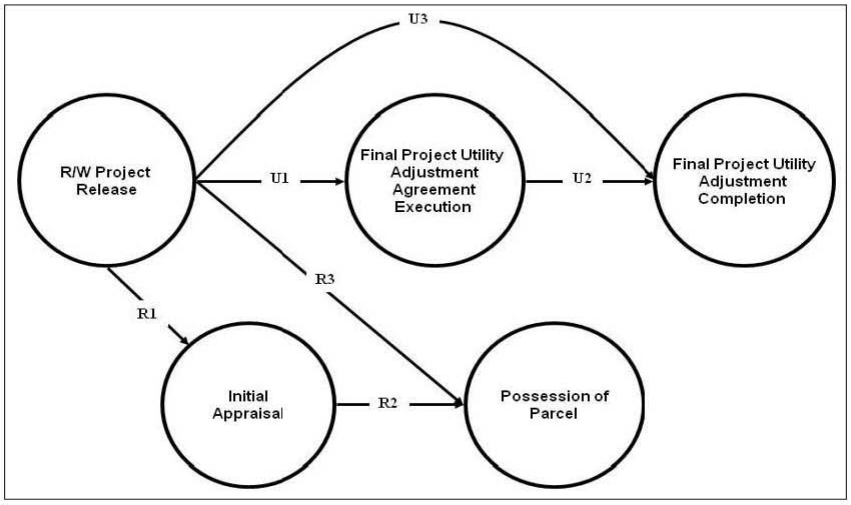


Figure 2.10 Categories of Durations

- **Statistics Concepts**

As mentioned in the Chapter I, RUDI provides statistical information plots and tables based on historical data of past projects of TxDOT. Therefore, the users need to understand basic statistics concepts to interpret RUDI data. The following are fundamental statistics concepts used in RUDI.

a) Percentile

A percentile is a value on a scale of one hundred that indicates the percent of a distribution that is equal to or below it. For example, a certain value at the 70th percentile is equal to or greater than 70 percent of the accumulated values. Therefore, in the example (Figure 2.2) below, the duration X=500 days is the value at the 70th percentile. 70 percent of the historical durations are lower than or equal to the duration X=500 days.

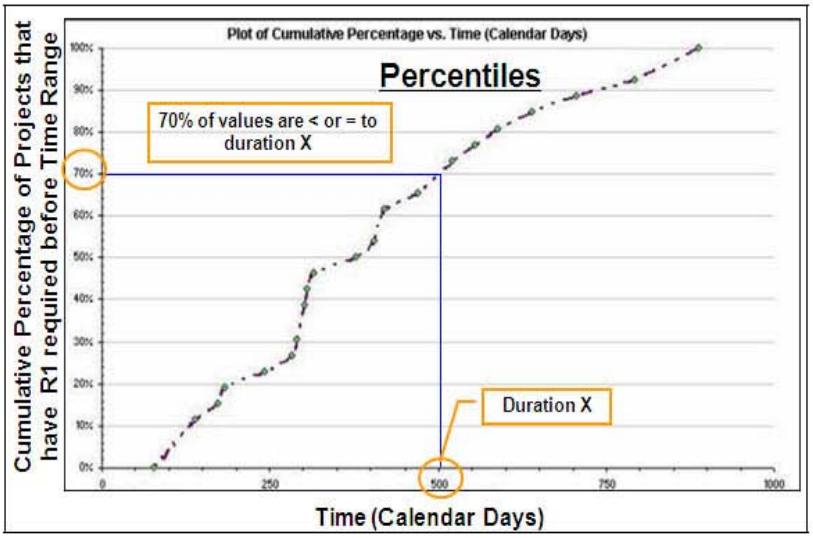


Figure 2.11 Percentile Range A

b) Percentile Range

Is defined as = P90 - P10 where P90 and P10 are the 90th and 10th percentile respectively. In the example below the user could use the values between the 20th and the 70th percentile to estimate a range of duration values. Therefore, for this specific factor, the R1 duration varies from 180 days (20th) to 500 days (70th), as shown in Figure 2.3. The next section provides guidance on how to define Percentile Range values for your project.

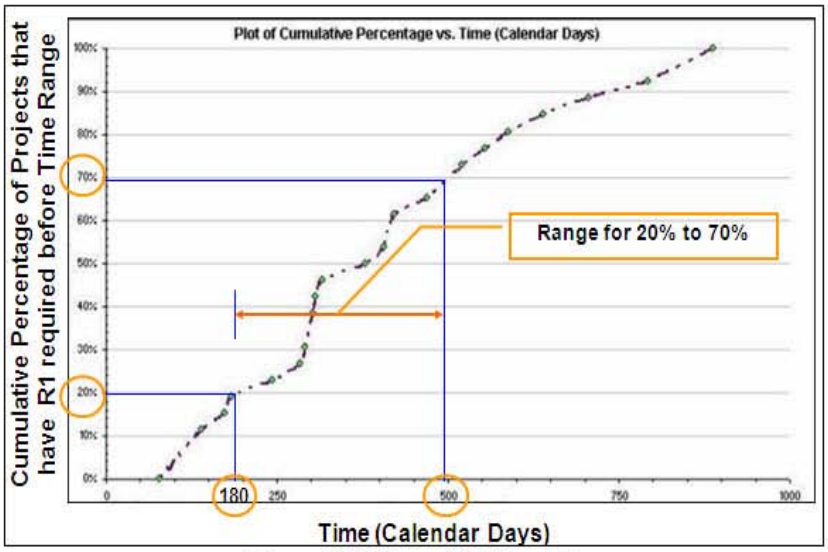


Figure 2.12 Percentile Range B

c) Percentile Range Matrix

A key decision for the user to make in RUDI is to select a percentile range. To help the user, a percentile range matrix is given as a guide. The matrix provides the user with appropriate percentile ranges based on two variables: degree of uncertainty and degree of schedule urgency. Both variables pursue three categories of levels: low, moderate and high. Schedule urgency is determined by the overall highway project schedule condition and other duration factors. As shown in the matrix below (Figure 2.4), the higher the level of urgency, the lower the recommended values of the percentile range. R/W acquisition and utility adjustment durations are influenced by factors that will collectively determine the R/W and utility adjustment level of uncertainty. Therefore, as presented in the matrix, the higher the degree of uncertainty, the higher the values of the percentile range. The selection of urgency and uncertainty is left to the user to determine for the project in question.

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

Figure 2.13 Percentile Range Matrix

Part 2: RUDI Step by Step

This section covers all the procedures needed to estimate durations using RUDI. In addition, interpretation of information provided by RUDI is presented in detail. The user can follow the steps (Figure 2.5) below in order to get information for their duration estimates. An example is used to describe the steps.

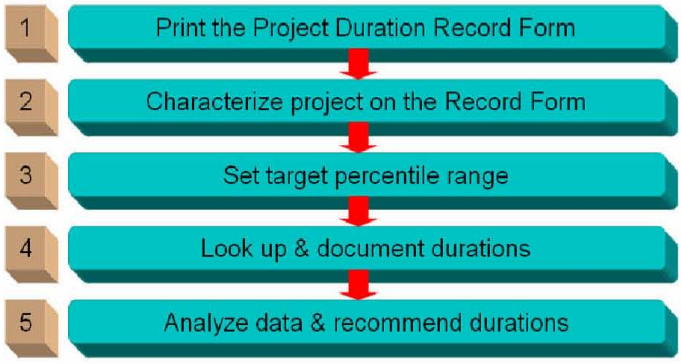


Figure 2.14 RUDI Usage Procedures

- **Example**

The user wants to estimate the R1 duration (between the R/W Project Release and the Possession of Parcel) of an R/W project that has fifteen parcels in a rural location, with a moderate degree of schedule urgency and a low degree of uncertainty.

