0-4997-P2

USER GUIDE FOR THE DECISION SUPPORT TOOL FOR COMBINED TRANSPORTATION AND UTILITY CONSTRUCTION STRATEGY

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1.1 Introduction

This document is the user's guide for the Decision Support Tool (DST) developed to help officials in the Texas Department of Transportation (TxDOT) decide when the Combined Transportation and Utility Construction (CTUC) approach should be pursued. By definition, the CTUC approach makes the highway contractor responsible for the bulk of the construction of major utility-related appurtenances, such as underground duct banks, vaults, manholes, sanitary sewers, or poles (O'Connor et al. 2004). Recent research studies have indicated that the CTUC approach might be an effective remedy for utility adjustment delays (GAO 1999) (AASHTO 2004) (Ellis et al. 2003); however, CTUC challenges such as utility service reliability, utility adjustment quality, and how to best sell to reluctant utility owners usually frustrate TxDOT decision-makers as to when to apply the CTUC approach. Thus, this tool, developed using Microsoft® Visual Basic for Application (VBA) and Microsoft® Excel, aims to create an interactive decision support environment so that not only TxDOT decision-makers, but also utility representatives can easily enter analysis data of their utility adjustments into CTUC DST. CTUC DST can then feed back the corresponding opinions from both TxDOT and the utility industry experts, who have extensive experience in managing utility adjustments, in order to facilitate communication and coordination between both parties.

1.2 CTUC Decision-Making Process

Establishing the CTUC decision-making process was the first step in developing a beneficial decision support tool. Figure 1.1 shows the proposed CTUC decision-making process (O'Connor et al 2005). Each rectangle represents an activity and contains a description of that activity. The bottom portion of the rectangle indicates which party is responsible for each activity (i.e. utility owner or TxDOT). The two actual meetings to be held for CTUC decision-making purposes (Activities #1 and #4) are indicated with bolded rectangles.

The proposed CTUC decision-making process was designed to be implemented as early in the project as possible, but it cannot begin until the necessary information on project parameters, constraints, etc. are available. Consequently, Activity #1 of the process, CTUC Phase 1 Analysis, is scheduled to occur at approximately 0 percent Plan, Specification, and Estimate (PS&E). At this point on the project timeline, it is generally assumed that TxDOT will have a rough idea of which utilities will require adjustments, the approximate level of complexity, etc. CTUC Phase 1 Analysis is performed by TxDOT alone. The goal of this analysis is for TxDOT to use CTUC DST to separate utilities that are definitely not suitable for the CTUC approach from those which may be appropriate for it.

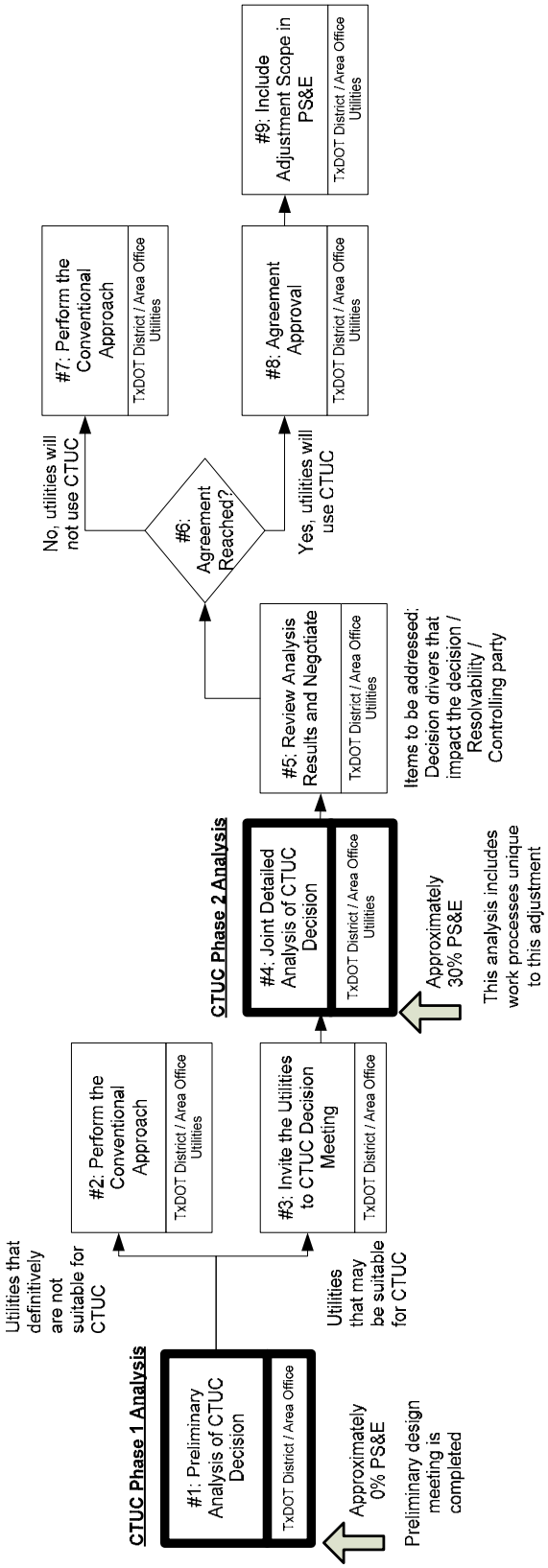

Figure 1.1 Proposed CTUC Decision-Making Process

Following CTUC Phase 1 Analysis, those utilities deemed *not suitable* for the CTUC approach are then adjusted by the conventional method (Activity #2). Those utilities that *may be suitable* for the CTUC approach are invited (Activity #3) to CTUC Phase 2 Analysis (Activity #4), at which time both TxDOT decision-makers and the utility representatives are expected to negotiate with each other about the applicability of the CTUC approach.

CTUC Phase 2 Analysis is performed as a combined effort by TxDOT decision-makers and the utility representatives, at approximately 30 percent PS&E. This analysis activity is performed during a meeting in which both the utility representatives and TxDOT staff provide information as prompted by CTUC DST. As indicated by the name, this phase requires more comprehensive information input from the stakeholders than in the previous phase and is thereby able to produce more thorough results. Once CTUC DST has gathered the necessary information from each party, it will provide outputs to guide each utility adjustment, recommending whether the CTUC approach would be beneficial for the given adjustment.

Following CTUC Phase 2 Analysis, Activity 5 requires each utility representative to meet individually with TxDOT to review CTUC analysis results and negotiate. This activity provides the utility and TxDOT the opportunity to discuss potential project-specific challenges that can be met through effective coordination, as well as rectify possible concerns associated with the CTUC approach and give participants the chance to consider procedural changes that could result in a more effective adjustment process. The ideal result of Activity #5 would be either a CTUC agreement between TxDOT and the utility owner, or a decision for the utility to perform the conventional adjustment approach (Activity #7). The actual CTUC decision is made during Activity #6.

Once the utility owner and TxDOT are able to establish a CTUC agreement that pleases both parties, Activities #8 and #9 are executed. These activities simply make the acceptance of the CTUC agreement official and initiate the inclusion of the utility adjustment scope in the final PS&E.

In sum, CTUC DST is designed to provide assistance in CTUC Phase 1 and Phase 2 Analyses. In Chapter 2, the instructions of each step provided by CTUC DST for Phase 1 Analysis will be detailed. Chapter 3 will focus on CTUC Phase 2 Analysis from a utility assessor's perspective, while Chapter 4 will explain how to complete CTUC Phase 2 Analysis from a TxDOT assessor's perspective.

1.3 CTUC Knowledge Base Sources

Six CTUC decision drivers assessment workshops were conducted in TxDOT San Antonio, Houston, and Dallas districts to establish the CTUC knowledge base. Three of the six workshops were conducted to invite TxDOT experts knowledgeable about the CTUC approach, and twenty-eight TxDOT experts with an average of 13.8 years of work experience attended. The other three workshops were conducted to invite utility experts knowledgeable about the CTUC approach, and twenty-four utility experts with an average of 12.1 years of work experience representing water, wastewater, communication, power, and gas types of utilities attended. In addition, the following evaluative scheme was used to obtain the numeric value of each decision driver's impact level:

- ☐ Use "-4" to represent "Show-Stopper"
- ☐ Use "-3" to represent "Anti-CTUC and high impact"

- ☐ Use “-2” to represent “Anti-CTUC and medium impact”
- ☐ Use “-1” to represent “Anti-CTUC and low impact”
- ☐ Use “ 0” to represent “Neutral”
- ☐ Use “ 1” to represent “Pro-CTUC and low impact”
- ☐ Use “ 2” to represent “Pro-CTUC and medium impact”
- ☐ Use “ 3” to represent “Pro-CTUC and high impact”
- ☐ Do not include the experts who chose “Impact Level = Don’t Know”

The complete comparison tables of both parties’ assessment results will be published in the research final report. Basically, between the two parties’ assessments, only one decision driver was found to have significantly different impact levels – the consideration of handling hazardous materials. Labeled “HAZMAT” on the questionnaire, the issue is whether hazardous materials-related work only applies to the utility adjustment work. This difference is understandable since hazardous materials are extremely difficult to handle, and utility owners would want to use the CTUC approach because it will be the highway contractor’s responsibility to handle hazardous materials. On the other hand, TxDOT would naturally want to exclude this difficult work from the contract. Thus, the average impact level of HAZMAT from TxDOT experts’ perspective is -2.93, while the average impact level of HAZMAT from all utility experts’ perspective is +1.9.

1.4 System Requirements

The following system requirements are recommended for operating CTUC DST:

1) Operating System: Microsoft Windows 98, Me, 2000, XP, or 2003. Windows XP or 2003 recommended.
2) Microsoft Excel Version: Microsoft Excel 2000 or higher. Microsoft Excel 2003 recommended.

1.5 Installation and Setup

The complete tool is provided on CDROM as an EXCEL file, “CTUCDST.xls.” Please copy “CTUCDST.xls” to your local hard disk. Prior to use of CTUC DST, Excel macro security levels must be set to medium or the tool will not run. To accomplish this, go to the “Tool” menu then scroll down to “Macro” and then over to “Security.” Once the security dialog box will open, choose the “Security Level” tab. Within this box, select the “Medium” level radio button. Each time CTUC DST is deployed to a new computer environment, this macro security level must be maintained. On subsequent uses of the tool, the “Enable Macros” dialog box will automatically appear when the tool is opened; press the “Enable Macros” button at the beginning of each session.

2. CTUC Phase 1 Analysis

2.1 Overview of CTUC Phase 1 Analysis

This chapter describes use of CTUC DST for performing CTUC Phase 1 Analysis, a part of the process geared primarily for TxDOT assessors. Step-by-step instructions are given, and all the steps are illustrated in Figure 2.1. The first step involves either creating a new project or retrieving previous CTUC analysis records (explained further in Section 2.2). Then, CTUC DST will guide the assessor to the configuration form for all utility adjustments involved in the highway project (explained further in Section 2.3). After completing these project information forms, the assessor will be asked a series of yes/no questions concerning project-specific issues and characteristics (explained further in Section 2.4). In Step 4, the assessor will first specify the knowledge base source, and CTUC DST will then show the graphical analysis results. The assessor will see expert opinions regarding the applicability of CTUC for the selected utility adjustment in a series of bar charts (explained further in Section 2.5). In Step 5, CTUC DST will show the text report listing all decision drivers ranked according to their impact levels (explained further in Section 2.6). Finally, as mentioned in Section 1.2, the assessor will need to specify which utilities are to be analyzed further in CTUC Phase 2 Analysis (explained further in Section 2.7).

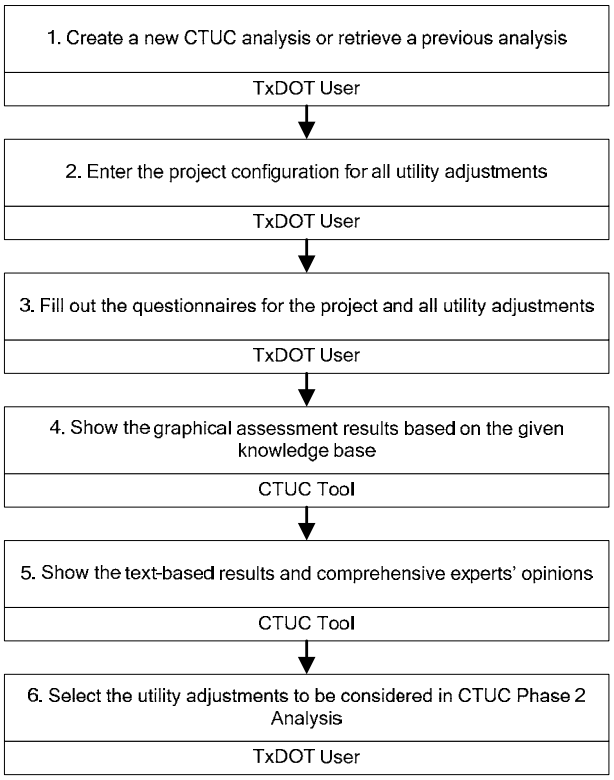

Figure 2.1 Steps of CTUC Phase 1 Analysis

2.2 Creating/Retrieving a CTUC Phase 1 Analysis

Once CTUC DST is opened, the computer will display the front page, as shown in Figure 2.2. On this page, the assessor can press the "Start CTUC Analysis" button if this is the first time he or she performs CTUC Phase 1 Analysis for the project. Creating a new CTUC analysis will be discussed in Section 2.2.1.

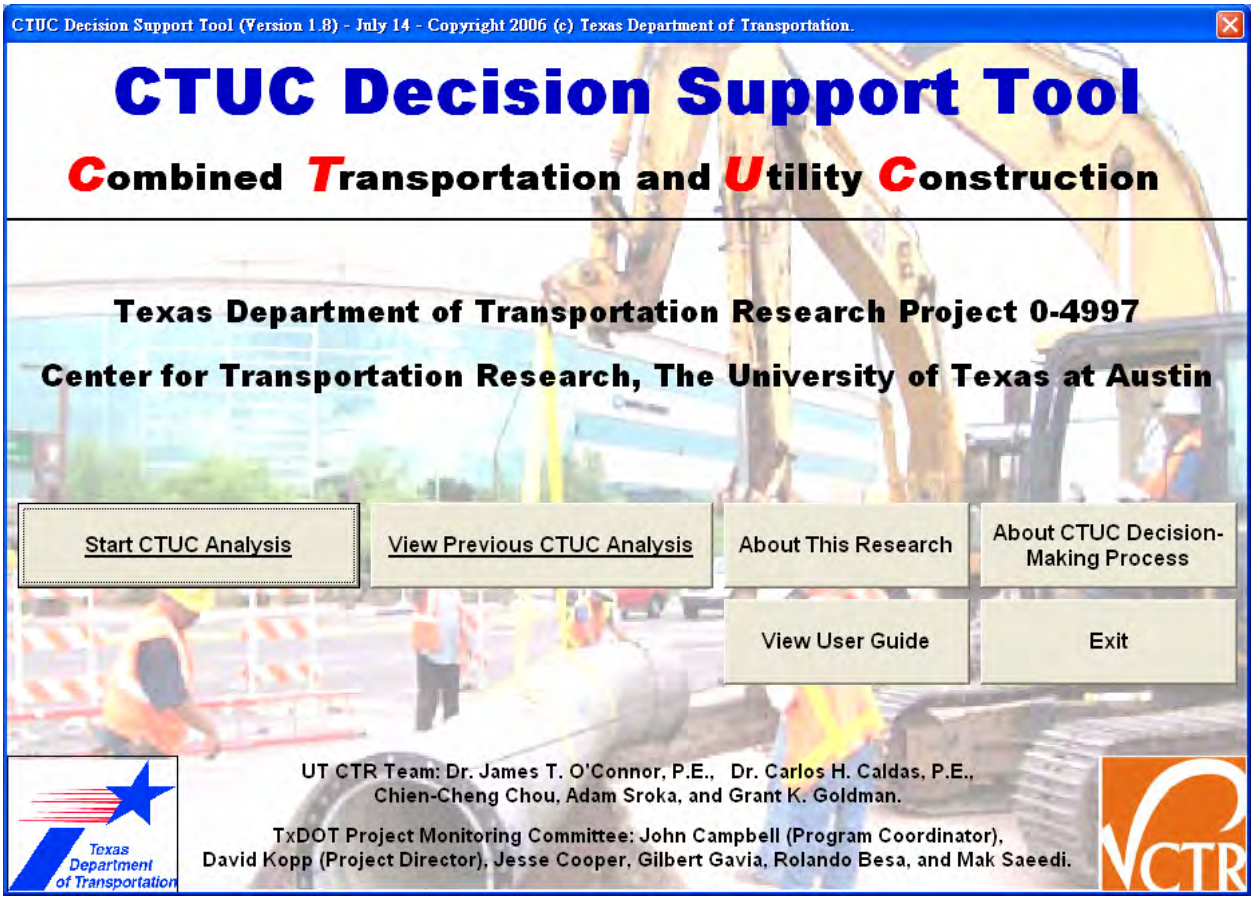

Figure 2.2 The Front Page of CTUC DST

However, if the project has been analyzed before, the assessor can press the "View Previous CTUC Analysis" button to retrieve one of the previous analysis records. The assessor can press the "About This Research" button to see the background information of this research project. The "About CTUC Decision-Making Process" button is linked to the CTUC decision-making process diagram. By clicking the "View User Guide" button, the assessor can see this manual, and the "Exit" button closes the tool.

For example, an assessor who has finished CTUC Phase 1 Analysis for the project at 0 percent PS&E may want to perform CTUC Phase 2 Analysis at 30 percent PS&E. Or an assessor who has finished CTUC Phase 1 Analysis at 0 percent PS&E may want to perform CTUC Phase 1 Analysis again for the same project at 15 percent PS&E. As long as the assessor wants to review previous CTUC analysis records, CTUC DST will ask the assessor to pick the TxDOT district and the project (discussed further in Section 2.2.2). Then, CTUC DST will ask the

assessor to pick one of these previous analysis records in order to review the real analysis data the assessor had entered before (discussed further in Section 2.2.3).

2.2.1 Start a New CTUC Phase 1 Analysis

Pressing the "Start CTUC Analysis" button will prompt CTUC DST to display a form for the project and assessor information. As shown in Figure 2.3, there are three information blocks within the form. The first two blocks are straightforward. In the combo box labeled "1.1 Your TxDOT District," the assessor can click the drop-down arrow to show a list of all TxDOT districts and then select the district by clicking its name. The assessor can also find the TxDOT district of interest by typing in the first letter of the district's name and allowing the computer to pull up the district name(s) that begin with that letter. After answering Question 1.1, the assessor will see all area offices' names shown inside the next combo box labeled "1.2 Your TxDOT Area Office." The assessor then simply picks the area office in which the project is located. If the project belongs to two or more area offices, or if the area office is unknown, the assessor can select the last item in the combo box and enter the area office information in the text box below.

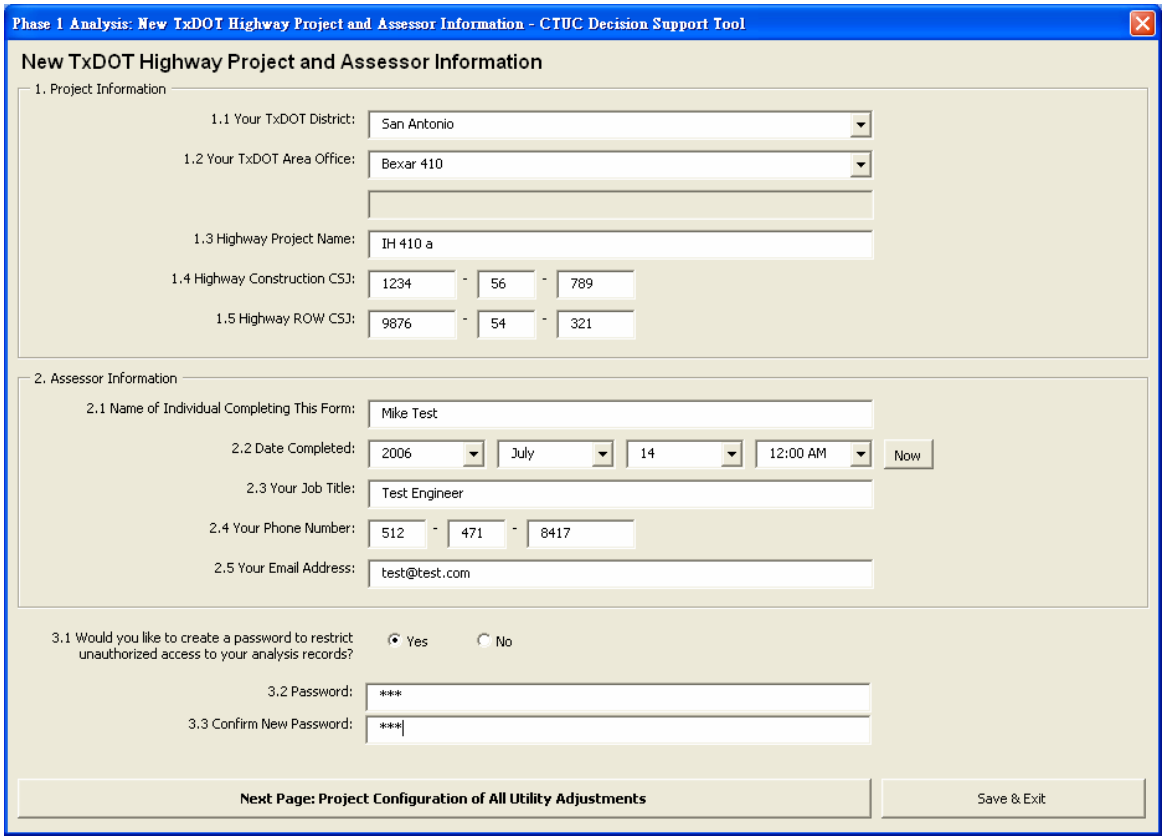

Figure 2.3 New Project and Assessor Information Form

The remaining text boxes in the first two blocks are easy to fill. Note that when the assessor enters numbers in the text boxes labeled "1.4 Highway Construction CSJ," "1.5 Highway ROW CSJ" and "2.4 Your Phone Number," the digit sequences the assessor can type in

each one are constrained by their respective formats. In addition, the assessor can press the "Now" button to automatically enter the current system date and time into Question 2.2.

Questions 3.1 to 3.3 are about whether to create a password to protect the analysis data. Assessors can select "No" in Question 3.1 to avoid the login process in the future. The assessor can select "Yes" in Question 3.1 and enter a password in Questions 3.2 and 3.3 to prevent unauthorized access to the analysis data.

Finally, assessors can press the "Next Page: Project Configuration of All Utility Adjustments" button to save the newly created data and go to the next step, which will be described in Section 2.3.

2.2.2 Retrieve a Previous CTUC Phase 1 Analysis: Select a District and a Project

If the "View Previous CTUC Analysis" button is pressed, shown in Figure 2.2, CTUC DST will ask the assessor to select a TxDOT district, as shown in Figure 2.4. After selecting the district, the assessor can press the "OK" button to see the list of all projects in the district, as shown in Figure 2.5. There are two list-boxes in Figure 2.5. The list-box on the left displays all projects CTUC DST has recorded in this TxDOT district. The list-box on the right is for utility assessors and will be discussed in Chapter 3.

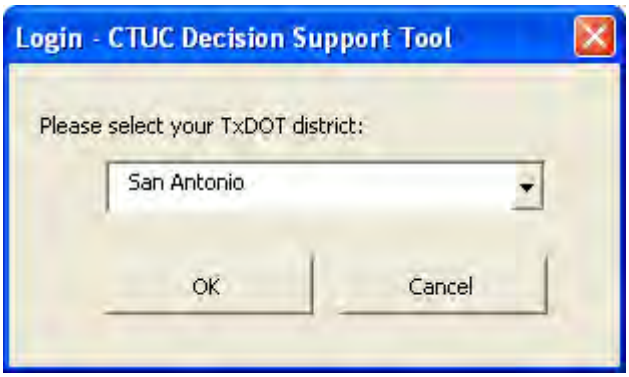

Figure 2.4 Select a TxDOT District

Figure 2.5 shows how six columns are presented in the left hand list-box: 1) Highway Project Name and Its CCSJ; 2) Area Office; 3) CTUC Phase; 4) Password Needed?; 5) Last Assessor; and 6) Assessment Date. The assessor can either select any line item and press the "Login as a TxDOT User" button or simply double-click the line item in order to retrieve the project analysis data. Note that if a project needs password protection, CTUC DST will show "Yes" in the "Password Needed?" column for this project and will prompt the assessor to enter the password in a dialog box, as shown in Figure 2.6. If the password the assessor enters is correct, CTUC DST will then proceed to process future assessors' requests.

- **For Demonstration Purposes**

  Because CTUC DST is equipped with some sample data, the essential steps of this section's functions will be explained here for demonstration purposes.

  1) After pressing the "View Previous CTUC Analysis" button shown in Figure 2.2, assessors will see the page shown in Figure 2.4.

2) *Assessors can select the "San Antonio District" shown in Figure 2.4 to see two projects in the left list-box shown in Figure 2.5.*
3) *Assessors can select the first line item, the project name of which is "IH 410 A," to go through the login process (see Figure 2.6).*
4) *Assessors can enter "abc" as the password to go to the step described in the next section.*
5) *Assessors can also select the second line item, the project name of which is "IH 10," to go to the next step without experiencing the login process.*

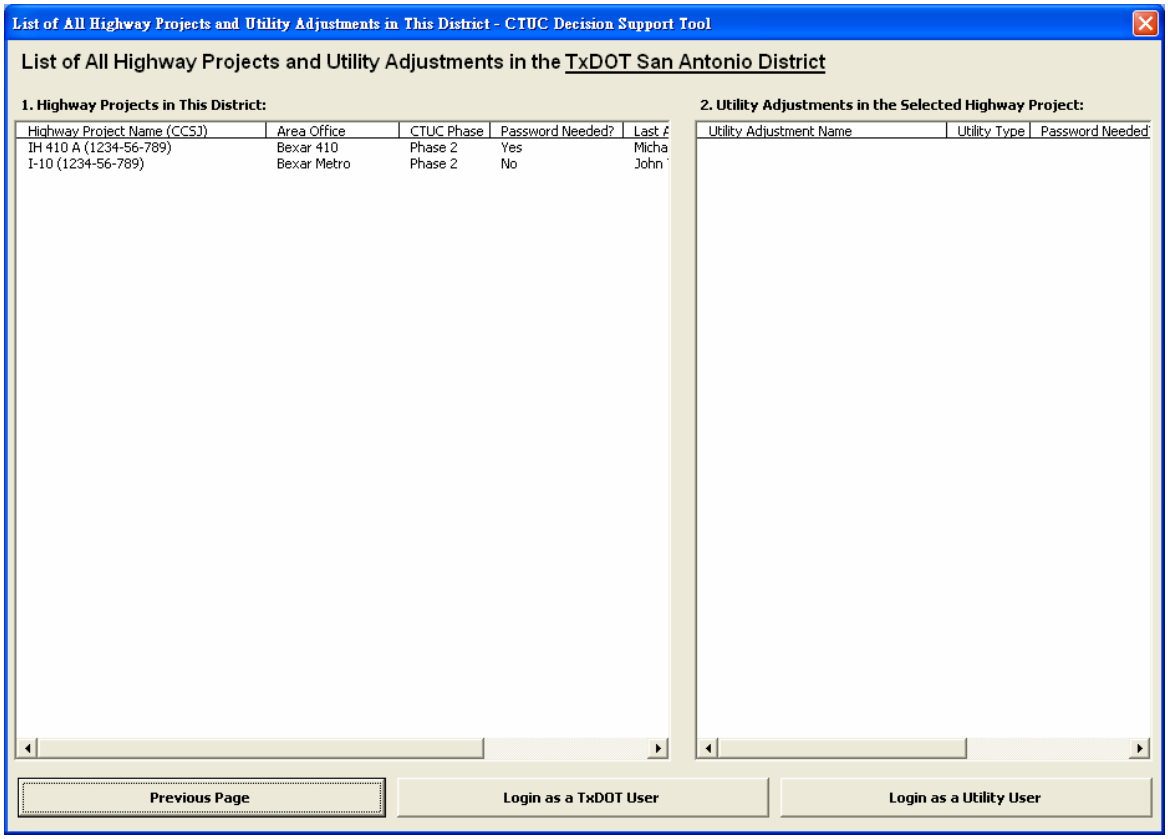

Figure 2.5 List of All Projects within the TxDOT District

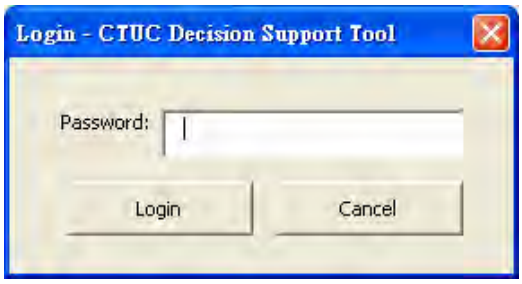

Figure 2.6 Login Form for a Project with Password Protection

2.2.3 Retrieve a Previous CTUC Phase 1 Analysis: Select an Analysis Record

Since one project may have been analyzed many times, this section will describe the form layout and the actions required to retrieve one of the previously entered CTUC analysis records. After the assessor enters the correct password for the project or the assessor selects a project that does not require a password, CTUC DST will show the list of all previously entered analysis records for this project, as shown in Figure 2.7.

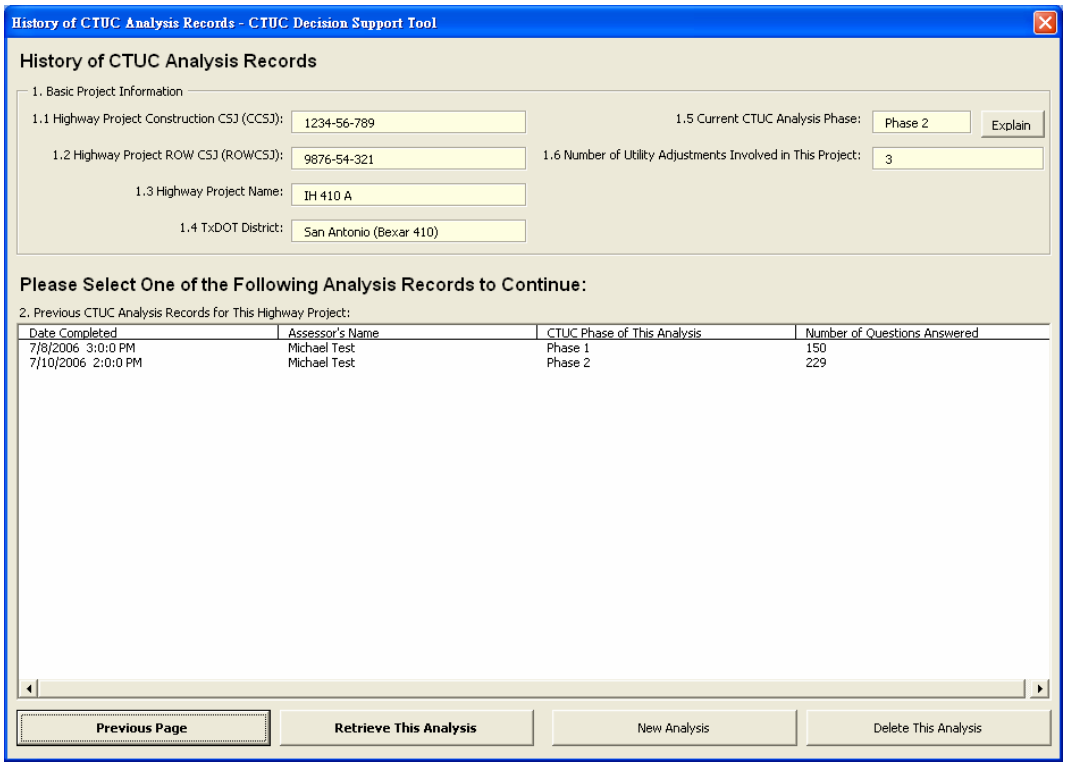

Figure 2.7 History of Previous CTUC Analysis Records

Figure 2.7 shows six unchangeable project information fields and one list-box of all analysis records within the project. In CTUC DST, all information fields that are unchangeable are highlighted in yellow. These fields can remind assessors of the data they have entered for the current project. The list-box on the bottom half of the page shows four columns associated with each analysis record: 1) Date Completed; 2) Assessor's Name; 3) CTUC Phase of This Analysis; and 4) Number of Questions Answered. The first two columns provide basic information from each analysis, and the contents can be changed via the "Project and Assessor Information" form discussed at the end of this section. The third column provides the current CTUC phase of each analysis, and the value will be "Phase 1" or "Phase 2." Note that the information field labeled "1.5 Current CTUC Analysis Phase" in Figure 2.7 means the current CTUC phase of *the project*, and this field will be changed from "Phase 1" to "Phase 2" whenever a new CTUC Phase 2 Analysis record is created. The final column reflects how many questions the assessor has answered.

Four buttons are shown at the bottom of the page shown in Figure 2.7 that help the assessor navigate to the either previous or the next page. If the assessor selects an analysis record

in the list-box and presses the “Retrieve This Analysis” button, or if the assessor double-clicks any analysis record, CTUC DST will show the project and assessor information form of the selected analysis record (see Figure 2.8). If the assessor selects an analysis record and presses the “New Analysis” button, CTUC DST will copy all the internal data from the selected analysis record onto a new CTUC analysis form. The assessor can thus begin a new CTUC analysis (either Phase 1 or Phase 2) based on previously entered work. If the assessor only presses the “New Analysis” button without selecting any analysis record, a blank form will be created. Finally, if the assessor selects an analysis record and presses the “Delete This Analysis” button, CTUC DST will delete all data associated with this analysis record.

Figure 2.8 shows the “Project and Assessor Information” form and is similar to the form in Figure 2.3. The assessor can change the name of the project, CCSJ, ROWCSJ, etc. Only the project’s TxDOT district and area office cannot be changed. In other words, the assessor must select the correct district and area office whenever a new project is created.

- **For Demonstration Purposes**

  The essential steps of this section’s functions are summarized as follows:

  1) *Assume assessors selects “IH 410 A” as the project in the previous section, as Figure 2.7 shows.*
  2) *Assessors can double-click the first line item, which is for CTUC Phase 1 Analysis, to retrieve the analysis data as shown in Figure 2.8.*
  3) *Assessors can fill out all questions and press the “Next Page: Project Configuration of All Utility Adjustments” button to save the data and to proceed to the page described in the next section.*

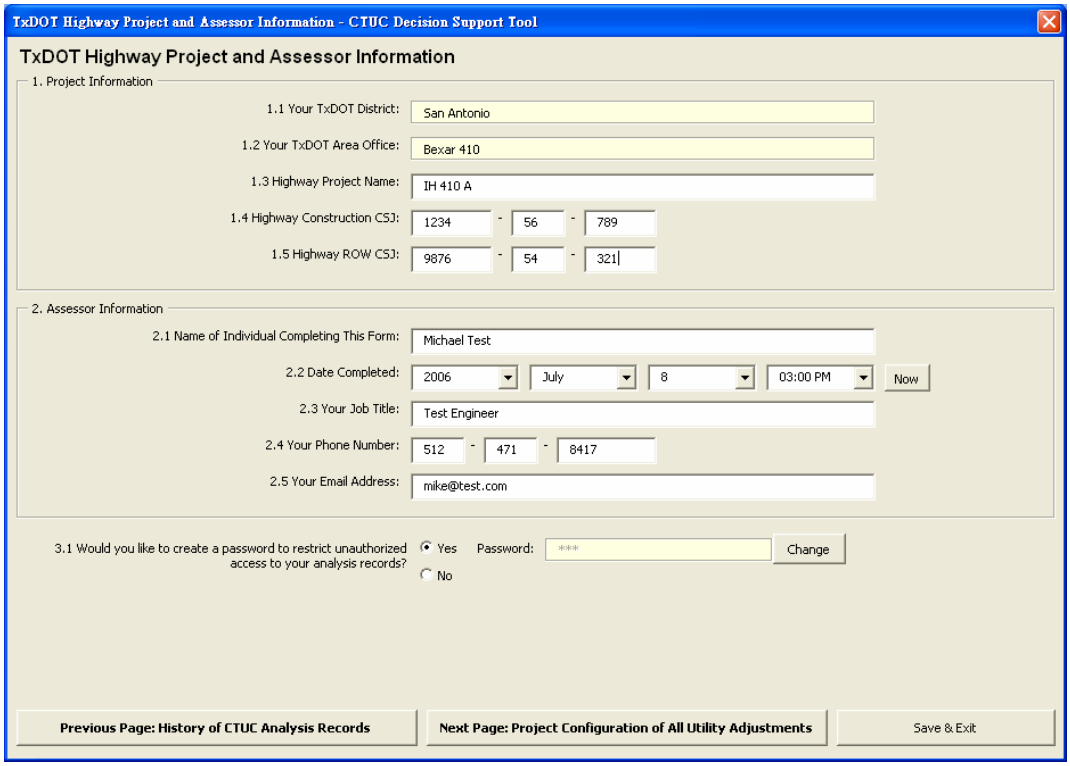

Figure 2.8 TxDOT Highway Project and Assessor Information

2.3 Setting Up Utility Adjustments for the Project

Before performing any CTUC analysis, the assessor needs to set up the configuration of all utility adjustments involved in the project. Figure 2.9 shows the steps required to set up the configuration of utility adjustments. Basically, the assessor needs to create one utility adjustment at a time and then add it to the project. Sections 2.3.1 to 2.3.3 will describe in detail the steps of the process, and will provide procedural descriptions for setting up the configuration for a sample project.

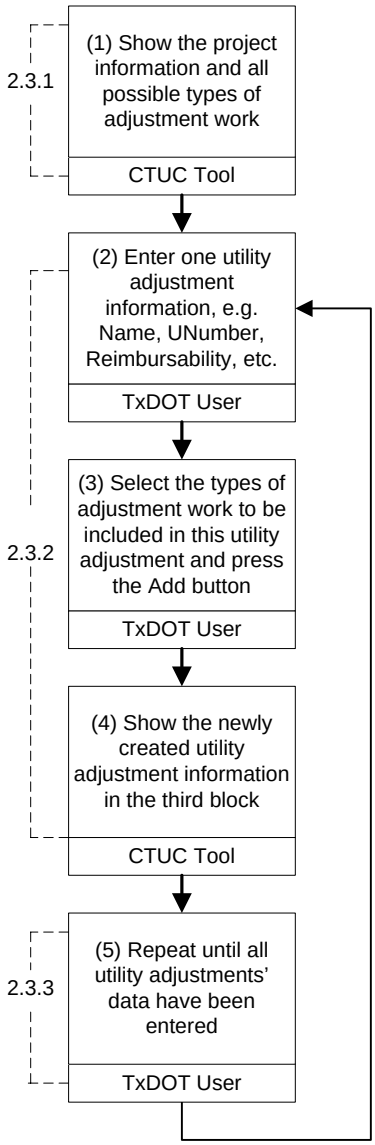

Figure 2.9 Steps to Set Up the Configuration of Utility Adjustments

2.3.1 DST Shows Project Information and Types of Adjustment Work

After the assessor fills out the form for project and assessor information (see Figure 2.8), CTUC DST will show the configuration form (see Figure 2.10). There are three major blocks on this form. The first block, labeled "1. Basic Project Information," lists key information for the project and the assessor. The information fields in this block are fixed because the assessor will have already specified both the project and the CTUC analysis record. The second block, labeled "2. Please Input Information of the Utility Adjustment," provides a place for assessors to enter the principal information of a utility adjustment. Note that when the form first appears, most fields are empty except the list-box labeled "2.6 Please Select the Types of Utility Adjustment Work." This box shows all possible types of utility adjustment work to be selected by the assessor later in the process. The third block, labeled "3. List of All Utilities within the Limits of the Project," shows the current list of all utilities within the limits of the project. If the project is newly created, there will be no data in this list-box; however, if the project has been analyzed before, there must be at least one utility adjustment record shown here.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *Assessors can scroll up or down to view all possible types of adjustment work in the list-box 2.6.*
  2) *If assessors select the sample project, "IH 410 A" in the previous step, there will be three utility adjustments shown in the third block of questions.*

2.3.2 Assessor Enters Utility Adjustment Data

After Figure 2.10 is shown, the assessor can begin to enter information on only one utility adjustment at a time. Basically, creating a utility adjustment requires that the second block's six information fields all be filled:

2.1 Utility Adjustment Name

The name of the utility adjustment should be entered in this field. In addition to the name of the utility facility, including the *range* or *station* information in this field is recommended. This field is required for each utility adjustment and cannot be modified once created.

2.2 Subject Utility Number

The utility number of the utility adjustment should be entered in this field. This field is optional for each utility adjustment.

2.3 Is the utility a Local Public Agency (LPA)?

If the utility is a LPA, the assessor can check the box and the text next to the checkbox will change the default "No" value to "Yes."

2.4 Is the eligibility ratio of this utility adjustment 100 percent or nearly 100 percent?

A "nearly 100 percent" reimbursable utility adjustment means the costs the utility owner should pay is not a factor that will influence the CTUC decision. The assessor should select one of the three options in the CTUC Phase 1 Analysis, which are "Yes," "No," and "Don't know." The "Don't know" option will be meaningless and disappear in the CTUC Phase 2 Analysis because the decision-makers should already know the eligibility ratio of the utility adjustment before negotiating the CTUC decision in CTUC Phase 2 Analysis. This field is *required* for each utility adjustment.

2.5 Description

This field is optional and supplements the description of each utility adjustment.

2.6 Please Select the Types of Utility Adjustment Work

If a utility adjustment includes one or more types of adjustment work, this list-box can help assessors accurately record such information. Eighteen types of adjustment work are listed here and originate from the TxDOT Utility Database. Selecting at least one type of adjustment work in this list-box is *required* for each utility adjustment.

