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16. Abstract

In December 2007, the Texas Department of Transportation (TxDOT) received delivery of a web-based system that automates the submission, review, approval, construction, and archival of utility installation requests at TxDOT. The system, called Utility Installation Review (UIR), enables users to submit and process installation requests online, including supporting documentation such as design and construction drawings. The system also includes an online geographic information system (GIS)-based interface that enables users to locate and query proposed installation requests using an interactive map. The system includes tabular and GIS-based reporting options.

This report summarizes the work completed in 2008. The original intent for this year was to conduct research implementation activities in three main areas: (a) maintain UIR software and conduct knowledge transfer based on user feedback and needs, (b) assist TxDOT with the statewide UIR training program, and (c) provide technical support to district and utility company users. As of December 2007, five TxDOT districts were online: Bryan, Fort Worth, Houston, Pharr, and San Antonio. At the beginning of 2008, TxDOT decided to postpone the statewide implementation of UIR until appropriate funding using an inter-agency agreement could be identified to support that effort. As a result, the researchers' focus in 2008 was to maintain the UIR software, conduct knowledge transfer, and provide technical support to district and utility company users in the five districts where UIR was active. This report summarizes these activities.

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UTILITY INSTALLATION REVIEW SYSTEM –

2008 FOLLOW-UP REPORT

by

Cesar Quiroga, P.E.
Research Engineer
Texas Transportation Institute

Jerry Le
Software Applications Developer
Texas Transportation Institute

and

Yingfeng Li
Assistant Research Scientist
Texas Transportation Institute

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TEXAS TRANSPORTATION INSTITUTE
The Texas A&M University System
College Station, Texas 77843-3135

DISCLAIMER

The contents of this document reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). This document does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. The engineer in charge of the project was Cesar Quiroga, P.E. (Texas Registration #84274).

The United States Government and the State of Texas do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

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- Houston District: Mike Alford, Leonard Polk, and Katie Deese;
- Pharr District: Robert Florez, Jennifer Beltran, and Ana Ramirez; and
- San Antonio District: Dan Stacks, Melanie McBride, and Maria Trevino.

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LIST OF ACRONYMS, ABBREVIATIONS, AND TERMS

DXF	Drawing Interchange File
FHWA	Federal Highway Administration
GIF	Graphics Interchange Format
GIS	Geographic Information System
JPEG	Joint Photographic Experts Group
PDF	Portable Document Format
PNG	Portable Network Graphics
RSC	Regional Support Center
SCOT	Standard Committee on Training
SQL	Structured Query Language
TIFF	Tagged Image File Format
TQD	Training, Quality, and Development
TSD	Technology Services Division
TTI	Texas Transportation Institute
TxDOT	Texas Department of Transportation
UAR	Utility Accommodation Rules
UIR	Utility Installation Review

CHAPTER 1. INTRODUCTION

In December 2007, the Texas Transportation Institute (TTI) submitted a web-based system that automates the submission, review, approval, construction, and archival of utility installation requests at the Texas Department of Transportation (TxDOT). The system, called Utility Installation Review (UIR), enables users to submit and process installation requests online, including supporting documentation such as design and construction drawings. The system also includes an online geographic information system (GIS)-based interface that enables users to locate and query installation requests using an interactive map. The system includes tabular and GIS-based reporting options.

Additional information about UIR and its implementation at TxDOT is available in a number of documents, including the following:

- implementation report (*1*),
- training materials (*2*), and
- system and documentation, which includes an installation guide and a user manual (*3*).

This report summarizes the work completed in 2008. The original intent for this year was to conduct research implementation activities in three main areas:

- maintain UIR software and conduct knowledge transfer based on user feedback and needs,
- assist TxDOT with the statewide UIR training program, and
- provide technical support to district and utility company users.

As of December 2007, five TxDOT districts were online: Bryan, Fort Worth, Houston, Pharr, and San Antonio. At the beginning of 2008, TxDOT decided to postpone the statewide implementation of UIR until appropriate funding using an inter-agency agreement could be identified to support that effort. As a result, the researchers' focus in 2008 was to maintain the UIR software, conduct knowledge transfer, and provide technical support to district and utility company users in the five districts where UIR was active. The following chapter summarizes these activities.

CHAPTER 2. ACTIVITIES COMPLETED IN 2008

SUMMARY OF ACTIVITIES

Based on feedback provided by users, the researchers provided system maintenance support to ensure the continuous usability of all UIR system components. As needed, maintenance support included modifications to the code, user interfaces, and reporting procedures.

The researchers provided support in response to two types of system maintenance requests: requests to address problems or "bugs" and requests for new functionality. To address system bugs, the researchers replicated the problem based on user feedback; modified and tested the revised code on TTI's servers; and coordinated with the Technology Services Division (TSD) for delivery, testing, and acceptance of the revised code. To address requests for new functionality, the researchers assessed functional and system requirements; wrote and tested the code; and coordinated with TSD for delivery, testing, and acceptance of the revised code.