First, the user needs to print the Project Duration Record Form that allows the user to record information as they use RUDI. The Project Duration Record Form becomes part of the project documentation.

Second, the user needs to characterize the project he/she is preparing for the duration estimation. As addressed in the example's description, characterizing the project means that the user identifies the following items: number of parcels, location type, district R/W staff size, and district annual R/W budget.

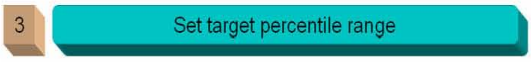
The user also needs to judge both the degree of schedule urgency of the project and the degree of uncertainty. This judgment is mostly based on the user's experience and evaluation of previous TxDOT project performance.

The following data should be recorded on the Record Form (Figure 2.6).

- Number of Parcels: 10 or greater
- Location Type: Rural
- Degree of Schedule Urgency: Moderate (M)
- Degree of Uncertainty: Low (L)

RIGHT OF WAY ACQUISITION PROCESS DURATIONS						
Choices			R1			
			From R/W Project Release To Initial Appraisal			
			Degree of Schedule Urgency		L ☐ M X H ☐	
			Degree of Uncertainty		L X M ☐ H ☐	
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐				
	10 or greater	X	30	50		
	30 or less	☐				
	More than 30	☐				
Location Type	Urban	☐				
	Rural	X	30	50		
Average						
Range						
Recommended duration						

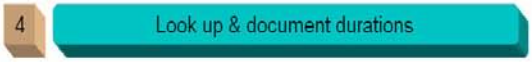
Figure 2.15 Simplified Project Record Form Showing the Project Characteristics



Next, the user needs to set a percentile range that might be appropriate for the R1 duration of the project. In this example, the user has selected the level of schedule urgency as "moderate." In addition, the user decided that the project has a low degree of uncertainty in duration drivers due to a small number of parcels and its location. For this example, the 30^{th} – 50^{th} percentile was selected. This value is determined by the Percentile Range Matrix, which shows that a 30^{th} – 50^{th} percentile range is the most appropriate for project having a moderate degree of schedule urgency and a low degree of uncertainty (Figure 2.7).

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

Figure 2.16 Percentile Range Matrix for the Example



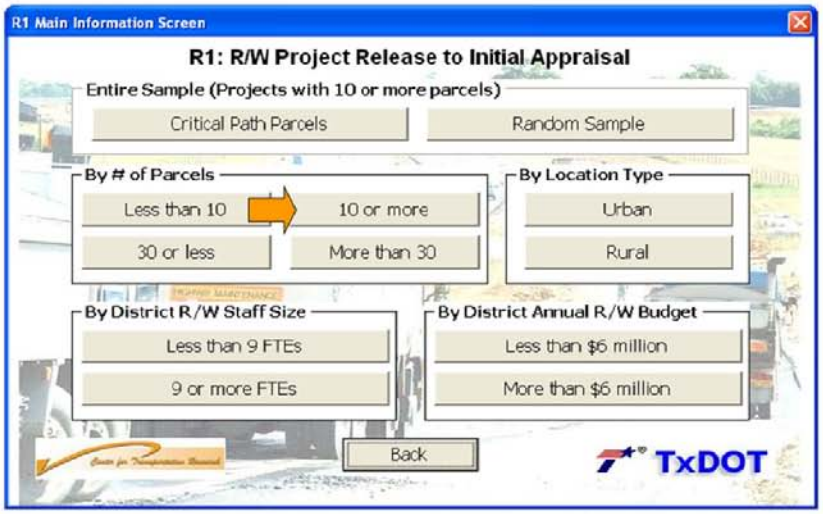
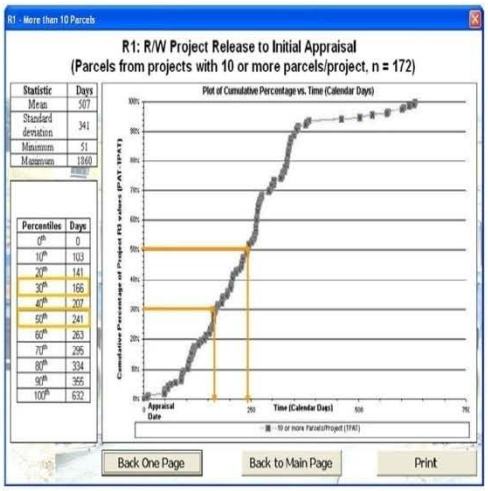


Figure 2.17 R1: R/W Project Release to Initial Appraisal for Parcel Selection

After the selection of the percentile range, the user needs to click the "R1: R/W Project Release to Initial Appraisal" to find more detailed information (Figure 2.8).
The user has access to the duration data, which are presented in two different formats: graphical plots and statistical information (Figure 2.9). Each graph is a plot presenting cumulative percentile

versus time (calendar days) for certain duration. The descriptive statistics describe the plot information in detail. These data are presented in a statistical summary table and a percentile table. The first table shows the mean, the standard deviation, and the minimum and maximum values of historical duration; while the second table shows the percentiles of these data. For R/W data, statistics are listed on the left side of the window for many different conditions. From the plots or tables of statistical information, the user has recorded 166 – 241 days for parcels (Figure 2.9).



RIGHT OF WAY ACQUISITION PROCESS DURATIONS

Choices			R1 From R/W Project Release To Initial Appraisal			
Degree of Schedule Urgency			L ☐ M X H ☐			
Degree of Uncertainty			L X M ☐ H ☐			
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐				
	10 or greater	X	30	50	166	241
	30 or less	☐				
	More than 30	☐				
Location Type	Urban	☐				
	Rural	☐				
Average						
Range						
Recommended duration						

Figure 2.18 Cumulative Distribution Plot and Simplified R/W Duration Record Form

For the second selection criterion (rural), the user needs to access the statistical plot and to find the durations related to the type of location in which the project is located (Figure 2.10).