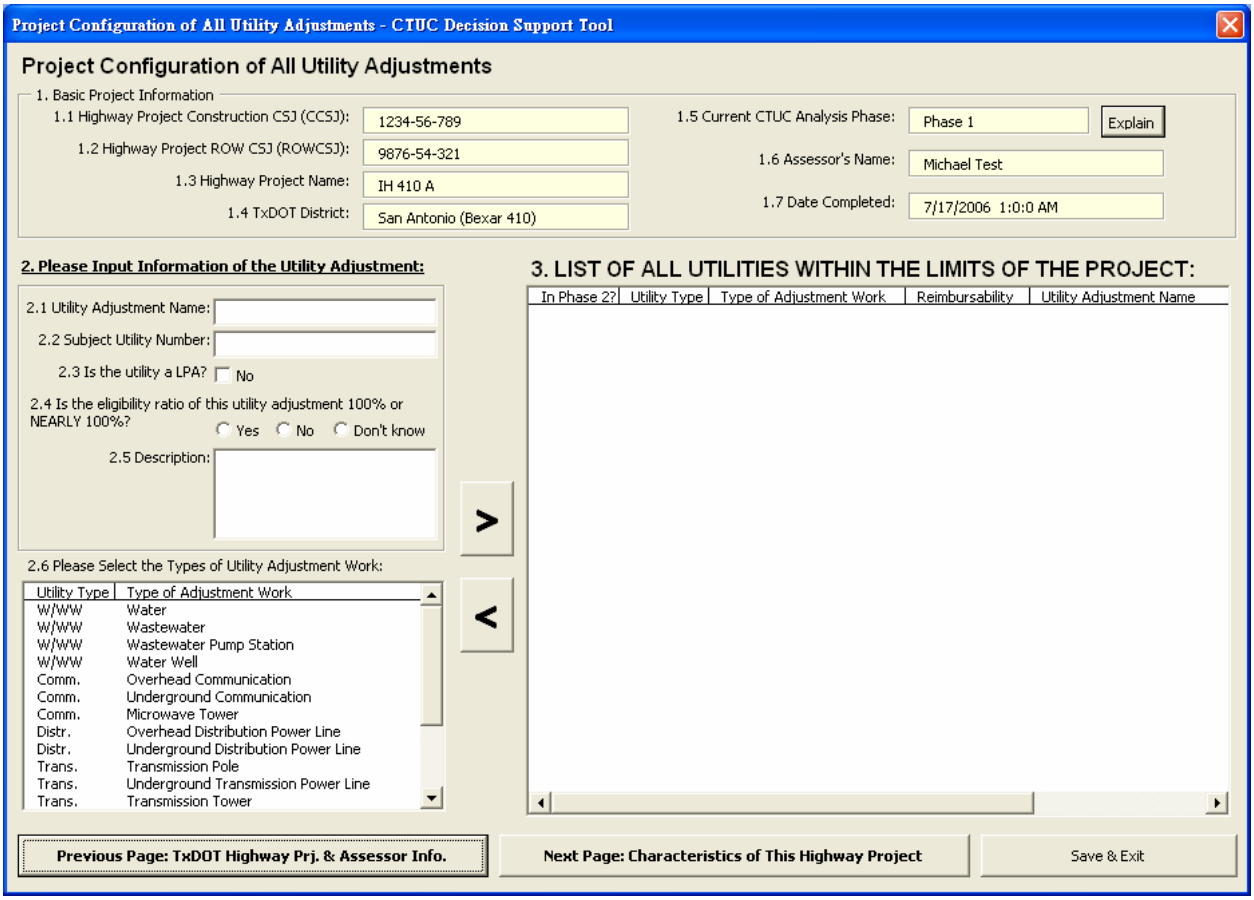

Figure 2.10 Initial Status of the Configuration Form for a New Project

In addition, if the assessor wants to select more than one type of adjustment work, he or she can press the "Ctrl" key and click those line items of the types of adjustment work. After the assessor has finished fields 2.1-2.6, the assessor can press the "→" button to add the utility adjustment's information to the project.

After having created one utility adjustment, as shown in Figure 2.11, CTUC DST will list the newly created utility adjustment in the list-box in the third block of the form, as shown in Figure 2.12. Five columns are displayed in the list-box:

1. In Phase 2?

If the utility adjustment does not need CTUC Phase 2 Analysis, "No" will be shown here. This field is controlled by the last step of the CTUC Phase 1 Analysis, which will be described in detail in Section 2.7.

2. Utility Type

Currently, six utility types exist in CTUC DST. They are:
Water and/or wastewater (W/WW)
Communication (Comm.)
Distribution Power Line (Distr.)
Transmission Power Line (Trans.)
Natural Gas (Gas)
Other (Other)

3. Type of Adjustment Work

Currently, eighteen utility types exist in CTUC DST. They are:

Water and/or Wastewater Category:
- Water
- Wastewater
- Wastewater Pump Station
- Water Well

Communication Category:
- Overhead Communication
- Underground Communication
- Microwave Tower

Distribution Power Line Category:
- Overhead Distribution Power Line
- Underground Distribution Power Line

Transmission Power Line Category:
- Transmission Pole
- Underground Transmission Power Line
- Transmission Tower

Natural Gas Category:
- High Pressure Gas Line
- Low Pressure Gas Line
- Liquid Petroleum Line

Other Category:
- Irrigation Pipeline
- Irrigation Canal
- Other

4. Reimbursability

This field represents the answer to Question 2.4. It can be "Reimbursable," "Non-Reimbursable," or "Don't Know."

5. Utility Adjustment Name

This field shows the name of the utility adjustment. Note that the utility adjustment name should be unique among the names of the other utility adjustments of the same type within one project.

- **For Demonstration Purposes**

The essential steps of this section's functions are summarized as follows:

1) *In 2.1, assessors enter "Water Line (Range/Station A-B)" in this field.*
2) *In 2.2, assessors enter "U10001" in this field.*
3) *In 2.3, assessors check the box.*

4) *In 2.4, assessors check "Yes."*
5) *In 2.5, assessors enter "Additional information can be entered here. For example, utility positions, contact persons, etc." Figure 2.11 shows the result of this entry.*
6) *In 2.6, assessors select the "Water" line item.*
7) *Assessors press the "→" button. Figure 2.12 shows the result of this action.*
8) *Assessors can press the "Previous Page: TxDOT Highway Prj. & Assessor Info." button to save the current configuration and to visit the form for editing project and assessor information.*

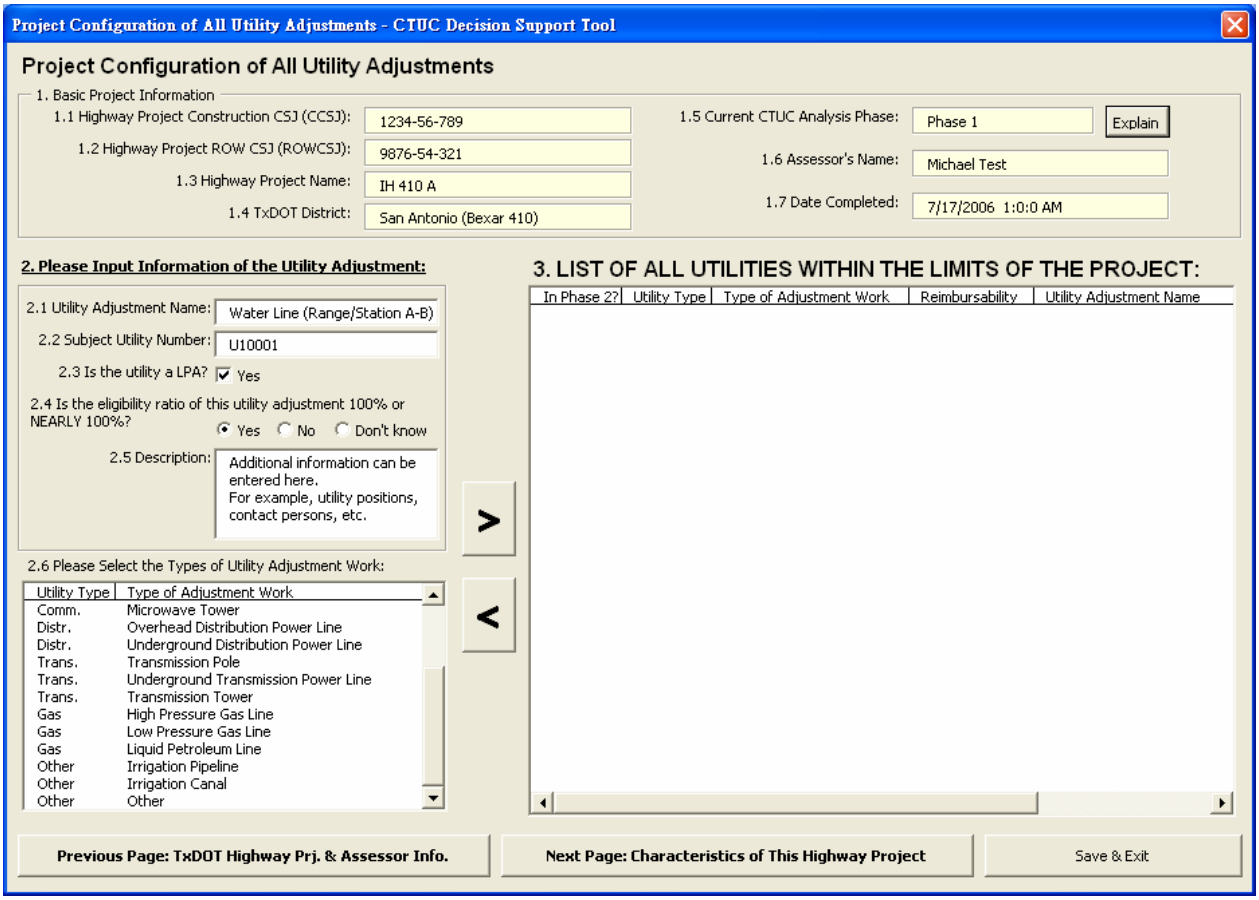

Figure 2.11 Filling Out One Utility Adjustment's Information

2.3.3 Repeat Until All Adjustment Data Are Entered

If the project is new, the assessor needs to serially enter each utility adjustment's information until all the information has been entered.

If the assessor finds typos or other errors in the utility adjustment data, he or she can select the line item with errors in the third block, and CTUC DST will render this utility adjustment's information in the second block. At this time, the assessor can modify the error data in the second block directly and then press the "→" button to reflect the changes. Note that "2.1 Utility Adjustment Name" cannot be modified once created.

Assume that a utility adjustment has many types of adjustment work. If the assessor would like to delete only some types of adjustment work, he or she can select those types of adjustment work in the third block by pressing the "Ctrl" key and selecting these line items and then press the "←" button to delete them. Note that if a project has more than one utility adjustment, the assessor can delete a utility adjustment by deleting all of this utility adjustment's types of adjustment work. However, if the assessor has already performed any CTUC analysis, deleting the utility adjustment will cause CTUC DST to display "[Delete]" in the first column of the line item in the third block even though the actual data will not be deleted.

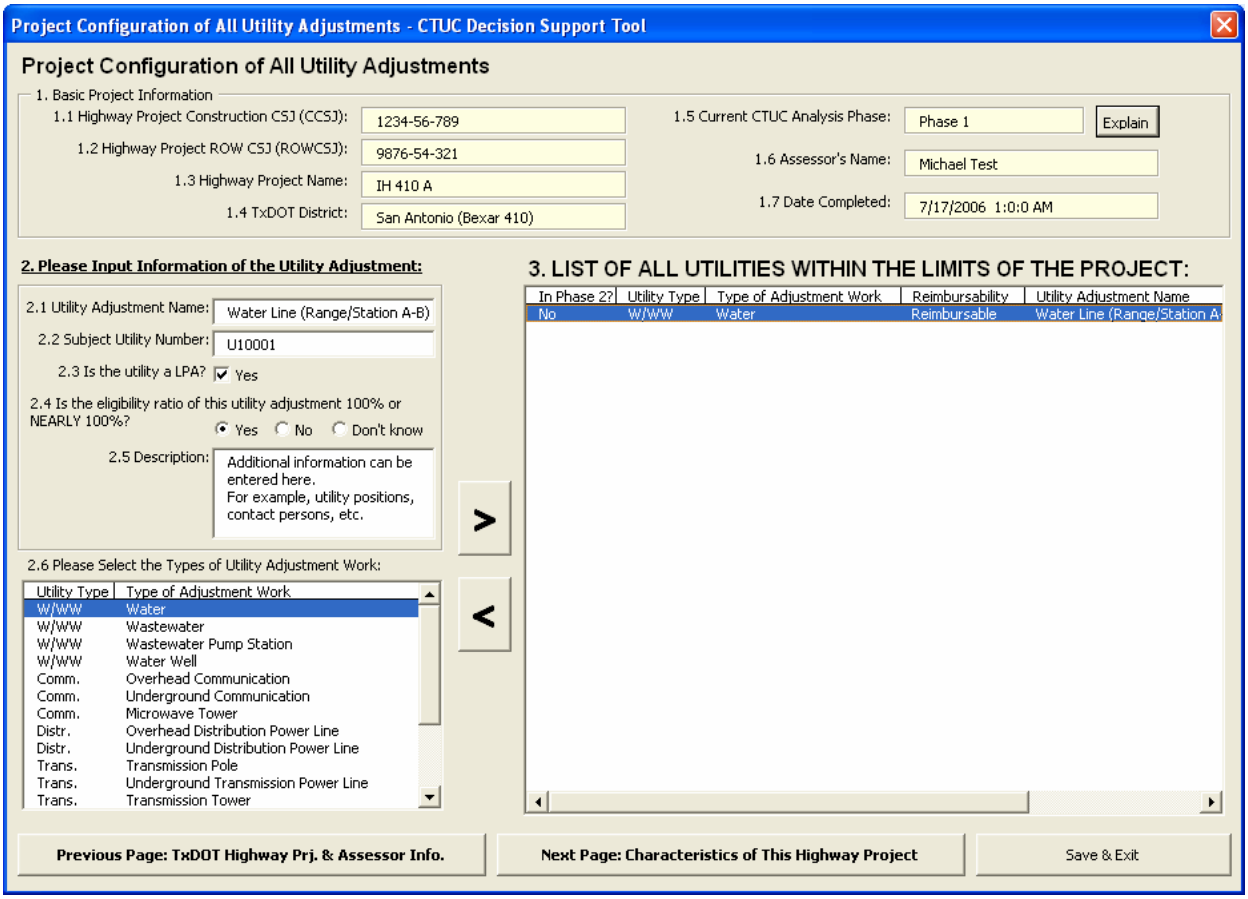

Figure 2.12 One Utility Adjustment Has Been Created for the Project

- **For Demonstration Purposes**

  Assume the sample project has three utility adjustments, as shown in Figure 2.13; the assessor wants to change the reimbursability of "Water Line (Range/Station A-B)" from "Reimbursable" to "Non-Reimbursable." The essential steps of this section's functions are summarized as follows:

  1) *Assessors can select "Water Line (Range/Station A-B)" in the third block.*
  2) *CTUC DST will show this utility adjustment's information in the second block.*
  3) *Assessors can select "No" in Question 2.4.*
  4) *Assessors can press the "→" button.*
  5) *CTUC DST will reflect the change in the third block.*

6) *Assessors can press the "Next Page: Characteristics of This Highway Project" button to save the information and to visit the next page.*

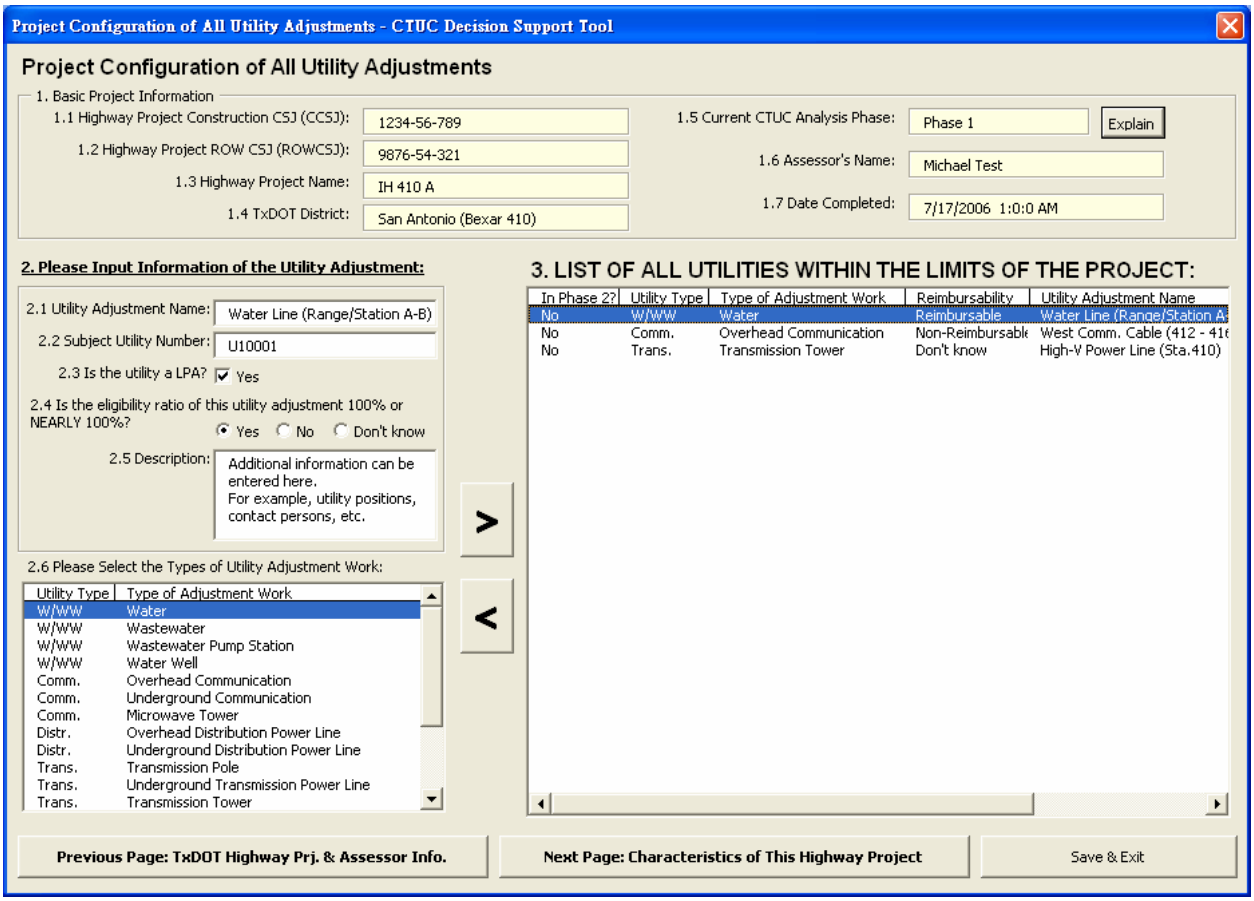

Figure 2.13 A Project with Three Utility Adjustments

2.4 Filling Out Project and Utility Questionnaires

This section describes the main activities of CTUC DST. When the assessor has finished setting up the utility adjustments for the project, the assessor can begin to analyze the applicability of CTUC for each utility adjustment. In the CTUC Phase 1 Analysis, CTUC DST will ask assessors a series of questions, which includes project-scope, utility-scope, and contract-related questions. Section 2.4.1 will discuss the project-scope questions. Section 2.4.2 will discuss the utility-scope questions. Section 2.4.3 will discuss the contract-related questions.

2.4.1 Project-Scope Questions

Figure 2.14 shows the five project-scope questions. Usually the assessor can only respond "Yes," "No," or "Don't know yet" to a question. But for Question 2.5, the assessor needs to consider the current project situation regarding schedule pressures and select only one option that best describes the current circumstance.

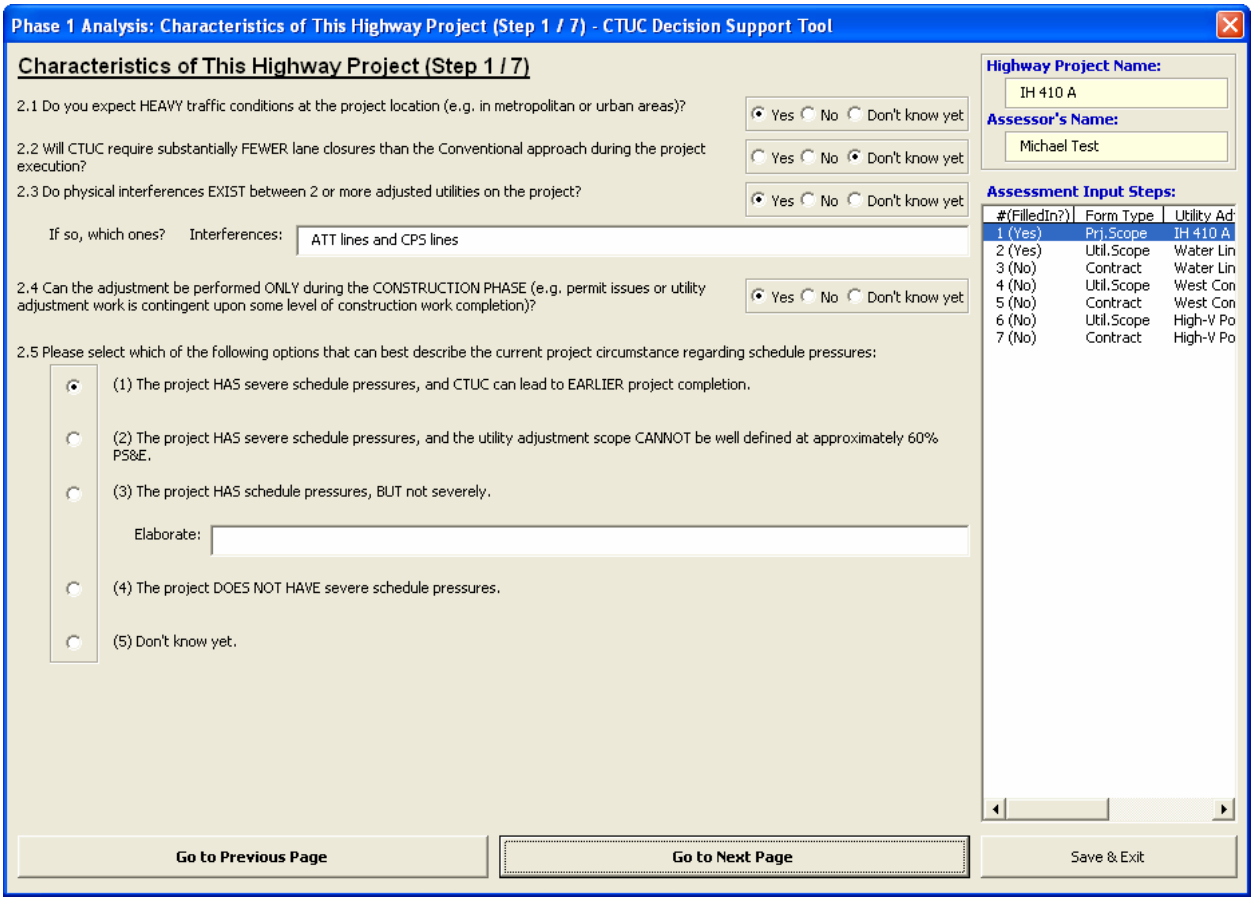

Figure 2.14 A Project with Three Utility Adjustments

Note that on the right side of the form shown in Figure 2.14, CTUC DST shows the project name, the assessor's name, and a list-box displaying all pages or steps that will be presented later. Because one project can have many utility adjustments, CTUC DST will prepare only one page regarding all project-scope issues. The assessment results for the project-scope issues will be applied to all utility adjustments within that project.

CTUC DST will show two pages for each utility adjustment in the CTUC Phase 1 Analysis. One page contains utility-scope issues, and the other page contains contract-related issues. Therefore, if a project has three utility adjustments, seven steps are required for assessors to complete the CTUC Phase 1 Analysis.

The list-box labeled "Assessment Input Steps" in Figure 2.14 can be used as a shortcut to any of the page. The assessor can press the "Go to Previous Page" or "Go to Next Page" button several times to reach the desired page. With use of the shortcut, however, assessors can double-click the line item of the desired step to visit that page directly. In addition, the list-box also shows whether the assessor has already completed the page. If the assessor fails to answer any of the questions on a page and presses the "Go to Next Page" or "Go to Previous Page" button directly, "Don't know yet" will be presumed as the answer to the blank questions on that page.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

1) *Assume the assessor selects the sample project data from CTUC Phase 1 Analysis of IH 410 A. CTUC DST will show three utility adjustments for the project.*
2) *Assessors can answer the five project-scope questions shown in Figure 2.14.*
3) *Assessors can press the "Go to Next Page" to save the information and proceed to the next page.*

2.4.2 Utility-Scope Questions

As Figure 2.15 shows, the questions presented on this page, are about the specific utility adjustment, the name of which will be displayed at the top of the page. Note that CTUC DST will highlight the step that the assessor is currently working on in the list-box on the right side of the page. In the text boxes for Questions 3.2 and 3.6, assessors can enter more than one line of words to comment on the project.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

1) *Assessors can answer the ten questions, as shown in Figure 2.15.*
2) *Assessors can press the "Go to Next Page" to save the information and to proceed to the next page.*

2.4.3 Contract-Related Questions

As mentioned in Section 2.3, the reimbursability of a utility adjustment can be coded as "Reimbursable," "Non-Reimbursable," or "Don't know." Hence, the contract-related questions are presented in accordance with the type of reimbursability the assessor selects in Section 2.3. Figure 2.16 shows the page with contract-related questions for reimbursable utility adjustments; Figure 2.17 shows the page with contract-related questions for non-reimbursable utility adjustments; Figure 2.18 shows the page with contract-related questions for the utility adjustment with unknown reimbursability.

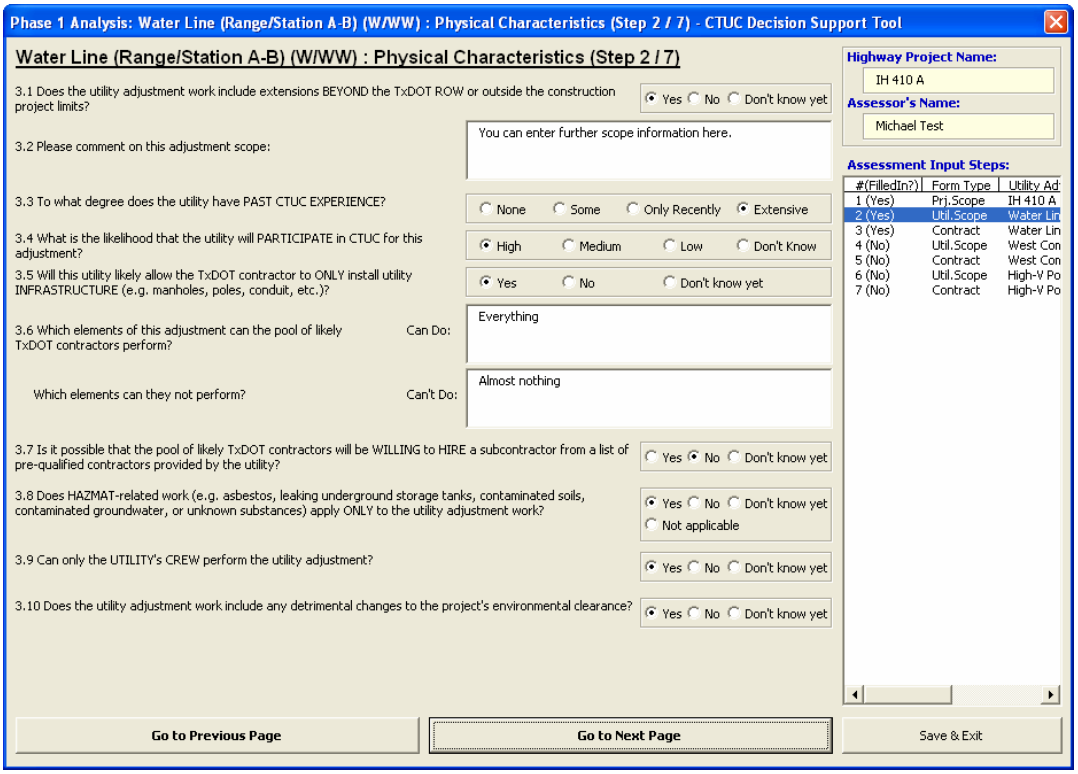

Figure 2.15 Utility-Scope Questions in CTUC Phase 1 Analysis

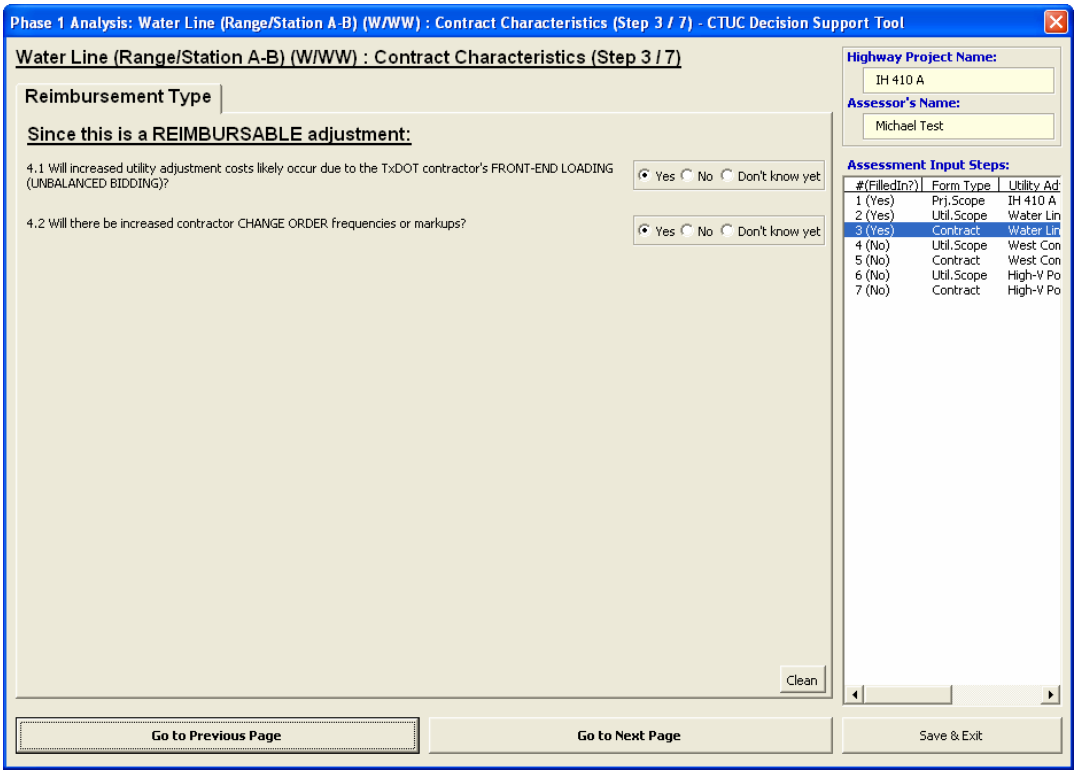

Figure 2.16 Contract-Related Questions for Reimbursable Adjustment

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *If the utility adjustment is 100 percent reimbursable, assessors can answer the two questions, as shown in Figure 2.16.*
  2) *If the utility adjustment is non-reimbursable, assessors can answer the five questions, as shown in Figure 2.17.*
  3) *If the reimbursability of the utility adjustment is unknown, assessors can answer the seven hypothetical questions, as shown in Figure 2.18.*
  4) *Assessors can press the "Go to Next Page" to save the information and proceed to the next page.*

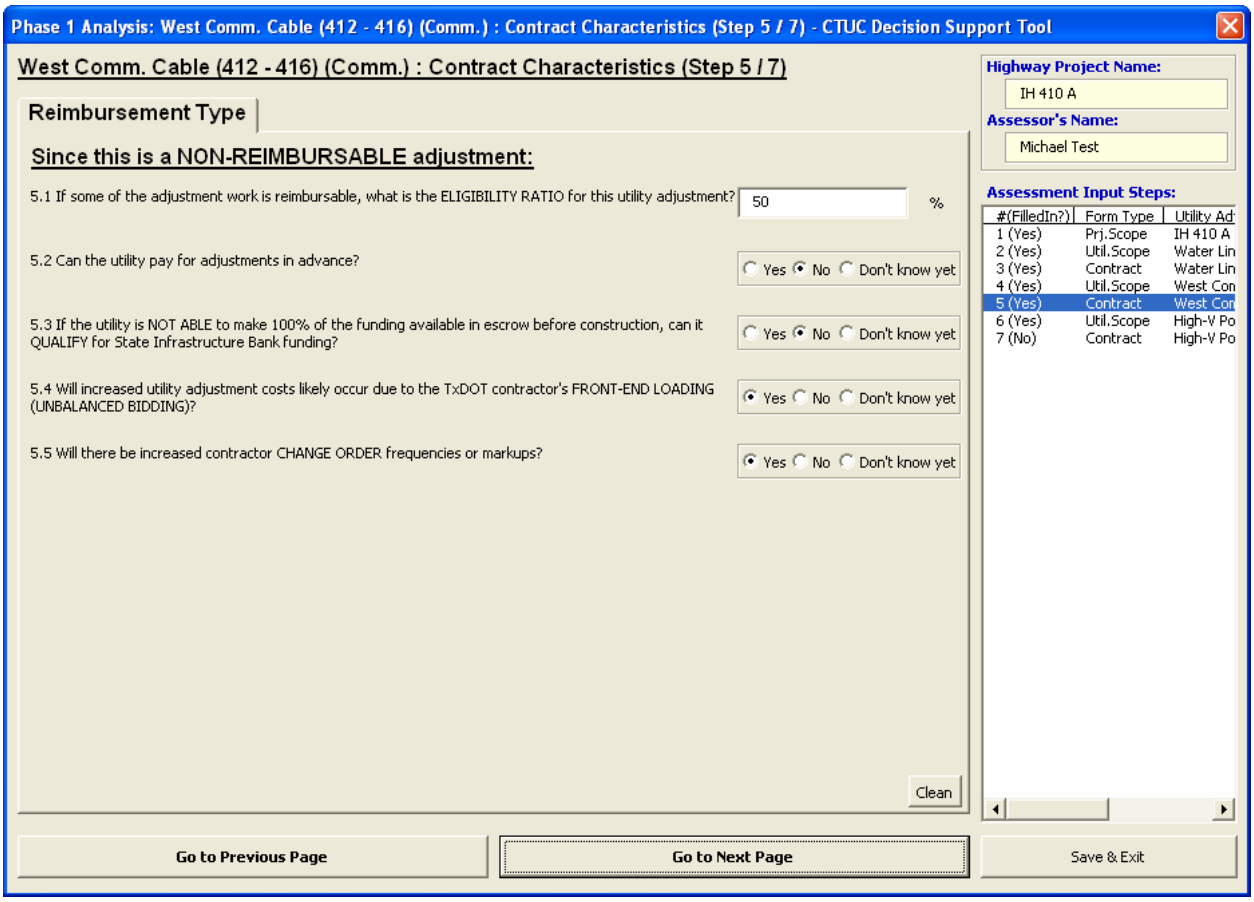

Figure 2.17 Contract-Related Questions for Non-Reimbursable Adjustment

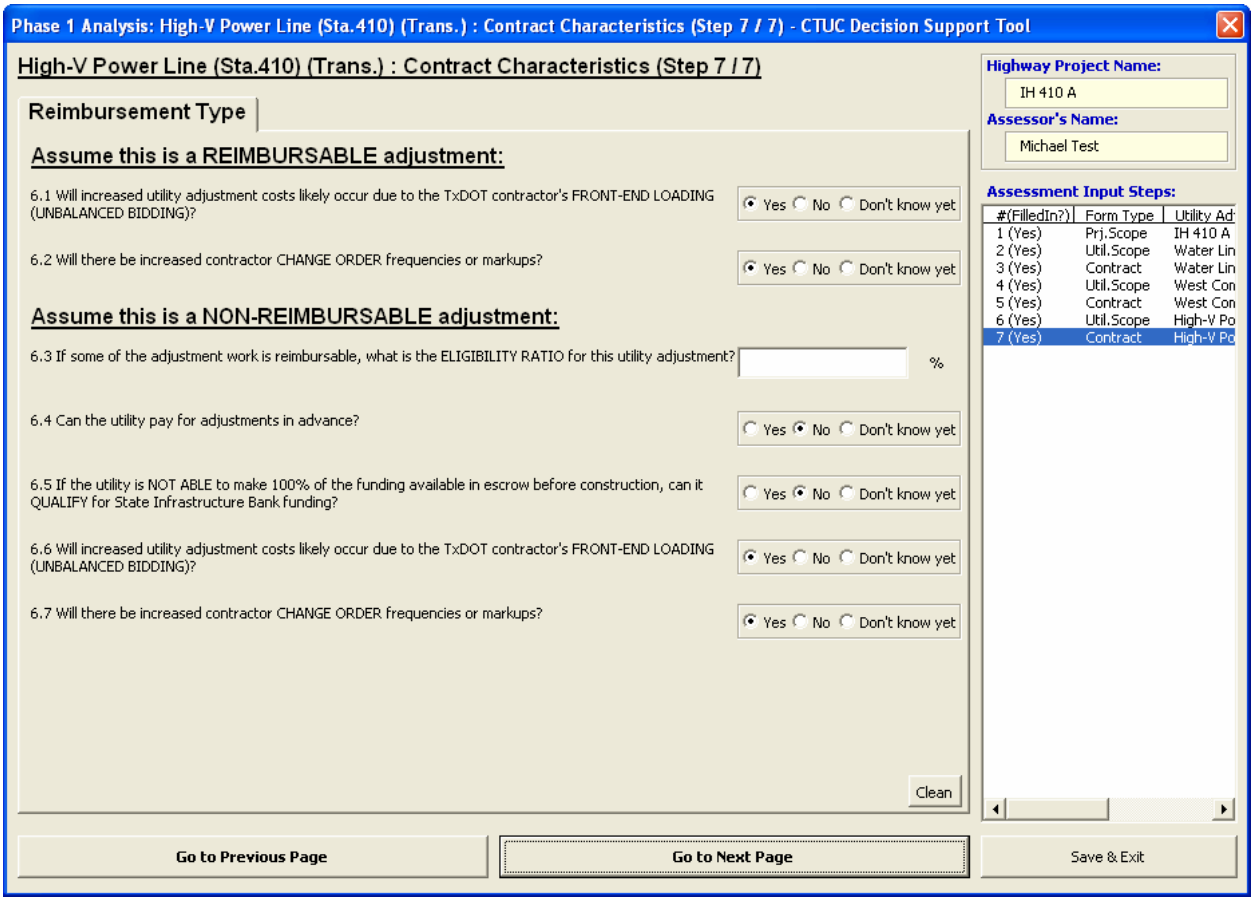

Figure 2.18 Contract-Related Questions for Reimbursability Unknown Adjustment

2.5 Reviewing Top Six CTUC Decision Drivers

CTUC DST produces two different types of reports. One is the graphical report and the other is the text report. After the assessor has answered all questions in the previous sections, CTUC DST generates the reports in order to reflect the experts' opinions with regard to the applicability of the CTUC approach for each utility adjustment. This section focuses on how to generate the graphical report of the analysis results, while Section 2.6 will describe the production of the detailed text report for each utility adjustment.

2.5.1 Report Setting for CTUC Phase 1 Analysis

There are two questions for report setting of the CTUC Phase 1 Analysis, as shown in Figure 2.19. The first question requires the assessor to select one of the utility adjustments involved in the project, and the other requires the selection of the knowledge base source to be applied to interpret the analysis results.

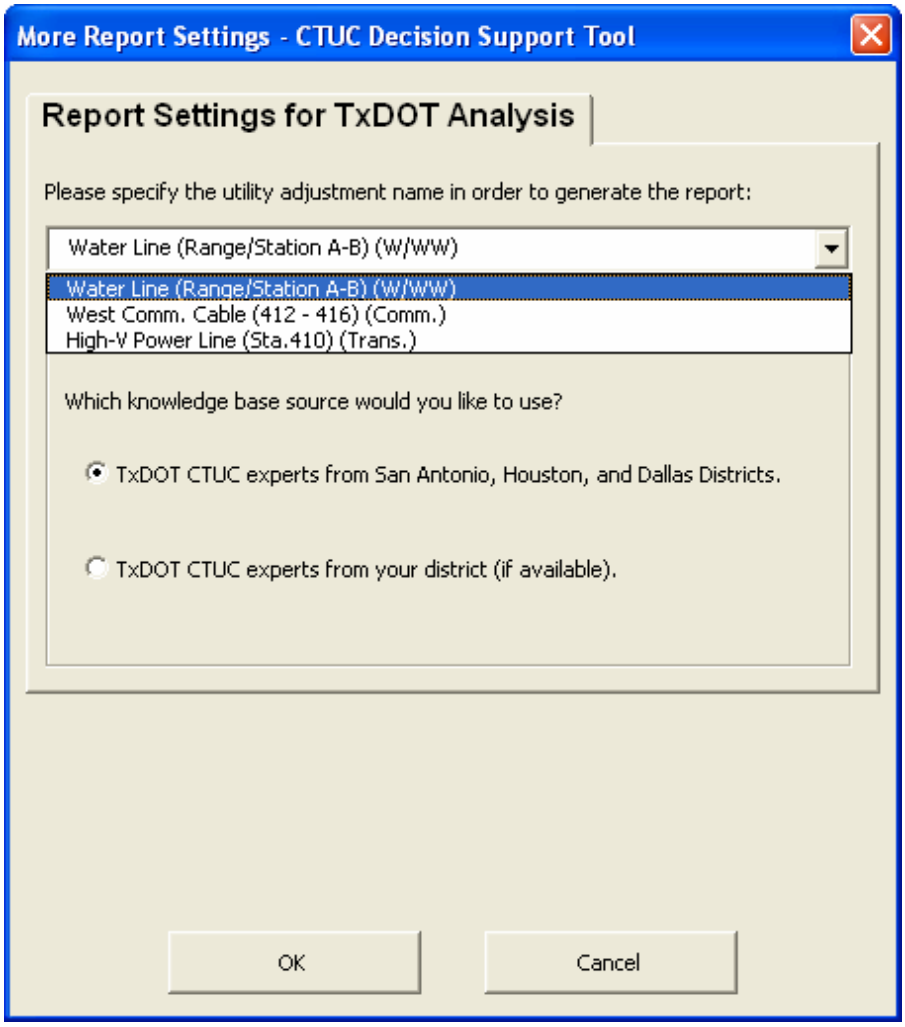

Figure 2.19 Report Setting for CTUC Phase 1 Analysis

Because the reports generated by CTUC DST aim at explaining the explanation of the applicability of CTUC for one utility adjustment, the assessor first needs to select one of the utility adjustments involved in the project first so that CTUC DST can incorporate the relevant information into the report.