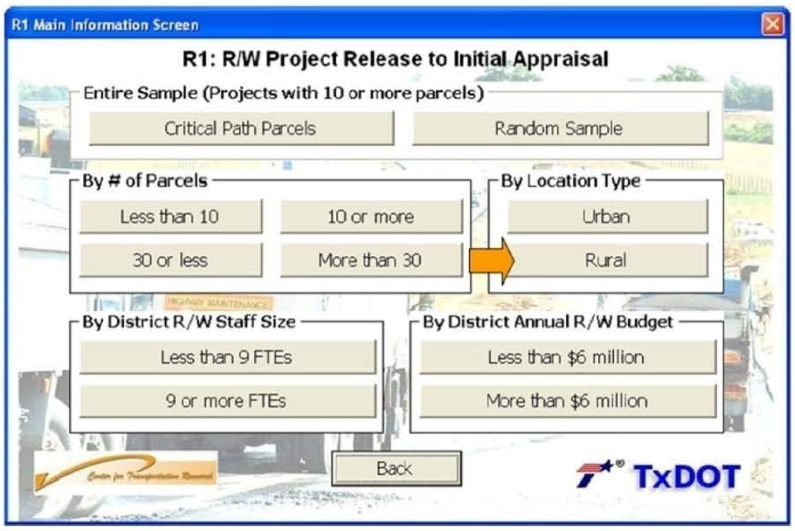
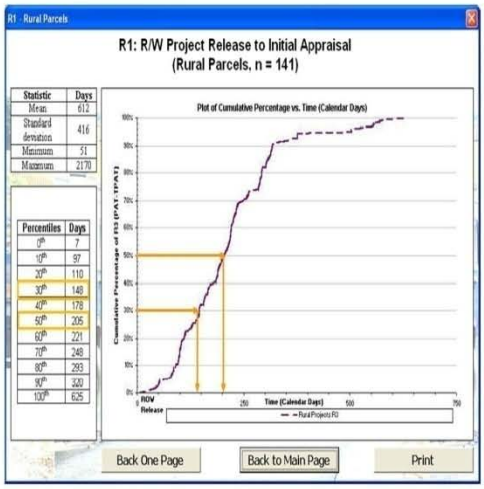


Figure 2.19 R1: R/W Project Release to Initial Appraisal for Location Type Selection

From the plots or tables of statistical information, the user could record 148 – 205 days for rural location type (Figure 2.11).



RIGHT OF WAY ACQUISITION PROCESS DURATIONS

Choices			R1 From R/W Project Release To Initial Appraisal			
			Degree of Schedule Urgency: L ☐ M X H ☐			
			Degree of Uncertainty: L X M ☐ H ☐			
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐				
	10 or greater	X	30	50	166	241
	30 or less	☐				
	More than 30	☐				
Location Type	Urban	☐				
	Rural	X	30	50	148	205
Average						
Range						
Recommended duration						

Figure 2.20 Cumulative Distribution Plot and Simplified R/W Duration Record Form

The figure below illustrates how the Duration Record Form should appear after completing all the previous procedures (Figure 2.12). The user needs to calculate averages of percentile ranges and durations for the R1. For this example, as shown in Figure 2.12, the user can get a range of 30^{th}-50^{th}

percentile and obtain an average range of 157 – 223 days for estimating the R1 duration. Finally, the user could select a tight range of 166-205 days for the R1 duration.

RIGHT OF WAY ACQUISITION PROCESS DURATIONS						
Choices			R1			
			From R/W Project Release To Initial Appraisal			
			Degree of Schedule Urgency		L ☐ M ☒ H ☐	
			Degree of Uncertainty		L ☒ M ☐ H ☐	
			Percentiles		Duration	
			Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐				
	10 or greater	☒	30	50	166	241
	30 or less	☐				
	More than 30	☐				
Location Type	Urban	☐				
	Rural	☒	30	50	148	205
Average			30	50	157	223
Range			30-50		166-205	
Recommended duration						

Figure 2.21 Simplified Project Duration Record Form for the Example

As a final procedure, the user should select the most reasonable duration within the range defined in Step 4. The selection depends considerably on personal judgment based on knowledge of previous Right of Way projects. In this example, the user could choose either extreme or median values of the range. To determine the recommended duration, the user also needs to consider the factors that mostly affect the intended duration. The user could recommend 196 days for the R1 duration. In this case, researchers added approximately 30 days as a buffer to the minimum estimate because the user was not certain about the value provided by RUDI.

Appendix A: The Project Duration Record Form

R/W ACQUISITION AND UTILITY ADJUSTMENT PROCESS DURATION RECORD FORM

Project CSJ	
Project Title	
Date of Analysis	
Name of Analyst	
Project Description	
Unusual Circumstances (i.e. congested corridor, wetlands, lawyer activity, etc., if known)	
Project Current Status	

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PERCENTILE RANGE MATRIX

Percentile Ranges				
		Degree of Uncertainty		
		Low	Moderate	High
Degree of Schedule Urgency	High	10-30	10-40	10-50
	Moderate	30-50	30-60	30-70
	Low	50-70	50-80	50-90

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RIGHT OF WAY ACQUISITION PROCESS DURATIONS

Choices			R1				R2				R3			
			From R/W Project Release To Initial Appraisal				From Initial Appraisal To Possession of Parcel				From R/W Project Release To Possession of Parcel			
			Degree of Schedule Urgency L☐ M☐ H☐				Degree of Schedule Urgency L☐ M☐ H☐				Degree of Schedule Urgency L☐ M☐ H☐			
			Degree of Uncertainty L☐ M☐ H☐				Degree of Uncertainty L☐ M☐ H☐				Degree of Uncertainty L☐ M☐ H☐			
			Percentiles		Duration		Percentiles		Duration		Percentiles		Duration	
			Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
Number of Parcels	Less than 10	☐												
	10 or greater	☐												
	30 or less	☐												
	More than 30	☐												
Location Type	Urban	☐												
	Rural	☐												
District ROW Staff Size	Less than 9 FTEs	☐												
	9 or more FTEs	☐												
District Annual ROW Budget	Less than $6 million	☐												
	More than $6 million	☐												
Average														
Range														
Recommended duration														

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UTILITY ADJUSTMENT PROCESS DURATIONS

Choices			U1				U2				U3			
			From R/W Project Release To Final Project Utility Adjustment Agreement Execution				From Final Project Utility Adjustment Agreement Execution To Final Project Utility Adjustment Completion				From R/W Project Release To Final Project Utility Adjustment Completion			
			Degree of Schedule Urgency L ☐ M ☐ H ☐				Degree of Schedule Urgency L ☐ M ☐ H ☐				Degree of Schedule Urgency L ☐ M ☐ H ☐			
			Degree of Uncertainty L ☐ M ☐ H ☐				Degree of Uncertainty L ☐ M ☐ H ☐				Degree of Uncertainty L ☐ M ☐ H ☐			
			Percentiles		Duration		Percentiles		Duration		Percentiles		Duration	
			Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher	Lower	Higher
TxDOT Highway Type														
TxDOT Project Type														
Utility Type														
Reimbursable	Reimbursable	☐												
	Non-Reimbursable	☐												
LPA Funding	LPA Funded	☐												
	Non-Funded	☐												
Federal Funding	Federally Funded	☐												
	Non-Federally Funded	☐												
Location Category	Urban	☐												
	Rural	☐												
	Metropolitan	☐												
Utility Adjustment Speed	Quick	☐												
	Slow	☐												
Average														
Range														
Recommended duration														

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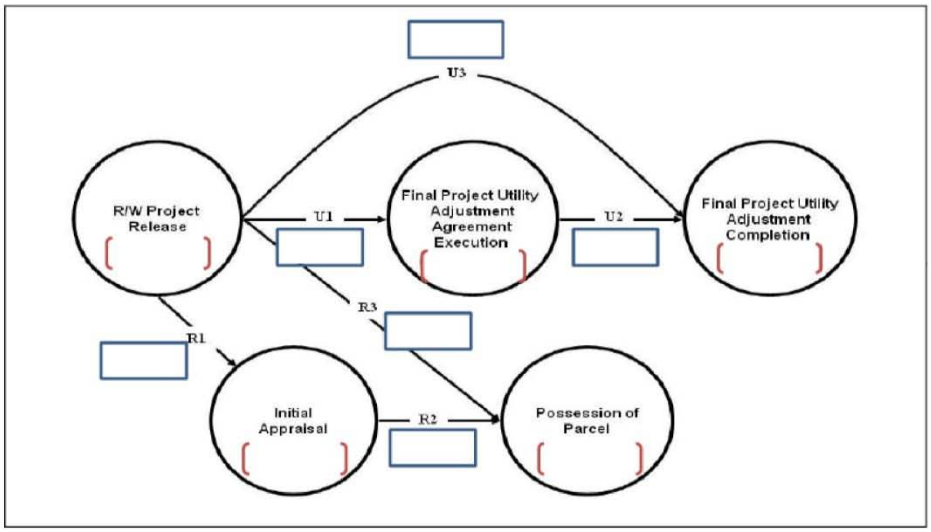
KEY PROCESS MILESTONES



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RECOMMENDED DURATIONS AND MILESTONE DATES

Right Of Way Acquisition	Utility Adjustment
Justifications	

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Appendix B: The RUDI Glossary

Terms	Meaning	Usage
Appraisal Approved Date	The Date the District Engineer approves ROW-A-10, Tabulation of Values form	R/W
Appraisal Date	The date recorded by the appraiser on TxDOT Form ROW-A-6, Real Estate Appraisal Report	R/W
Control-Section-Job (CSJ) number	A nine-digit number for projects assigned to all on-system public highways in Texas	R/W
Critical Path Parcel (CPP)	The one parcel in a project that is the final acquired property for the project before construction letting	R/W&Utility
Highway Type	Interstate, US Highway, State Highway, FM/RM	
Full-Time Equivalent (FTE)	An employee who works the standard hours in a time period; FTE is used to quantify manpower in a district	R/W
Local Public Agency (LPA)	Any political subdivision of the State of Texas (State), such as a city, county or other public agency with legal authority to acquire R/W for highways or public roads and to provide adjustment benefits	R/W
Mean	A statistical measurement of the central tendency, or average, of a set of values	R/W&Utility
Median	The midpoint value in a series; the median is not necessarily the same as the mean value	R/W&Utility
Parcel	All property that the State will take on a project. Any single project may contain one or a number of properties that the State needs to acquire; these properties are called parcels. A project will have a CSJ number and one or more parcels associated with the project	R/W&Utility
Percentiles	The percentage of data points (historical durations in the case of RUDI) that are below a particular value	R/W&Utility
Possession of Parcel	By reason of deposit, the state of Texas is now entitled to enter upon and take possession of said property based on Notice of Deposit	R/W
Possession of Parcel Date	The date of completion of ROW-N-72, Title Company's Closing Statement for negotiated parcels	R/W
Random Sample	A sample selected from a statistical population such that each selected member of the sample has an equal probability of being selected	R/W
Range	In descriptive statistics, the range is the length of the smallest interval which contains all the data. It is calculated by subtracting the smallest observation from the greatest and provides an indication of statistical dispersion	R/W&Utility
Right of Way (R/W)	A general term denoting land, property or interest therein, usually in a strip acquired for or devoted to transportation purposes	R/W

Right of Way Acquisition	Process integral to project development for acquiring land for construction start-up	R/W
Right of Way Release	Highway project release authorized by the ROW Division which allows R/W to be acquired by the districts. This authorization is communicated to the districts by memo, notifying them of R/W project release	R/W
Standard Deviation (SD)	Standard deviation is defined as the positive square root of the variance and is a measure of variability expressed in the same units as the data. The standard deviation is very much like a mean or an "average" of all data deviations from the mean value. In a normal (symmetric and bell-shaped) distribution, about two-thirds of the scores fall between +1 and -1 standard deviations from the mean and the standard deviation is approximately 1/4 of the range	R/W&Utility
Types of Utilities	Cap & Removal Pipeline, Extend Casing, High Pressure Gas, Irrigation Pipeline, Liquid Petroleum Line, Low Pressure Gas, Microwave Tower, Overhead Communications, Overhead Power, Sanitary Sewer, Sewer Line, Transmission Pole, Transmission Tower, Underground Communications, Underground Power, UJUA Only, Wastewater, Wastewater Pump Station, Water, Other	Utility
Utility Adjustment	Process that are integral parts of overall project delivery and depends heavily on such other processes as design, environmental clearance, and project prioritization, among others	Utility
BR	Bridge Replacement	Project Type
CNF	Convert Non-Freeway to Freeway	Project Type
HES	Hazard Elimination & Safety	Project Type
INC	Interchange - New or Reconstructed	Project Type
MSC	Miscellaneous	Project Type
NNF	New Location Freeway	Project Type
OV	Overlay	Project Type
RER	Rehabilitation of Existing Road	Project Type
UGN	Upgrade to Standards Non-Freeway	Project Type
UPG	Upgrade to Standards Freeway	Project Type
WF	Widen Freeway	Project Type
WNF	Widen Non-Freeway	Project Type

Appendix C: Trouble Shooting

- **Enable an unsigned macros to run**

To allow unsigned macros to run, the Trust all installed add-ins and templates check box must be selected on the Trusted Publishers tab of the Security dialog box. This option is selected by default. If it is not selected (recommended), Excel allows you to run only macros that have trusted digital signatures.

1. On the **Tools** menu, point to **Macro**, and then click **Security**.
2. On the **Trusted Publishers** tab, select the **Trust all installed add-ins and templates** check box.

- **Error Starting RUDI**

If the user received the following error message, as the user runs macro in the RUDI.xls file,

"*The macros in this project are disabled. Please refer to the online help or documentation of the host application to determine how to enable macros.*"

The user could use the following steps to resolve the error symptom.

1. If the RUDI.xls file is open, close it.
2. On the **Tools** menu, point to **Macro** and click **Security**.
3. In the **Security** dialog box, click the Security Level tab.
4. Click **Medium** and then click **OK**.
5. Open the RUDI.xls file again. When prompted whether to enable or disable macros, click "Enable Macros".

Appendix D: Model Project Description Form

GENERIC PROJECT DESCRIPTION FORM

Project Basic Facts	
Driver	**Value**
1. ☐ TxDOT Project Type	☐ RER (Rehabilitation of Existing Road) ☐ UGN (Upgrade to Standards Non-Freeway) ☐ NNF (New Location Non-Freeway) ☐ INC (Interchange - New or Reconstructed) ☐ WF (Widen Freeway) ☐ WNF (Widen Non-Freeway) ☐ BR (Bridge Replacement) ☐ CNF (Convert Non-Freeway to Freeway) ☐ HES (Hazard Elimination/Safety) ☐ MSC (Miscellaneous) ☐ NLF (New Location Freeway) ☐ OV (Overlay) ☐ UPG (Upgrade to Standards ☐ BWR (Bridge Widening/Repair)
2. ☐ TxDOT Highway Type	☐ IH (Interstate) ☐ SH (State Highway) ☐ FM (Farm to Market road) ☐ CS (City Street) ☐ US (US highway) ☐ RM (Ranch to Market road)
3. ☐ Project Location Type	☐ Urban ☐ Rural ☐ Metropolitan
4. ☐ Right-of-Way and Utility Scope	☐ Only R/W acquisition ☐ Only Utility adjustment ☐ Both R/W acquisition and Utility adjustment
5. ☐ Status of Schematic Design	☐ Completed ☐ In-progress ☐ Not Started
6. ☐ Status of Boundary Surveying	☐ Completed ☐ In-progress ☐ Not Started
7. ☐ Status of Environmental Clearance	☐ Completed ☐ In-progress ☐ Not Started
8. ☐ Status of Right-of-Way Map	☐ Completed ☐ In-progress ☐ Not Started