The second report setting question requires the selection of the CTUC knowledge base source. CTUC DST users may want to review opinions only from their district's experts, or from all TxDOT experts whose opinions have been collected and stored in CTUC DST. Presently, the knowledge base of CTUC DST includes the opinions of the TxDOT experts from the San Antonio, Houston, and Dallas districts who attended the CTUC decision drivers assessment workshops. Hence, if the assessor is from one of the three districts, he or she can select the knowledge base source from all three districts or from one district only. Additionally, if the assessor is not from one of the three districts, CTUC DST will use the default value, which is the knowledge base source from three districts, regardless of the assessor's choice.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

1) *Assessors can select the first utility adjustment shown on the page represented in Figure 2.19.*
2) *Assessors can select the option entitled "TxDOT CTUC experts from San Antonio, Houston, and Dallas districts."*
3) *Assessors can press the "OK" button to generate the graphical report.*

2.5.2 Graphical Report of the CTUC Phase 1 Analysis

Figure 2.20 shows the graphical report. The six major areas in this report are: 1) Report Title; 2) Report Info.; 3) Control Panel; 4) Top 6/6 Decision Drivers; 5) Level of Pro-CTUC; and 6) Level of Anti-CTUC. The following paragraphs will describe each area in more detail.

1. Report Title (at the top of the report)

CTUC DST will show the project name and district information in the first line of the report title. The name of the utility adjustment and the abbreviation of the utility type involved will be shown in the second line of the report title.

2. Report Info. (on the upper left side of the report)

CTUC DST will show the name of the assessor, the analysis date, and the print date. In the field titled "Knowledge Base Source," CTUC DST will show the knowledge base source the assessor selected in Section 2.5.1. Finally, the color used to reflect the impact level of the given project circumstance will be shown in the field titled "Legend."

3. Control Panel (on the lower left side of the report)

Five buttons are provided in this area. The button labeled "Report Setting" will invoke the report setting form, as shown in Figure 2.19. The button labeled "Previous Page" will trigger the contract-related form mentioned in Section 2.4.3. The button labeled "Next: Detailed Rpt." will invoke the text report discussed in the next section. The button labeled "Print" will prompt the active printer name to print the current page. The button labeled "Exit" will save all data and close CTUC DST.

4. Top 6/6 Decision Drivers (in the middle column of the report)

This area lists twelve decision drivers that will most influence the CTUC decision, either in a positive or negative way. Each decision driver is enclosed by a gray box, and is underlined and correlated with one of the questions asked in Section 2.4. The abbreviated description of the project circumstance is shown below the decision driver. This description is the best answer to the question from the assessor's perspective. The assessor can click any box in this area to get further explanation, as shown in Figure 2.21. For example, the first Pro-CTUC decision driver is "Schedule Pressures" and its project circumstance is "Severe schedule pressure," as shown in Figure 2.20. If the assessor wonders why CTUC DST shows such a result, he or she can click the "Schedule Pressures" box to show a detailed explanation, which includes the original question and the assessor's answer to the question (see Figure 2.21).

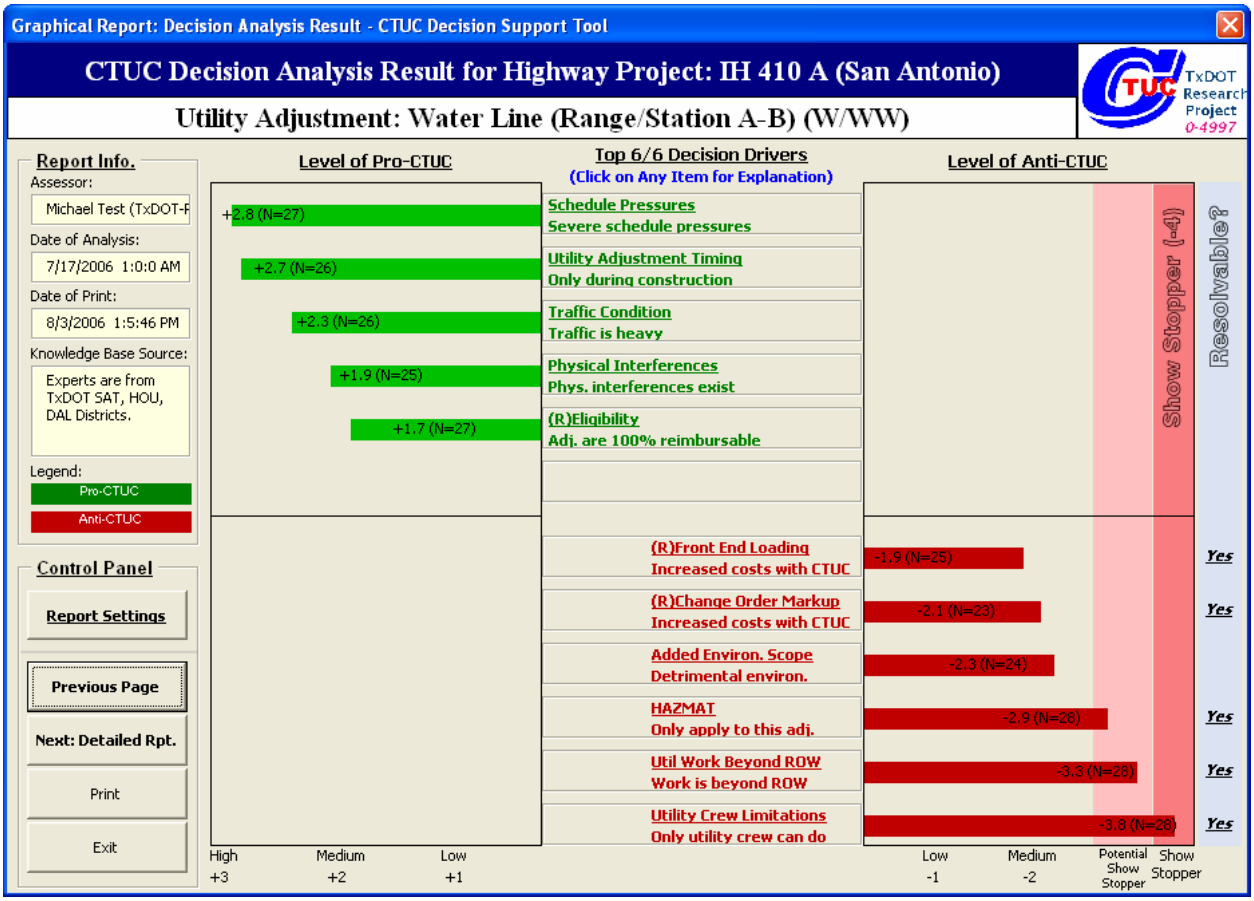

Figure 2.20 Graphical Report of One Utility Adjustment Analysis Results

5. Level of Pro-CTUC (in the second left column of the report)

The level of Pro-CTUC for each decision driver is derived from the average opinion of the experts concerning the given project circumstance listed in the middle of the form. Basically, in order to develop the knowledge base, these experts have been asked to use "High Impact," "Medium Impact," "Low Impact," or "No Impact" to assess the given project circumstance's impact level on the CTUC decision. Furthermore, CTUC DST uses "3" to represent "High Impact," "2" to represent "Medium Impact," "1" to represent "Low Impact," and "0" to represent "No Impact," as is shown in the bottom line of the form. Therefore, a project circumstance with a lengthy green bar means almost all experts think the current situation will influence the CTUC decision in a positive way, i.e., Pro-CTUC. Note that the level of Pro-CTUC is primarily determined by the *experts*, *not* by the *assessor*. However, the assessor can decide which group of experts to be used as the knowledge base source for a given CTUC decision. If the assessor selects the combination of the San Antonio, Houston, and Dallas districts as the knowledge base source, the total number of experts should be 28 (N=28) in current CTUC DST. For example, the impact level of the top Pro-CTUC decision driver is "+2.8 (N=27)," which means most of the twenty-seven experts believe that the given project circumstance is Pro-CTUC and has "High Impact" on the CTUC decision. The experts' "Don't Know" values for the project circumstance are excluded from the impact level calculation.

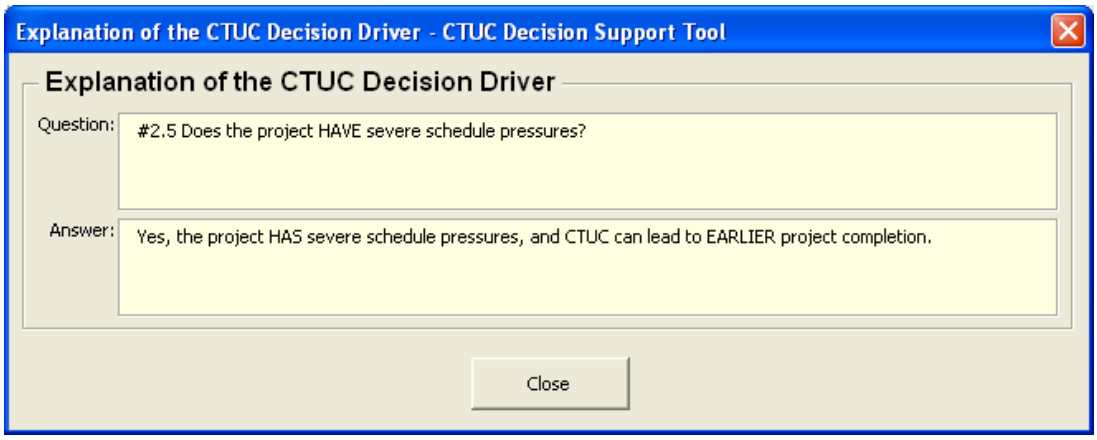

Figure 2.21 Short Explanation of the CTUC Decision Driver

6. Level of Anti-CTUC (in the right column of the report)

The format for the level of Anti-CTUC for each decision driver is similar to that for the level of Pro-CTUC. Basically, CTUC DST uses "-4" to represent "Show Stopper," "-3" to represent "High Impact," "-2" to represent "Medium Impact," "-1" to represent "Low Impact," and "0" to represent "No Impact", as shown in the bottom line of the form. Therefore, a project circumstance with a lengthy red bar means almost all experts think the current situation will influence the CTUC decision in a negative way, i.e., Anti-CTUC. The last blue column represents the resolvability of each decision driver. Because the experts have been asked to assess whether or not process changes could facilitate the use of CTUC, CTUC DST is able to show the resolvability results by displaying "Yes" for such project circumstances identified by the experts.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *After assessors have answered all questions in the previous section, they can see the report setting form, as shown in Figure 2.19.*
  2) *Assessors can select "Water Line Section I (W/WW)" as the utility adjustment to generate the report.*
  3) *Assessors can choose the first option as the knowledge base source in Figure 2.19 and press the "OK" button.*
  4) *CTUD DST will generate the graphical report as shown in Figure 2.20.*
  5) *Assessors can click the decision driver box at the top of the page to prompt the dialog box shown in Figure 2.21.*

2.6 Reviewing the Text Report of the CTUC Decision

Because the graphical report can only show the top six Pro-CTUC and Anti-CTUC decision drivers, the text report described in this section is designed to provide other important opinions regarding the CTUC applicability to a given utility adjustment. For example, some questions described in Section 2.4 are currently unanswerable by the assessor but have been found by the experts to have significant impact levels on the CTUC decision. Hence, the text report will list all impact level types of CTUC decision drivers to allow the assessor to comprehend the CTUC applicability to the given utility adjustment and to learn lessons from the experts.

2.6.1 Text Report of the CTUC Phase 1 Analysis

Figure 2.22 shows the text report of the CTUC Phase 1 Analysis for a sample utility adjustment. The layout of this report is similar to the graphical one; therefore, only the portions that differ between the two reports are described below:

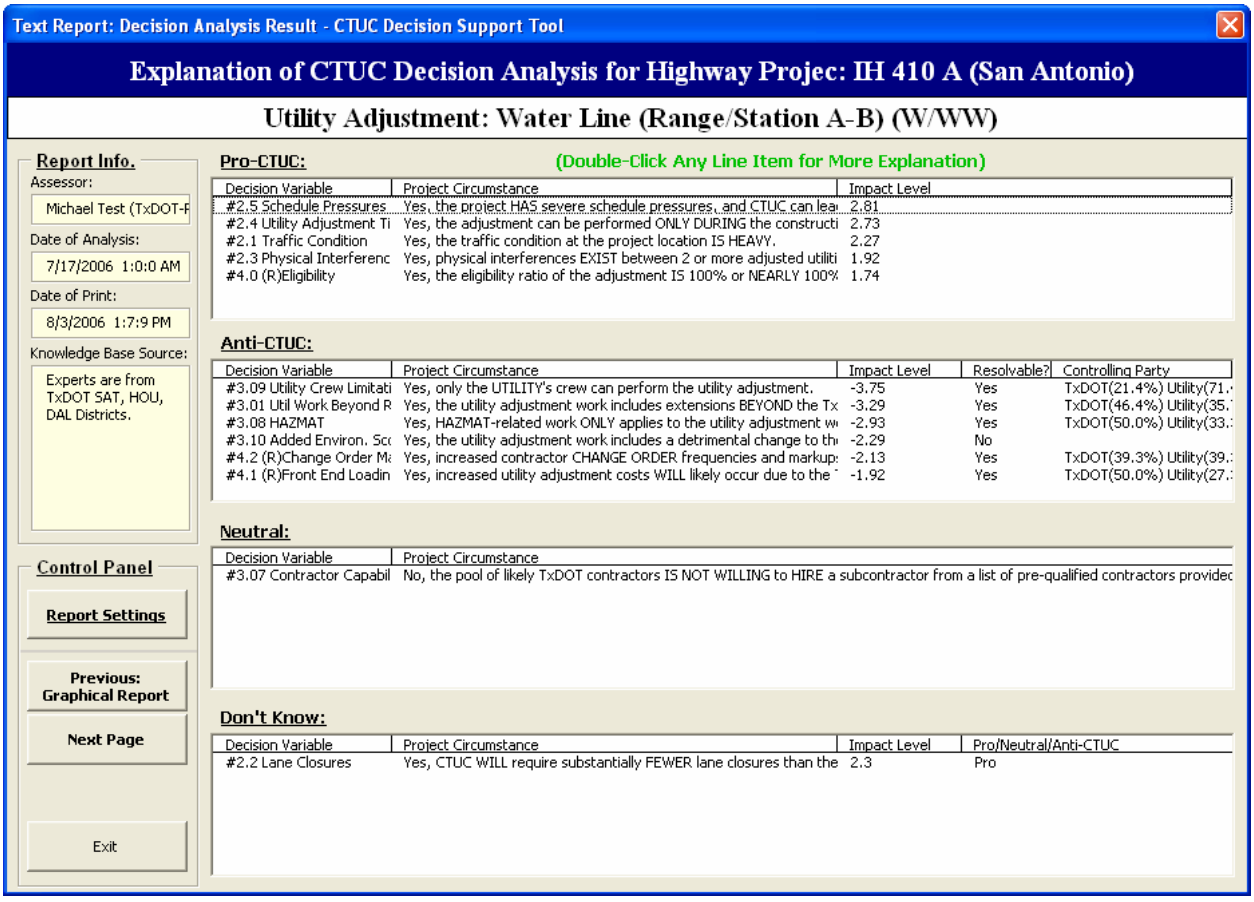

Figure 2.22 Text Report of One Utility Adjustment Analysis Results

1. Pro-CTUC (in the first list-box)

This table has three columns described as follows: 1) Decision Variable: manifests the name of each Pro-CTUC decision driver; 2) Project Circumstance: manifests the current project circumstance specified by the assessor; 3) Impact Level: manifests the numerical impact level assessed by the experts for the project circumstance. Note that these Pro-CTUC decision drivers are ranked according to their impact levels. The assessor can double-click any line item to show the detailed experts' opinions, as shown in Figure 2.23.

2. Anti-CTUC (in the second list-box)

This table has five columns described as follows: 1) Decision Variable: shows the name of each Anti-CTUC decision driver; 2) Project Circumstance: shows the current project circumstance specified by the assessor; 3) Impact Level: shows the numerical impact level assessed by the experts for the project circumstance; 4) Resolvable?: shows whether or not the project circumstance could be resolved to facilitate CTUC by any process change according to the experts; 5) Controlling Party: shows what percentage of each controlling party is responsible for such process changes. Note that these Anti-CTUC decision drivers are ranked according to their impact levels. The assessor can double-click any line item to show the detailed experts' opinions, as shown in Figure 2.23.

3. Neutral (in the third list-box)

This table has two columns described as follows: 1) Decision Variable: shows the name of each Neutral decision driver, which by definition will not influence the CTUC decision; 2) Project Circumstance: shows the current project circumstance specified by the assessor. Note that these Neutral decision drivers are ranked according to their original question numbers and can help decision-makers make the CTUC problem simper by eliminating unnecessary factors. The assessor can double-click any line item to show the detailed experts' opinions, as shown in Figure 2.23.

4. Don't Know (in the fourth list-box)

This table has four columns described as follows: 1) Decision Variable: shows the name of each decision driver, which corresponds to a question unknown to the assessor; 2) Project Circumstance: shows one of the possible answers to this unknown question; 3) Impact Level: shows the numerical impact level assessed by the experts for the project circumstance; 4) Pro/Neutral/Anti-CTUC: shows "Pro" if the impact level is positive, "Anti" if the impact level is negative, and "Neutral" if the impact level is zero. Note that these "Don't Know" decision drivers are ranked according to their absolute values of the impact levels. The assessor can double-click any line item to show the detailed experts' opinions, as shown in Figure 2.23.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *After assessors have reviewed the graphical report, assessors can press the "Next: Detailed Rpt." button to generate the text report.*
  2) *Assessors can double-click the first line item in "Pro-CTUC" to show the dialog box represented in Figure 2.23.*
  3) *Assessors can double-click the second line item in "Anti-CTUC" to show the dialog box represented in Figure 2.24.*

2.6.2 Review of Detailed Experts' Opinions

If assessors double-click any line item in any of the list-boxes in Figure 2.22, CTUC DST will display the dialog box containing detailed experts' opinions, as shown in Figure 2.23 or 2.24. There are three blocks in this form. The first block, titled "Review of Project Circumstance," shows the question and answer for the decision driver and the project circumstance, respectively. For some project circumstances, CTUC DST will also show the suggestion from experts, as shown in Figure 2.24.

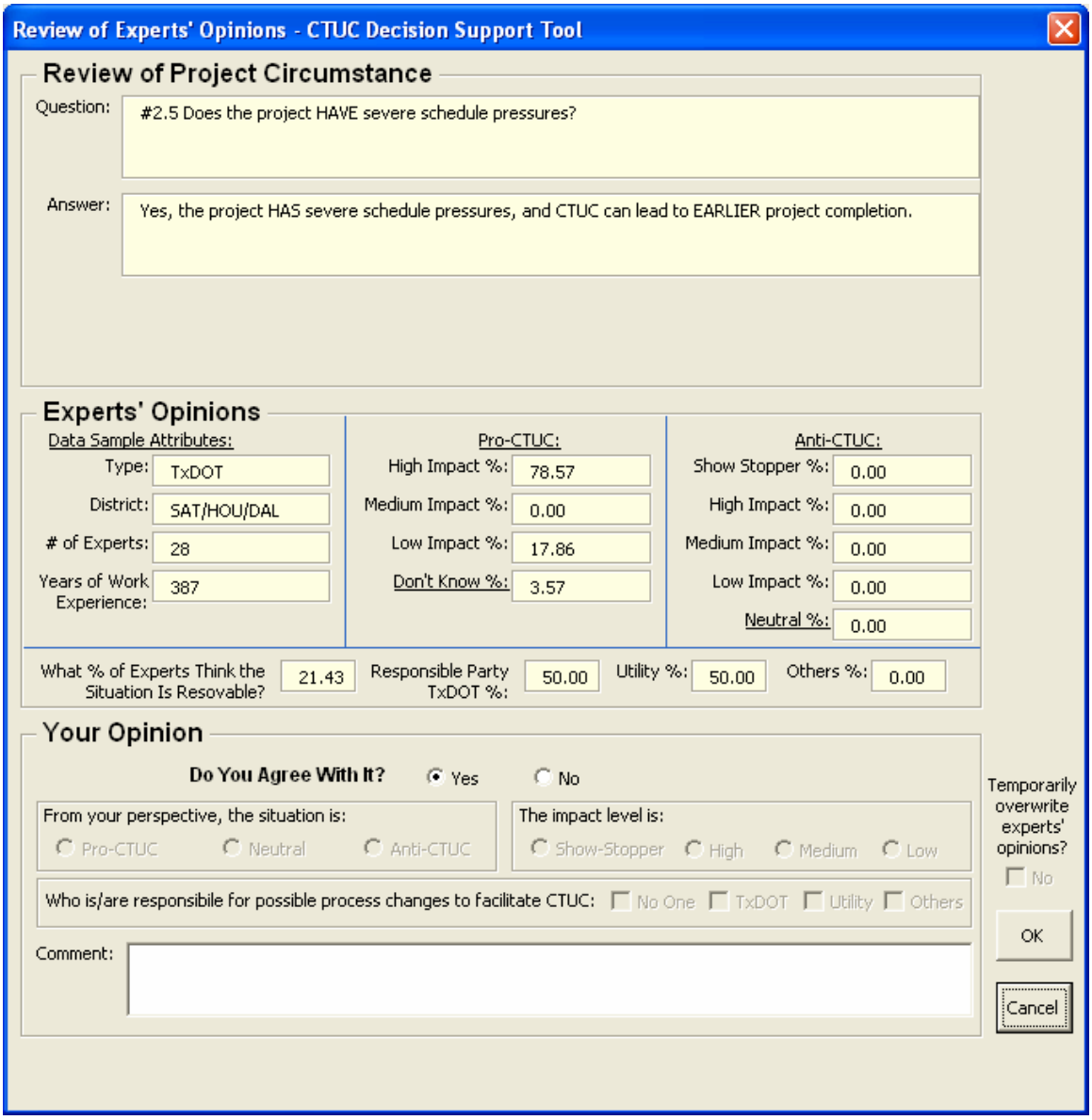

Figure 2.23 Detailed Explanation of the CTUC Decision Driver: Without Any Change

The second block, titled "Experts' Opinions," lists basic attributes of the expert group and shows the distribution of the experts' opinions for impact level and resolvability. For example, as shown in Figure 2.23, assessors can see that one (28*3.57%=1) of the twenty-eight

experts cannot judge the impact level, i.e., select “Don’t Know” on CTUC, based on the given project circumstance. Six (28*21.43%=6) of the twenty-eight experts thought the given project circumstance could be resolved to facilitate CTUC, and one-half of the six experts thought that TxDOT is responsible for process changes, while the other half thought the utility owners are.

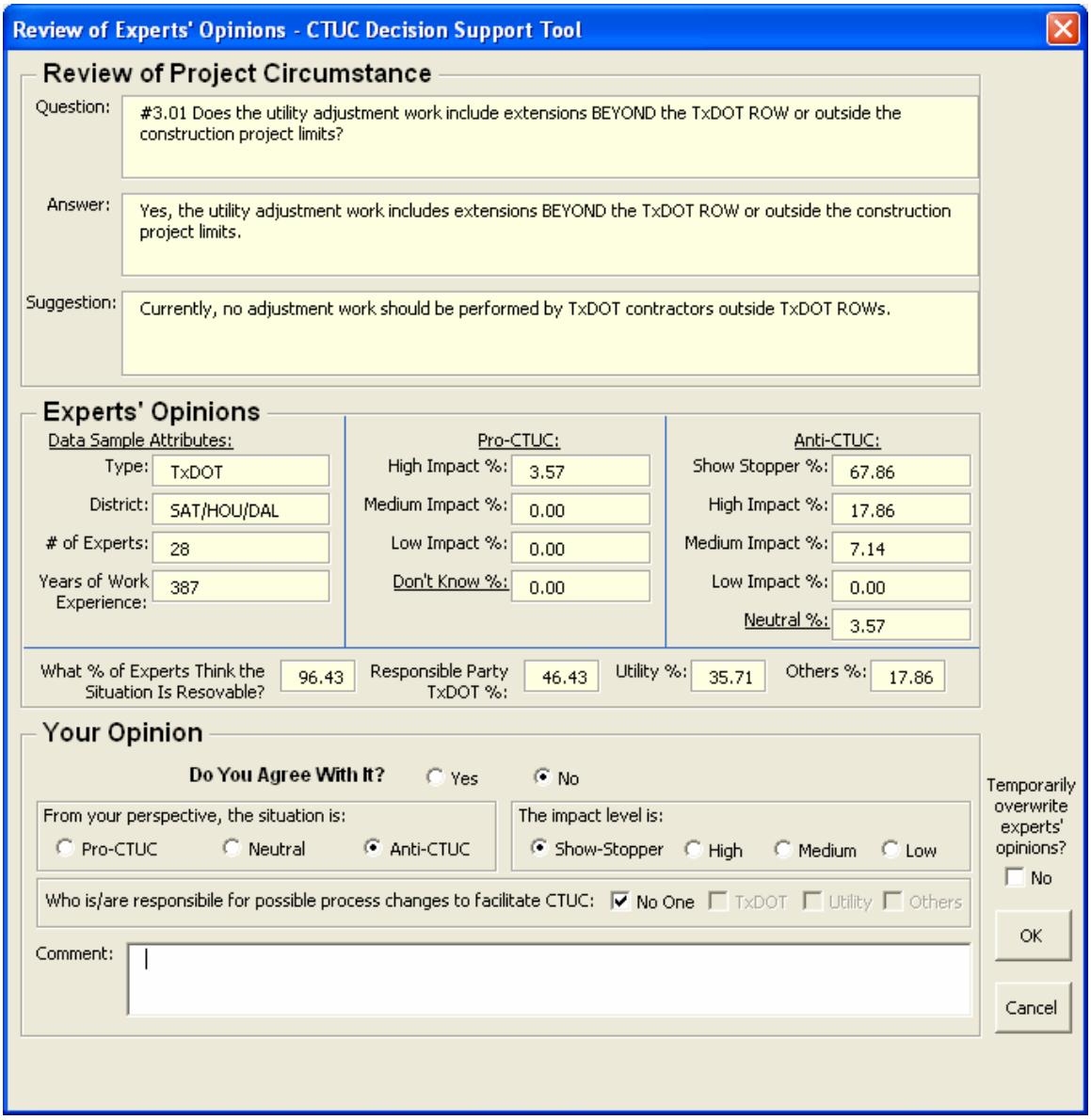

Figure 2.24 Detailed Explanation of the CTUC Decision Driver: With Changes

The third block, titled “Your Opinion,” provides a text box for the assessor’s own opinion. Figure 2.23 demonstrates a case in which the assessor agrees with the experts’ opinions; hence, the assessor cannot select any option or enter any comment in this block. The “OK” button and the “Cancel” button provide the same function, which is to close the dialog box without modifying any data. Note that if the assessor has double-clicked the decision drivers that are

"Don't Know" or originally "Neutral," the assessor cannot select "No" as the answer to "Do You Agree with It?"

Figure 2.24 illustrates a case in which the assessor does not agree with the experts' opinions. The assessor can then answer the three assessment questions and enter some comments in the text box at the bottom of the form. Finally, if the assessor wants to temporarily overwrite the experts' opinions, which means the impact level associated with this project circumstance will be changed, he or she can check the box labeled "Temporarily overwrite experts' opinions?". In this case, the assessor will see the change of this impact level reflected in both the graphical report and the text report. Note that the knowledge base source will be unaltered. The assessor can use the following steps to get back the original experts' opinions: 1) the assessor can select another group as the knowledge base source; 2) CTUC DST can generate a new report in order to overwrite current opinions; 3) the assessor can then select the original expert group as the knowledge base source; 4) CTUC DST can thus generate the original report.

If the assessor gives his or her own comments without checking the box labeled "Temporarily overwrite experts' opinions?", both experts' opinions and the assessor's comments will be stored in CTUC DST, and the assessor's opinion can be retrieved later in order to retrospect to project situations.

2.7 Selecting the Utility Adjustments to Be Included in the Phase 2 Analysis

After the assessor has reviewed the two report results of CTUC Phase 1 Analysis, the assessor needs to indicate which of the utility adjustments should be analyzed further in the CTUC Phase 2 Analysis, which will be performed jointly by TxDOT and utility decision-makers. Figure 2.25 shows the initial form, if the sample project is used. There are three blocks in the form. The first block, titled "1. Highway Project Information," shows basic highway project information. The second block, titled "Utility Adjustment Information," will not show any information unless the assessor clicks any line item in any of the list-boxes in the third block.

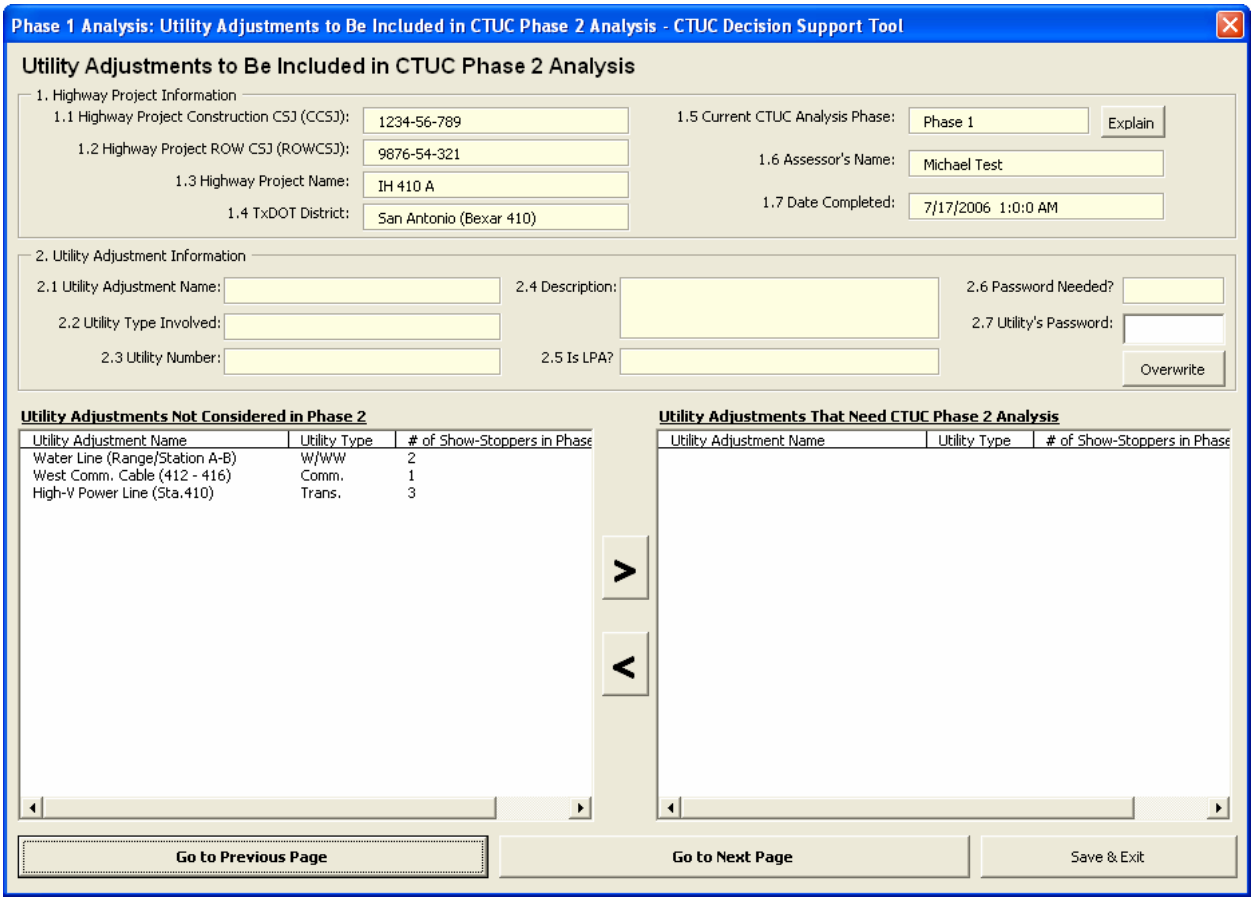

Figure 2.25 Initial Form for Determining Utilities to Be Included in CTUC Phase 2 Analysis

Initially, the left list-box, titled "Utility Adjustments Not Considered in Phase," will show all utility adjustments involved in the highway project. The assessor can select any line item to show detailed information of the utility adjustment in the second block. CTUC DST will also show in the third column in the left list-box the number of show-stoppers, defined as the number of the average impact levels greater than "-3."

The assessor can select one utility adjustment at a time and press the "→" button to move this line item to the right list-box, labeled "Utility Adjustments That Need CTUC Phase 2 Analysis." If the assessor still wants this utility adjustment to stay in CTUC Phase 1 Analysis, he or she can press the "←" button to move the line item in the right list-box to the left list-box, as shown in Figure 2.26.

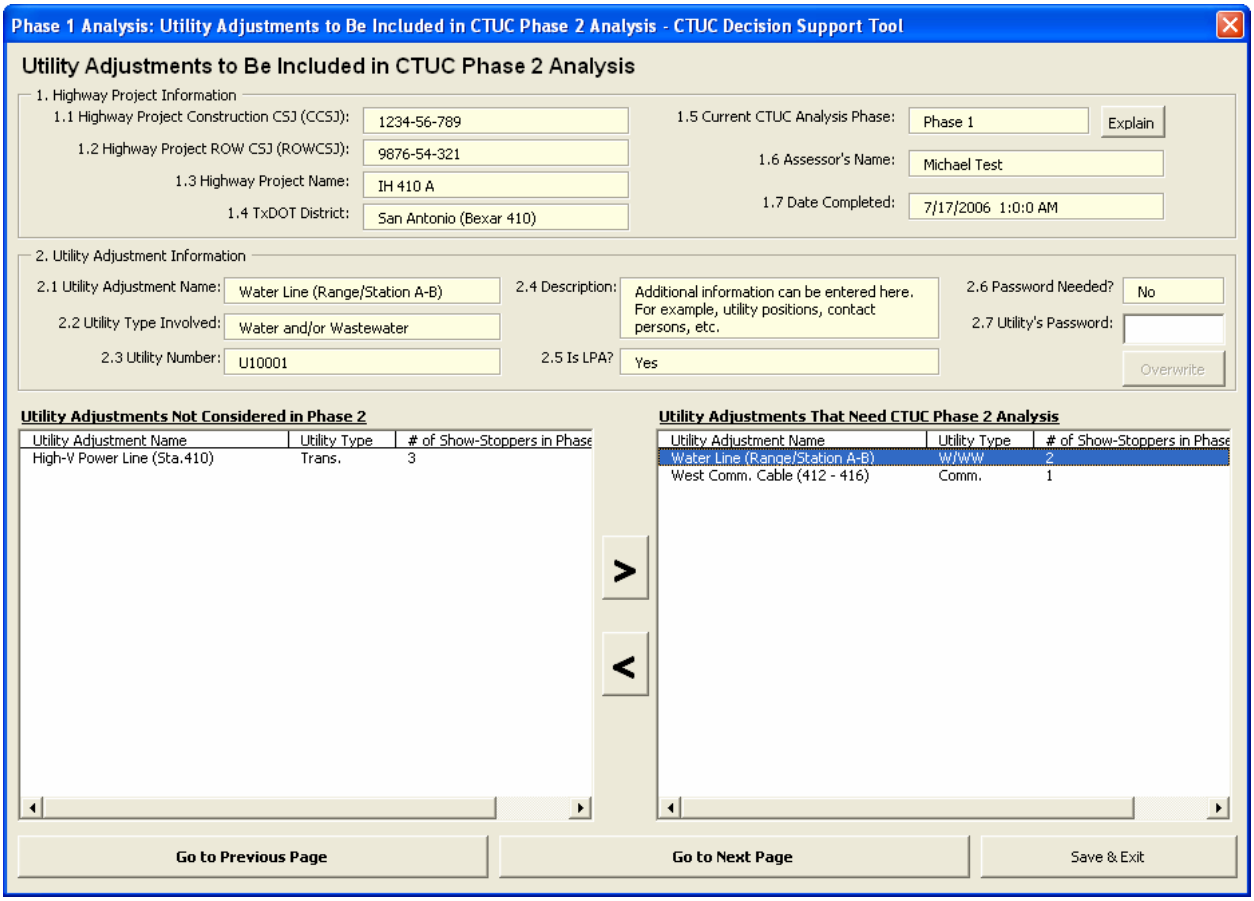

Figure 2.26 Form for Determining Utilities to Be Included in CTUC Phase 2 Analysis

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *After assessors have reviewed the text report, assessors can press the "Next Page" button to see the form shown in Figure 2.25.*
  2) *Assessors can select "Water Line Section I" and press the "→" button to move to the right-hand list-box.*
  3) *Assessors can select "West Communication Cable II" and press the "→" button to move to the left hand list-box.*

2.8 End of CTUC Phase 1 Analysis

When the assessor has determined which of the utility adjustments involved in the CTUC Phase 1 Analysis should be analyzed further in CTUC Phase 2 Analysis, CTUC Phase 1 Analysis is considered complete. Hence, the assessor can print all analysis results, simply close the tool, or visit previous pages to make modifications (see Figure 2.27). Figure 2.28 shows a portion of the final report for the highway project.

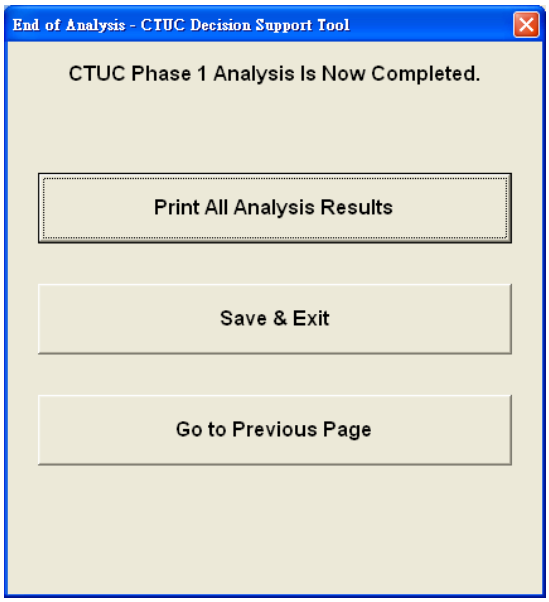

Figure 2.27 End of CTUC Phase 1 Analysis

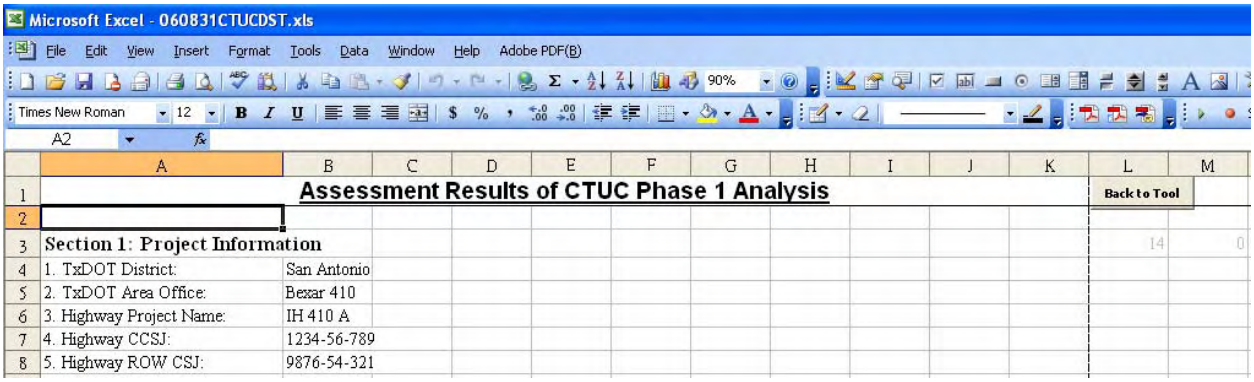

Figure 2.28 Excel Worksheet for CTUC Phase 1 Analysis Final Report

When the assessor presses the "Print All Analysis Results" button shown in Figure 2.27, CTUC DST will display an Excel worksheet with the CTUC analysis results. The assessor can print or print-preview this preformatted worksheet just like a standard Excel worksheet. The assessor can also return to CTUC DST by pressing the "Back to Tool" button in the top row of the worksheet, as Figure 2.28 shows.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *After assessors have determined which of the utility adjustments involved should be analyzed further in the CTUC Phase 2 Analysis, they can press the "Go to Next Page" to complete CTUC Phase 1 Analysis (see Figure 2.26).*
  2) *Assessors can press the "Print All Analysis Results" button to view the Excel worksheet report.*
  3) *CTUC DST will prompt a message box, which alerts the user that the report has been generated successfully.*
  4) *Assessors can print the Excel worksheet report, as shown in Figure 2.28.*
  5) *Assessors can press the 'Back to Tool" button shown in Figure 2.28.*
  6) *Assessors can press the "Save & Exit" button to save and close CTUC DST.*

3. CTUC Phase 2 Utility Analysis

3.1 Overview of CTUC Phase 2 Utility Analysis

This chapter describes the use of CTUC DST for performing the CTUC Phase 2 Utility Analysis, which is conducted solely by utility assessors. Step-by-step instructions are shown below in Figure 3.1. The first step involves retrieving one of the CTUC analysis records created by TxDOT assessors in CTUC Phase 1 Analysis (explained further in Section 3.2). Then, CTUC DST will guide the utility assessor to the questionnaire forms. The assessor will be asked a series of yes/no questions concerning the utility-specific issues and characteristics (explained further in Section 3.3). In Step 3, the assessor will first specify the knowledge base source he or she will use, and CTUC DST will display the graphical analysis results. The assessor will see experts' opinions regarding the applicability of the CTUC approach for a given utility adjustment, formatted as bar charts (explained further in Section 3.4). In Step 4, CTUC DST will show the text report listing all decision drivers according to the ranking of their impact levels (explained further in Section 3.5).