9. ☐ Internal R/W Staff Size of a District	☐ Less than 9 FTEs ☐ 9 or more than 9 FTEs
10. ☐ District R/W Annual Budget	☐ Less than $6million ☐ More than $6million
11. ☐ Dedication of Funds to the Project (R/W and Construction)	☐ Yes ☐ No ☐ Unknown
12. ☐ LPA Funded or Non-LPA Funded	☐ LPA funded ☐ Non-LPA funded
13. ☐ Federally Funded or Non-Federally Funded	☐ Federally funded ☐ Non-Federally funded
14. ☐ Funding Limitations for the Project	☐ LPA or Utility Company needing an SIB loan ☐ Partial payments from funding ☐ Time required to fund the project ☐ Other _____ ☐ None
15. ☐ Level of Acceptance of the Project by the Public	☐ Extensive supportive ☐ Not supportive ☐ Mixed
16. ☐ Level of Political Pressure	☐ Extensive ☐ Moderate ☐ Minimal
17. ☐ Common Concerns of Property Owners	☐ Access ☐ Safety ☐ Project duration ☐ Compensation ☐ Other _____
18. ☐ Current Status of the R/W Project	☐ Request R/W CSJ ☐ Request R/W full release ☐ Assigned R/W CSJ ☐ R/W full release ☐ Pending release
Right of Way Acquisition	
Driver	**Value**
19. ☐ Number of Parcels for Acquisition	☐ Less than 10 ☐ 10 to 30 ☐ More than 30

20. ☐ Different Types of Parcel Usages	☐ Vacant ☐ Agricultural ☐ Other _____	☐ Residential ☐ Religious facility	☐ Commercial ☐ Parking lot ☐ Unknown
21. ☐ Frequency of Eminent Domain	☐ Several ☐ Unknown	☐ Some	☐ None
22. ☐ Source of Personnel to be used for R/W Acquisition	☐ Outsourced	☐ District staff	☐ Unknown
23. ☐ Availability of District R/W Appraisers (District Staff and Outsourced)	☐ Adequate	☐ Marginally adequate	☐ Inadequate
24. ☐ Is Funding Available for Outsourcing Staff Assistance?	☐ Yes	☐ No	☐ Unknown
25. ☐ Type of Property Owners	☐ All in-state	☐ Some out-of-state	☐ Unknown
26. ☐ Level of Familiarity with Key Landowners	☐ High	☐ Low	☐ Unknown
27. ☐ Are There Any Property Tenants to Consider?	☐ Yes	☐ No	☐ Unknown
28. ☐ Need for Residential Relocation	☐ Substantial	☐ Some	☐ None
29. ☐ Level of Local Availability of Replacement Housing Facilities	☐ High ☐ Unknown	☐ Medium	☐ Low
30. ☐ Need for Business Relocation	☐ Substantial	☐ Some	☐ None
31. ☐ Level of Local Availability of Replacement Business Facilities	☐ High ☐ Unknown	☐ Medium	☐ Low
32. ☐ Likelihood of Title Curative Actions	☐ High ☐ Unknown	☐ Medium	☐ Low

33. ☐ Responsiveness of Local Title Companies to TxDOT	☐ High	☐ Medium	☐ Low
	☐ Unknown		
Utility Adjustment			
Driver	**Value**		
34. ☐ Have SUE Investigations Been Performed?	☐ Yes	☐ No	☐ Unknown
35. ☐ Will SUE Investigations Be Performed? (If no or unknown in the driver # 34)	☐ Yes	☐ No	☐ Unknown
36. ☐ Utility Type	☐ Overhead power	☐ Buried power	☐ Waste water
	☐ Water	☐ Underground communication	
	☐ Overhead communication		☐ Gas
	☐ Other _____		☐ Unknown
37. ☐ Number of Utilities Located in Public R/W	☐ Less than 4	☐ 4 to 7	☐ More than 7
	☐ Unknown		
38. ☐ Number of Utilities Located in Private Easement	☐ Less than 4	☐ 4 to 7	☐ More than 7
	☐ Unknown		
39. ☐ Number of Utilities for Adjustments or Relocations	☐ Less than 4	☐ 4 to 7	☐ More than 7
	☐ Unknown		
40. ☐ Is there any Utility Adjustment to be Included in the Highway Construction Contract?	☐ Yes	☐ No	☐ Unknown
41. ☐ Responsiveness of Utility Companies to TxDOT Needs	☐ High	☐ Medium	☐ Low
	☐ Unknown		
42. ☐ Adjustment is Reimbursable Utility or Non-Reimbursable Utility	☐ Reimbursable	☐ Non-reimbursable	☐ Unknown

GENERIC PROJECT (B) DESCRIPTION FORM

Project Basic Facts	
Driver	**Value**
1. ☐ TxDOT Project Type	☑ RER (Rehabilitation of Existing Road) ☐ UGN (Upgrade to Standards Non-Freeway) ☐ NNF (New Location Non-Freeway) ☐ INC (Interchange - New or Reconstructed) ☐ WF (Widen Freeway) ☐ WNF (Widen Non-Freeway) ☐ BR (Bridge Replacement) ☐ CNF (Convert Non-Freeway to Freeway) ☐ HES (Hazard Elimination/Safety) ☐ MSC (Miscellaneous) ☐ NLF (New Location Freeway) ☐ OV (Overlay) ☐ UPG (Upgrade to Standards ☐ BWR (Bridge Widening/Repair)
2. ☐ TxDOT Highway Type	☐ IH (Interstate) ☐ SH (State Highway) ☑ FM (Farm to Market road) ☐ CS (City Street) ☐ US (US highway) ☐ RM (Ranch to Market road)
3. ☐ Project Location Type	☐ Urban ☑ Rural ☐ Metropolitan
4. ☐ Right of Way and Utility Scope	☐ Only R/W acquisition ☐ Only Utility adjustment ☑ Both R/W acquisition and Utility adjustment
5. ☐ Status of Schematic design	☑ Completed ☐ In-progress ☐ Not Started
6. ☐ Status of Boundary Surveying	☑ Completed ☐ In-progress ☐ Not Started

7. ☐ Status of Environmental Clearances	☑ Completed ☐ In-progress ☐ Not Started
8. ☐ Status of Right of Way Map	☑ Completed ☐ In-progress ☐ Not Started
9. ☐ Internal R/W Staff Size of a District	☑ Less than 9 FTEs ☐ 9 or more than 9 FTEs
10. ☐ District R/W Annual Budget	☑ Less than $6million ☐ More than $6million
11. ☐ Dedication of Funds to the Project (R/W and Construction)	☑ Yes ☐ No ☐ Unknown
12. ☐ LPA Funded or Non-LPA Funded	☑ LPA funded ☐ Non-LPA funded
13. ☐ Federally Funded or Non-Federally Funded	☑ Federally funded ☐ Non-Federally funded
14. ☐ Funding Limitations for the Project	☐ LPA or Utility Company needing an SIB loan ☐ Partial payments from funding participants ☐ Time required to fund the project ☐ Other _____ ☑ None
15. ☐ Level of Acceptance of the Project by the Public	☑ Extensive supportive ☐ Not supportive ☐ Mixed
16. ☐ Level of Political Pressure	☐ Extensive ☑ Moderate ☐ Minimal
17. ☐ Common Concerns of Property Owners	☑ Access ☐ Safety ☐ Project duration ☐ Compensation ☐ Other _____
18. ☐ Current Status of the R/W Project	☐ Request R/W CSJ ☐ Request R/W full release ☐ Assigned R/W CSJ ☑ R/W full release ☐ Pending release

Right of Way Acquisition			
Driver	**Value**		
19. ☐ Number of Parcels for Acquisition	☐ Less than 10	☐ 10 to 30	☑ More than 30
20. ☐ Different Types of Parcel Usages	☐ Vacant ☐ Agricultural ☐ Other _____	☑ Residential ☐ Religious facility	☑ Commercial ☐ Parking lot
21. ☐ Frequency of Eminent Domain Acquisition	☑ Several ☐ Unknown	☐ Some	☐ None
22. ☐ Source of Personnel to be used for R/W Acquisition	☐ Outsourced	☑ District staff	☐ Unknown
23. ☐ Availability of District R/W Appraisers (District Staff and Outsourced)	☐ Adequate	☑ Marginally adequate	☐ Inadequate
24. ☐ Is Funding Available for Outsourcing Staff Assistance?	☑ Yes	☐ No	☐ Unknown
25. ☐ Type of Property Owners	☐ All in-state	☑ Some out-of-state	☐ Unknown
26. ☐ Level of Familiarity with Key Landowners	☑ High	☐ Low	☐ Unknown
27. ☐ Are There Any Property Tenants to Consider?	☐ Yes	☑ No	☐ Unknown
28. ☐ Need for Residential Relocation	☑ Substantial	☐ Some	☐ None
29. ☐ Level of Local Availability of Replacement Housing Facilities	☐ High ☐ Unknown	☐ Medium	☑ Low
30. ☐ Need for Business Relocation	☑ Substantial	☐ Some	☐ None

31. ☐ Level of Local Availability of Replacement Business Facilities	☐ High ☐ Medium ☑ Low ☐ Unknown
32. ☐ Likelihood of Title Curative Actions	☑ High ☐ Medium ☐ Low ☐ Unknown
33. ☐ Responsiveness of Local Title Companies to TxDOT	☑ High ☐ Medium ☐ Low ☐ Unknown
Utility Adjustment	
Driver	**Value**
34. ☐ Have SUE Investigations Been Performed?	☐ Yes ☑ No ☐ Unknown
35. ☐ Will SUE Investigations Be Performed? (If no or unknown in the driver # 34)	☑ Yes ☐ No ☐ Unknown
36. ☐ Utility Type	☐ Overhead power ☐ Buried power ☐ Waste water ☑ Water ☑ Underground communication ☑ Overhead communication ☑ Gas ☑ Other: Electric pipes
37. ☐ Number of Utilities Located in Public R/W	☐ Less than 4 ☑ 4 to 7 ☐ More than 7 ☐ Unknown
38. ☐ Number of Utilities Located in Private Easement	☐ Less than 4 ☑ 4 to 7 ☐ More than 7 ☐ Unknown
39. ☐ Number of Utilities for Adjustments or Relocations	☐ Less than 4 ☐ 4 to 7 ☑ More than 7 ☐ Unknown
40. ☐ Is There Any Utility Adjustment to be Included in the Highway Construction Contract?	☐ Yes ☑ No ☐ Unknown

41. ☐ Responsiveness of Utility Companies to TxDOT Needs	☑ High ☐ Unknown	☐ Medium	☐ Low
42. ☐ Adjustment is Reimbursable Utility or Non-Reimbursable Utility	☑ Reimbursable	☑ Non-reimbursable	☐ Unknown

Appendix E: Questionnaires for Data Collection

RUDI Questionnaires

- Importance Assessment of the Key Drivers in the Right-of-Way (R/W) Acquisition and Utility Adjustment Processes
- Duration Estimates: Non-RUDI based Duration Estimate
  RUDI based Duration Estimate

TxDOT Implementation Project 5-4617

Research Team Members:
John Campbell
Tommy Jones
Larry Black
James T. O'Connor
William O'Brien
Taehong Sohn

Texas Department of Transportation
The University of Texas at Austin

Right of Way Acquisition and Utility Adjustment Process
Duration Information System (RUDI)

Dear workshop participants,

Ever since right of way acquisition has been an organized business activity in Texas, involved and affected parties both sides of the R/W line have asked the question "How long does it take to acquire right of way? And, "When will this new highway be completed?" For over 40 years there has not been a reasonable answer to these questions. Predicting the duration of R/W acquisition processes has historically been a problematic issue without a definitive and reliable means of forecasting the successful delivery of clear right of way for highway construction. The Texas Department of Transportation's inability to consistently predict the completion of this activity causes project delays, cost overruns and negative economic impact to commerce in general.

Knowing of these negative economic repercussions, numerous investigations, process reviews and retooling efforts have been conducted in an attempt to understand and streamline R/W process durations and address unrealistic letting dates. However, none of these efforts produced a framework and tool that could suggest a date of R/W delivery.

Then early in 2003 at the prompting of John Campbell, ROW Division Director, and under the direction of the Research and Technology Implementation Office, a research project was authorized and commissioned to research delays in right of way and utility processes. The Center for Transportation Research at the University of Texas at Austin has scientifically measured right of way and utility historical data and developed a tool to assist the right of way practitioner when providing an advance indication of R/W delivery for construction.

This tool is called the "Right of Way Acquisition and Utility Adjustment Process Duration Information Tool" (RUDI). It is an innovative tool that reviews a historical data directory to make intelligent predictions of time to acquire R/W and adjust utilities. RUDI is the first functional model of this type of decision assistance tool. RUDI is believed to be a wise first step toward providing a knowledgeable advisory of R/W project completion thereby supporting the mission of TxDOT to work cooperatively to provide safe, effective and efficient movement of people and goods. We trust this tool will be a benefit to your operations.

Sincerely,

Larry Black
District Right of Way Administrator
Amarillo District Office
Texas Department of Transportation

No: **Date:** _____

This questionnaire is designed to collect data for the research being conducted by Texas Department of Transportation and The University of Texas at Austin. Your responses are extremely important to conduct subsequent research steps and for the success of this project. Your responses will be treated with ***CONFIDENTIAL*** and data will be presented in such a way that your identity cannot be connected with specific published data. Thus, we encourage you to read through ***ALL*** of the questions and answer them beforehand as much as possible. Please fill out the personal information as well. Thank you in advance for your participation.

---

1. General Information

Please answer the following questions so that we can get a better understanding of your professional background.