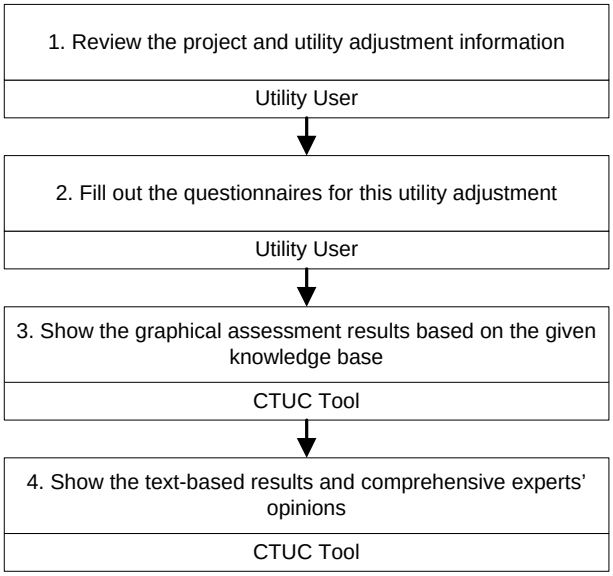

Figure 3.1 Steps of CTUC Phase 2 Utility Analysis

3.2 Retrieving a CTUC Phase 2 Utility Analysis

After CTUC DST is opened, the computer will display the front page, as shown in Figure 3.2. On this page, the utility assessor can press the "View Previous CTUC Analysis" button to retrieve one of the CTUC analysis records created by TxDOT assessors in CTUC Phase 1 Analysis. In addition, the utility assessor can press the "About This Research" button to view the background information of this research project. The "About CTUC Decision-Making Process" button is linked to the CTUC decision-making process diagram. The "View User Guide" button will show this manual, and the "Exit" button will close the tool.

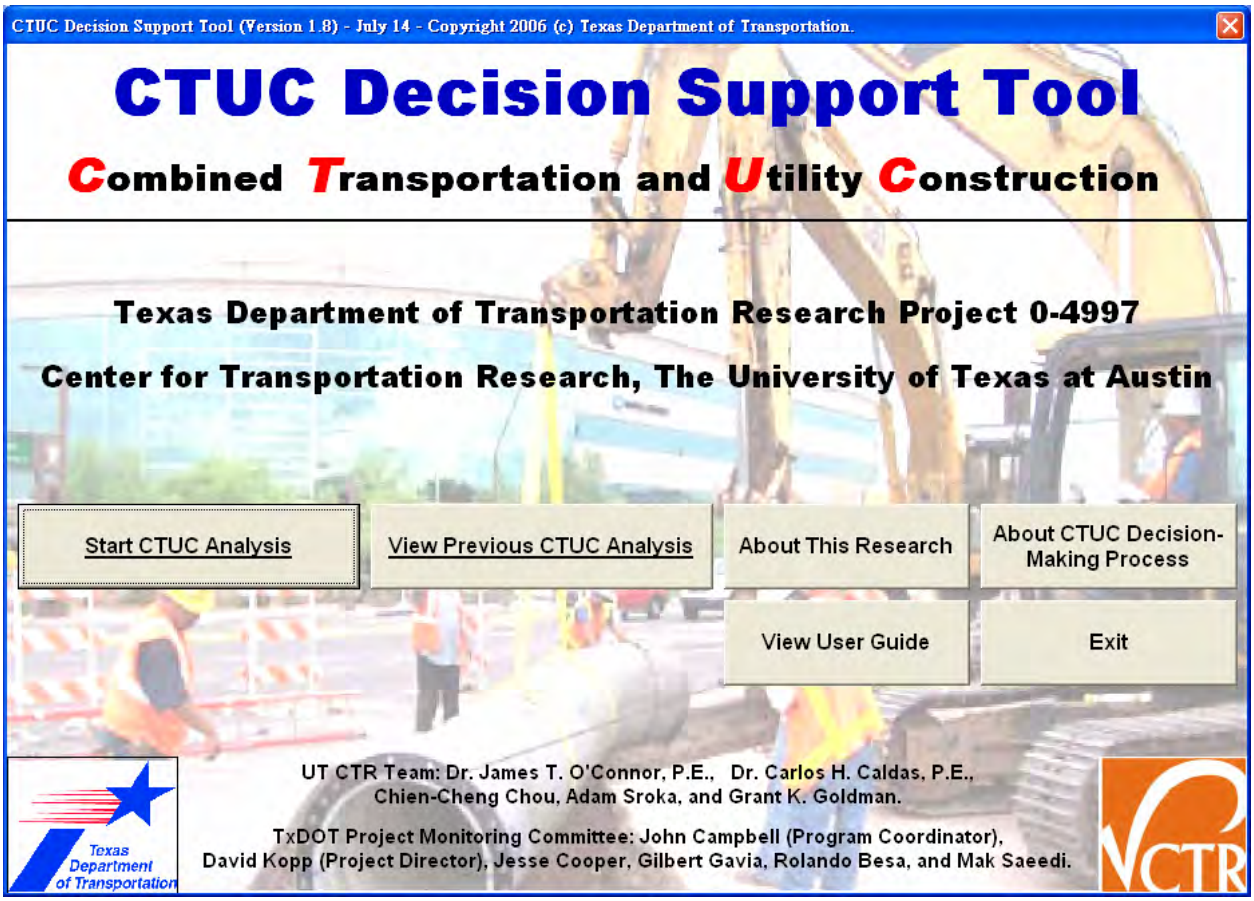

Figure 3.2 The Front Page of CTUC DST

3.2.1 Retrieve a CTUC Phase 2 Utility Analysis: Select a District and a Project

If the "View Previous CTUC Analysis" button is pressed, CTUC DST will ask the assessor to select a TxDOT district, as shown in Figure 3.3. After selecting the district, the assessor can press the "OK" button to see the list of all projects in the district, as shown in Figure 3.4. There are two list-boxes in Figure 3.4. The list-box on the left displays all projects CTUC DST has in this TxDOT district. The list-box on the right displays all utility adjustments included in the selected project.

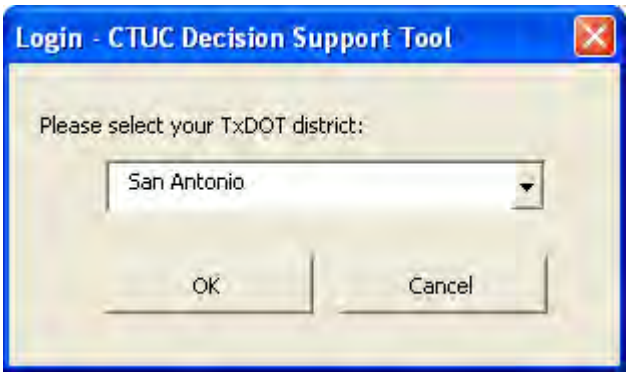

Figure 3.3 Select a TxDOT District

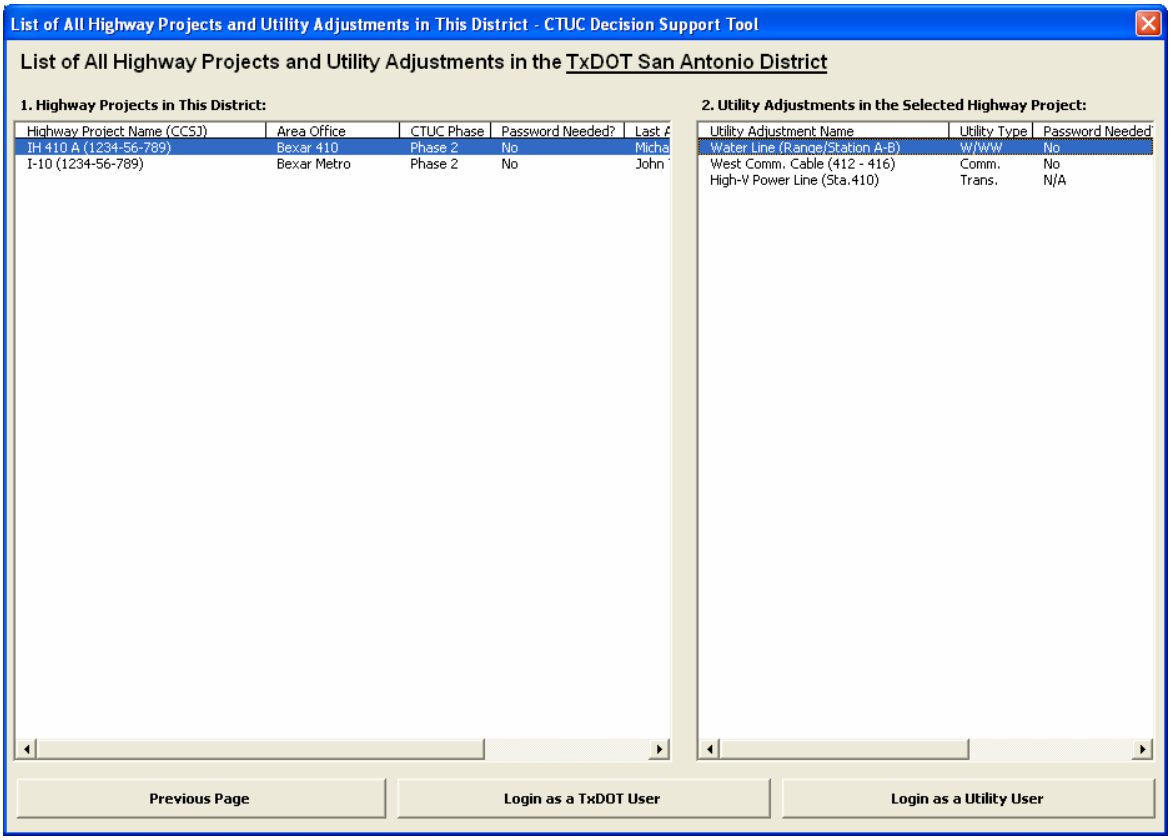

Figure 3.4 List of All Projects and Utility Adjustments within the TxDOT District

Six columns are presented in the list-box on the left: 1) Highway Project Name and Its CCSJ; 2) Area Office; 3) CTUC Phase; 4) Password Needed?; 5) Last Assessor; and 6) Assessment Date. The assessor can select any line item in the left-hand list-box, and the corresponding utility adjustments involved in the project will be displayed in the right-hand list-box. Five columns are presented in the right-hand list-box: 1) Utility Adjustment Name; 2) Utility Type; 3) Password Needed?; 4) Last Assessor; and 5) Assessment Date. Initially, because the utility assessor has not entered any data, the fourth and fifth columns will not contain any

information and the third column will always be “No,” which means no password is needed for retrieving this utility adjustment’s information. Note that assessors should not select any line item other than their utility adjustment name.

If the utility assessor has selected his or her utility adjustment in the right-hand list-box, the assessor can then press the “Login as a Utility User” button, or simply double-click the line item in the right list-box to retrieve the utility analysis data. Note that if a utility adjustment needs the password protection, CTUC DST will show “Yes” in the “Password Needed?” column for this utility adjustment and will provide a dialog box for the assessor to enter the password, as shown in Figure 3.5. If the password the assessor enters is correct, CTUC DST will allow the assessor’s future requests.

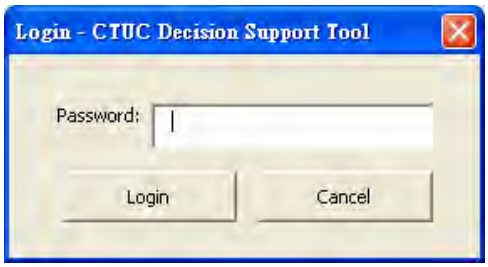

Figure 3.5 Login Form for a Utility Adjustment with Password Protection

- **For Demonstration Purposes**

  Because CTUC DST is equipped with some sample data, the essential steps of this section’s functions will be explained here for demonstration purposes.

  1) *After pressing the “View Previous CTUC Analysis” button in Figure 3.2, assessors will see the window represented in Figure 3.3.*
  2) *Assessors can select the “San Antonio District” option shown in Figure 3.3 to see two projects in the left-hand list-box shown in Figure 3.4.*
  3) *Assessors can select the first line item, whose project name is “IH 410 A,” in the left list-box.*
  4) *Assessors can see the list of all utility adjustments involved in the selected project, as shown in the right-hand list-box shown in Figure 3.4.*
  5) *Assessors can double-click the first line item, whose utility adjustment name is “Water Line (Range/Station A-B)” to visit the step described in the next section. If assessors double-click the third line item, “High-V Power Line (Sta.410)” (a utility adjustment that needs no further CTUC analysis according to TxDOT assessors), utility assessors will see the message box shown in Figure 3.6.*

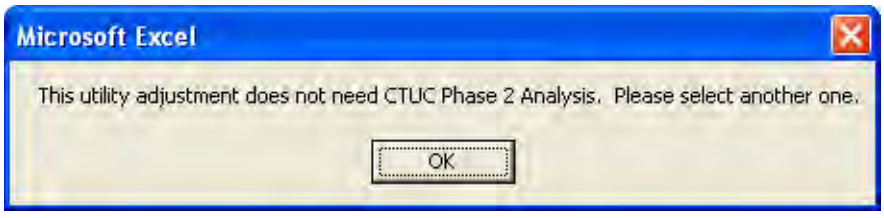

Figure 3.6 Message Box of Double-Clicking a Wrong Utility Adjustment

3.2.2 Retrieve a Previous CTUC Phase 2 Utility Analysis: Select an Analysis Record

One utility adjustment may have been analyzed many times. This section will describe the form layout and the actions required to retrieve one of the previously entered CTUC analysis records. Once the assessor has entered the correct password for the project, or has selected a utility adjustment that does not need any password, CTUC DST will show the list of all previous analysis records for this utility adjustment, as shown in Figure 3.7. Note that initially there should be no record in the list-box because the assessor has not yet analyzed this utility adjustment. In this case, the assessor can press the "New Analysis" button to show the form seen in Figure 3.8, in order to enter utility adjustment and assessor information.

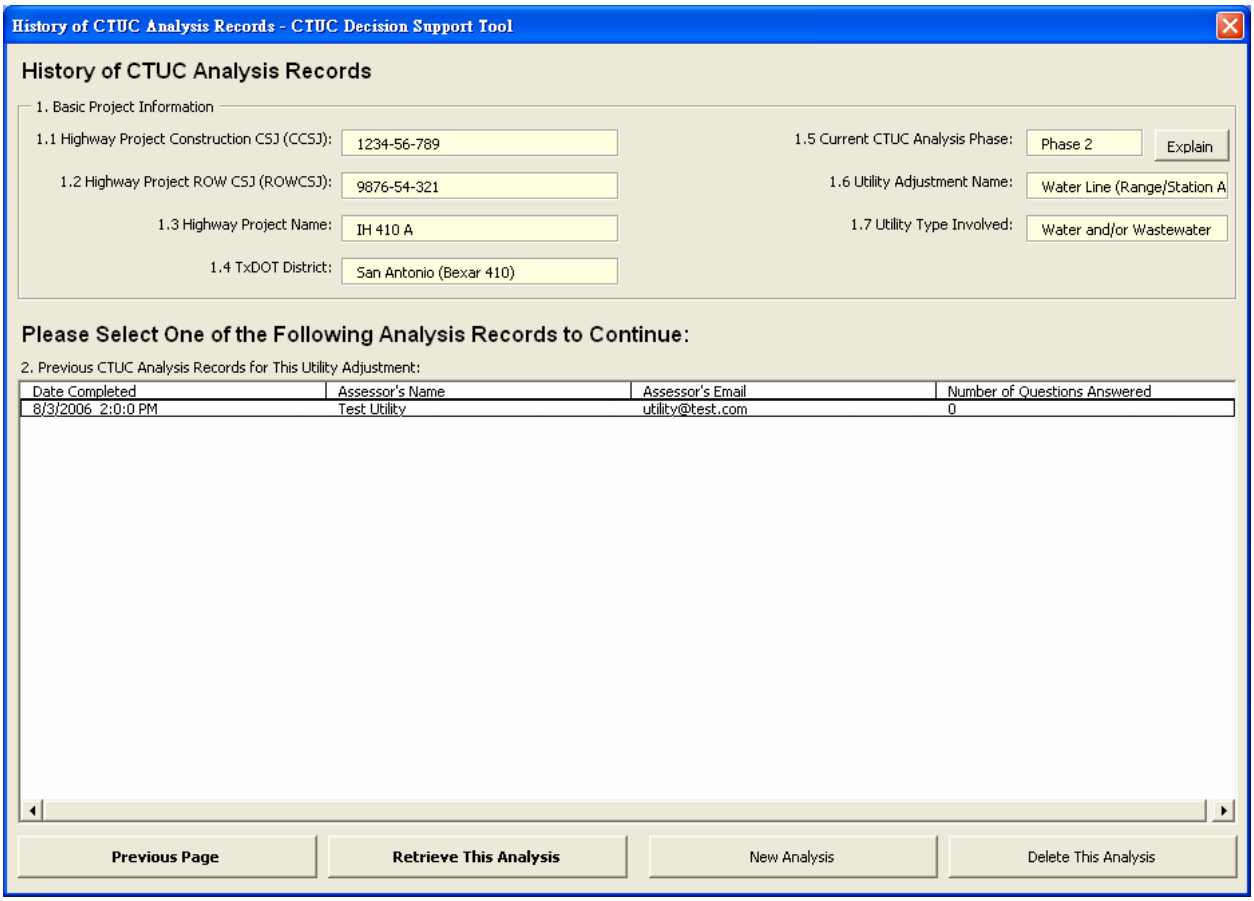

Figure 3.7 History of Previous CTUC Analysis Records

Figure 3.7 shows seven unchangeable project information fields and one list-box of all analysis records within the utility adjustment. In CTUC DST, all information fields that are unchangeable are highlighted in yellow. These fields remind assessors of the current project and utility adjustment they are working on. The list-box at the bottom of the page shows four columns associated with each analysis record: 1) Date Completed; 2) Assessor's Name; 3) Assessor's Email; and 4) Number of Questions Answered. The first three columns convey basic information of each analysis, and the contents can be changed via the form discussed at the end of this section. The fourth column shows the number of questions answered by the assessor.

Four buttons are shown in the bottom of Figure 3.7; these buttons can help the assessor navigate to the previous or next page. If there is at least one record in the list-box, and if the assessor selects an analysis record in the list-box and presses the "Retrieve This Analysis" button, or if the assessor double-clicks any analysis record, CTUC DST will show the utility adjustment and assessor information form of the selected analysis record, as shown in Figure 3.8. If the assessor selects an analysis record and presses the "New Analysis" button, CTUC DST will copy all internal data of the selected analysis record into the form shown in Figure 3.8 so that the assessor can begin a new CTUC analysis based on previous work. Finally, if the assessor selects an analysis record and presses the "Delete This Analysis" button, CTUC DST will delete all data associated with this analysis record.

Figure 3.8 shows the utility adjustment and assessor information. The assessor can change the utility number, whether or not it is a LPA, the description of the utility adjustment, and all assessor information fields. The utility adjustment name, the utility type, and the types of adjustment work cannot be changed. In other words, the TxDOT assessor must enter the correct information in the CTUC Phase 1 Analysis so that the utility assessor can obtain correct data in Figure 3.8.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *Assume assessors select "Water Line (Range/Station A-B)" as the utility adjustment in the previous section, as Figure 3.7 shows.*
  2) *If assessors do not see any record in the list-box, assessors can press the "New Analysis" button to show the form shown in Figure 3.8. Otherwise, assessors can double-click the any line item to retrieve the analysis data, as shown in Figure 3.8.*
  3) *Assessors can fill out all questions and press the "Next Page: Questionnaire of This Utility Adjustment" button to save and visit the page described in the next section.*

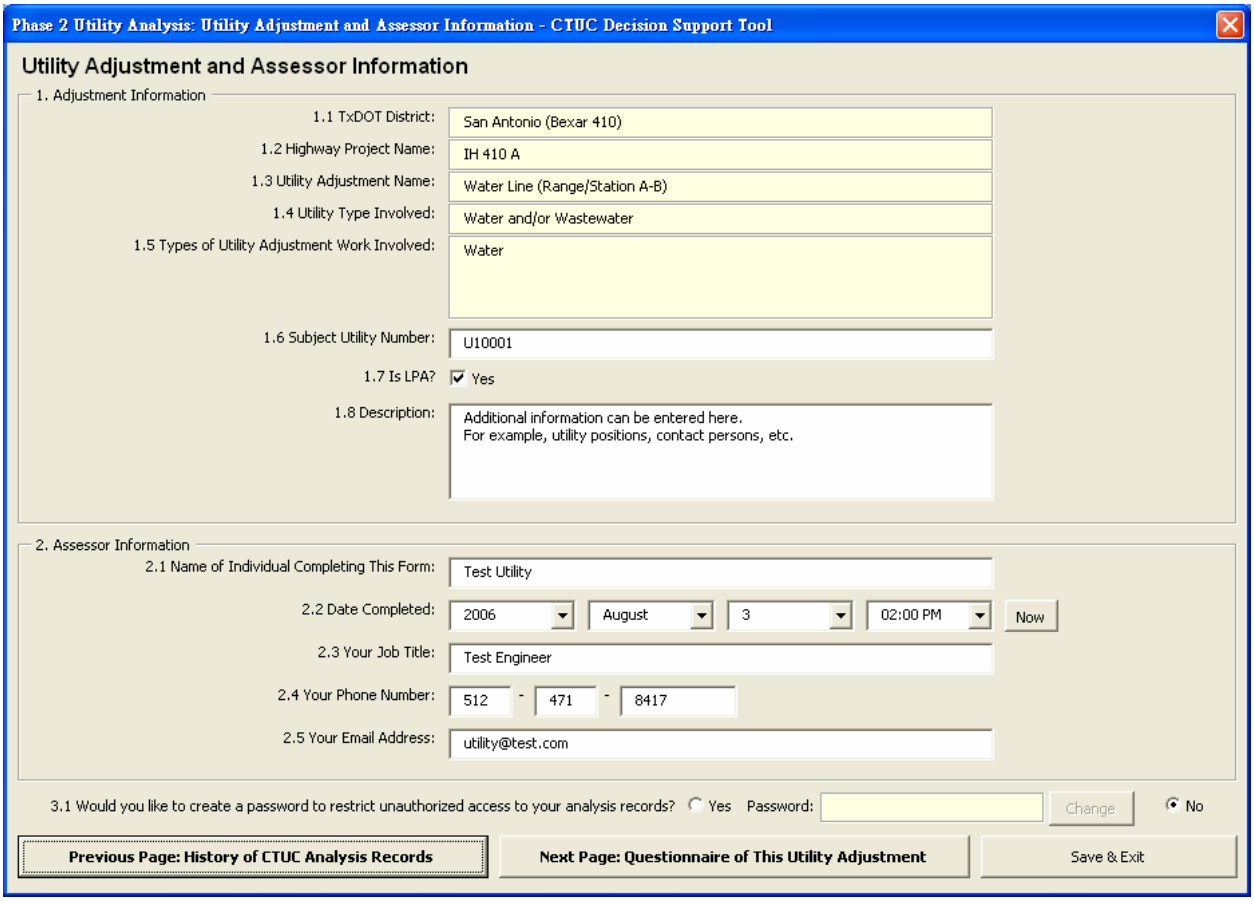

Figure 3.8 Utility Adjustment and Assessor Information

3.3 Filling Out Project and Utility Questionnaires

This section describes the main activities of CTUC DST. When the assessor has finished entering utility adjustment and assessor information, the assessor can begin to analyze the applicability of CTUC for this utility adjustment. In the CTUC Phase 2 Utility Analysis, CTUC DST will ask assessors a series of questions, which include project-scope, utility-scope, and contract-related questions. Section 3.3.1 will discuss the project-scope questions. Section 3.3.2 will discuss the utility-scope questions. Section 3.3.3 will discuss the contract-related questions.

3.3.1 Project-Scope Questions

There are five questions in Figure 3.9. Usually the assessor can only respond “Yes,” “No,” or “Don’t know yet” to a question. For Question 2.5, the assessor needs to consider the current project situation regarding schedule pressures and select only one option that best describes the current circumstance.

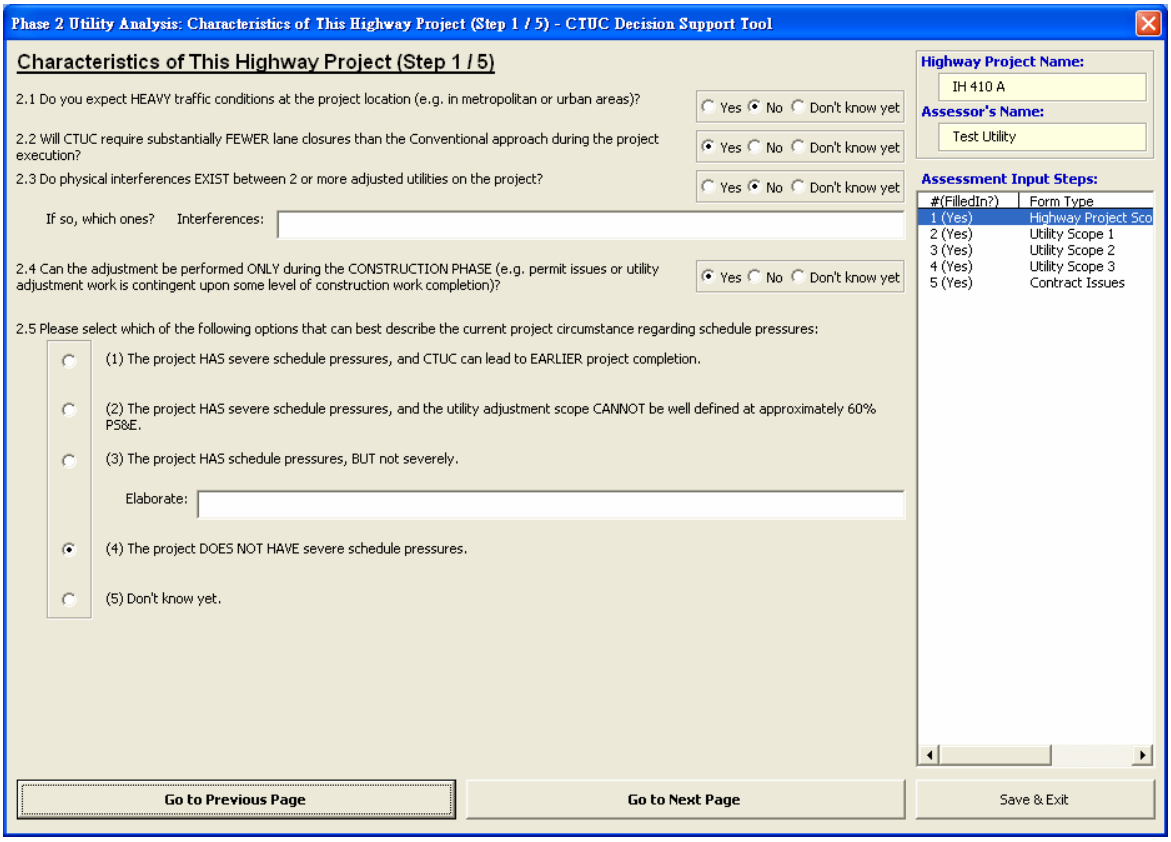

Figure 3.9 Project-Scope Questions in CTUC Phase 2 Utility Analysis

Note that on the right side of Figure 3.9, CTUC DST will show the project name, the assessor's name, and a list-box displaying all pages or steps that will be presented later. CTUC DST will prepare only one page regarding all project-scope issues and will produce three pages for utility-scope questions and one page for contract-related questions.

The right list-box can be used as a shortcut to the other page. Traditionally, the assessor can press the "Go to Previous Page" or "Go to Next Page" button several times to go to the desired page. With use of the shortcut, assessors can also double-click the line item of the desired step to visit that page directly. In addition, the list-box also shows whether or not the assessor has filled in the page before. If the assessor does not answer any questions in a page and presses the "Go to Next Page" or "Go to Previous Page" button directly, CTUC DST will presume "Don't know yet" as the answer to all questions on that page.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *Assume assessors represent "Water Line (Range/Station A-B)" and have finished the utility adjustment and assessor information page.*
  2) *Assessors can answer these five project-scope questions, as shown in Figure 3.9.*
  3) *Assessors can press the "Go to Next Page" to save the information and proceed to the next page.*

3.3.2 Utility-Scope Questions

There are three pages of questions pertaining to this utility-scope group. As shown in Figures 3.10, 3.11 and 3.12, the utility adjustment name will be displayed at the top of the three pages. If the subject utility adjustment can have underground facilities that will be shared with other utility owners, Question 3.9 with two sub-questions will show. In other words, if the subject utility adjustment only includes the types of utility adjustment work such as overhead communication lines, overhead distribution power lines, and transmission poles, Question 3.9 will not show. Furthermore, if the assessor answers "No" to Question 3.9, Question 3.9.1 and Question 3.9.2 do not need to display because no shared facilities exist in the utility adjustment.

Figure 3.11 presents Questions 3.10 and 3.11, whose appearances are contingent on the certain types of utility adjustment work, e.g., relocating poles. Hence, because the type of utility adjustment work analyzed in Figure 3.11 is to relocate water lines, Questions 3.10 and 3.11 will be shown in a gray color and assessors cannot provide answers. Questions 3.14 and 3.15 are for analyzing the current condition of hazardous materials (HAZMAT). If the assessor thinks there is no HAZMAT in the site, he or she will select "No" to all of the sub-questions in Question 3.14. CTUC DST will then disable Question 3.15, which means the hypothetical circumstance is not applicable to the utility adjustment.

Note that CTUC DST will highlight the step that the assessor is currently working on in the list-box on the right side of the page. For Questions 3.2, 3.6, 3.9.1, 3.10, and 3.24, assessors can enter more than one line of words in the text boxes as comments on the project or utility adjustment.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *Assessors can answer these ten questions, as shown in Figure 3.10, 3.11, and 3.12.*
  2) *Assessors can press the "Go to Next Page" to save the information and proceed to the next page.*

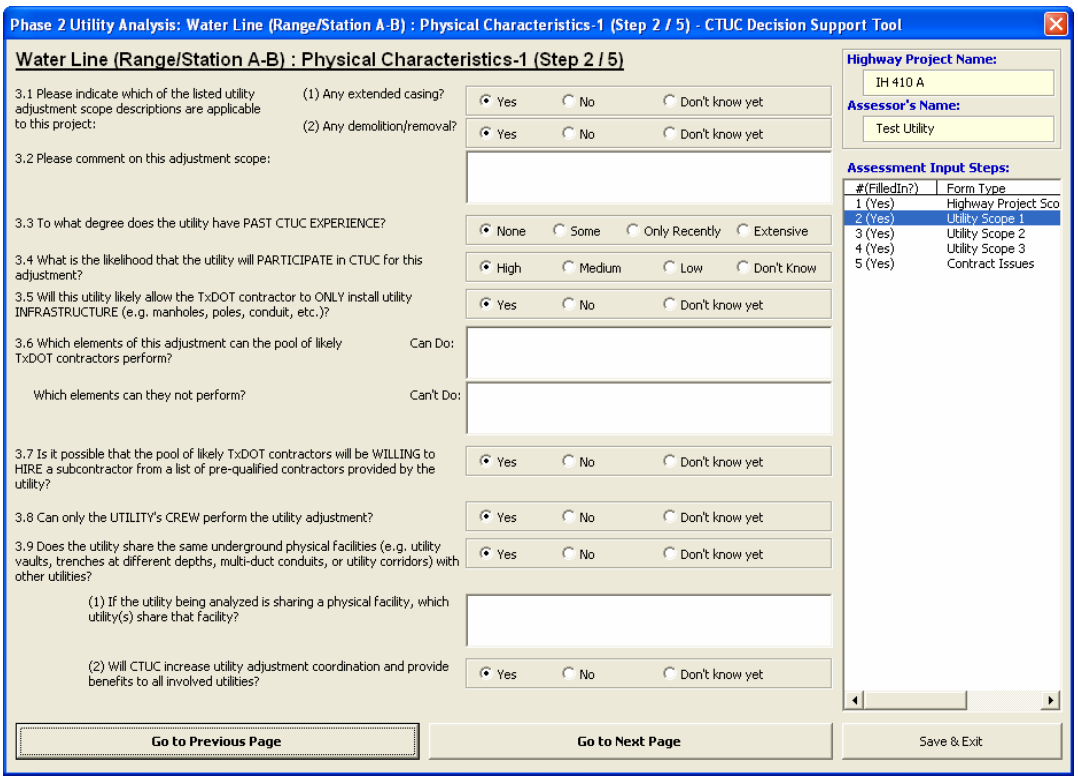

Figure 3.10 Utility-Scope Questions in CTUC Phase 2 Utility Analysis: Part 1

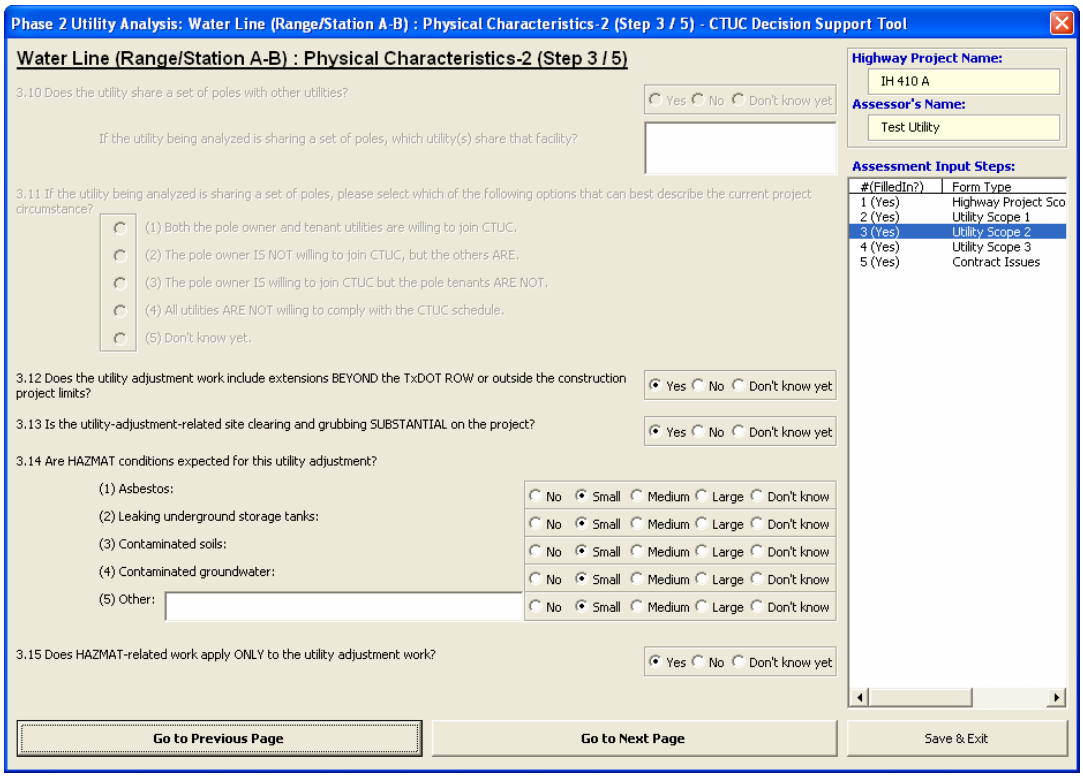

Figure 3.11 Utility-Scope Questions in CTUC Phase 2 Utility Analysis: Part 2

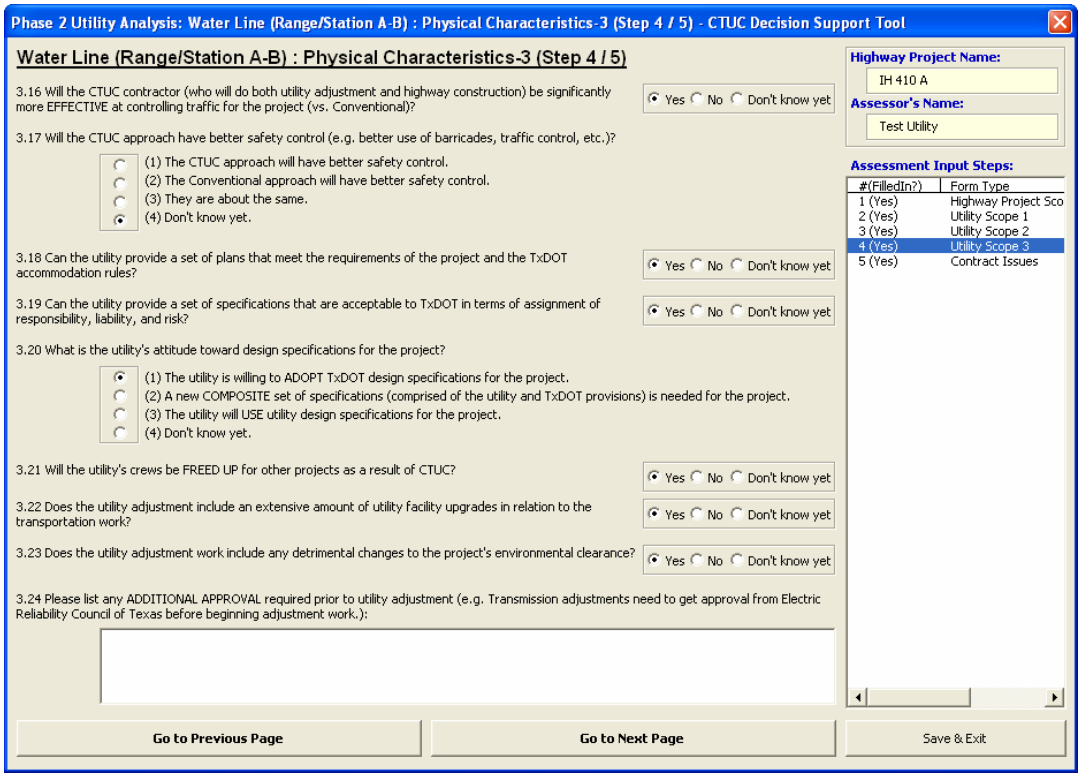

Figure 3.12 Utility-Scope Questions in CTUC Phase 2 Utility Analysis: Part 3

3.3.3 Contract-Related Questions

As noted before, the reimbursability of a utility adjustment can be reimbursable or non-reimbursable. Hence, the contract-related questions will be presented in accordance with the type of reimbursability the assessor selects in Question 4.1, as shown in Figure 3.13 and 3.14. Figure 3.13 shows contract-related questions for reimbursable utility adjustments, while Figure 3.14 shows contract-related questions for non-reimbursable utility adjustments.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *If the utility adjustment is 100 percent reimbursable, assessors can answer these two questions, as shown in Figure 3.13.*
  2) *If the utility adjustment is non-reimbursable, assessors can answer these nine questions as shown in Figure 3.14.*
  3) *Assessors can press the "Go to Next Page" to save the information and proceed to the next page.*

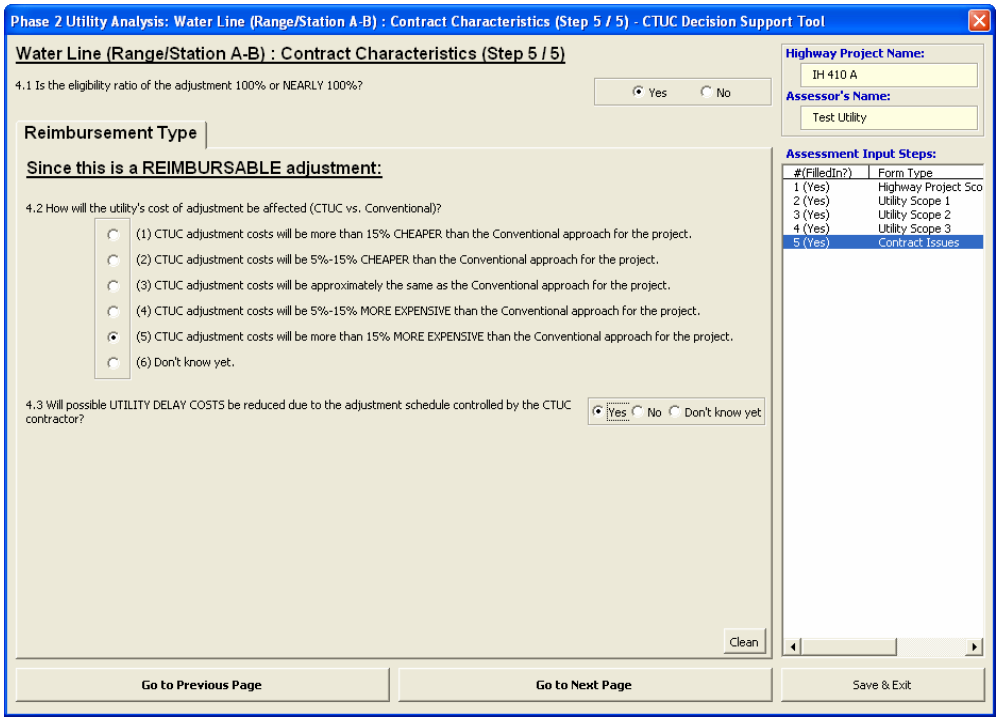

Figure 3.13 Contract-Related Questions for Reimbursable Adjustment

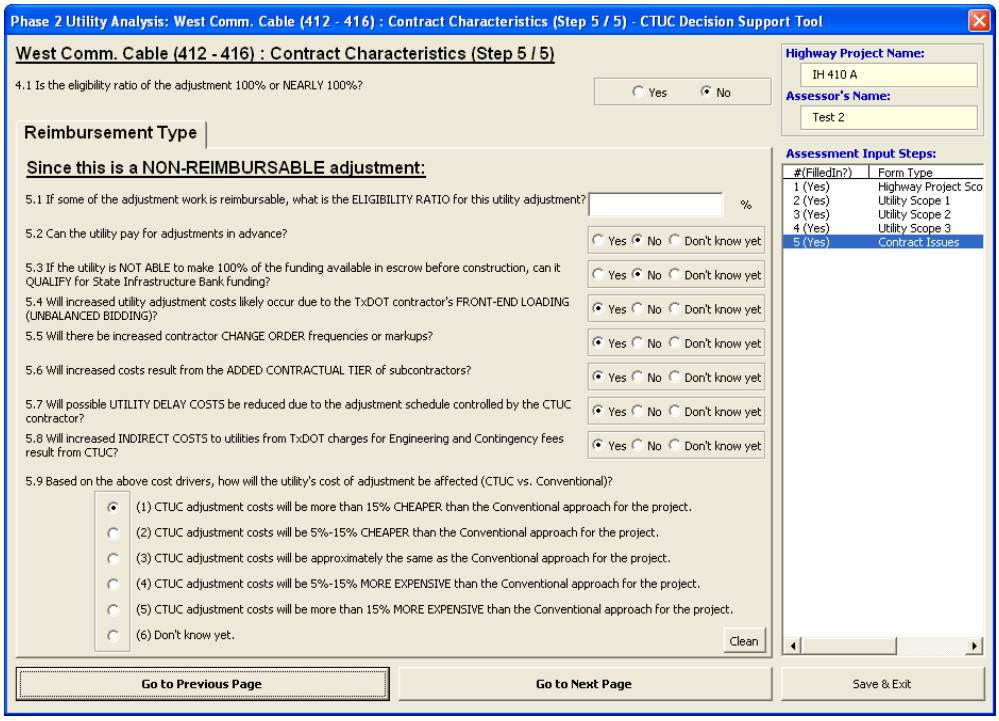

Figure 3.14 Contract-Related Questions for Non-Reimbursable Adjustment

3.4 Reviewing Top Six CTUC Decision Drivers

CTUC DST has two different types of reports. One is the graphical report and the other is the text report. After the assessor has answered all questions in the previous section, CTUC DST is able to generate the reports in order to demonstrate the experts' opinions with regard to the applicability of the CTUC approach for the utility adjustment. This section focuses on how to generate the graphical report of the analysis results, while Section 3.5 will describe the production of the detailed text report for the utility adjustment.

3.4.1 Report Setting for the CTUC Phase 2 Utility Analysis

There are two questions for report setting of the CTUC Phase 2 Utility Analysis, as shown in Figure 3.15. The first question is about selecting the scope of the expert group to be incorporated into the knowledge base. The second question is about selecting which types of utility experts to be incorporated into the knowledge base. The knowledge base will be applied to interpret the analysis results; hence, the assessor needs to specify the source of the knowledge base.

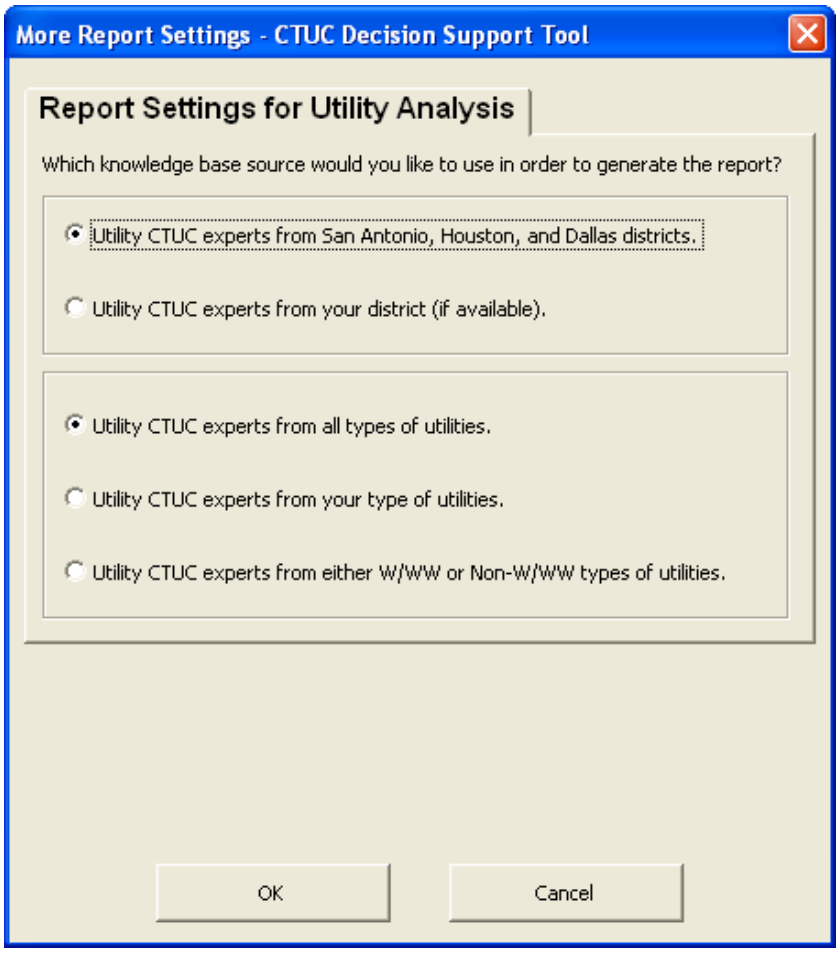

Figure 3.15 Report Setting for CTUC Phase 2 Utility Analysis

Because the reports in CTUC DST are dedicated to the explanation of the applicability of CTUC for the utility adjustment, the utility assessor may want to review opinions from utility experts in their districts only or from all Texas utility experts, whose opinions have been collected and stored in CTUC DST. Presently, the knowledge base of CTUC DST includes the opinions of utility experts who had attended the CTUC decision drivers assessment workshops in the San Antonio, Houston, and Dallas districts. Hence, if the assessor is from one of the three districts, he or she can select the knowledge base source with either three districts combined or just one district. Additionally, if the assessor is not from one of the three districts, CTUC DST will use the default value, which is the knowledge base source with the three districts combined, regardless of the assessor's choice.

For the second question, the utility assessor may want to review the opinions from their types of utility experts only. In some situations, the assessor may want to review the opinions from all types of utility experts so that he or she can get a general idea regarding a specific issue. In addition, because most past CTUC projects belong to the water and wastewater types of utilities, if the assessor would like to know the general idea from the utility companies who have occasionally applied the CTUC approach before, the assessor can select the third option in the second question, which is "utility CTUC experts from either W/WW or Non-W/WW types of utilities."

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *Assessors can select the option entitled "Utility CTUC experts from San Antonio, Houston, and Dallas districts."*
  2) *Assessors can select the option entitled "Utility CTUC experts from all types of utilities."*
  3) *Assessors can press the "OK" button to see the graphical report.*

3.4.2 Graphical Report of CTUC Phase 2 Utility Analysis

Figure 3.16 shows the graphical report. There are six major areas in this report: 1) Report Title, 2) Report Info., 3) Control Panel, 4) Top 6/6 Decision Drivers, 5) Level of Pro-CTUC, 6) Level of Anti-CTUC. The following paragraphs will describe each area in more detail.

1. Report Title (at the top of the report)

CTUC DST will show the project name and district information in the first line of the report title. The name of the utility adjustment and the abbreviation of the utility type involved will be shown in the second line of the report title.

2. Report Info. (in the upper left side of the report)

CTUC DST will show the name of the assessor, the analysis date, and the print date. In the file named "Knowledge Base Source," CTUC DST will show the knowledge base source the assessor selected in Section 3.4.1. Finally, the color used to reflect the impact level of the given project circumstance will be shown in the file named "Legend."

3. Control Panel (in the lower left side of the report)

Five buttons are provided in this area. The button labeled "Report Setting" will invoke the report setting form as shown in Figure 3.15. The button labeled "Previous Page" will trigger the contract-related form mentioned in Section 3.3.3. The button labeled "Next: Detailed Rpt." will invoke the text report discussed in the next section. The button labeled "Print" will

prompt the active printer name and print the current page. The button labeled “Exit” will save all data and close CTUC DST.

4. Top 6/6 Decision Drivers (in the middle column of the report)

This area lists twelve decision drives that will most influence the CTUC decision, either in a positive or negative way. Each decision driver is enclosed by a gray box with underline and correlates with one question mentioned in Section 3.3. The abbreviated description of the project circumstance, which was specified by the assessor as the best answer to the question, is shown below the decision driver. The assessor can click any box in this area to get more explanation, as shown in Figure 3.17. For example, the first Pro-CTUC decision driver is “(R)Utility Delay Costs” and its project circumstance is “Reduced costs with CTUC,” as shown in Figure 3.16. If the assessor wonders why CTUC DST shows such a result, he or she can click the box of “(R)Utility Delay Costs” to show a detailed explanation, as shown in Figure 3.17, which displays the original question and the assessor’s answer to the question.

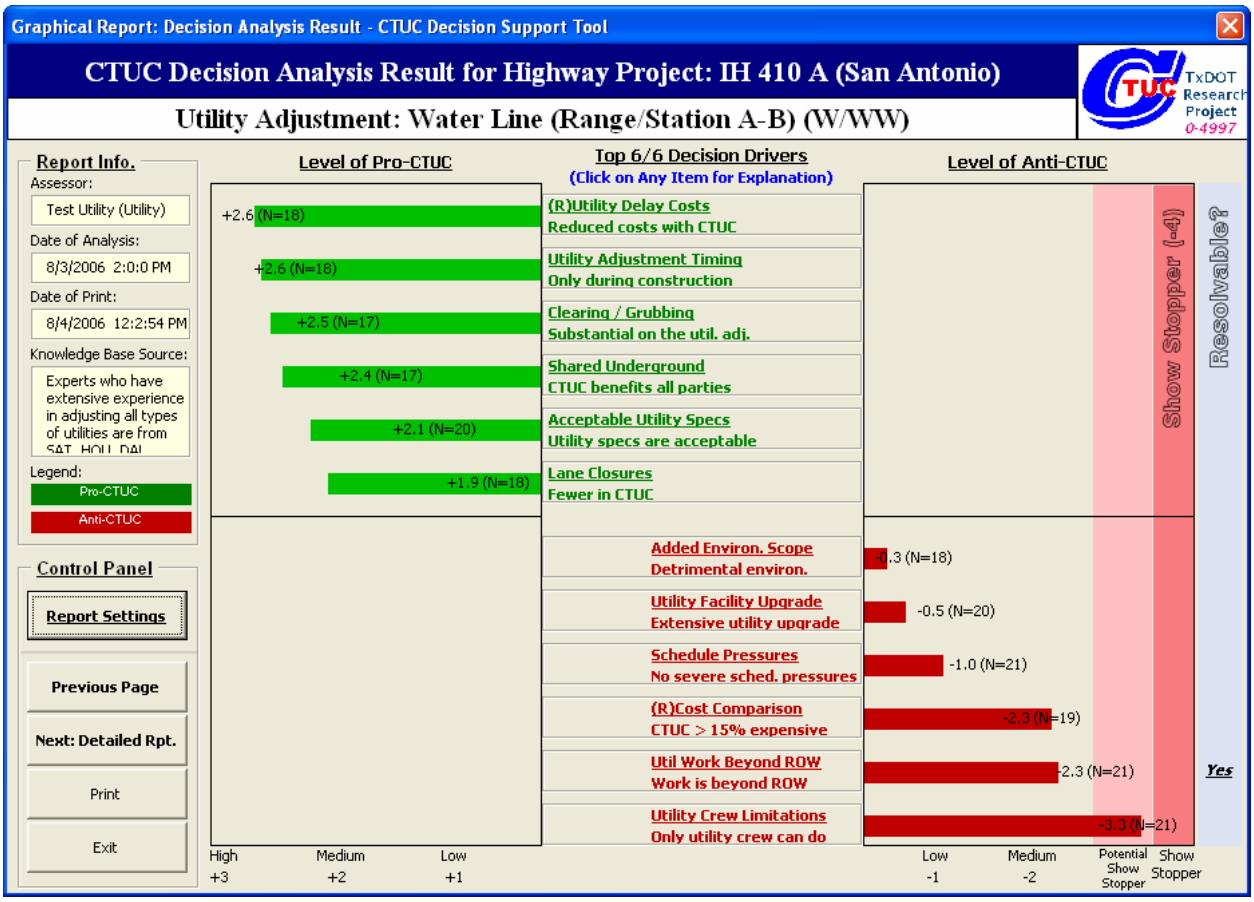

Figure 3.16 Graphical Report of the Analysis Results from Utility Perspective

5. Level of Pro-CTUC (in the second left column of the report)

The level of Pro-CTUC for each decision driver is derived from the average opinion of the experts concerning the given project circumstance listed in the middle of the form. Basically, in order to develop the knowledge base, these experts have been asked to use “High Impact,” “Medium Impact,” “Low Impact,” or “No Impact” to assess the given project circumstance’s

impact level on the CTUC decision. Furthermore, CTUC DST uses "3" to represent "High Impact," "2" to represent "Medium Impact," "1" to represent "Low Impact," and "0" to represent "No Impact," as shown in the bottom line of the form. Therefore, a project circumstance with a lengthy green bar means almost all experts think the current situation will influence the CTUC decision in a positive way, i.e., Pro-CTUC. Note that the level of Pro-CTUC is primarily determined by the *experts*, *not* by the *assessor*. However, the assessor can decide the group of experts to be used as the knowledge base source. If the assessor selects the combination of San Antonio, Houston, and Dallas districts as the knowledge base source, the total number of experts should be 24 (N=24) in current CTUC DST. For example, the impact level of the top Pro-CTUC decision driver is "+2.6 (N=18)," which means most of the eighteen experts think the given project circumstance is Pro-CTUC and has "High Impact" on the CTUC decision. Experts who select "Don't Know" for the project circumstance will be excluded from the impact level calculation.

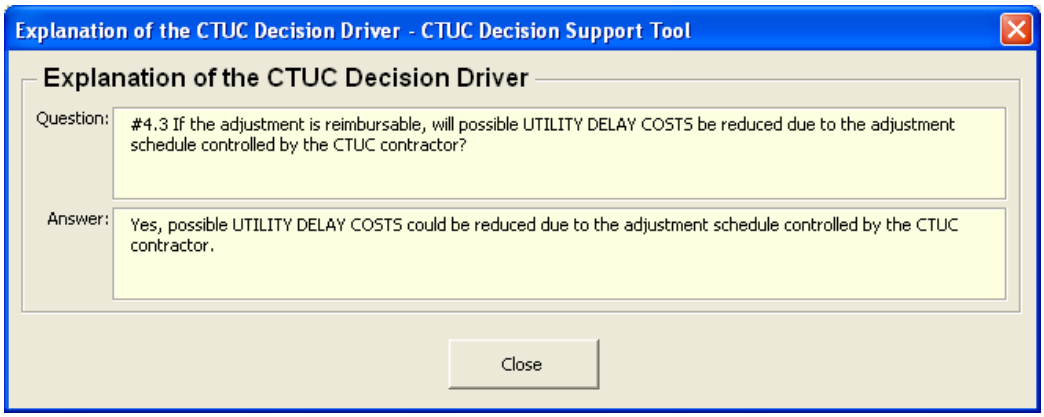

Figure 3.17 Short Explanation of the CTUC Decision Driver

6. Level of Anti-CTUC (in the right column of the report)

The format of the level of Anti-CTUC for each decision driver is similar to that of the level of Pro-CTUC. Basically, CTUC DST uses "-4" to represent "Show Stopper," "-3" to represent "High Impact," "-2" to represent "Medium Impact," "-1" to represent "Low Impact," and "0" to represent "No Impact", as shown in the bottom line of the form. Therefore, a project circumstance with a lengthy red bar means almost all experts think the current situation will influence the CTUC decision in a negative way, i.e., Anti-CTUC. The last blue column represents the resolvability of each decision driver. Since the experts have been asked to assess whether or not process changes could facilitate the use of CTUC, CTUC DST is able to show the resolvability results by displaying "Yes" for such project circumstances identified by the experts.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) Assessors can click the top decision driver box to show the dialog box in Figure 3.17, which is the most Pro-CTUC decision driver.

3.5 Reviewing the Text Report of the CTUC Decision

Because the graphical report can show only the top six Pro-CTUC or Anti-CTUC decision drivers, the text report is designed to supplement other important opinions regarding the CTUC applicability of the given utility adjustment. For example, some questions described in Section 3.3 are currently unknown to the assessor but have significant impact levels on the CTUC decision from the experts' perspectives. Hence, the text report will list all impact level types of CTUC decision drivers in order for the assessor to comprehend the CTUC applicability of the given utility adjustment and to learn lessons from experts.

3.5.1 Text Report of CTUC Phase 1 Analysis

Figure 3.18 shows the text report of CTUC Phase 2 Utility Analysis for the sample utility adjustment. The layout of this report is similar to the graphical one; therefore, only the portions that vary between the two reports are described:

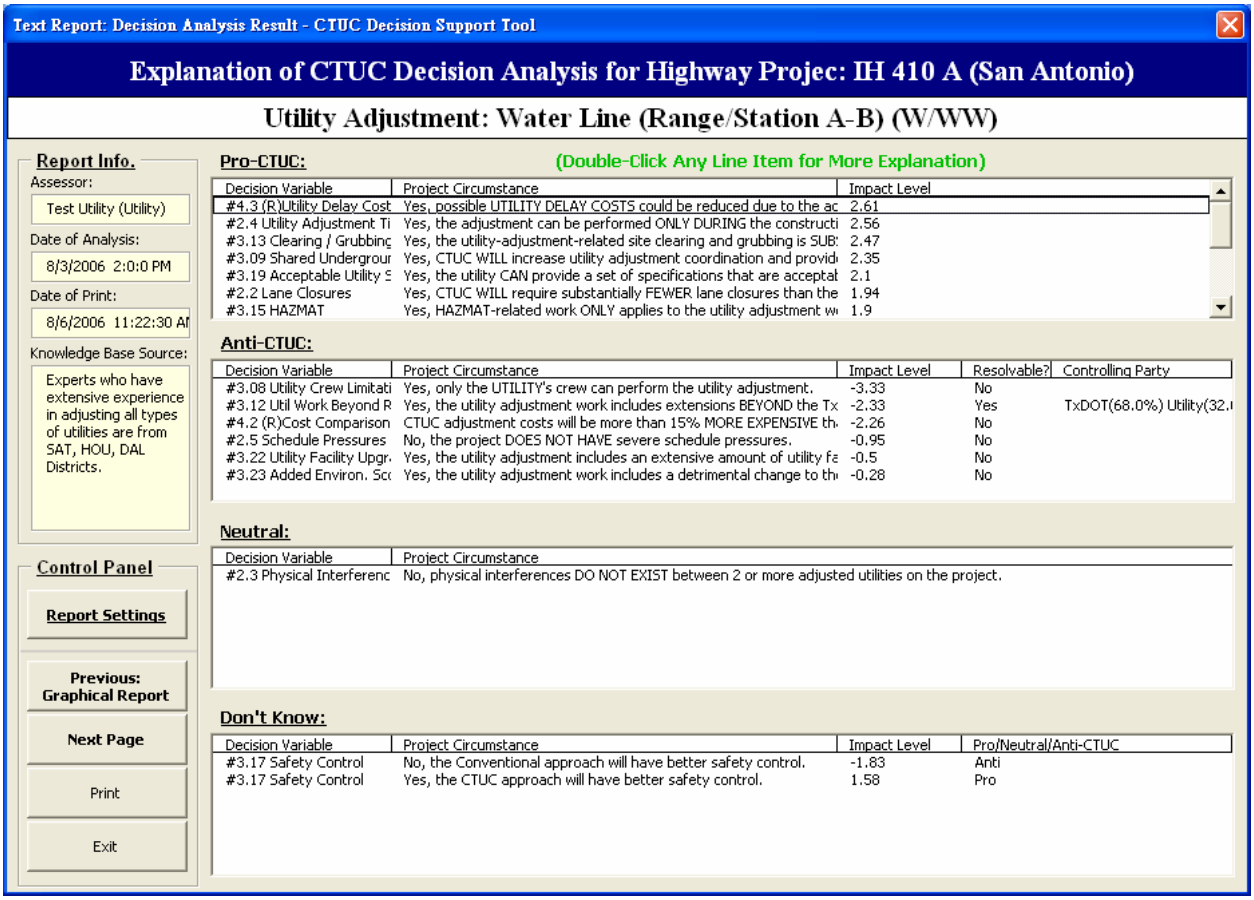

Figure 3.18 Text Report of Utility Adjustment Analysis Results

1. Pro-CTUC (in the first list-box)

This table has three columns described as follows: 1) Decision Variable: manifests the name of each Pro-CTUC decision driver; 2) Project Circumstance: manifests the current project

circumstance specified by the assessor; 3) Impact Level: manifests the numerical impact level assessed by the experts for the project circumstance. Note that these Pro-CTUC decision drivers are ranked according to their impact levels. The assessor can double-click any line item to show the detailed experts' opinions, as shown in Figure 3.19.

2. Anti-CTUC (in the second list-box)

This table has five columns described as follows: 1) Decision Variable: shows the name of each Anti-CTUC decision driver; 2) Project Circumstance: shows the current project circumstance specified by the assessor; 3) Impact Level: shows the numerical impact level assessed by the experts for the project circumstance; 4) Resolvable?: shows whether or not the project circumstance could be resolved to facilitate CTUC by any process change from experts' views; 5) Controlling Party: shows what percentage of each controlling party is responsible for such process changes. Note that these Anti-CTUC decision drivers are ranked according to their impact levels. The assessor can double-click any line item to show the detailed experts' opinions as shown in Figure 3.19.

3. Neutral (in the third list-box)

This table has two columns described as follows: 1) Decision Variable: shows the name of each Neutral decision driver, which by definition will not influence the CTUC decision; 2) Project Circumstance: shows the current project circumstance specified by the assessor. Note that these Neutral decision drivers are ranked according to their original question numbers and can help decision-makers make the CTUC problem simper by eliminating unnecessary factors. The assessor can double-click any line item to show the detailed experts' opinions as shown in Figure 3.19.

4. Don't Know (in the fourth list-box)

This table has four columns described as follows: 1) Decision Variable: shows the name of each decision driver which corresponds to a question unknown to the assessor; 2) Project Circumstance: shows one of the possible answer to this unknown question; 3) Impact Level: shows the numerical impact level assessed by the experts for the project circumstance; 4) Pro/Neutral/Anti-CTUC: shows "Pro" if the impact level is positive, "Anti" if the impact level is negative, and "Neutral" if the impact level is zero. Note that these "Don't Know" decision drivers are ranked according to their absolute values of the impact levels. The assessor can double-click any line item to show the detailed experts' opinions as shown in Figure 3.19.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *After assessors have reviewed the graphical report, assessors can press the "Next: Detailed Rpt." button to show the text report.*
  2) *Assessors can double-click the first line item in "Pro-CTUC" to show the dialog box of Figure 3.19.*
  3) *Assessors can double-click the second line item in "Anti-CTUC" to show the dialog box of Figure 3.20.*

3.5.2 Review of Detailed Experts' Opinions

If assessors double-click any line item in any of the list-boxes in Figure 3.18, CTUC DST will display the dialog box containing detailed experts' opinions as shown in Figure 3.19 or 3.20. There are three blocks in this form. The first block, titled "Review of Project Circumstance,"

shows the question and answer for the decision driver and project circumstance respectively. For some project circumstances, CTUC DST will also show the suggestion from experts.

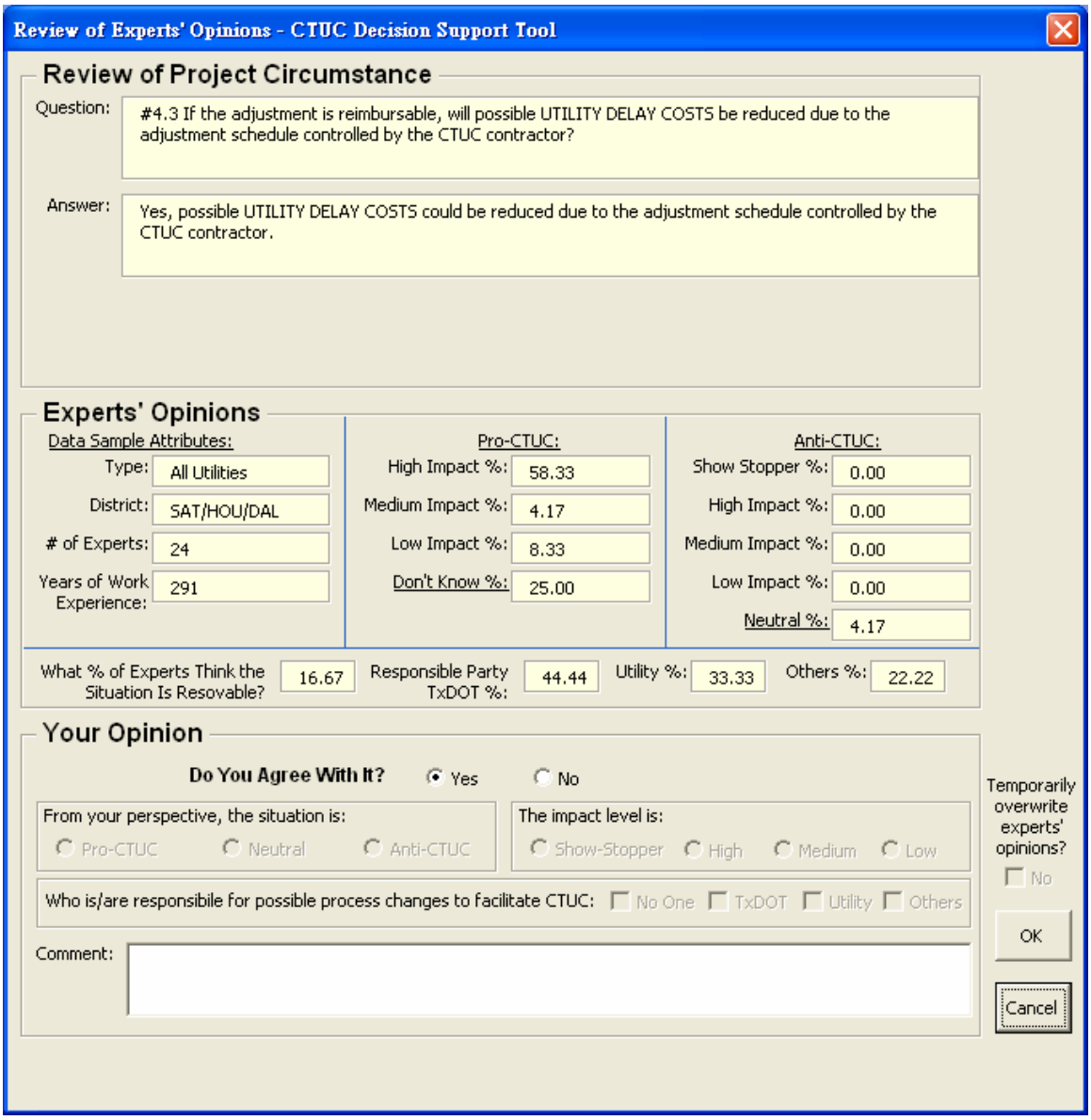

Figure 3.19 Detailed Explanation of the CTUC Decision Driver: Without Any Change

The second block, titled "Experts' Opinions," will list basic attributes of the expert group and show distribution of the experts' opinions for impact level and resolvability. For example, as shown in Figure 3.19, assessors can realize that six (24*25%=6) of the 24 experts can not judge the impact level, i.e., select "Don't Know," on CTUC based on the given project circumstance. Four (24*16.67%=4) of the 24 experts thought the given project circumstance could be resolved to facilitate CTUC, and almost one-half of the four experts thought TxDOT is responsible for process changes.

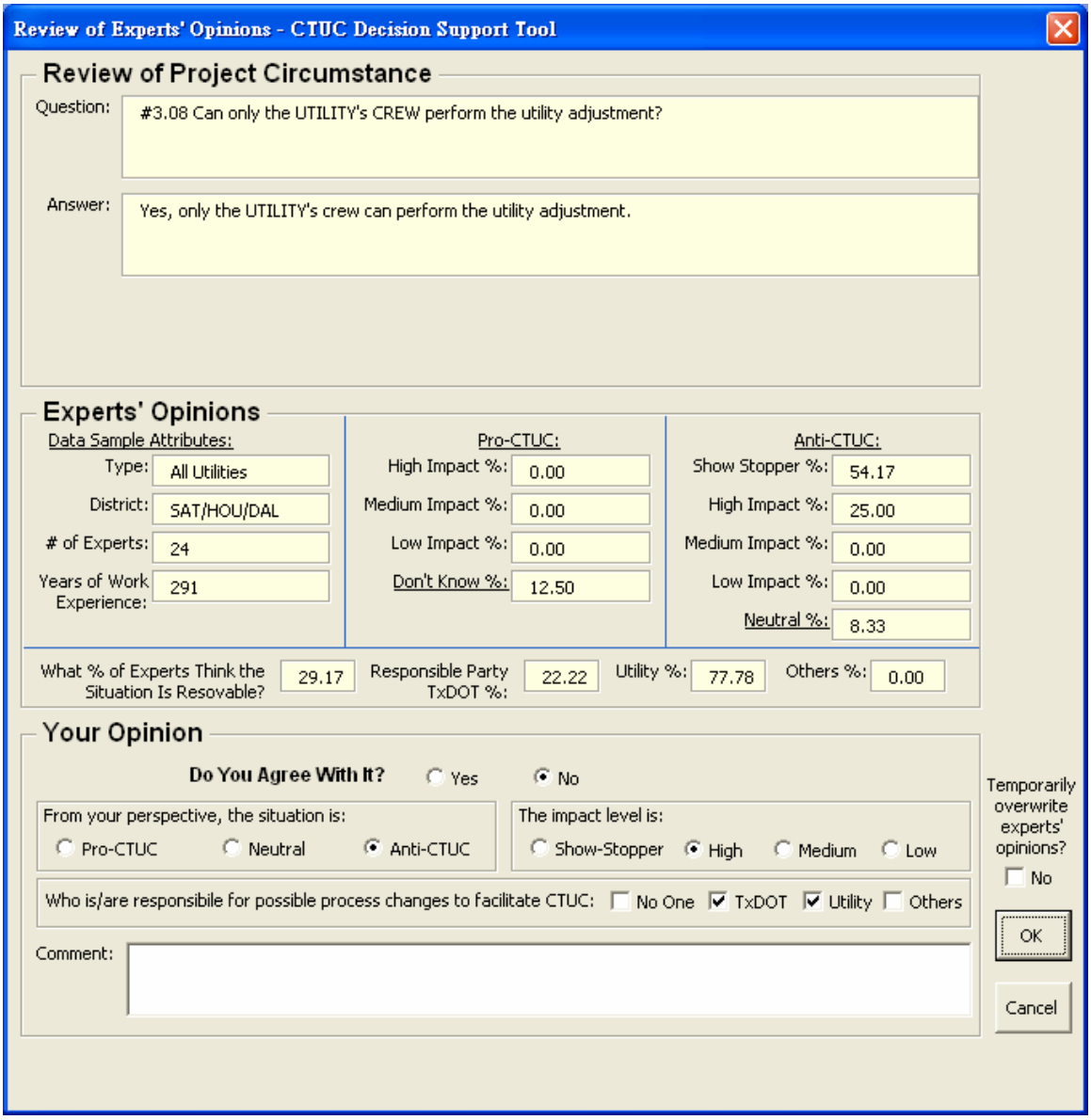

Figure 3.20 Detailed Explanation of the CTUC Decision Driver: With Changes

The third block, titled "Your Opinion," provides a place to enter the assessor's own opinion. Figure 3.19 demonstrates the case where the assessor agrees with the experts' opinions; hence, the assessor cannot select any option or enter any comment in this block. The "OK" button and the "Cancel" button provide the same function, which is to close the dialog box without modifying any data. Note that if the assessor has double-clicked the decision drivers that are "Don't Know" or originally "Neutral," the assessor cannot select "No" as the answer to "Do You Agree with It?"

Figure 3.20 illustrates a case in which the assessor does not agree with the experts' opinions. The assessor can then answer the three assessment questions and enter some comments in the bottom text box. Finally, if the assessor wants to temporarily overwrite the experts' opinions, which means the impact level associated with this project circumstance will be

changed, he or she can check the box labeled “Temporarily overwrite experts’ opinions?”. In this case, the assessor will see the change of this impact level in both the graphical report and the text report. Note that the knowledge base source is still unaltered. The assessor can use the following steps to get back the original experts’ opinions: 1) the assessor can select another group as the knowledge base source; 2) CTUC DST can generate a new report in order to overwrite current opinions; 3) the assessor can then select the original expert group as the knowledge base source; 4) CTUC DST can thus generate the original report.

If the assessor gives his or her own comments without checking the box labeled “Temporarily overwrite experts’ opinions?”, both experts’ opinions and the assessor’s comments will be stored in CTUC DST, and the assessor’s opinion can be retrieved later in order to retrospect to project situations.

3.6 End of CTUC Phase 2 Utility Analysis

When the assessor has reviewed both the graphical and text reports, the CTUC Phase 2 Utility Analysis is complete. Hence, the assessor can print all analysis results, just close the tool, or visit previous pages to make modifications. Figure 3.21 shows the form that presents those options. Figure 3.22 shows a portion of the final report for the utility adjustment.

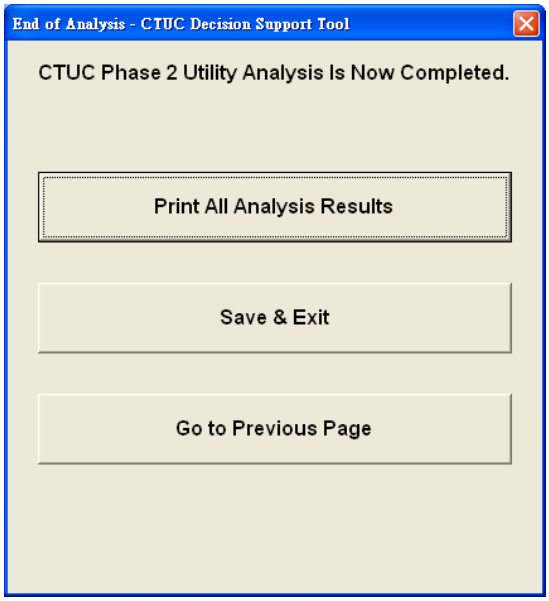

Figure 3.21 End of CTUC Phase 2 Utility Analysis

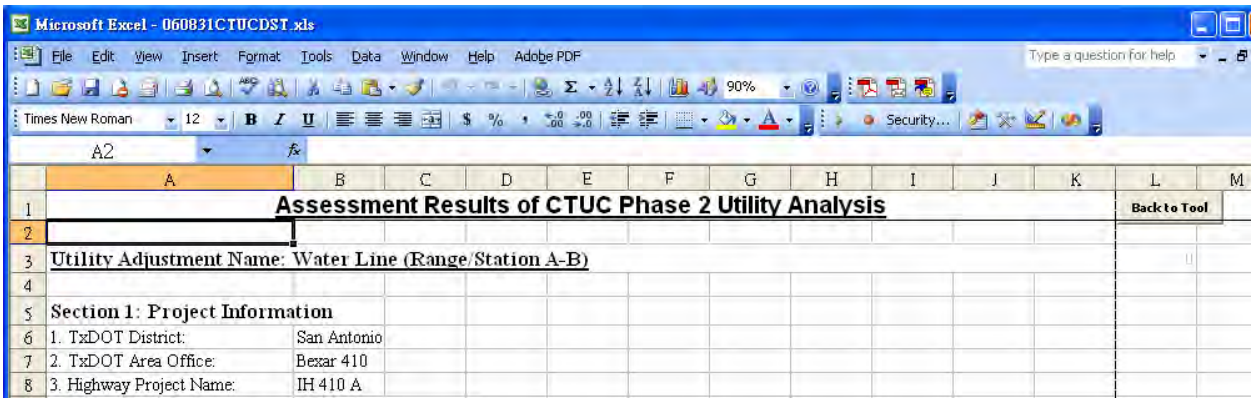

Figure 3.22 Excel Worksheet for CTUC Phase 2 Utility Analysis Final Report

When the assessor presses the "Print All Analysis Results" button in Figure 3.21, CTUC DST will display an Excel worksheet to list the CTUC analysis results. The assessor can print or print-preview this preformatted worksheet just like a normal Excel worksheet. The assessor can also go back to CTUC DST by pressing the "Back to Tool" button in the top row in the worksheet as Figure 3.22 shows.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *After assessors have reviewed the text report, assessors can press the "Go to Next Page" in Figure 3.18 to complete CTUC Phase 2 Utility Analysis.*
  2) *Assessors can press the "Print All Analysis Results" button to view the Excel worksheet report.*
  3) *CTUC DST will prompt a message box to alert that the report has been generated successfully.*
  4) *Assessors can print the Excel worksheet report as shown in Figure 3.21.*
  5) *Assessors can press the 'Back to Tool" button in Figure 2.22.*
  6) *Assessors can press the "Save & Exit" button to save and close CTUC DST.*

4. CTUC Phase 2 TxDOT Analysis

4.1 Overview of CTUC Phase 2 TxDOT Analysis

This chapter describes use of CTUC DST for performing CTUC Phase 2 TxDOT Analysis, which is primarily operated by TxDOT assessors. Step-by-step instructions are given as shown in Figure 4.1. The first step is about retrieving one CTUC Phase 2 TxDOT Analysis record and reviewing the project configuration information (explained further in Section 4.2). After completing these project information forms, the TxDOT assessor will be asked a series of yes/no questions concerning the project-specific issues and characteristics (explained further in Section 4.3). In Step 3, because generating comparison reports require that the utility assessors finish their analyses, the TxDOT assessor should review their responding status and select the appropriate utility analysis record (explained further in Section 4.4). In Step 4, the TxDOT assessor will specify the knowledge base sources, and CTUC DST will show the graphical analysis results for both parties. The assessor will see both parties' experts' opinions regarding the applicability of CTUC for the selected utility adjustment in the format of bar charts (explained further in Section 4.5). Finally, CTUC DST will show the text report listing all decision drivers in accordance with the ranking of their impact levels for both parties (explained further in Section 4.6).

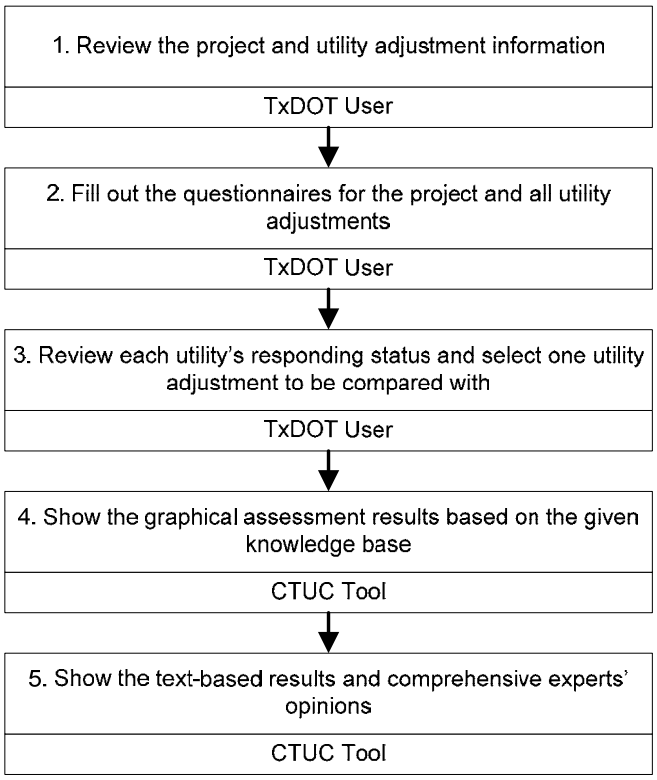

Figure 4.1 Steps of CTUC Phase 2 TxDOT Analysis

4.2 Retrieving a CTUC Phase 2 TxDOT Analysis

After CTUC DST is opened, the computer will display the front page as shown in Figure 4.2. This is the same page as in CTUC Phase 1 Analysis. The following sections will describe the steps required to perform CTUC Phase 2 TxDOT Analysis.

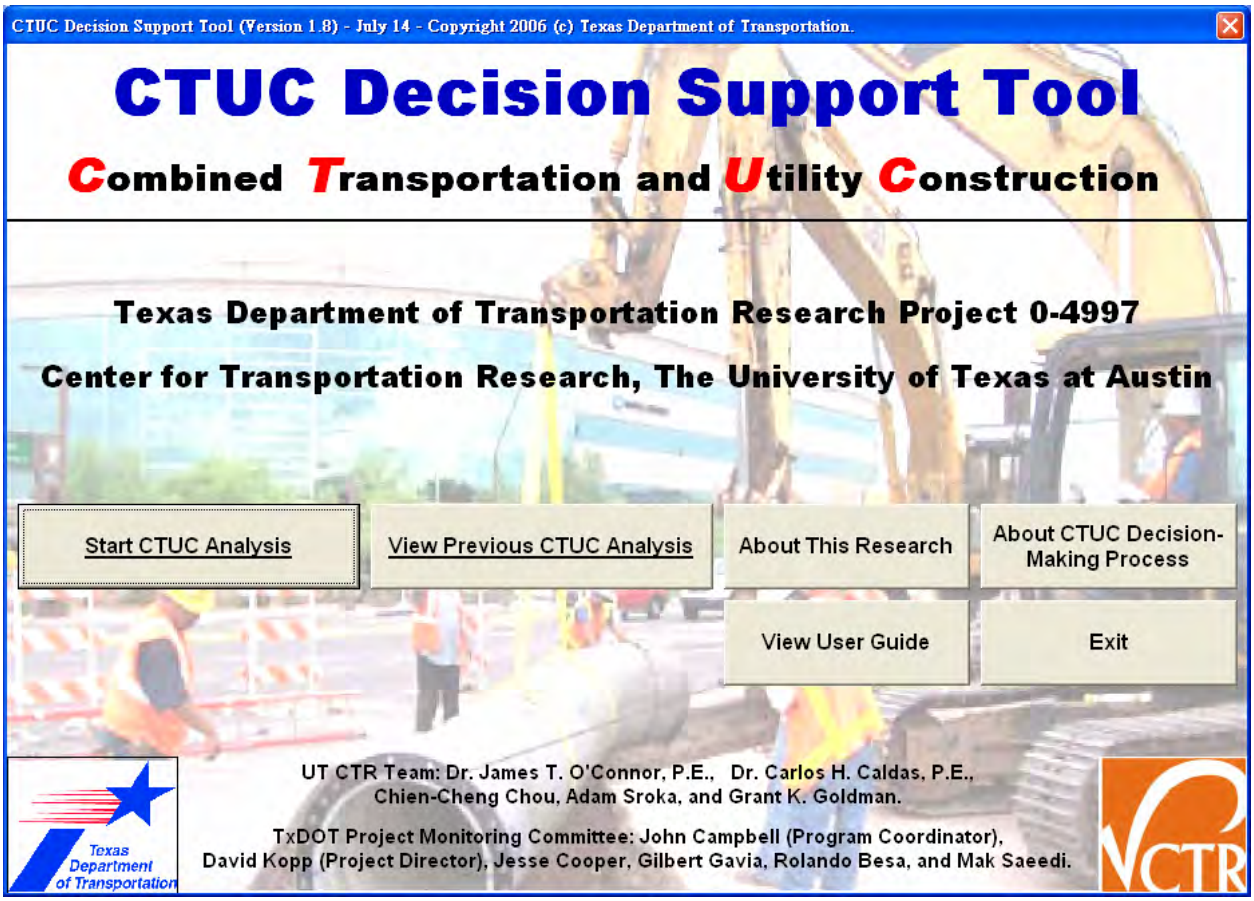

Figure 4.2 The Front Page of CTUC DST

4.2.1 Retrieve a CTUC Phase 2 TxDOT Analysis: Select a District and a Project

Pressing the "View Previous CTUC Analysis" button in Figure 4.2 is the starting point of CTUC Phase 2 TxDOT Analysis. CTUC DST will ask the assessor to select a TxDOT district as shown in Figure 4.3. After selecting the district, the assessor can press the "OK" button to see the list of all projects in the district as shown in Figure 4.4. There are two list-boxes in Figure 4.4. The left list-box displays all projects CTUC DST has in this TxDOT district. The right list-box is for utility assessors, as discussed in Chapter 3.