A. Personal information

Name: _____

Email address: _____ Phone number: _____

B. Current district

☐Abilene ☐Amarillo ☐Austin ☐Beaumont

☐Childress ☐San Angelo ☐Lufkin ☐El Paso

☐Laredo ☐Odessa ☐Bryan ☐Wichita Falls

☐Other _____

C. Current position title

☐R/W administrator ☐R/W appraiser ☐R/W agent

☐Utility agent ☐Other _____

D. Number of years of industry experience in R/W or (and) Utility adjustment work

_____

E. Briefly describe the main duties of your current position over the past three years

_____

_____

_____

_____

_____

2. Pre-Application Importance of the Key Drivers in the R/W Acquisition and Utility Adjustment Processes

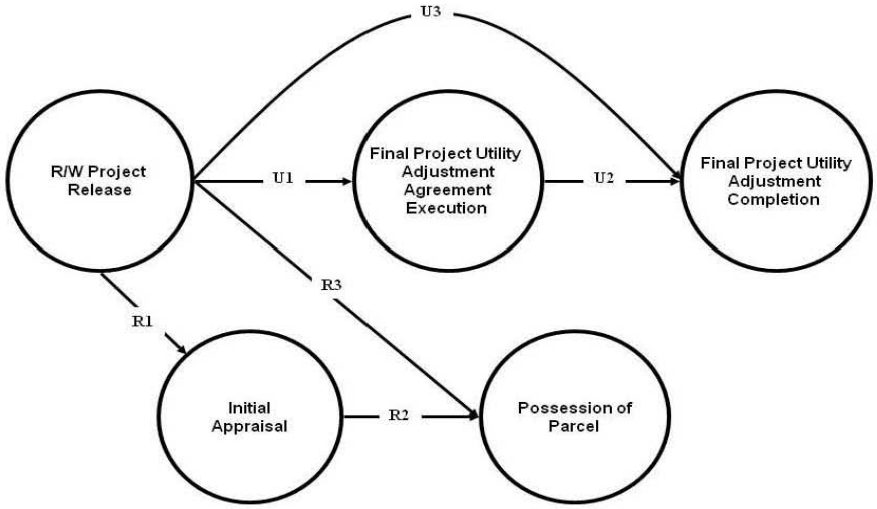
The following matrix is intended to evaluate the level of importance of the drivers used in predicting durations for acquiring right of way and adjusting utilities. Choose a value that best describes the level of importance of the driver.

Driver	Level of Importance in Determining Durations			
Project Basic Facts	**Not Important**	**Low**	**Moderate**	**High**
1. TxDOT Project Type	☐	☐	☐	☐
2. TxDOT Highway Type	☐	☐	☐	☐
3. Project Location Type	☐	☐	☐	☐
4. Right-of-Way and Utility Scope	☐	☐	☐	☐
5. Status of Schematic Design	☐	☐	☐	☐
6. Status of Boundary Surveying	☐	☐	☐	☐
7. Status of Environmental Clearance	☐	☐	☐	☐
8. Status of Right-of-Way Map	☐	☐	☐	☐
9. Internal R/W Staff Size of a District	☐	☐	☐	☐
10. District R/W Annual Budget	☐	☐	☐	☐
11. Dedication of Funds to the Project (R/W and Construction)	☐	☐	☐	☐
12. LPA Funded or Non-LPA Funded	☐	☐	☐	☐
13. Federally Funded or Non-Federally Funded	☐	☐	☐	☐
14. Funding Limitations for the Project	☐	☐	☐	☐
15. Level of Acceptance of the Project by the Public	☐	☐	☐	☐
16. Level of Political Pressure	☐	☐	☐	☐
17. Common Concerns of Property Owners	☐	☐	☐	☐
18. Current Status of the R/W Project	☐	☐	☐	☐
Right of Way Acquisition	**Not Important**	**Low**	**Moderate**	**High**
19. Number of Parcels for Acquisition	☐	☐	☐	☐

20. Different Types of Parcel Usages	☐	☐	☐	☐
21. Frequency of Eminent Domain	☐	☐	☐	☐
22. Source of Personnel to be used for R/W Acquisition	☐	☐	☐	☐
23. Availability of District R/W Appraisers (District Staff and Outsourced)	☐	☐	☐	☐
24. Is Funding Available for Outsourcing Staff Assistance?	☐	☐	☐	☐
25. Type of Property Owners	☐	☐	☐	☐
26. Level of Familiarity with Key Landowners	☐	☐	☐	☐
27. Are There Any Property Tenants to Consider?	☐	☐	☐	☐
28. Need for Residential Relocation	☐	☐	☐	☐
29. Level of Local Availability of Replacement Housing Facilities	☐	☐	☐	☐
30. Need for Business Relocation	☐	☐	☐	☐
31. Level of Local Availability of Replacement Business Facilities	☐	☐	☐	☐
32. Likelihood of Title Curative Actions	☐	☐	☐	☐
33. Responsiveness of Local Title Companies to TxDOT	☐	☐	☐	☐
Utility Adjustment	**Not Important**	**Low**	**Moderate**	**High**
34. Have SUE Investigations Been Performed?	☐	☐	☐	☐
35. Will SUE Investigations Be Performed? (If no or unknown in the driver # 34)	☐	☐	☐	☐
36. Utility Type	☐	☐	☐	☐
37. Number of Utilities Located in Public R/W	☐	☐	☐	☐
38. Number of Utilities Located in Private Easement	☐	☐	☐	☐
39. Number of Utilities for Adjustments or Relocations	☐	☐	☐	☐
40. Is there any Utility Adjustment to be Included in the Highway Construction Contract?	☐	☐	☐	☐
41. Responsiveness of Utility Companies to TxDOT Needs	☐	☐	☐	☐
42. Adjustment is Reimbursable Utility or Non-Reimbursable Utility	☐	☐	☐	☐

No: Name: _____

Non-RUDI Based Duration Estimate



Project ID	Non-RUDI Based Duration Estimate		
	R1	R2	R3
	U1	U2	U3

Please provide additional information used in your non-RUDI based estimates.

1) _____

2) _____

3) _____

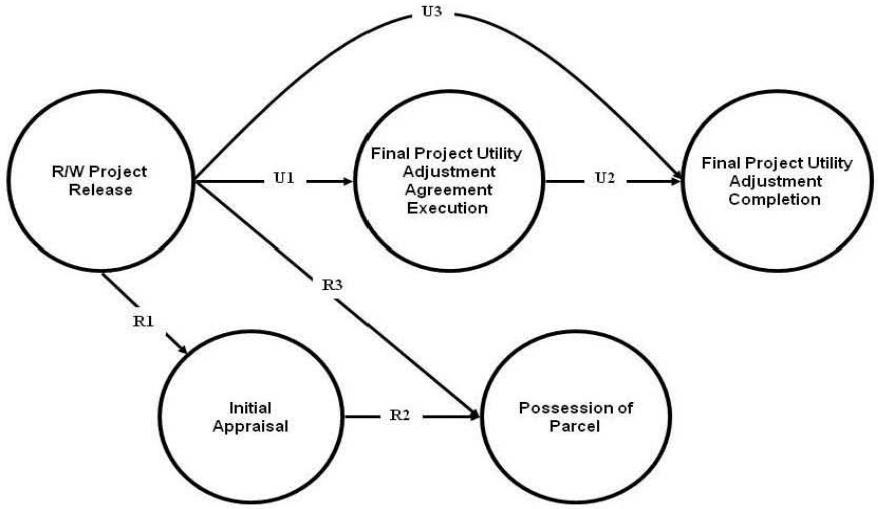
4) _____

5) _____

4

No: Name: _____

RUDI Based Duration Estimate



Project ID	RUDI Based Duration Estimate		
	R1	R2	R3
	U1	U2	U3

Please provide additional information used in your RUDI based estimates.