Six columns are presented in the left list-box in Figure 4.4: 1) Highway Project Name and Its CCSJ, 2) Area Office, 3) CTUC Phase, 4) Password Needed?, 5) Last Assessor, 6) Assessment Date. The assessor can either select any line item whose CTUC Phase is equal to 2 and press the "Login as a TxDOT User" button, or simply double-click the line item in order to retrieve the project analysis data. Note that if a project needs the password protection, CTUC

DST will show “Yes” in the “Password Needed?” column for this project and will prompt a dialog box for the assessor to enter the password as shown in Figure 4.5. If the password the assessor enters is correct, CTUC DST will then be allowed to process future assessors’ requests.

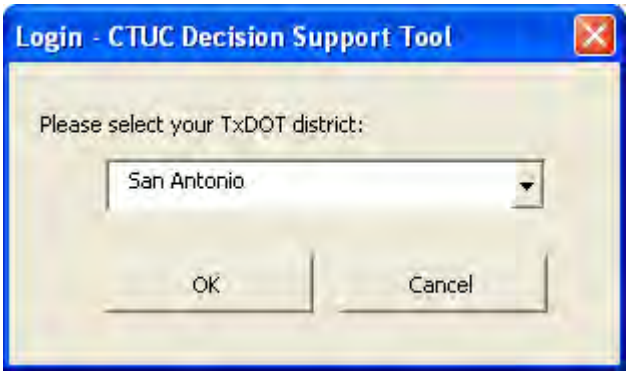

Figure 4.3 Select a TxDOT District

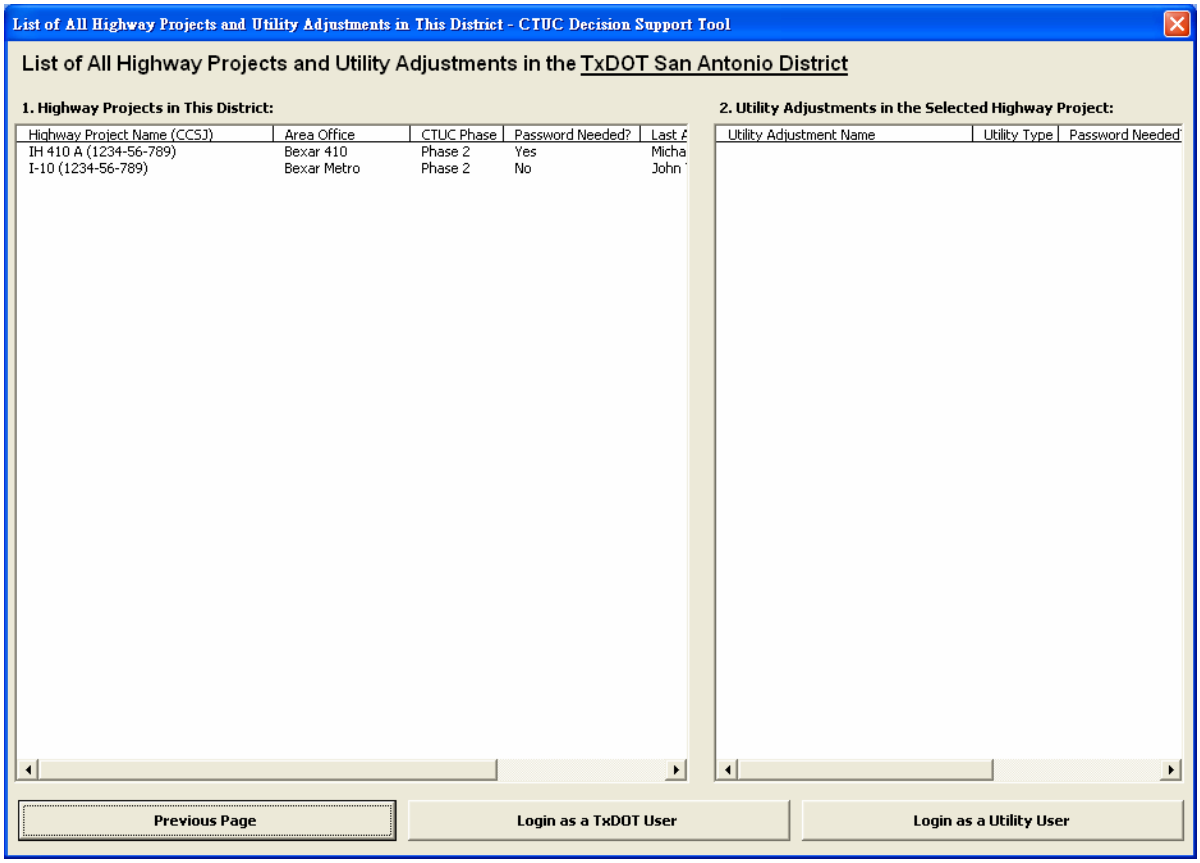

Figure 4.4 List of All Projects within the TxDOT District

- **For Demonstration Purposes**

  Since CTUC DST is equipped with some sample data, the essential steps of this section’s functions will be explained here for demonstration purposes.

1) *After pressing the "View Previous CTUC Analysis" button in Figure 4.2, assessors will see Figure 4.3.*
2) *Assessors can select the "San Antonio District" in Figure 4.3 to see two projects in the left list-box in Figure 4.4.*
3) *Assessors can select the first line item, whose project name is "IH 410 A," to experience the login process as shown in Figure 4.5.*
4) *Assessors can enter "abc" as the password to go to the step described in the next section.*
5) *Assessors can also select the second line item, whose project name is "IH 10," to go to the next step without experiencing the login process.*

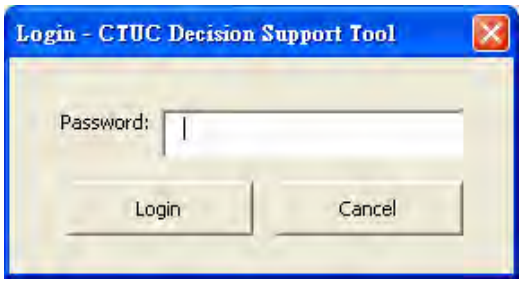

Figure 4.5 Login Form for a Project with Password Protection

4.2.2 Retrieve a Previous CTUC Phase 2 TxDOT Analysis: Select a Analysis Record

One project may have been analyzed many times. This section will describe the form layout and the actions required to retrieve one of the previous CTUC analysis records. After the assessor enters the correct password for the project, or the assessor selects the project that does not need any password, CTUC DST will show the list of all previous analysis records for this project as shown in Figure 4.6.

Figure 4.6 shows six, unchangeable project information fields and one list-box of all analysis records within the project. In CTUC DST, all unchangeable information fields are marked in yellow. These fields can remind assessors of the current project they have worked on. The bottom list-box shows four columns associated with each analysis record: 1) Date Completed, 2) Assessor's Name, 3) CTUC Phase of This Analysis, 4) Number of Questions Answered. The first two columns are about basic information of each analysis, and the contents can be changed via the form discussed in the end of this section. The third column is about the current CTUC phase of each analysis, and the value can be "Phase 1" or "Phase 2." Note that the information field labeled "1.5 Current CTUC Analysis Phase" in Figure 4.6 means the current CTUC phase of *the project*, and this field will be changed from "Phase 1" to "Phase 2" as long as the CTUC Phase 2 TxDOT Analysis has been performed. The final column is about how many questions the assessor has answered.

Four buttons are shown in the bottom of Figure 4.6; these buttons can help the assessor navigate to the previous or next page. If the assessor selects an analysis record in the list-box and presses the "Retrieve This Analysis" button, or if the assessor double-clicks any analysis record, CTUC DST will show the project and assessor information form of the selected analysis record as shown in Figure 4.7. If the assessor selects an analysis record and presses the "New Analysis" button, CTUC DST will copy all internal data from the selected analysis record into the form of

Figure 4.7 so that the assessor can begin a new CTUC analysis (either Phase 1 or Phase 2) based on previous work. If the assessor just presses the "New Analysis" button without selecting any analysis record, a blank form of Figure 4.7 will be created. Finally, if the assessor selects an analysis record and presses the "Delete This Analysis" button, CTUC DST will delete all data associated with this analysis record.

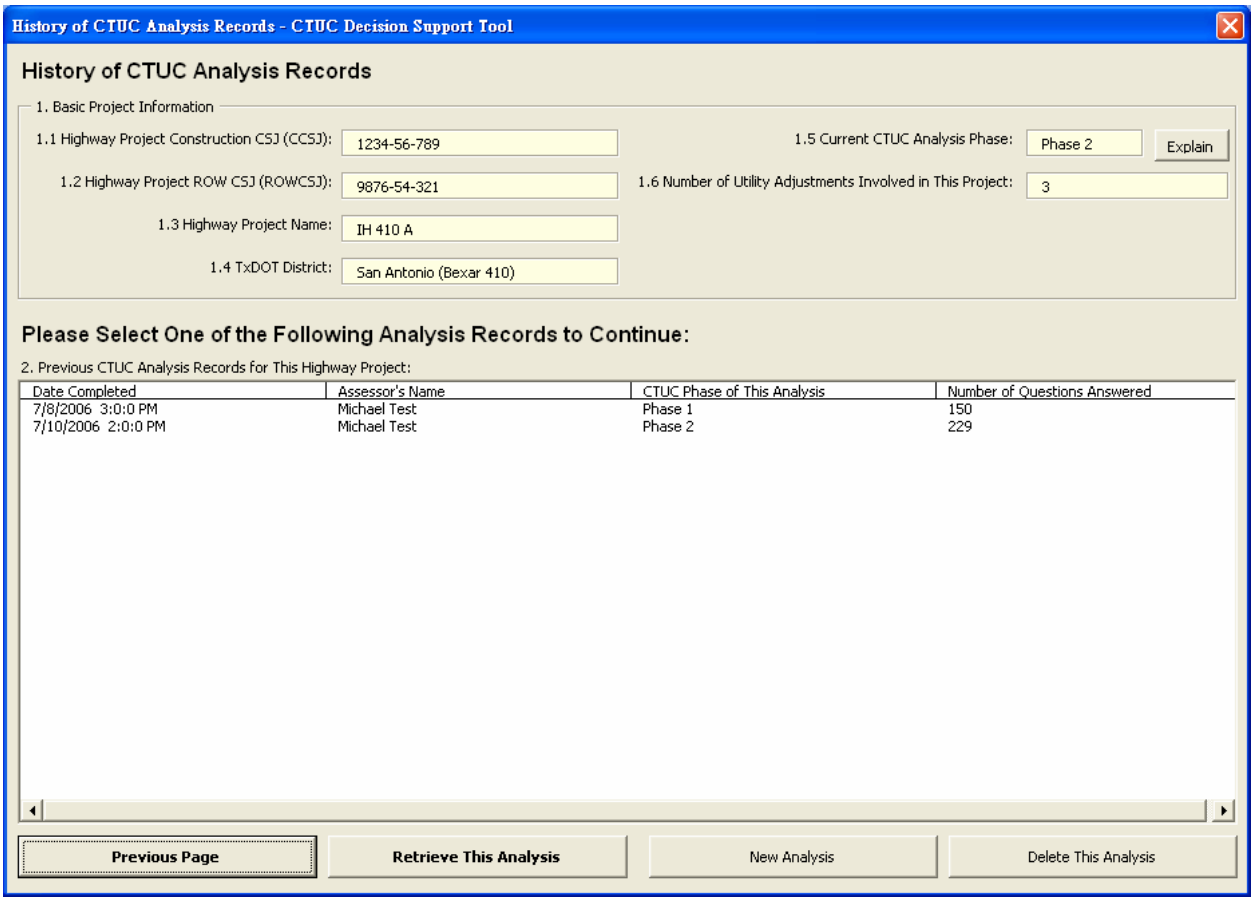

Figure 4.6 History of Previous CTUC Analysis Records

Figure 4.7 shows the project and assessor information. The assessor can change the name of project, CCSJ, ROWCSJ, et al. Only the project's TxDOT district and area office cannot be changed. In other words, the assessor must select the correct district and area office whenever a new project is created.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *Assume assessors selects "IH 410 A" as the project in the previous section as Figure 4.6 shows.*
  2) *Assessors can double-click the second line item, which is for CTUC Phase 2 TxDOT Analysis, to retrieve the analysis data as shown in Figure 4.7.*

3) *Assessors can fill out all questions and press the "Next Page: Project Configuration of All Utility Adjustments" button to save and visit the page described in the next section.*

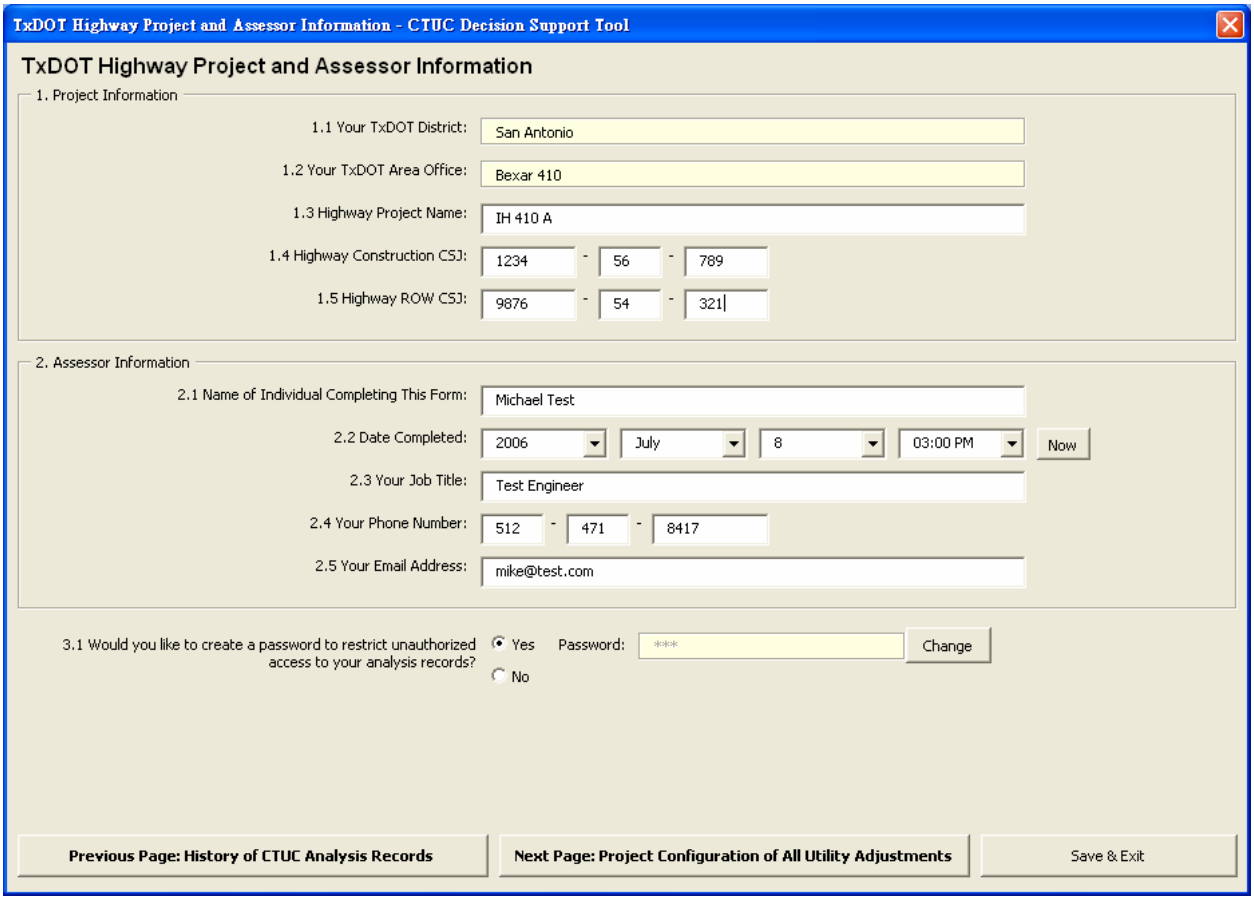

Figure 4.7 TxDOT Highway Project and Assessor Information

4.2.3 Update the Reimbursability for Each Utility Adjustment

After selecting one CTUC analysis record in CTUC Phase 2 TxDOT Analysis and filling out project and assessor information in the previous section, the assessor will be asked to review the configuration information for all utility adjustments involved in the project and update the reimbursability for each utility adjustment. Because CTUC Phase 1 Analysis is performed at approximately 0 percent PS&E, the reimbursability, i.e., whether or not a utility adjustment is 100 percent or nearly 100 percent reimbursable, of the utility adjustment may be changed when CTUC Phase 2 TxDOT Analysis will be performed. Hence, the assessor needs to update this information as shown in Figure 4.8 and 4.9.

Figure 4.8 shows the initial form when the assessor has finished the steps in the previous section. Basically, the assessor will see the reimbursability for each utility adjustment displayed in the fourth column in the right list-box labeled "3. List of all utilities within the limits of the project." The assessor can select any line item in the right list-box, and CTUC DST will show

the corresponding information of that utility adjustment selected in the second block labeled “2. Please Input Information of the Utility Adjustment.”

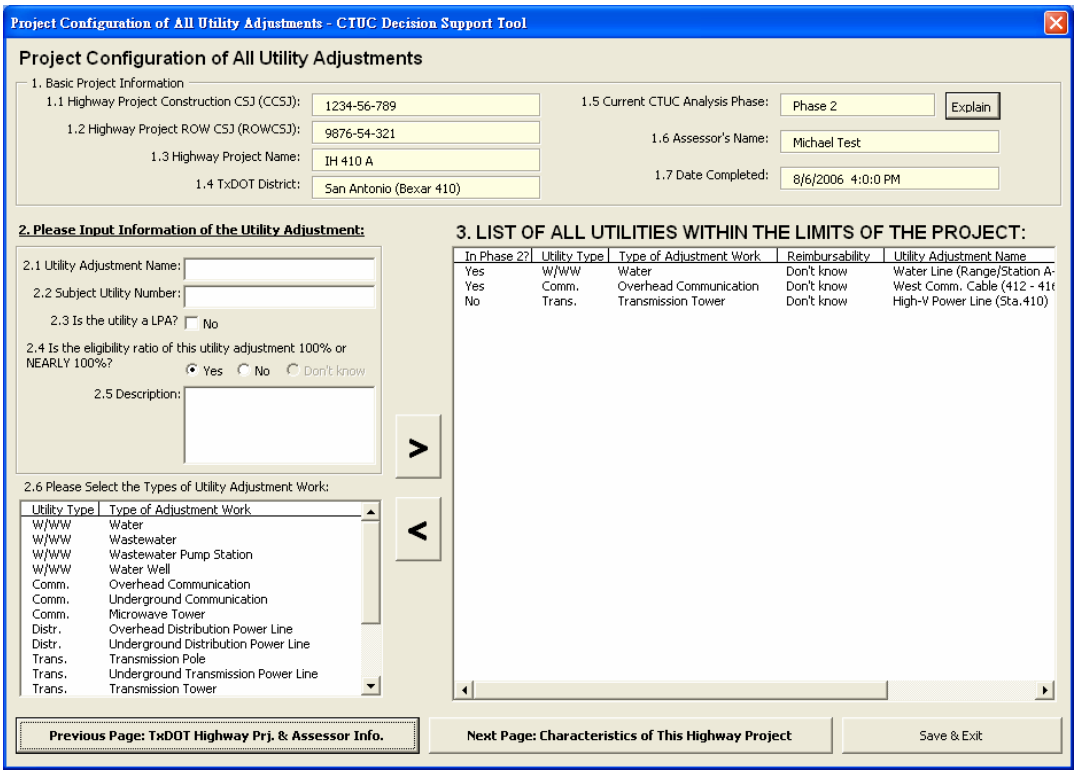

Figure 4.8 Initial Form of Project Configuration

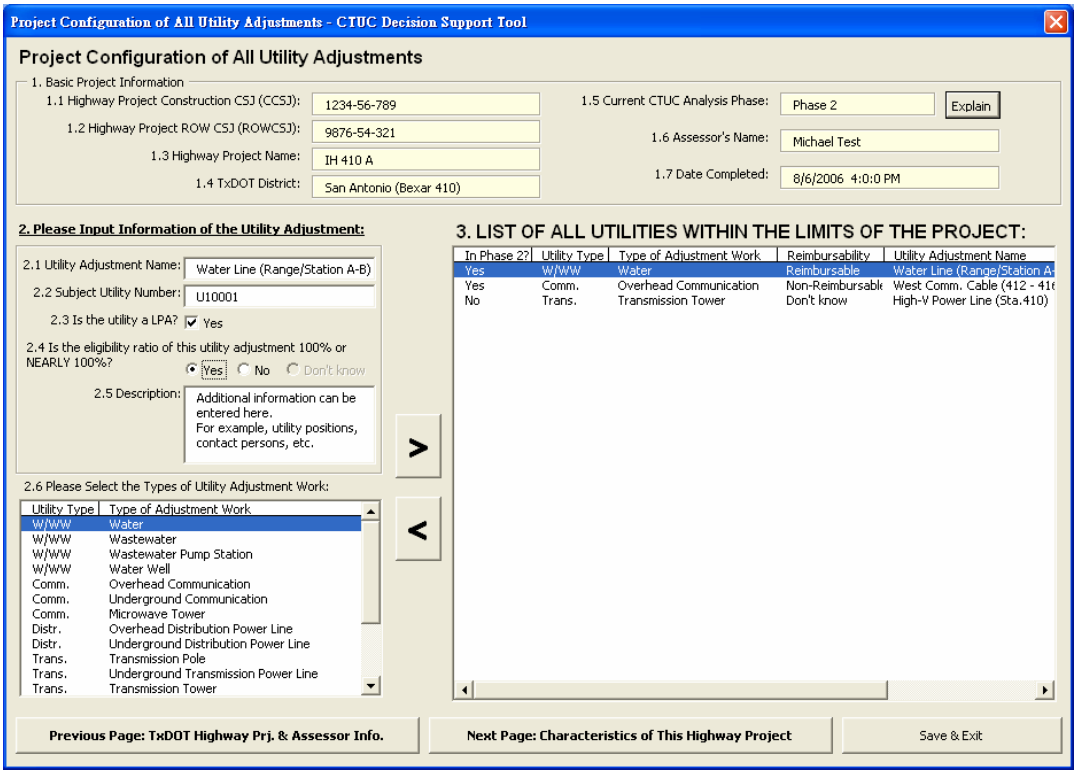

Figure 4.9 Updating the Reimbursability for Each Utility Adjustment

As noted in Section 2.3, the assessor can update any information of the utility adjustment other than utility adjustment name using the following steps: 1) select the desired line item in the right list-box; 2) CTUC DST show the corresponding information in the second block; 3) update the necessary fields other than Question 2.1 in the second block; 4) press the "→" button to update the utility adjustment.

Note that the assessor does not need to update the reimbursability of the utility adjustment whose CTUC Phase is equal to 1 because the current CTUC Phase is equal to 2. The first column in the right list-box displays whether or not the utility adjustment belongs to CTUC Phase 2 TxDOT Analysis. Therefore, the assessor does not need to update the reimbursability of the third utility adjustment as shown in Figure 4.8 and 4.9.

- **For Demonstration Purposes**

  Assume the sample project has three utility adjustments as shown in Figure 4.8; the assessor wants to change the reimbursability of "Water Line (Range/Station A-B)" from "Don't know" to "Reimbursable." The essential steps of this section's functions are summarized as follows:

  1) *Assessors can select "Water Line (Range/Station A-B)" in the third block.*
  2) *CTUC DST will show this utility adjustment's information in the second block.*
  3) *Assessors can select "Yes" in Question 2.4. Note that the "Don't know" option has been disabled because assessors have to select either "Yes" or "No" in CTUC Phase 2 Analysis.*
  4) *Assessors can press the "→" button.*

5) *CTUC DST will reflect the change in the third block.*
6) *Assessors can press the "Next Page: Characteristics of This Highway Project" button to save the information and proceed to the next page.*

4.3 Filling Out Project and Utility Questionnaires

This section describes the main activities of CTUC DST. When the assessor has finished setting up the utility adjustments for the project, the assessor can begin to analyze the applicability of CTUC for each utility adjustment. In CTUC Phase 2 TxDOT Analysis, CTUC DST will ask assessors a series of questions, which include project-scope, utility-scope, and contract-related questions. Section 4.3.1 will discuss the project-scope questions. Section 4.3.2 will discuss the utility-scope questions. Section 4.3.3 will discuss the contract-related questions.

4.3.1 Project-Scope Questions

There are five questions in Figure 4.10. Usually the assessor can respond only "Yes," "No," or "Don't know yet" to a question. For Question 2.5, the assessor needs to consider the current project situation regarding schedule pressures and select only one option that can best describe the current circumstance.

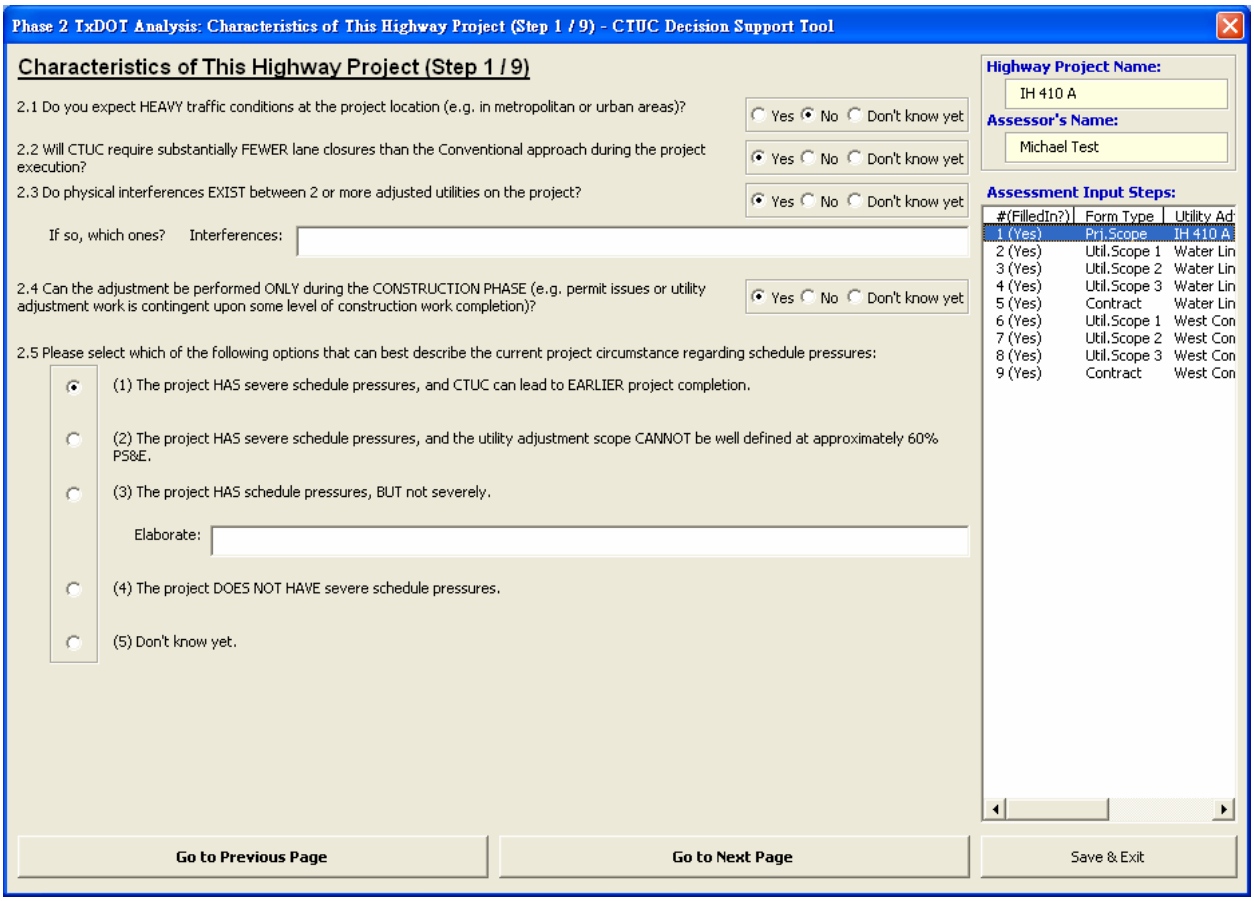

Figure 4.10 Project with Two Utility Adjustments in CTUC Phase 2 TxDOT Analysis

Note that in the right side of Figure 4.10, CTUC DST will show the project name, the assessor's name, and a list-box displaying all pages or steps that will be presented later. Since one project can have many utility adjustments, CTUC DST will prepare only one page regarding all project-scope issues. The analysis results for the project-scope issues will be applied to all utility adjustments within that project.

CTUC DST will show four pages for each utility adjustment in CTUC Phase 2 Analysis. Three pages contain utility-scope issues and the fourth page contains contract-related issues. Therefore, if a project has two utility adjustments in CTUC Phase 2 TxDOT Analysis, nine steps are required for assessors to complete CTUC Phase 2 TxDOT Analysis.

The list-box in the right side of Figure 4.10 can be used as a shortcut to the other page. Traditionally, the assessor can press the "Go to Previous Page" or "Go to Next Page" button several times to go to the desired page. With use of the shortcut, assessors can also double-click the line item of the desired step to visit that page directly. In addition, the list-box also show whether or not the assessor has filled in the page before. If the assessor does not answer any question in a page and press the "Go to Next Page" or "Go to Previous Page" button directly, CTUC DST will presume "Don't know yet" as the answer to all questions in that page.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *Assume the assessor selects the sample project data, which is "IH 410 A" and "Phase 2 Analysis," during the previous pages, so CTUC DST will show two utility adjustments for the project.*
  2) *Assessors can answer these five project-scope questions as shown in Figure 4.10.*
  3) *Assessors can press the "Go to Next Page" to save the information and proceed to the next page.*

4.3.2 Utility-Scope Questions

As shown in Figure 4.11, 4.12, and 4.13, the questions presented here are about the specific utility adjustment, whose name will be displayed in the top of the page. If the subject utility adjustment can have underground facilities that will be shared with other utility owners, Question 3.9 with two sub-questions in Figure 4.11 will show. In other words, if the subject utility adjustment only includes the types of utility adjustment work such as overhead communication lines, overhead distribution power lines, and transmission poles, Question 3.9 will not show. Furthermore, if the assessor answers "No" to Question 3.9, Question 3.9.1 and Question 3.9.2 do not need to display because no shared facilities exist in the utility adjustment.

Figure 4.12 presents Question 3.10 and 3.11 whose appearances are contingent on the certain types of utility adjustment work, e.g. relocating poles. Hence, because the type of utility adjustment work analyzed in Figure 4.12 is to relocate water lines, Question 3.10 and 3.11 will be shown in a gray color and assessors cannot provide answers. Question 3.14 and 3.15 are for analyzing the current condition of hazardous materials (HAZMAT). If the assessor thinks there is no HAZMAT in the site, he or she will select "No" to all of the sub-questions in Question 3.14. CTUC DST will then disable Question 3.15, which means the hypothetical circumstance is not applicable to the utility adjustment.

Note that CTUC DST will highlight the step that the assessor is currently working on in the list-box in the right side of the page. For Question 3.2, 3.6, 3.9.1, 3.10, and 3.24, assessors can enter more than one line of words in these text boxes as comments on the project or utility adjustment.

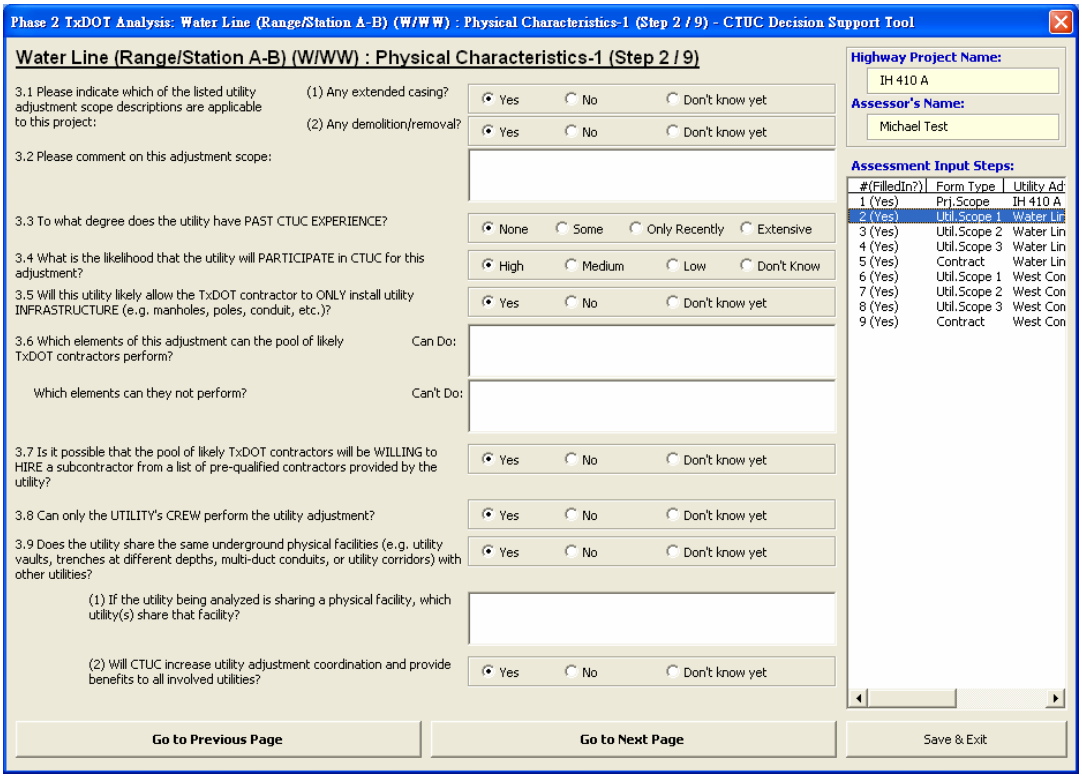

Figure 4.11 Utility-Scope Questions in CTUC Phase 2 TxDOT Analysis: Part 1

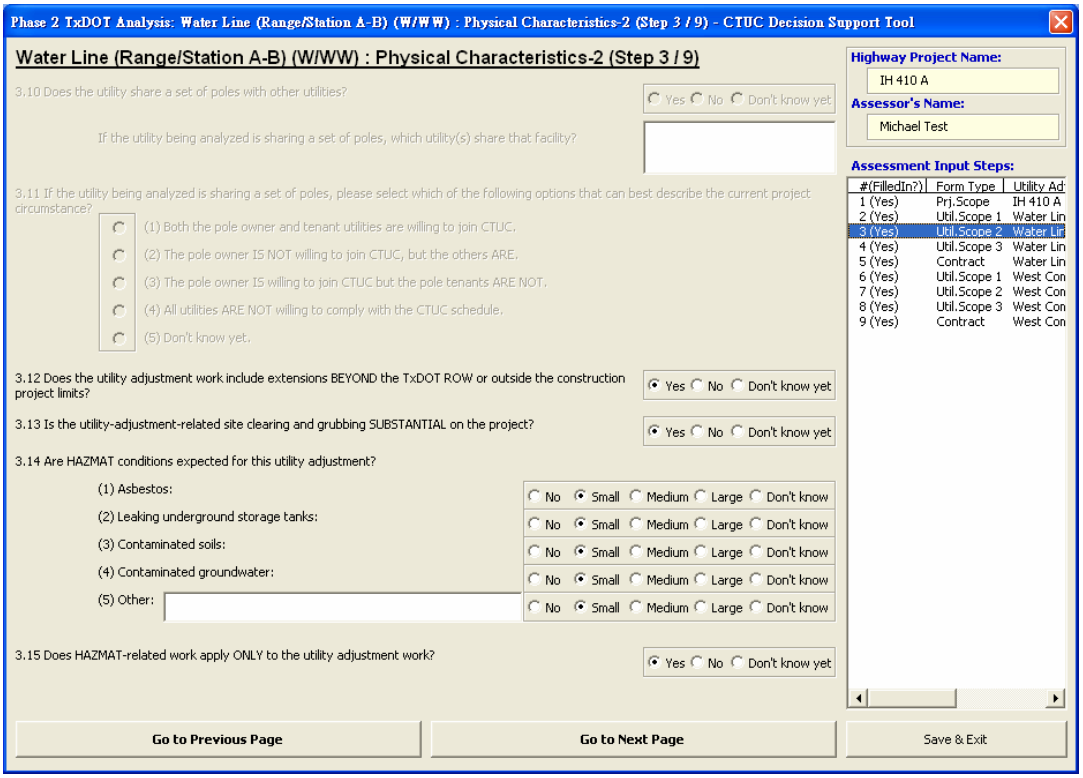

Figure 4.12 Utility-Scope Questions in CTUC Phase 2 TxDOT Analysis: Part 2

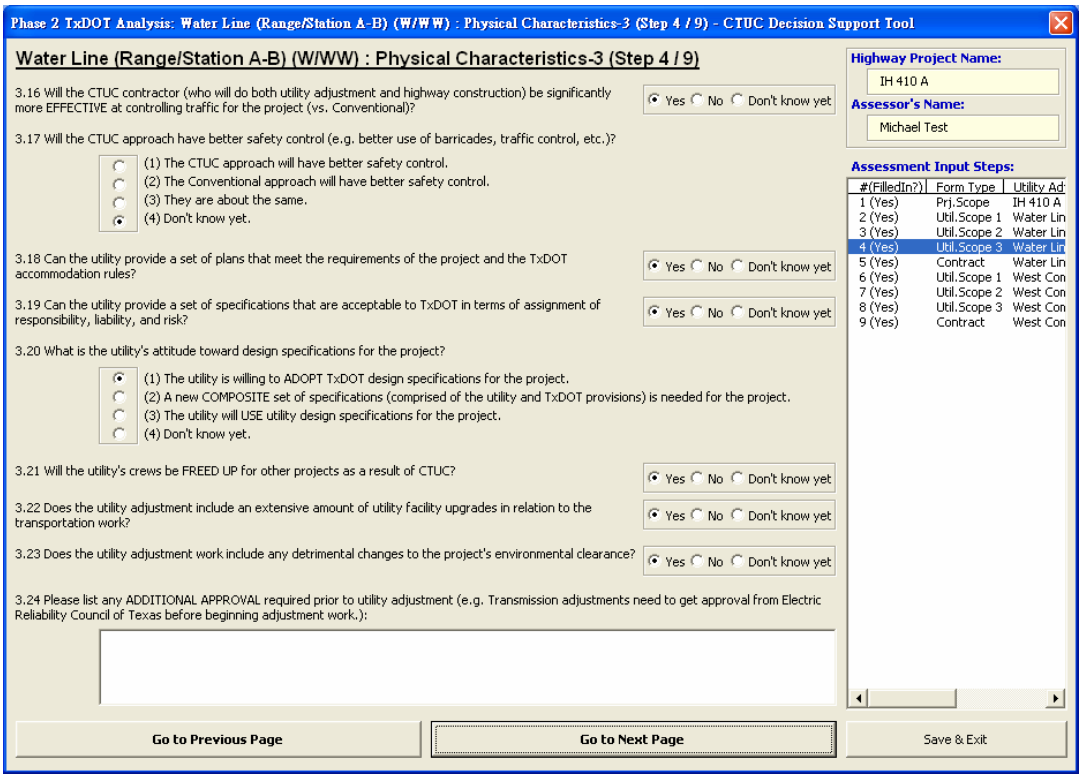

Figure 4.13 Utility-Scope Questions in CTUC Phase 2 TxDOT Analysis: Part 3

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) Assessors can answer these ten questions as shown in Figure 4.11, 4.12 and 4.13.

  2) Assessors can press the "Go to Next Page" to save the information and proceed to the next page.

4.3.3 Contract-Related Questions

As mentioned in Section 4.2.3, the reimbursability of a utility adjustment can be reimbursable or non-reimbursable. Hence, the contract-related questions will be presented in accordance with the type of reimbursability the assessor selects in Section 4.2.3. Figure 4.14 shows contract-related questions for reimbursable utility adjustments; Figure 4.15 shows contract-related questions for non-reimbursable utility adjustments.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) If the utility adjustment is 100% reimbursable, assessors can answer these questions as shown in Figure 4.14.

  2) If the utility adjustment is non-reimbursable, assessors can answer these questions as shown in Figure 4.15.

  3) Assessors can press the "Go to Next Page" to save the information and proceed to the next page.

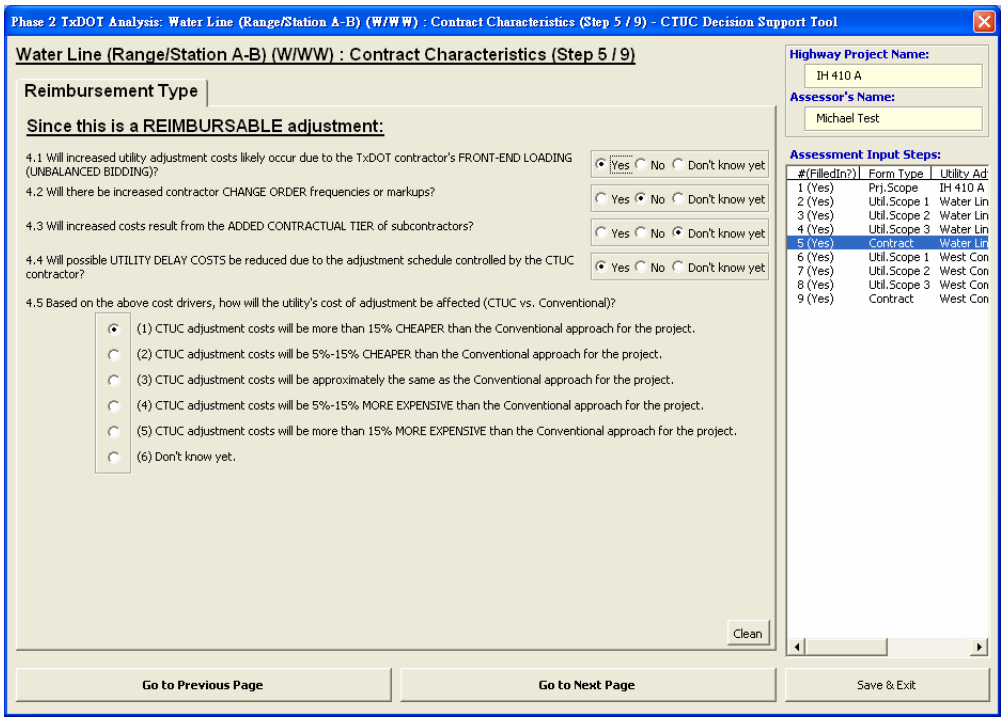

Figure 4.14 Contract-Related Questions for Reimbursable Adjustment

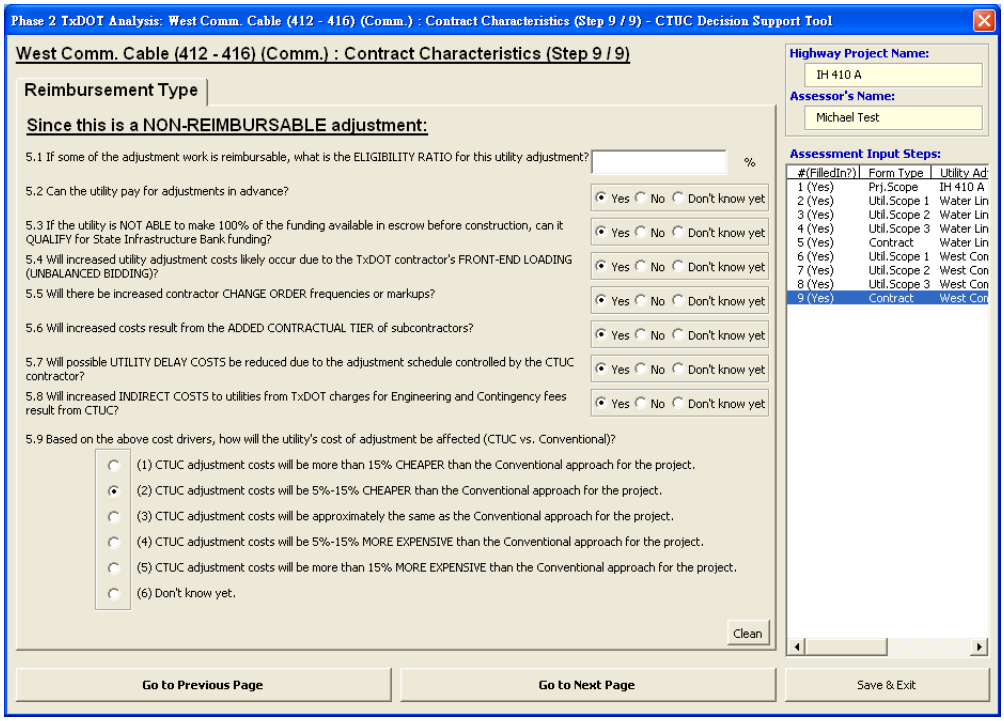

Figure 4.15 Contract-Related Questions for Non-Reimbursable Adjustment

4.4 Reviewing Each Utility Responding Status

CTUC DST can compare the TxDOT assessor's analysis results with the utility assessor's and generate comparison reports so that CTUC decision-makers from both parties can review their experts' opinions jointly. Generating comparison reports require that the utility assessors finish their analyses; hence, the TxDOT assessor should review their responding status and select the appropriate utility analysis record to be used in the comparison reports.

When the TxDOT assessor has finished answering all questions in the previous section, he or she will see the form as shown in Figure 4.16. There are three blocks in the form. The first block labeled "1. Highway Project Information" shows the highway and TxDOT assessor information." The second block labeled "2. Utility Adjustments Involved in CTUC Phase 2 Analysis" displays all utility adjustments involved in CTUC Phase 2 Analysis. Three columns are displayed in this block, and the TxDOT assessor can select any one of the line items in this block to retrieve all utility assessors' analysis records pertaining to this utility adjustment as shown in Figure 4.17.

The TxDOT assessor can then select one of the utility analysis records in the third block labeled "3. Utility Adjustment Information" as shown in Figure 4.18." If the selected utility analysis record contains the complete set of answers to all utility questions, also shown in the fourth block labeled "4. Questionnaire Responding Status," CTUC DST will be able to generate the comparison reports, which will be described in Section 4.5 and 4.6.

TxDOT assessors can press the "Generate TxDOT Report" button at any time to review the graphical report, followed by the text report, for displaying all decision drivers of CTUC Phase 2 TxDOT Analysis. The steps to manipulate the reports and the report layouts are the same as TxDOT Phase 1 Analysis, which were described in Section 2.5 and 2.6.

In addition, only when the TxDOT assessor has selected one of the utility analysis records completed by the utility assessor are the "Generate Utility Report" and "Compare Two Parties' Opinions" buttons enabled. In other words, the TxDOT assessor can review the TxDOT-only reports, utility-only reports, or the comparison reports as long as the appropriate analysis record is selected.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *If the TxDOT assessor wants to review the TxDOT-only reports, he or she can press the "Generate TxDOT Report" button. CTUC DST will ask the TxDOT assessor to select one of the utility adjustments involved in CTUC Phase 2 Analysis and the knowledge base source as described in Section 2.5.1.*
  2) *TxDOT Assessors can select the first line item in the second block in Figure 4.16.*
  3) *In Figure 4.17, CTUC DST will show only one analysis record pertaining to this utility adjustment.*
  4) *In Figure 4.18, TxDOT assessors can select this utility analysis record so that CTUC DST will show its responding status in the fourth block.*
  5) *TxDOT assessors can press the "Generate Utility Report" button to review the selected utility analysis record from utility experts' perspectives as described in Section 3.4 and 3.5.*
  6) *TxDOT assessors can press the "Compare Two Parties' Opinions" button as described in the next two sections.*

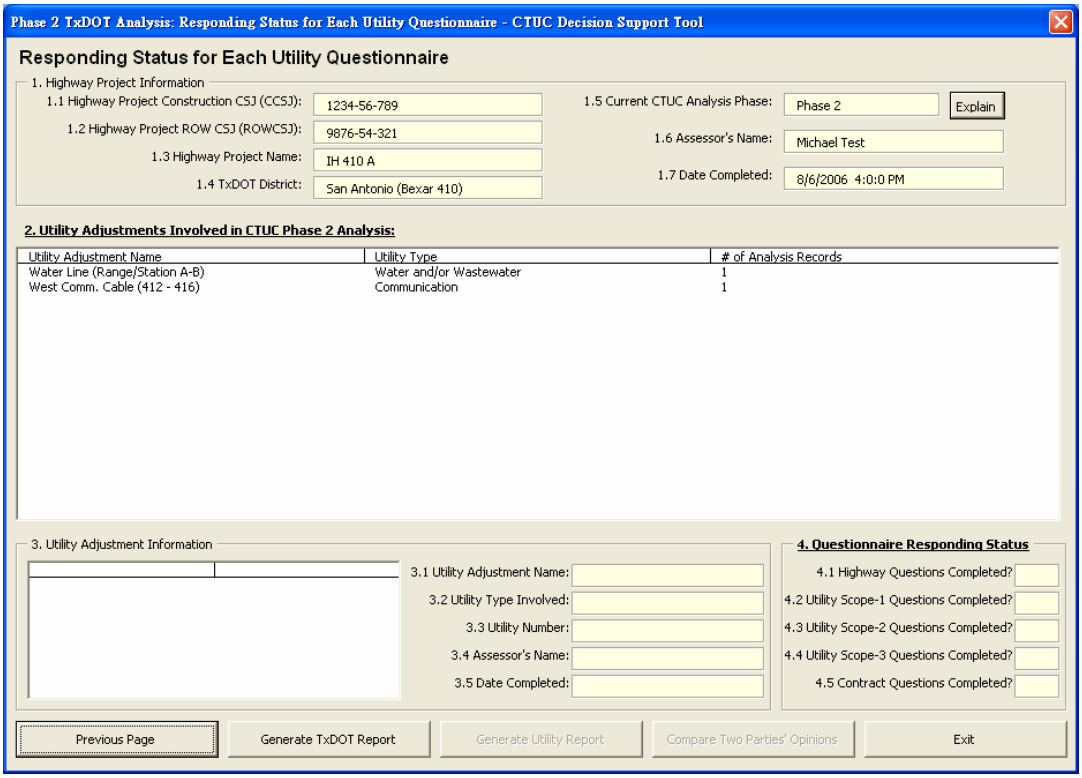

Figure 4.16 Initial Form of Responding Status for Each Utility Assessor

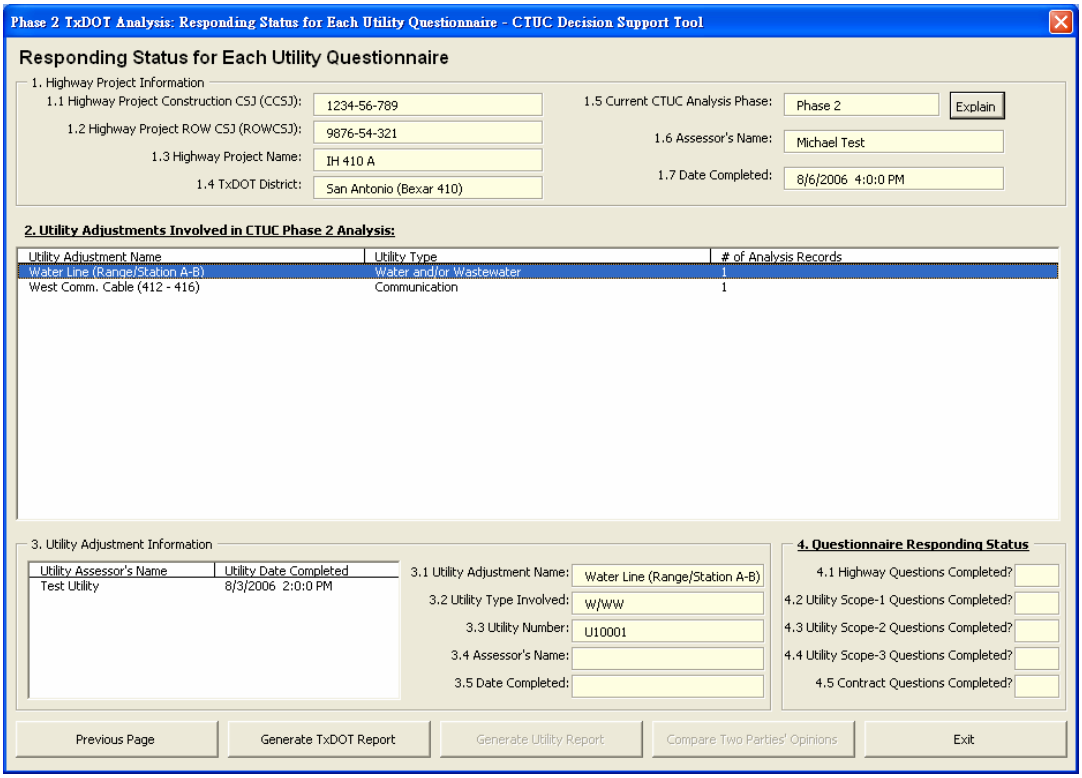

Figure 4.17 Selecting One Utility Adjustment to Show Its Utility Analysis Records

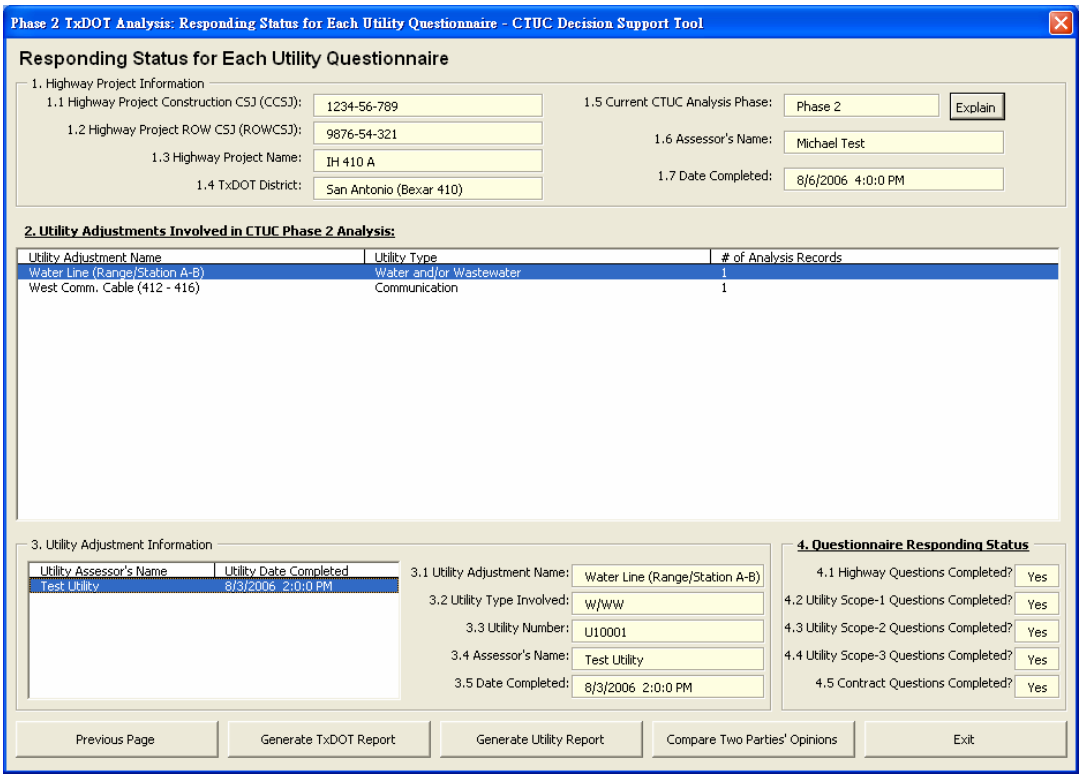

Figure 4.18 Selecting One Utility Analysis Record to Show Its Responding Status

4.5 Reviewing Top Six CTUC Decision Drivers

CTUC DST has two different types of comparison reports. One is the graphical comparison report and the other is the text comparison report. After both parties' assessors has answered all questions, CTUC DST is thus able to generate the comparison reports in order to demonstrate the experts' opinions with regard to the applicability of the CTUC approach for each utility adjustment. This section focuses on how to generate the graphical comparison report of the analysis results while Section 4.6 will describe the production of the detailed text comparison report for each utility adjustment.

4.5.1 Report Setting for CTUC Phase 2 Analysis

There are three portions of questions for report setting of CTUC Phase 2 Analysis as shown in Figure 4.19. The first portion is to select the knowledge base source for interpreting TxDOT analysis results, while the second portion is for interpreting utility analysis results. The third portion is to specify the party whose impact levels will serve as the ranking criterion.

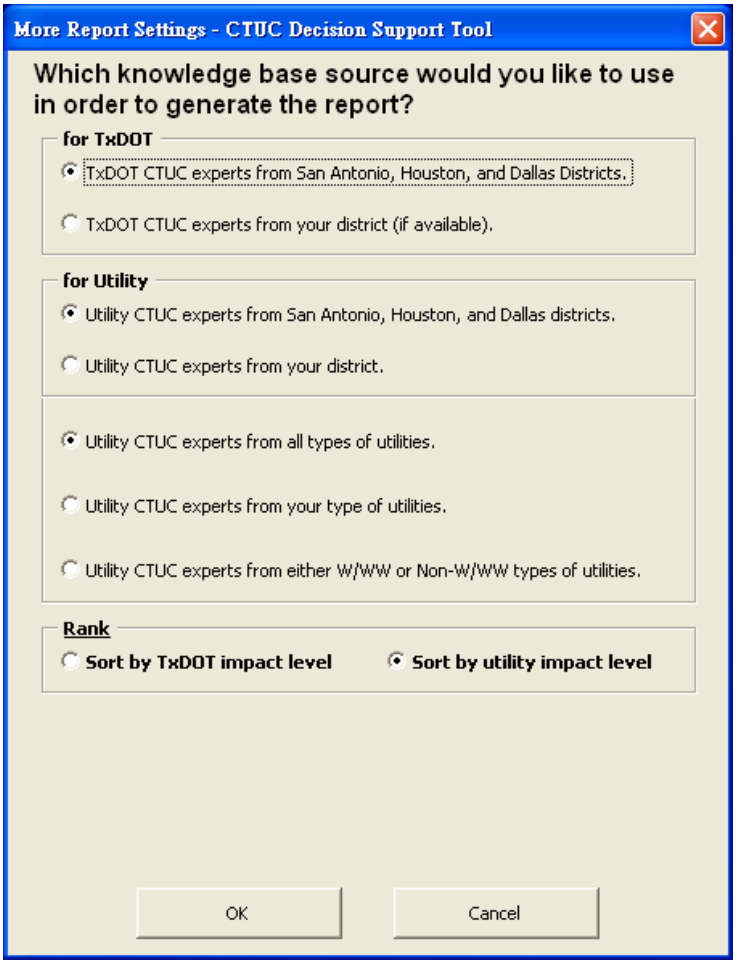

Figure 4.19 Report Setting for CTUC Phase 2 Analysis

Since the report compares both parties' analysis results, the TxDOT assessor is responsible for specifying the appropriate knowledge base sources of both parties. In the first portion titled "for TxDOT," the TxDOT assessor needs only to specify the scope of the knowledge base source, which could be either one district or the three districts combined as described in Section 2.5.1.

In the second portion, since the comparison reports in CTUC DST are dedicated to explanation of the applicability of CTUC for one utility adjustment, which was determined in the previous section, the TxDOT assessor may want to review opinions from utility experts in their district only or from all Texas utility experts whose opinions have been collected and stored in CTUC DST. Presently, the knowledge base of CTUC DST includes opinions of utility experts who had attended the CTUC decision drivers assessment workshops in San Antonio, Houston, and Dallas districts. Hence, if the TxDOT assessor is from one of the three districts, he or she can select the knowledge base source with either three districts combined or just one district. However, if the TxDOT assessor is not from one of the three districts, CTUC DST will use the default value, which is the knowledge base source with the three districts combined, regardless of the TxDOT assessor's choice.

In the next question, the TxDOT assessor may want to review the opinions from the subject utility adjustment's type of experts only. In some situations, the TxDOT assessor may want to review the opinions from all types of utility experts so that he or she can get a general idea regarding a specific issue. In addition, since most past CTUC projects belong to the water and wastewater type of utilities, if the TxDOT assessor would like to know the general idea from the utility companies who occasionally apply the CTUC approach before, the TxDOT assessor can select the third option in this question, which is "utility CTUC experts from either W/WW or Non-W/WW types of utilities."

In the third portion, the TxDOT assessor needs to indicate either TxDOT or utility impact levels to be used as the ranking criterion. Figure 4.20 shows the results if utility impact levels are chosen as the ranking criterion, which means each utility decision driver will be sorted by its impact level and the corresponding TxDOT decision driver will be displayed below the utility decision driver. Figure 4.21 shows the results if TxDOT impact levels are chosen as the ranking criterion.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *TxDOT assessors can select the option entitled "TxDOT CTUC experts from San Antonio, Houston, and Dallas districts." in Figure 4.19.*
  2) *TxDOT assessors can select the option entitled "Utility CTUC experts from San Antonio, Houston, and Dallas districts." in Figure 4.19.*
  3) *TxDOT assessors can select the option entitled "Utility CTUC experts from all types of utilities." in Figure 4.19.*
  4) *TxDOT assessors can select the option entitled "Sort by utility impact level" In Figure 4.19.*
  5) *TxDOT assessors can press the "OK" button to see the graphical comparison report.*

4.5.2 Graphical Comparison Report of CTUC Phase 2 Analysis

Figure 4.20 shows the graphical comparison report. There are six major areas in this report, which are: 1) Report Title, 2) Report Info., 3) Control Panel, 4) Top 6/6 Decision Drivers, 5) Level of Pro-CTUC, 6) Level of Anti-CTUC. The following paragraphs will describe each area in more detail.

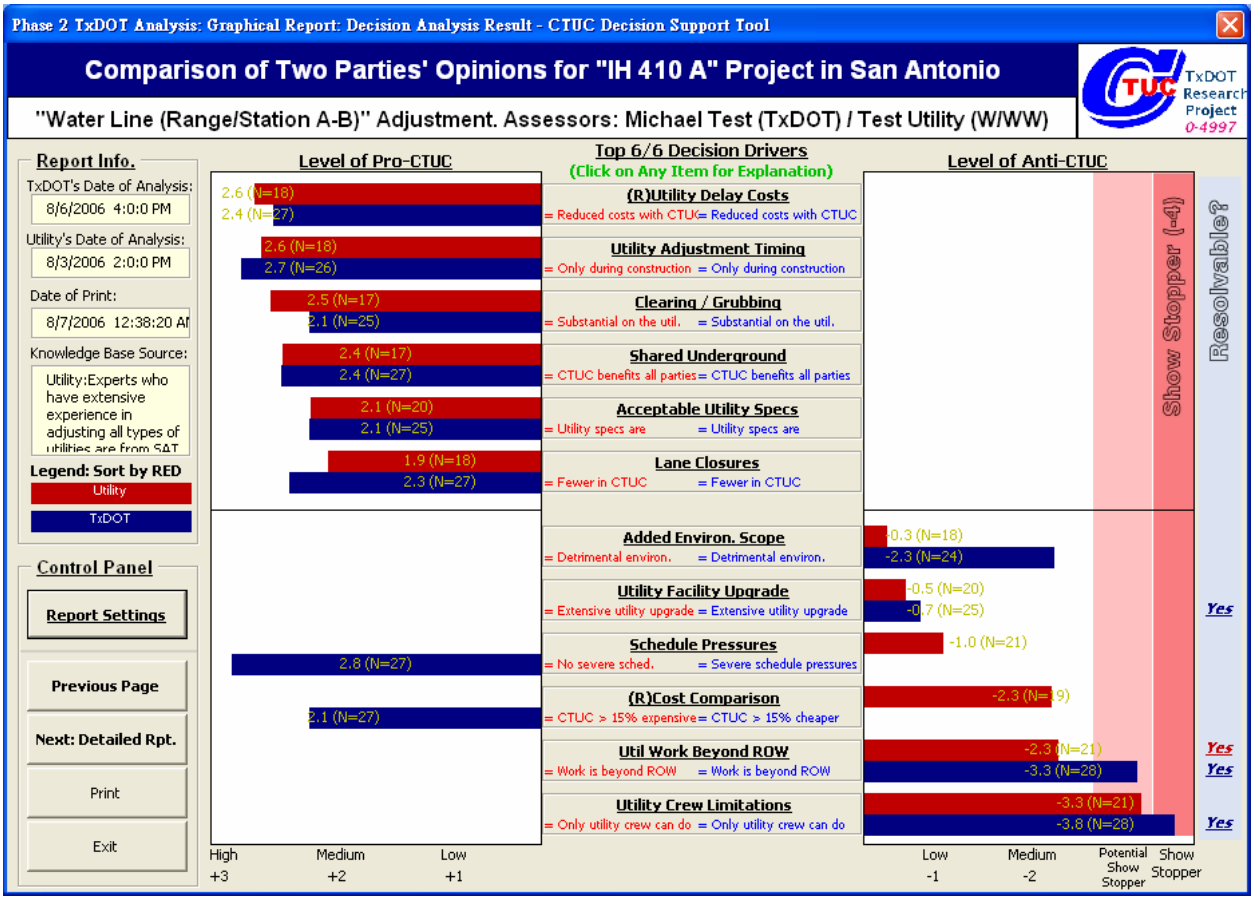

Figure 4.20 Graphical Comparison Report of the Analysis Results: Utility-First Perspective

1. **Report Title (in the top of the report)**
   CTUC DST will show the project name and district information in the first line of the report title. The name of the utility adjustment and the abbreviation of the utility type involved, as well as the assessors' names of both parties will be shown in the second line of the report title.
2. **Report Info. (in the upper left side of the report)**
   CTUC DST will show the analysis dates of both parties and the print date. In the field named "Knowledge Base Source," CTUC DST will show the knowledge base sources of both parties the TxDOT assessor selected in Section 4.5.1. Finally, the color used to represent the party will be shown in the field named "Legend." For example, Figure 4.20 uses "RED" to represent utility analysis results and "BLUE" to represent TxDOT analysis results, while Figure 4.21 uses "RED" to represent TxDOT analysis results and "BLUE" to represent utility analysis results. Note that CTUC DST always uses "RED" to represent the primary party whose impact levels serve as the ranking criterion.

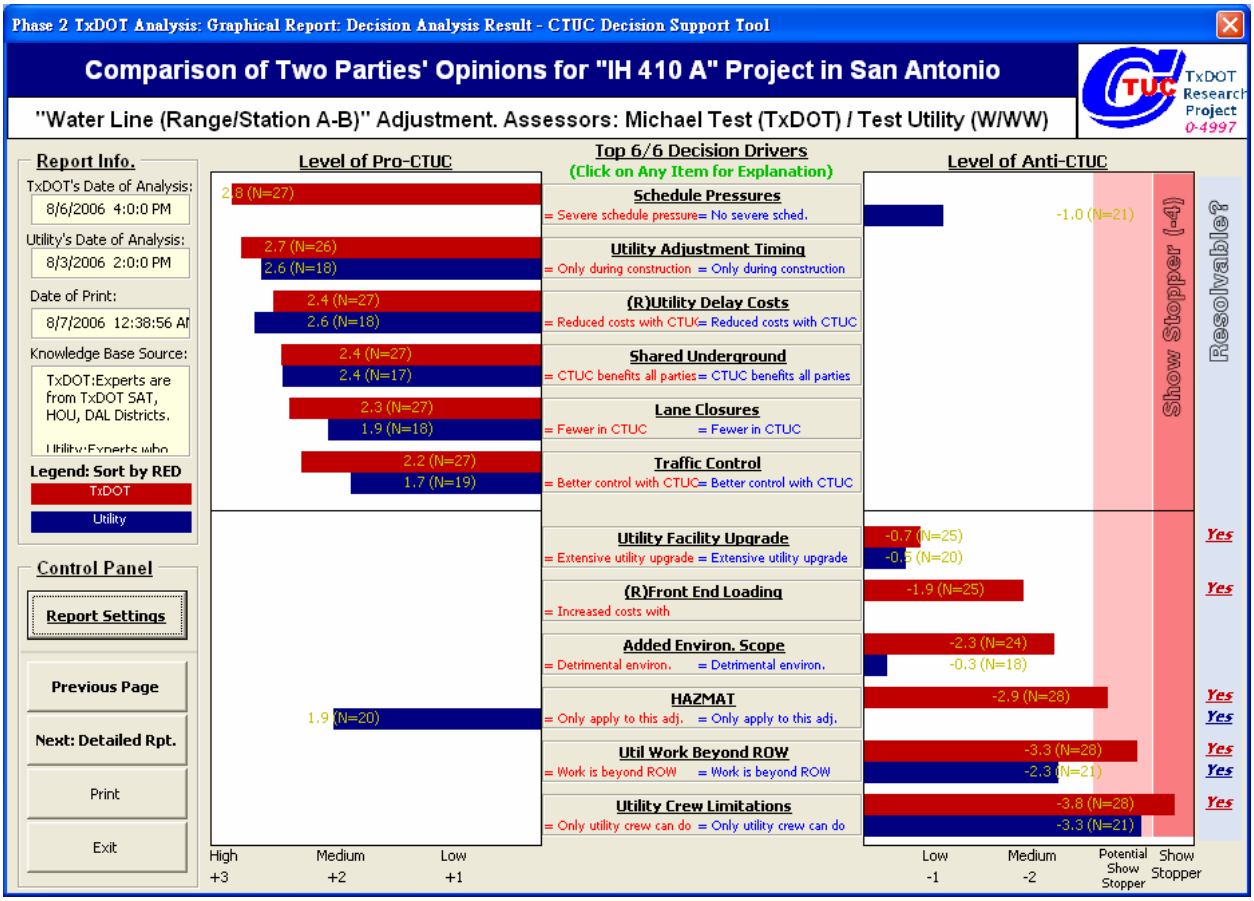

Figure 4.21 Graphical Comparison Report of the Analysis Results: TxDOT-First Perspective

3. Control Panel (in the lower left side of the report)

Five buttons are provided in this area. The button labeled "Report Setting" will invoke the report setting form as shown in Figure 4.19. The button labeled "Previous Page" will trigger the utility responding status form mentioned in Section 4.4. The button labeled "Next: Detailed Rpt." will invoke the text comparison report discussed in the next section. The button labeled "Print" will prompt the active printer name and print the current page. The button labeled "Exit" will save all data and close CTUC DST.

4. Top 6/6 Decision Drivers (in the middle column of the report)

This area lists 12 decision drives that will most influence the CTUC decision either in a positive or negative way. Each decision driver is enclosed by a gray box with underline and correlates with one question for both parties. The abbreviated description of the circumstance answered by one party assessor is shown below the decision driver, followed by the other party's circumstance for the same question. The TxDOT assessor can click any box in this area to get more explanation as shown in Figure 4.22. For example, the first Pro-CTUC decision driver is "Schedule Pressures" from TxDOT-first perspective as shown in Figure 4.21, and the circumstance answered by the TxDOT assessor is "Severe schedule pressure" while the circumstance answered by the utility assessor is "No severe schedule." If the TxDOT assessor might wonder why CTUC DST shows such the result, he or she can click the

box of “Schedule Pressures” to show the detailed explanation as shown in Figure 4.22, which displays the original question and the two answers to the question from both parties.

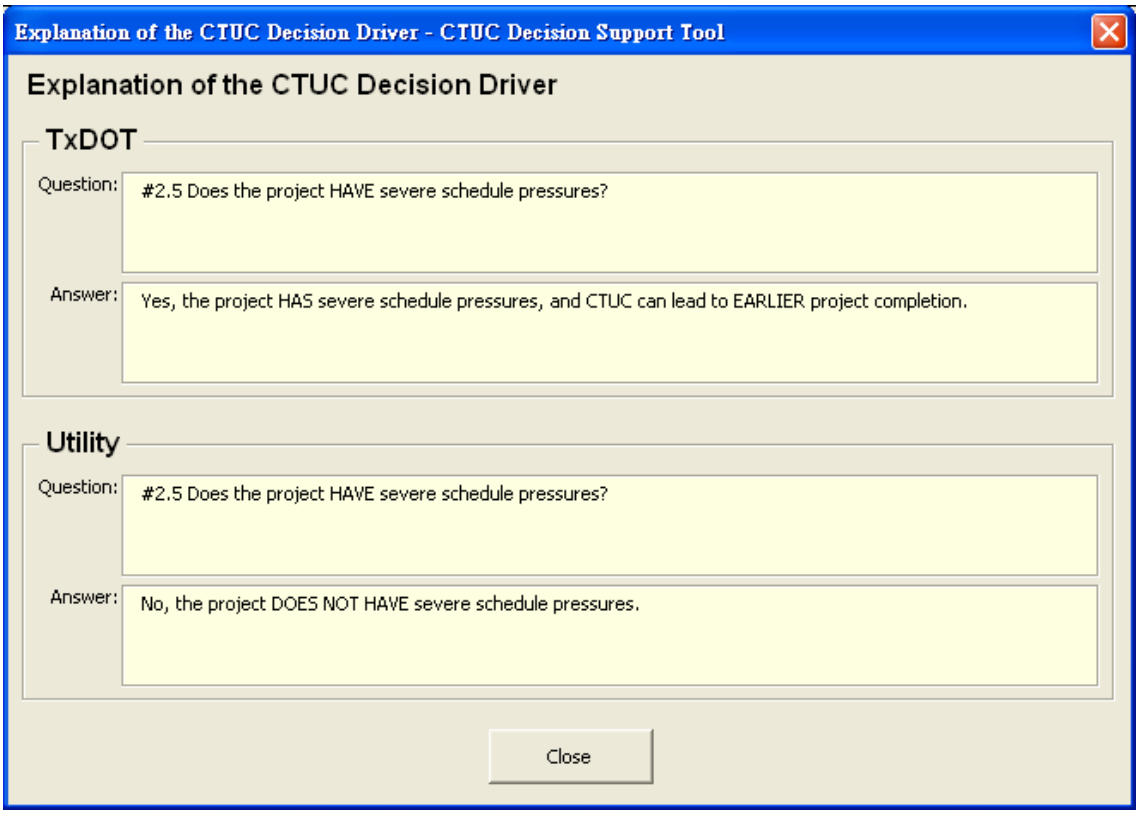

Figure 4.22 Short Explanation of the CTUC Decision Driver for Both Parties

5. Level of Pro-CTUC (in the second left column of the report)

The level of Pro-CTUC for each decision driver is derived from the average opinion of the experts concerning the give project circumstance listed in the middle of the form. Basically, in order to develop the knowledge base, these experts have been asked to use “High Impact,” “Medium Impact,” “Low Impact,” or “No Impact” to assess the given project circumstance’s impact level on the CTUC decision. Furthermore, CTUC DST uses “3” to represent “High Impact,” “2” to represent “Medium Impact,” “1” to represent “Low Impact,” and “0” to represent “No Impact” as shown in the bottom line of the form. Therefore, a project circumstance with a lengthy Pro-CTUC bar means almost all experts think the current situation will influence the CTUC decision in a positive way. Note that the level of Pro-CTUC is primarily determined by the *experts*, *not* by the *assessor*. However, the TxDOT assessor can decide the group of experts to be used as the knowledge base source. If the TxDOT assessor selects the combination of San Antonio, Houston, and Dallas districts as the knowledge base source, the total number of TxDOT experts should be 28 (N=28) while the total number of utility experts should be 24 (N=24) in current CTUC DST. For example, the TxDOT impact level of the top Pro-CTUC decision driver is “+2.8 (N=27)” as shown in Figure 4.21, which means most of the twenty seven TxDOT experts think the given project circumstance is Pro-

CTUC and has "High Impact" on the CTUC decision. Experts who select "Don't Know" for the project circumstance will be excluded from the impact level calculation.

6. Level of Anti-CTUC (in the right column of the report)

The format of the level of Anti-CTUC for each decision driver is similar to that of the level of Pro-CTUC. Basically, CTUC DST uses "-4" to represent "Show Stopper," "-3" to represent "High Impact," "-2" to represent "Medium Impact," "-1" to represent "Low Impact," and "0" to represent "No Impact" as shown in the bottom line of the form. Therefore, a project circumstance with a lengthy Anti-CTUC bar means almost all experts think the current situation will influence the CTUC decision in a negative way. The last blue column represents the resolvability of each decision driver. Since the experts have been asked to assess whether or not process changes could facilitate the use of CTUC, CTUC DST is able to show the resolvability results by displaying "Yes" for such project circumstances identified by the experts.

- **For Demonstration Purposes**

  The essential steps of this section's functions are summarized as follows:

  1) *After TxDOT assessors have finished configuring the comparison report setting, they will se the graphical comparison report as shown in Figure 4.20 or 4.21.*
  2) *TxDOT assessors can click the top decision driver box to access the dialog box in Figure 4.22, which is the most Pro-CTUC decision driver from TxDOT's perspective.*

4.6 Reviewing the Text Comparison Report of the CTUC Decision

Because the graphical comparison report can show only the top six Pro-CTUC or Anti-CTUC decision drivers, the text comparison report described in this section is designed to supplement other important opinions regarding the CTUC applicability of the given utility adjustment. For example, some questions described in Section 4.3 are currently unknown to the assessor but have significant impact levels on the CTUC decision from experts' perspectives. Hence, the text comparison report will list all impact level types of CTUC decision drivers in order for the TxDOT assessor to comprehend the CTUC applicability of the given utility adjustment and to learn lessons from experts.

4.6.1 Text Comparison Report of CTUC Phase 2 Analysis

Figure 4.23 shows the text comparison report of CTUC Phase 2 Analysis for the sample utility adjustment. The layout of this report is similar to the graphical one; therefore, only the portions that vary between the two reports are described:

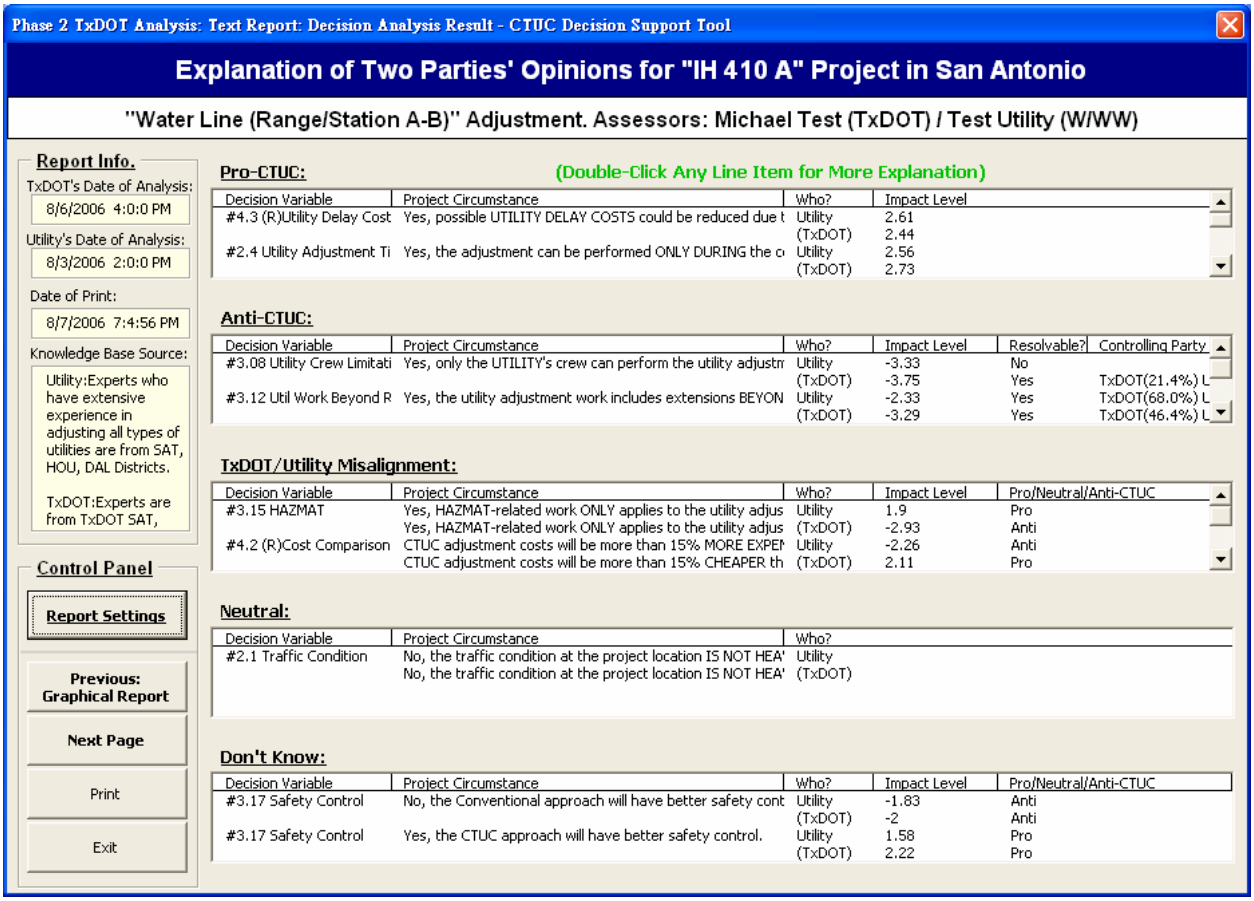

Figure 4.23 Text Comparison Report of the Analysis Results: Utility-First Perspective

1. Pro-CTUC (in the first list-box)

This table has four columns described as follows: 1) Decision Variable: manifests the name of each Pro-CTUC decision driver; 2) Project Circumstance: manifests the current project circumstance specified by the assessor; 3) Who?: manifests the party who performed the analysis; 4) Impact Level: manifests the numerical impact level assessed by the experts for the project circumstance. Note that this table lists only the circumstances analyzed by both parties with positive impact levels. The table will not include: 1) one party's impact level is positive while the other party's is negative, or vice versa; 2) the two parties select different project circumstances for the same question. Additionally, the selected party's Pro-CTUC decision drivers are ranked according to their impact levels, followed by the other party's Pro-CTUC decision driver. The TxDOT assessor can double-click any line item to show the detailed experts' opinions as shown in Figure 4.25.