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

5

Comparison of Non-RUDI Based and RUDI Based Estimates

Project ID	Non-RUDI Duration Estimate		RUDI-Based Duration Estimate		Difference	
					Days	%
	R1			R1		
	R2			R2		
	R3			R3		
	U1			U1		
	U2			U2		
	U3			U3		

If there is difference between Non-RUDI based estimate and RUDI based estimate, please provide your reasons for the differences.

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

6

No: **Name:** _____

3. Post-Application Importance of the Key Drivers in the R/W Acquisition and Utility Adjustment Processes

The following form is intended to assess the importance of the drivers used in determining durations of the R/W acquisition and Utility adjustment processes of Model project B. The common question for the drivers is '**Is this driver significant in determining your durations**?' If critical, check the "Yes" box. If not critical, check the "No" box.

Project Basic Facts		**Significant Duration Driver?**	
Driver	**Value**	**Yes**	**No**
1. TxDOT Project Type	☑ RER (Rehabilitation of Existing Road) ☐ UGN (Upgrade to Standards Non-Freeway) ☐ NNF (New Location Non-Freeway) ☐ INC (Interchange - New or Reconstructed) ☐ WF (Widen Freeway) ☐ WNF (Widen Non-Freeway) ☐ BR (Bridge Replacement) ☐ CNF (Convert Non-Freeway to Freeway) ☐ HES (Hazard Elimination/Safety) ☐ MSC (Miscellaneous) ☐ NLF (New Location Freeway) ☐ OV (Overlay) ☐ UPG (Upgrade to Standards ☐ BWR (Bridge Widening/Repair)	☐	☐
2. TxDOT Highway Type	☐ IH (Interstate) ☐ SH (State Highway) ☑ FM (Farm to Market road) ☐ CS (City Street) ☐ US (US highway) ☐ RM (Ranch to Market road)	☐	☐
3. Project Location Type	☐ Urban ☑ Rural ☐ Metropolitan	☐	☐

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4. Right-of-Way and Utility Scope	☐ Only R/W acquisition ☐ Only Utility adjustment ☑ Both R/W acquisition and Utility adjustment	☐	☐
5. Status of Schematic Design	☑ Completed ☐ In-progress ☐ Not Started	☐	☐
6. Status of Boundary Surveying	☑ Completed ☐ In-progress ☐ Not Started	☐	☐
7. Status of Environmental Clearance	☑ Completed ☐ In-progress ☐ Not Started	☐	☐
8. Status of Right-of-Way Map	☑ Completed ☐ In-progress ☐ Not Started	☐	☐
9. Internal R/W Staff Size of a District	☑ Less than 9 FTEs ☐ 9 or more than 9 FTEs	☐	☐
10. District R/W Annual Budget	☑ Less than $6million ☐ More than $6million	☐	☐
11. Dedication of Funds to the Project (R/W and Construction)	☑ Yes ☐ No ☐ Unknown	☐	☐
12. LPA Funded or Non-LPA Funded	☑ LPA funded ☐ Non-LPA funded	☐	☐
13. Federally Funded or Non-Federally Funded	☑ Federally funded ☐ Non-Federally funded	☐	☐
14. Funding Limitations for the Project	☐ LPA or Utility Company needing an SIB loan ☐ Partial payments from funding participants ☐ Time required to fund the project ☐ Other _____ ☑ None	☐	☐
15. Level of Acceptance of the Project by the Public	☑ Extensive supportive ☐ Not supportive ☐ Mixed	☐	☐
16. Level of Political Pressure	☐ Extensive ☑ Moderate ☐ Minimal	☐	☐

17. Common Concerns of Property Owners	☑ Access ☐ Safety ☐ Project duration ☐ Compensation ☐ Other _____	☐	☐
18. Current Status of the R/W Project	☐ Request R/W CSJ ☐ Request R/W full release ☐ Assigned R/W CSJ ☑ R/W full release ☐ Pending release	☐	☐
Right of Way Acquisition		**Significant Duration Driver?**	
Driver	**Value**	**Yes**	**No**
19. Number of Parcels for Acquisition	☐ Less than 10 ☐ 10 to 30 ☑ More than 30	☐	☐
20. Different Types of Parcel Usages	☐ Vacant ☑ Residential ☑ Commercial ☐ Agricultural ☐ Religious facility ☐ Parking lot ☐ Other _____	☐	☐
21. Frequency of Eminent Domain	☑ Several ☐ Some ☐ None ☐ Unknown	☐	☐
22. Source of Personnel to be used for R/W Acquisition	☐ Outsourced ☑ District staff ☐ Unknown	☐	☐
23. Availability of District R/W Appraisers (District Staff and Outsourced)	☐ Adequate ☑ Marginally adequate ☐ Inadequate	☐	☐
24. Is Funding Available for Outsourcing Staff Assistance?	☑ Yes ☐ No ☐ Unknown	☐	☐
25. Type of Property Owners	☐ All in-state ☑ Some out-of-state ☐ Unknown	☐	☐
26. Level of Familiarity with Key Landowners	☑ High ☐ Low ☐ Unknown	☐	☐
27. Are There Any Property Tenants to Consider?	☐ Yes ☑ No ☐ Unknown	☐	☐

28. Need for Residential Relocation	☑ Substantial	☐ Some	☐ None	☐	☐
29. Level of Local Availability of Replacement Housing Facilities	☐ High ☐ Unknown	☐ Medium	☑ Low	☐	☐
30. Need for Business Relocation	☑ Substantial	☐ Some	☐ None	☐	☐
31. Level of Local Availability of Replacement Business Facilities	☐ High ☐ Unknown	☐ Medium	☑ Low	☐	☐
32. Likelihood of Title Curative Actions	☑ High ☐ Unknown	☐ Medium	☐ Low	☐	☐
33. Responsiveness of Local Title Companies to TxDOT	☑ High ☐ Unknown	☐ Medium	☐ Low	☐	☐
Utility Adjustment				**Significant Duration Driver?**	
Driver	**Value**			**Yes**	**No**
34. Have SUE Investigations Been Performed?	☐ Yes	☑ No	☐ Unknown	☐	☐
35. Will SUE Investigations Be Performed? (If no or unknown in the driver #34)	☑ Yes	☐ No	☐ Unknown	☐	☐
36. Utility Type	☐ Overhead power ☑ Water ☑ Overhead communication ☑ Other: Electric pipes	☐ Buried power ☑ Underground communication	☐ Waste water ☐ Gas	☐	☐
37. Number of Utilities Located in Public R/W	☐ Less than 4 ☐ Unknown	☑ 4 to 7	☐ More than 7	☐	☐

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38. Number of Utilities Located in Private Easement	☐ Less than 4 ☐ Unknown	☑ 4 to 7	☐ More than 7	☐	☐
39. Number of Utilities for Adjustments or Relocations	☐ Less than 4 ☐ Unknown	☐ 4 to 7	☑ More than 7	☐	☐
40. Is there any Utility Adjustment to be Included in the Highway Construction Contract?	☐ Yes	☑ No	☐ Unknown	☐	☐
41. Responsiveness of Utility Companies to TxDOT Needs	☑ High ☐ Unknown	☐ Medium	☐ Low	☐	☐
42. Adjustment is Reimbursable Utility or Non-Reimbursable Utility	☑ Reimbursable	☑ Non-reimbursable	☐ Unknown	☐	☐