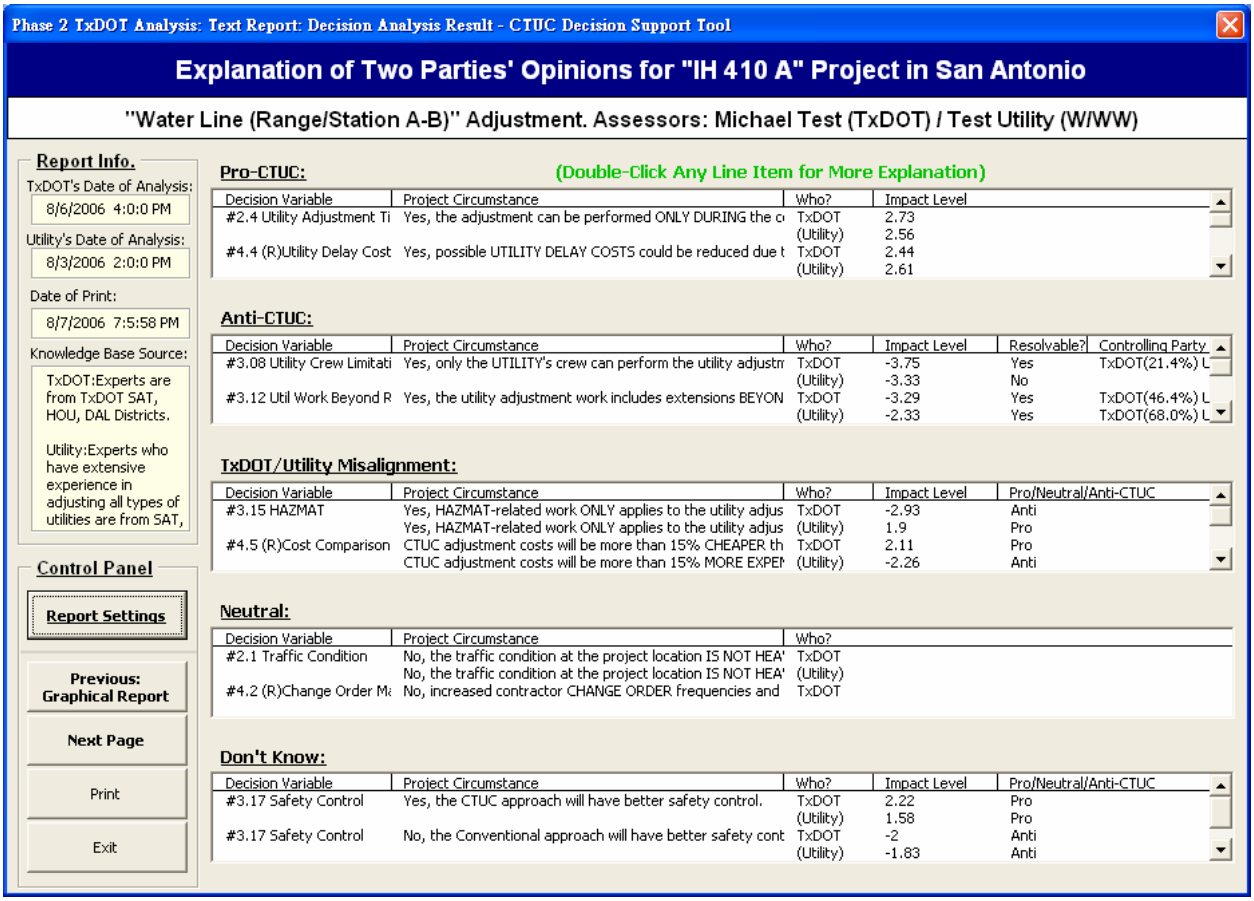

Figure 4.24 Text Comparison Report of the Analysis Results: TxDOT-First Perspective

2. Anti-CTUC (in the second list-box)

This table has six columns described as follows: 1) Decision Variable: shows the name of each Anti-CTUC decision driver; 2) Project Circumstance: shows the current project circumstance specified by the assessor; 3) Who?: manifests the party who performed the analysis; 4) Impact Level: shows the numerical impact level assessed by the experts for the project circumstance; 5) Resolvable?: shows whether or not the project circumstance could be resolved to facilitate CTUC by any process change from experts' views; 6) Controlling Party: shows what percentage of each controlling party is responsible for such process changes. Note that this table lists only the circumstances analyzed by both parties with negative impact levels. The table will not include: 1) one party's impact level is negative while the other party's is positive, or vice versa; 2) the two parties select different project circumstances for the same question. Additionally, the selected party's Anti-CTUC decision drivers are ranked according to their impact levels, followed by the other party's Anti-CTUC decision driver. The TxDOT assessor can double-click any line item to show the detailed experts' opinions as shown in Figure 4.25.

3. TxDOT / Utility Misalignment (in the third list-box)

This table has five columns described as follows: 1) Decision Variable: shows the name of each misalignment decision driver, which means both parties selected two different circumstances as the answers to the same question; 2) Project Circumstance: shows the

current project circumstance specified by the assessor; 3) Who?: manifests the party who performed the analysis; 4) Impact Level: shows the numerical impact level assessed by the experts for the project circumstance; 5) Pro/Neutral/Anti-CTUC: shows "Pro" if the impact level is positive, "Anti" if the impact level is negative, and "Neutral" if the impact level is zero. Note that this table lists: 1) one party's impact level is negative while the other party's is positive, or vice versa; 2) both parties select different project circumstances for the same question. Additionally, this table will sort these decision drivers by the difference between the decision driver's two impact levels. The TxDOT assessor can double-click any line item to show the detailed experts' opinions as shown in Figure 4.25.

4. Neutral (in the fourth list-box)

This table has three columns described as follows: 1) Decision Variable: shows the name of each Neutral decision driver, which by definition will not influence the CTUC decision; 2) Project Circumstance: shows the current project circumstance specified by the assessor; 3) Who?: manifests the party who performed the analysis. Note that the selected party's Neutral decision drivers are ranked according to their original question numbers, followed by the other party's Neutral decision driver. These Neutral decision drivers can help decision-makers make the CTUC problem simper by eliminating unnecessary factors. The TxDOT assessor can double-click any line item to show the detailed experts' opinions as shown in Figure 4.25.

5. Don't Know (in the fifth list-box)

This table has five columns described as follows: 1) Decision Variable: shows the name of each decision driver which corresponds to a question unknown to the assessor; 2) Project Circumstance: shows one of the possible answer to this unknown question; 3) Who?: manifests the party who performed the analysis; 4) Impact Level: shows the numerical impact level assessed by the experts for the project circumstance; 5) Pro/Neutral/Anti-CTUC: shows "Pro" if the impact level is positive, "Anti" if the impact level is negative, and "Neutral" if the impact level is zero. The selected party's "Don't Know" decision drivers are ranked according to their absolute values of the impact levels, followed by the other party's "Don't Know" decision driver. The TxDOT assessor can double-click any line item to show the detailed experts' opinions as shown in Figure 4.25.

- **For Demonstration Purposes**

The essential steps of this section's functions are summarized as follows:

1) *After TxDOT assessors have reviewed the graphical comparison report, they can press the "Next: Detailed Rpt." button to show the text comparison report as shown in Figure 4.23.*
2) *TxDOT assessors can press the "Report Settings" button in order to use TxDOT impact levels as the ranking criterion.*
3) *As shown in Figure 4.19, TxDOT assessors can select the option entitled "Sort by TxDOT impact level" and press the "OK" button.*
4) *TxDOT assessors can review the new report as shown in Figure 4.24. They can also double-click the first line item in "Pro-CTUC" to show the dialog box of Figure 4.25.*
5) *TxDOT assessors can double-click the first line item in "Anti-CTUC" to show the dialog box of Figure 4.26.*

4.6.2 Review of Detailed Experts' Opinions

If TxDOT assessors double-click any line item in any of the list-boxes in Figure 4.23 or 4.24, CTUC DST will display the dialog box containing detailed experts' opinions as shown in Figure 4.25 or 4.26. There are three blocks in this form. The first block, titled "Review of Project Circumstance," shows the question and answer for the decision driver and project circumstance respectively. For some project circumstances, CTUC DST will also show the suggestion from experts.

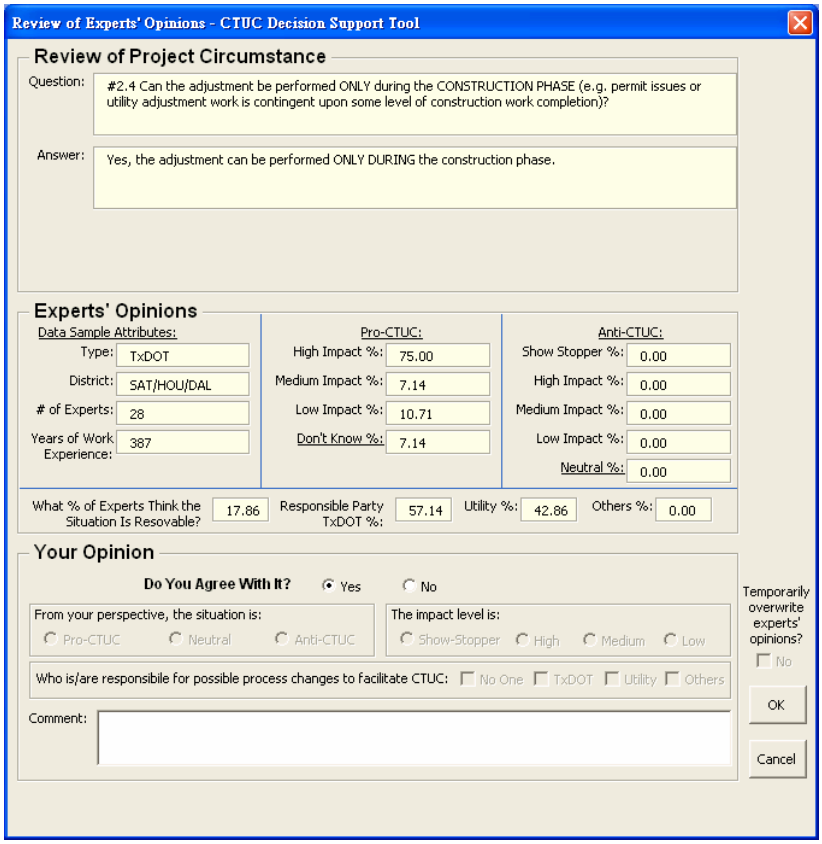

Figure 4.25 Detailed Explanation of the CTUC Decision Driver: Without Any Change

The second block, titled "Experts' Opinions," will list basic attributes of the expert group and show distribution of the experts' opinions for impact level and resolvability. For example, as shown in Figure 4.25, TxDOT assessors can realize that two (28*7.14%=2) of the 28 experts can not judge the impact level, i.e., select "Don't Know," on CTUC based on the given project circumstance. Five (28*17.86%=5) of the 28 experts thought the given project circumstance could be resolved to facilitate CTUC, and approximately one-half of the five experts thought TxDOT is responsible for process changes.

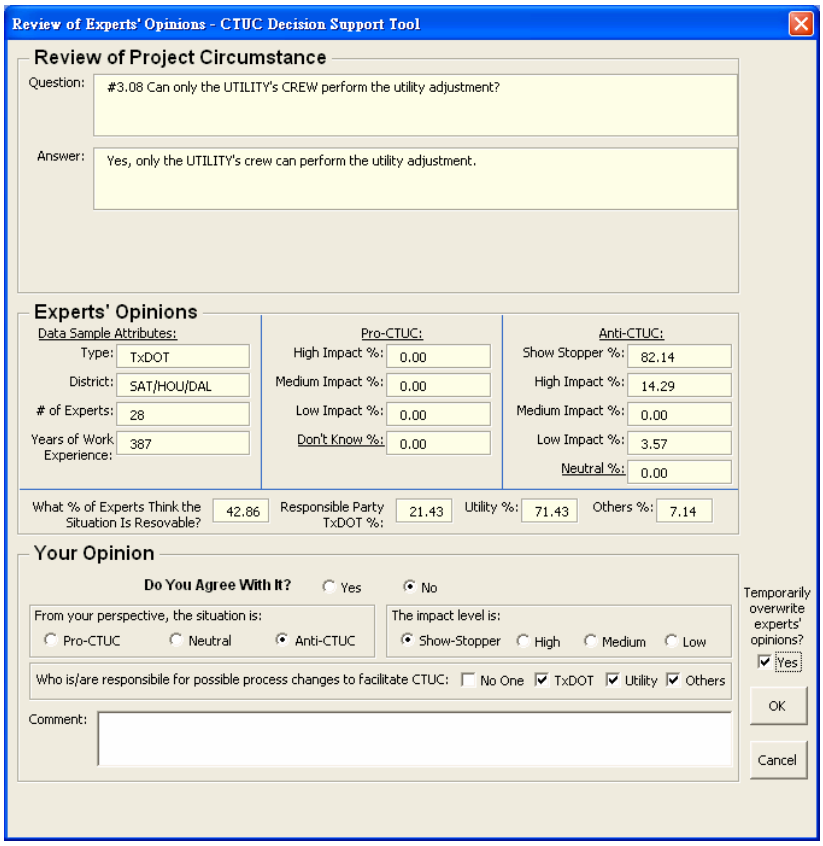

Figure 4.26 Detailed Explanation of the CTUC Decision Driver: With Changes

The third block labeled "Your Opinion" provides a place to enter the TxDOT assessor's own opinion. Figure 4.25 demonstrates the case where the TxDOT assessor agrees with the experts' opinions; hence, the TxDOT assessor cannot select any option or enter any comment in this block. The "OK" button and the "Cancel" button provide the same function, which is to close the dialog box without modifying any data. Note that if the TxDOT assessor has double-clicked the decision drivers that are "Don't Know" or originally "Neutral," the TxDOT assessor cannot select "No" as the answer to "Do You Agree with It?"

Figure 4.26 is the case where the TxDOT assessor does not agree with the experts' opinions. The TxDOT assessor can then answer the three assessment questions and enter some comments in the bottom text box. Finally, if the TxDOT assessor wants to temporarily overwrite the experts' opinions, which means the impact level associated with this project circumstance will be changed, he or she can check the box labeled "Temporarily overwrite experts' opinions?". In this case, the TxDOT assessor will see the change of this impact level in both the graphical and text comparison report. Note that the knowledge base source is still unaltered. The TxDOT assessor can use the following steps to get back the original experts' opinions: 1) the TxDOT assessor can select another group as the knowledge base source; 2) CTUC DST can generate a new report in order to overwrite current opinions; 3) the TxDOT assessor can then select the original expert group as the knowledge base source; 4) CTUC DST can thus generate the original report.

If the TxDOT assessor gives his or her own comments without checking the box labeled "Temporarily overwrite experts' opinions?", both experts' opinions and the TxDOT assessor's

comments will be stored in CTUC DST, and the TxDOT assessor's opinion can be retrieved later in order to retrospect to project situations.

4.7 End of CTUC Phase 2 Analysis

When the TxDOT assessor has reviewed both the graphical and text comparison reports, the CTUC Phase 2 Analysis for the subject utility adjustment is complete. Hence, the TxDOT assessor can print all analysis results, just close the tool, or visit previous pages in order to analyze additional utility adjustments. Figure 4.27 shows the form that presents those options. Figure 4.28 shows a portion of the final report for the utility adjustment.

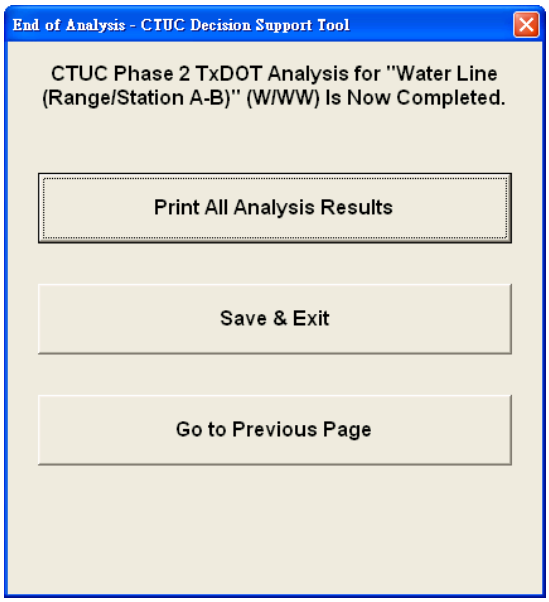

Figure 4.27 End of CTUC Phase 2 Analysis

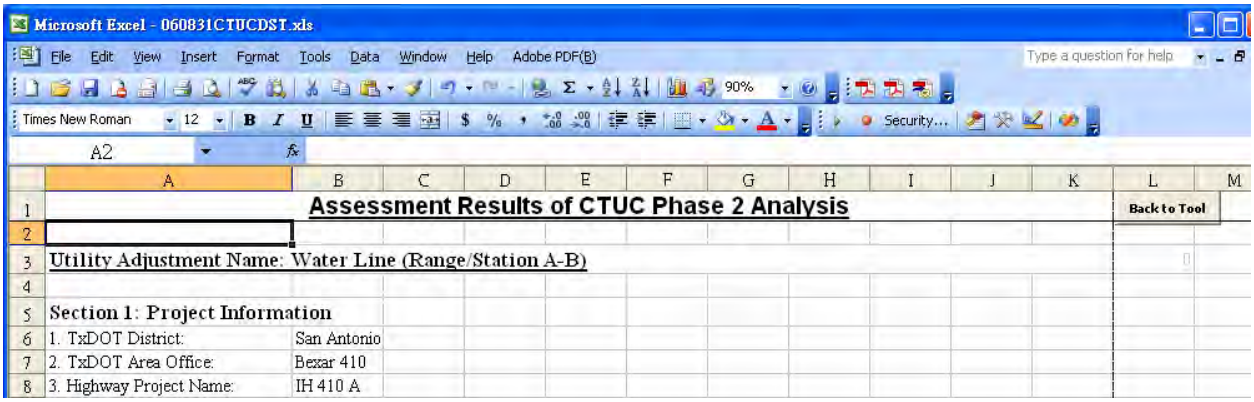

Figure 4.28 Excel Worksheet for CTUC Phase 2 Analysis Final Report

When the TxDOT assessor presses the "Print All Analysis Results" button in Figure 4.27, CTUC DST will display an Excel worksheet to list the CTUC analysis results. The TxDOT assessor can print or print-preview this preformatted worksheet just like a normal Excel

worksheet. The TxDOT assessor can also go back to CTUC DST by pressing the “Back to Tool” button in the top row in the worksheet as Figure 4.28 shows.

- **For Demonstration Purposes**

  The essential steps of this section’s functions are summarized as follows:

  1) *After TxDOT assessors have reviewed the text comparison report, they can press the “Go to Next Page” in Figure 4.23 or 4.24 to complete CTUC Phase 2 Analysis.*
  2) *TxDOT assessors can press the “Print All Analysis Results” button in Figure 4.27 to view the Excel worksheet report.*
  3) *CTUC DST will prompt a message box to alert that the report has been generated successfully.*
  4) *TxDOT assessors can print the Excel worksheet report as shown in Figure 4.28.*
  5) *TxDOT assessors can press the “Save & Exit” button to save and close CTUC DST.*
  6) *If TxDOT assessors want to review the other utility adjustments involved in CTUC Phase 2 Analysis, they can press the ‘Back to Tool” button in Figure 4.28 and press the “Previous Page” button twice to go to the utility responding status form as shown in Figure 4.16 in Section 4.4. They can select another utility adjustment’s analysis record to generate its final report.*

5. System User Guide

5.1 Change of TxDOT Assessor's Password

If TxDOT assessors have enabled the password protection for one highway project, they should always use the same password to access all of this highway project's analysis records. If they think these analysis records contain no confidential data, they can select "No" in Question 3.1 to stop the password protection, as highlighted in Figure 5.1.

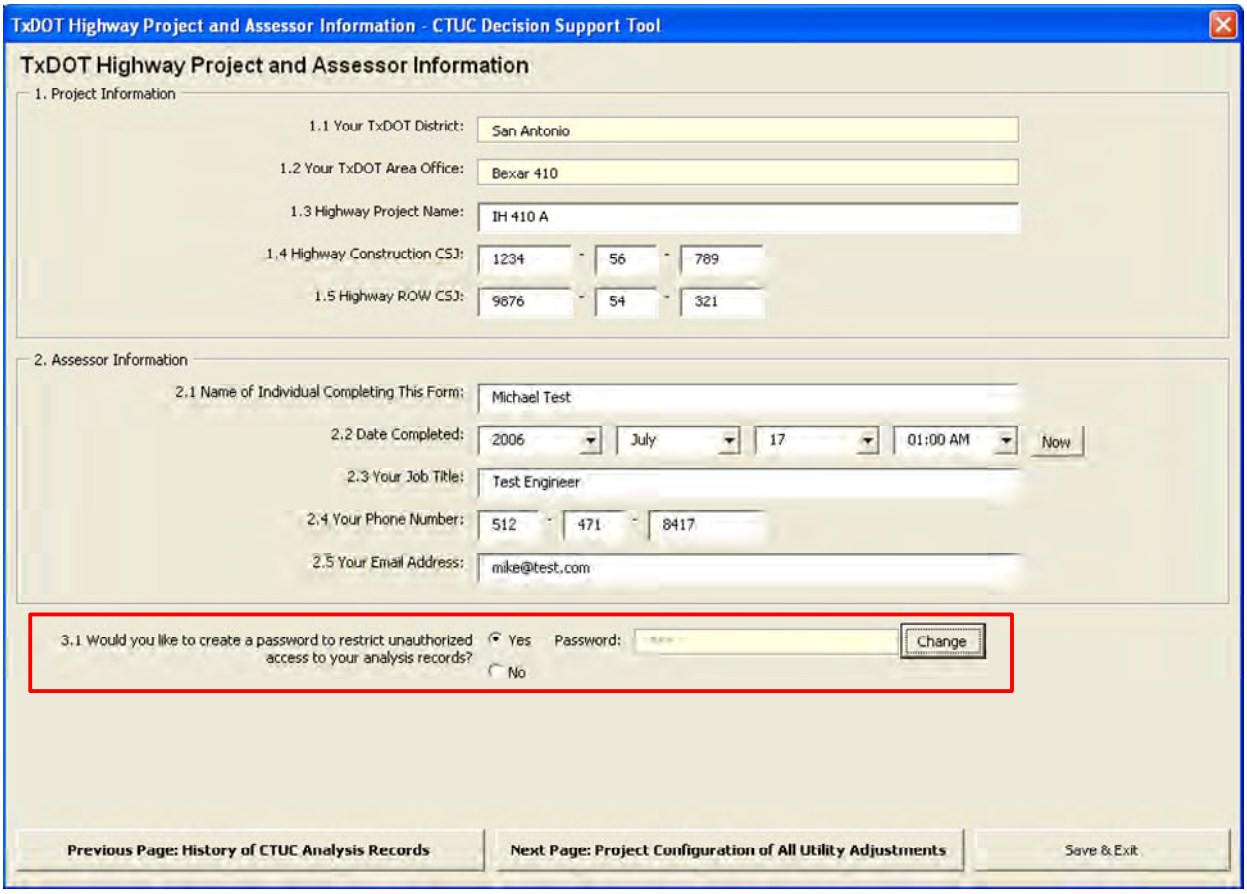

Figure 5.1 Password Protection in the TxDOT Project and Assessor Information Page

However, if TxDOT assessors forgot the password, they cannot go to the project and assessor information form to disable the password protection as shown in Figure 5.1. If they still want to access this project's analysis records, they can use the following steps to disable the password protection:

(1) Open CTUC DST as shown in Figure 5.2.
(2) Double-click the "C" as shown in the orange circle in Figure 5.2.

(3) An Excel workbook will be shown. Find the worksheet named “HighwayPrj” and click it as shown in Figure 5.3.

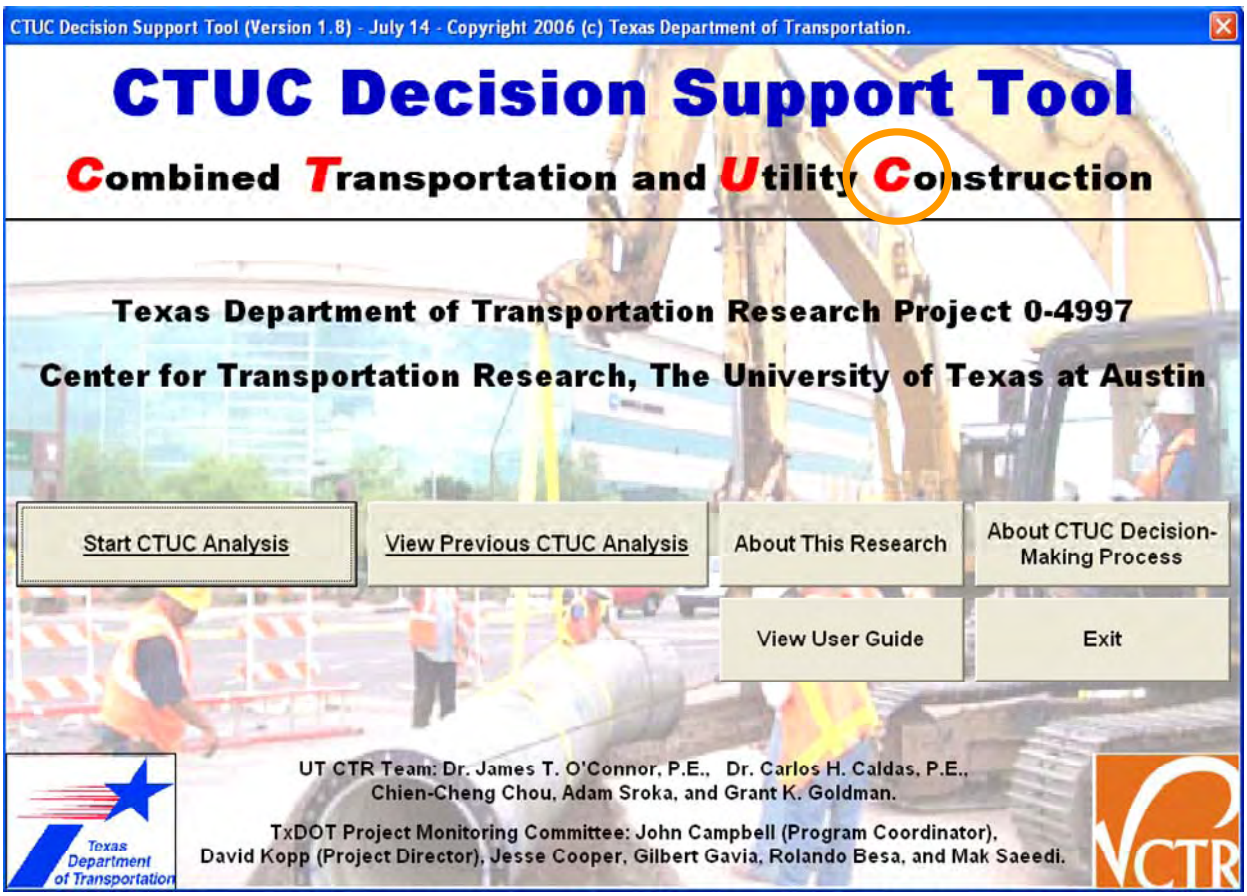

Figure 5.2 Double-Click the “C” in the Orange Circle

(4) In this worksheet, the third column will show the name of each highway project. Find the highway project’s row.
(5) In this row, its ninth column named “IsPublic” must be “FALSE.” Change it to “TRUE.”
(6) Do not modify any other data. Save the Excel workbook and close it.
(7) Re-open CTUC DST. The password protection for this highway project will be removed.

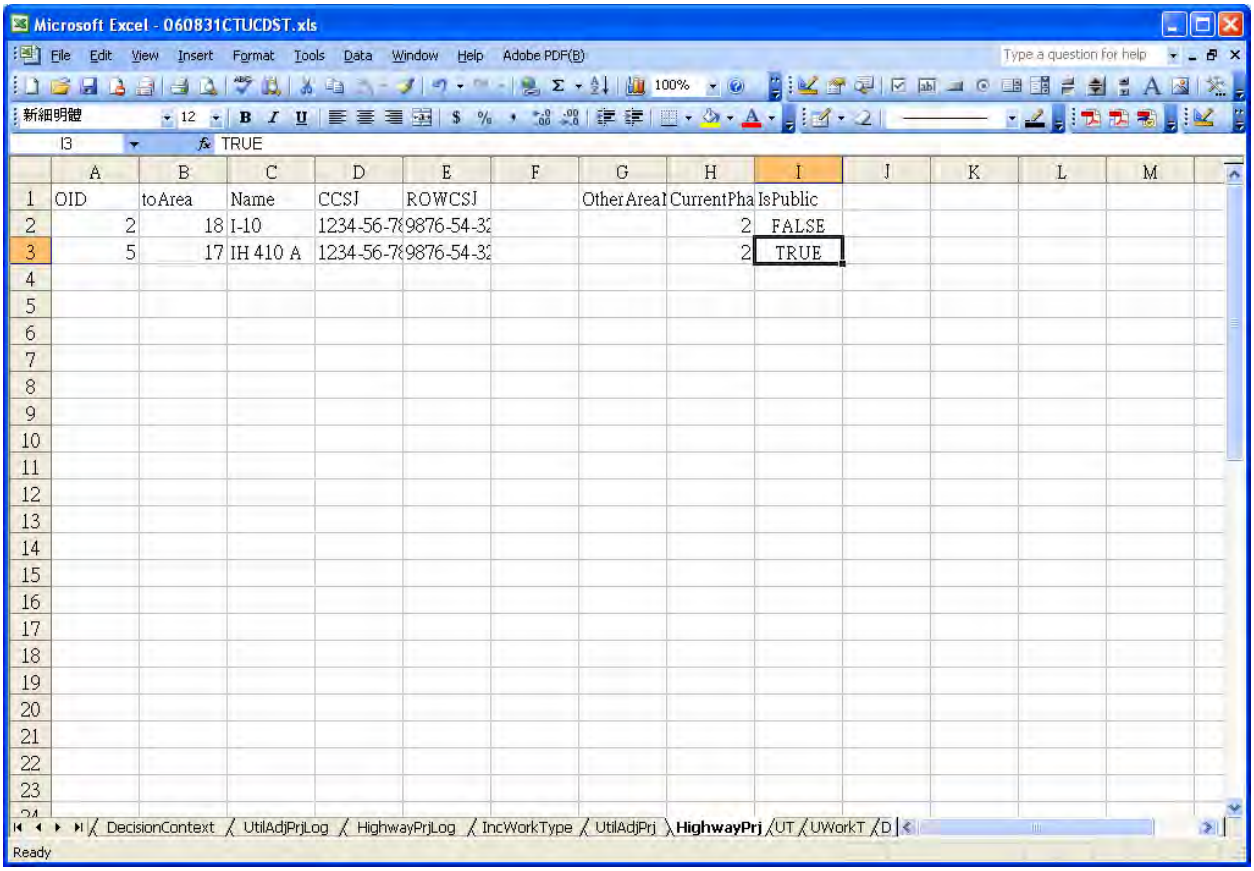

Figure 5.3 Change "IsPublic" Cell from "FALSE" to "TRUE"

5.2 Change of Utility Assessor's Password

If utility assessors have enabled the password protection for one utility adjustment, they should always use the same password to access all of this utility adjustment's analysis records. If they think these analysis records contain no confidential data, they can select "No" in Question 3.1 to stop the password protection, as highlighted in Figure 5.4.

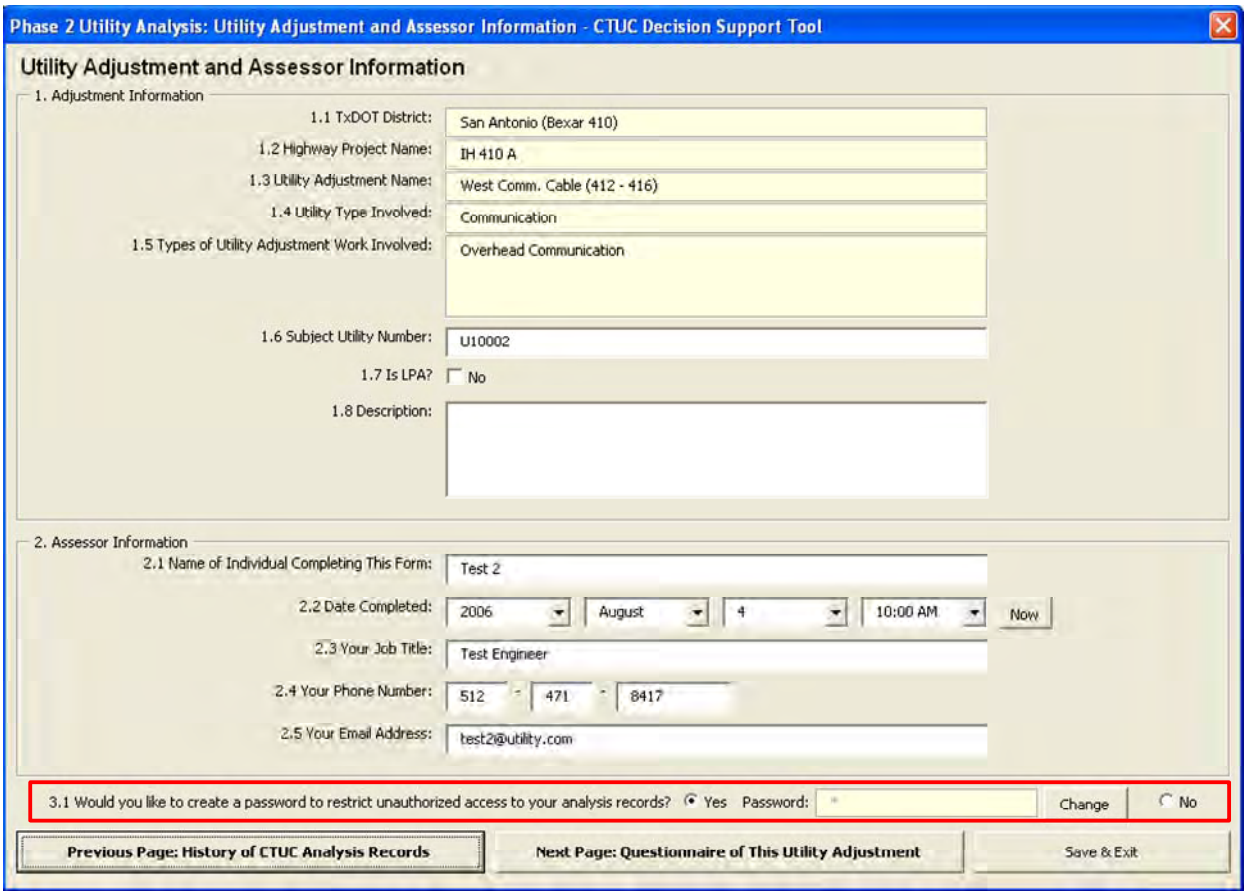

Figure 5.4 Password Protection in the Utility Adjustment and Assessor Information Page

However, if utility assessors forgot the password, they cannot go to the utility adjustment and assessor information form to disable the password protection as shown in Figure 5.4. If they still want to access this utility adjustment's analysis records, they can ask TxDOT users to perform the following steps to disable the password protection for them:

(1) Open CTUC DST. Select the district and the project.
(2) Double-click the "Phase 1" analysis record as shown in Figure 5.5.
(3) Press the button to go to the next page several times until Figure 5.6 shows.
(4) Select the utility adjustment where utility assessors forgot the password.
(5) If the utility adjustment does not need CTUC Phase 2 Analysis, its password protection is automatically disabled.

(6) If the utility adjustment's password protection has been disabled by utility assessors, the "Overwrite" button will be also disabled as shown in Figure 5.6, which means utility assessors do not need any password to access their analysis data.

(7) Enter the new password, which cannot be an empty string, for the utility adjustment whose password is unknown before. Press the "Overwrite" button. Be sure to press "Save & Exit" button to save and close CTUC DST so that utility assessors can re-open CTUC DST and login successfully.

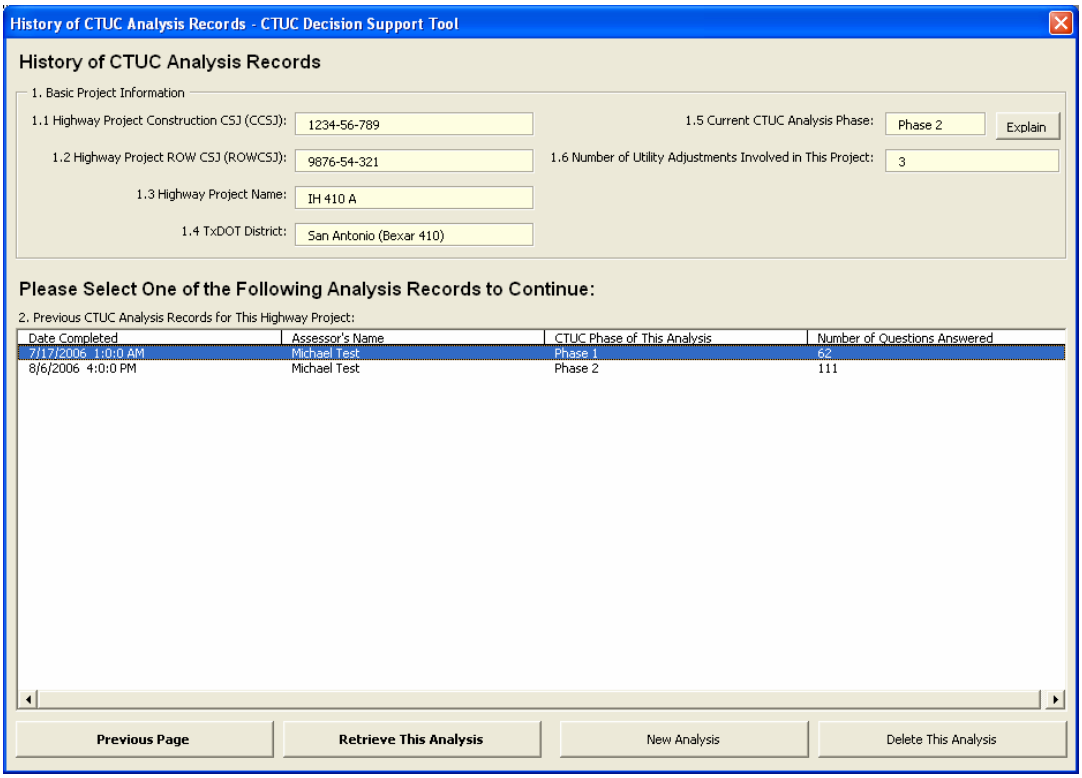

Figure 5.5 Double-Click the "Phase 1" Analysis Record

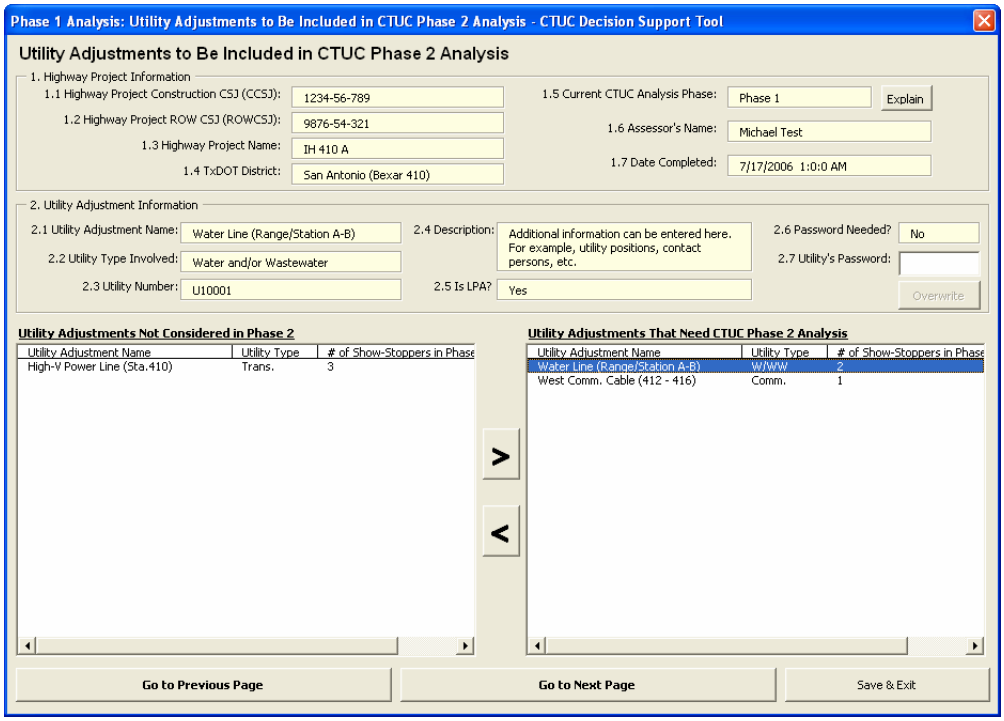

Figure 5.6 Select the Utility Adjustment That Does Not Need Password

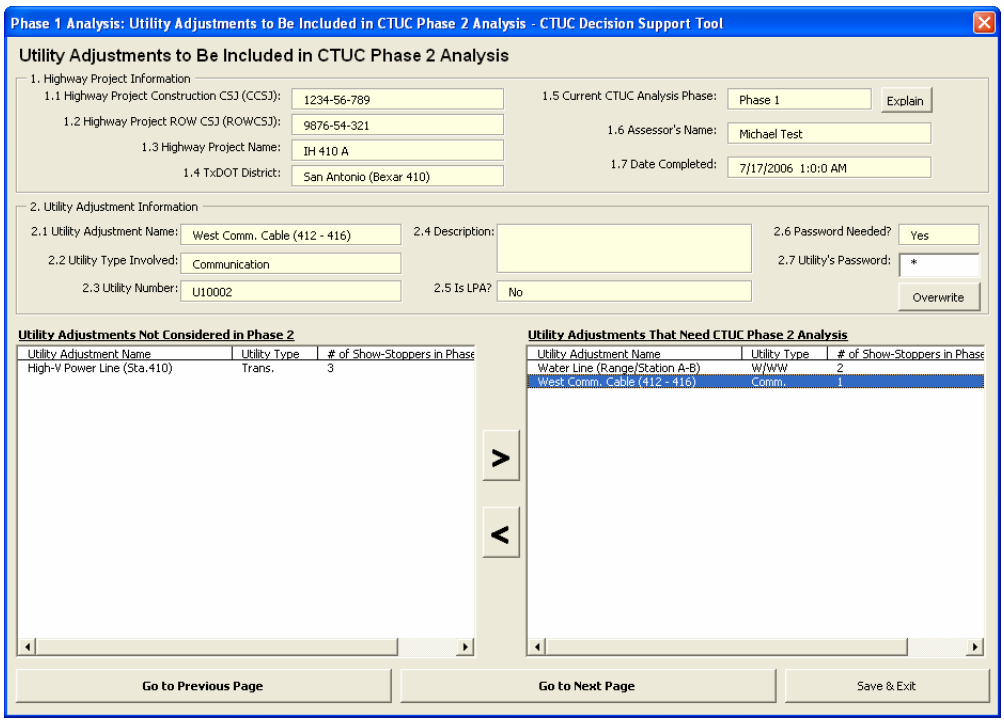

Figure 5.7 Enter the New Password in Question 2.7 and Press "Overwrite"

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