The appendix provides a list of the major issues the researchers addressed in 2008. In general, in order to ensure an efficient testing and delivery process, the researchers developed a communication protocol with TSD officials that flagged each issue according to the potential impact on TSD operations, as follows:

- **Source code change request**. A request of this type, which involved web server managers, included changes to the UIR source code.

- **Controlled data change request**. A request of this type, which involved database administrators, included changes to table records in the UIR Oracle database but not changes to the database structure.

- **Relational database service request**. A request of this type, which involved the state's data center contractor, Team for Texas, included changes to the structure of the UIR Oracle database. Any changes in database structure, including scripts and queries, were included in this category.

Each type of request involved different personnel at TSD. For efficiency, the researchers channeled all the requests through only one official who prepared the appropriate forms and forwarded the requests accordingly for processing.

Knowledge transfer to TxDOT officials involved the use of UIR system documentation (user manual, installation guide, training materials, and reports) to describe and explain UIR concepts and procedures. It also involved interactive sessions where TxDOT officials had a hands-on opportunity to learn about UIR.

The researchers also provided technical support to district and/or utility company users to address specific questions or problems they had while using UIR. Experience during the pilot phase prior to the system delivery in 2007 demonstrated that district and utility company users had problems in certain areas where the online permitting process approach was drastically

different from the traditional paper-based approach. Those areas included user account management issues, file uploading issues, use of the interactive mapping component, and client computer compatibility issues. Experience also demonstrated that an expedited response to user requests was a key requirement to ensure user acceptability of the system.

To achieve this objective, the researchers set up an internal procedure where an initial response was normally provided within an hour or two after receiving the initial email from users. If users reached the researchers by phone, the response was regularly provided right away. In either case, the researchers assessed the nature of the request, determined how to proceed, and provided feedback to the users. If the nature of the request was regarding a system "bug" or a desired new functionality, the researchers added the item to a "to-do" list, assessed its urgency and importance, and scheduled it accordingly. In total, the researchers received about 175 technical support requests from users in 2008 (around 75 requests were by phone, and the rest were by email).

UIR GROWTH IN 2008

Table 1 provides information about the number of installation owners, offices, and users registered in UIR. Table 1 also provides information about the number of TxDOT offices represented on the system, along with the number of registered TxDOT users. In general, the number of installation owners, offices, and registered users increased in 2008. Overall, the number of installation owner registered users increased from 1,507 to 2,470 (i.e., a 64 percent increase). The number of TxDOT users increased from 327 to 387 (i.e., an 18 percent increase).

Table 1. User Registration in UIR.

Item	As of 12/31/2007	As of 12/31/2008	% Change
Bryan District:			
Number of installation owners	60	109	82
Number of installation owner offices	79	133	68
Number of installation owner users	140	247	76
Number of TxDOT offices	20	20	0
Number of TxDOT users	57	66	16
Fort Worth District:			
Number of installation owners	66	135	105
Number of installation owner offices	116	206	78
Number of installation owner users	390	633	62
Number of TxDOT offices	19	19	0
Number of TxDOT users	40	43	8
Houston District:			
Number of installation owners	11	60	445
Number of installation owner offices	22	104	373
Number of installation owner users	68	365	437
Number of TxDOT offices	25	25	0
Number of TxDOT users	86	97	13
Pharr District:			
Number of installation owners	90	107	19
Number of installation owner offices	122	146	20
Number of installation owner users	483	652	35
Number of TxDOT offices	20	20	0
Number of TxDOT users	55	65	18
San Antonio District:			
Number of installation owners	82	104	27
Number of installation owner offices	143	179	25
Number of installation owner users	426	573	35
Number of TxDOT offices	33	33	0
Number of TxDOT users	89	116	30
Total:			
Number of installation owners	309	515	67
Number of installation owner offices	482	768	59
Number of installation owner users	1,507	2,470	64
Number of TxDOT offices	117	117	0
Number of TxDOT users	327	387	18

Table 2 provides information about the number of active and closed installation requests by district, with an indication of the last location of the requests on the system (at TxDOT or at the installation owner). As a reference, Table 2 also shows the date when users submitted the first installation request online at each district. Overall, the number of installation requests in UIR increased in 2008 from 6,306 to 12,584 (i.e., a 100 percent increase). The number of active requests increased from 2,808 to 5,463 (i.e., a 95 percent increase). The number of closed requests increased from 3,498 to 7,121 (i.e., a 104 percent increase).

Table 2. Active and Closed Installation Requests by District.

(a) As of 12/31/2007

District	Started	Active Requests as of 12/31/2007			Closed Requests as of 12/31/2007			Total
		At TxDOT	At Installation Owner	Subtotal	At TxDOT	At Installation Owner	Subtotal	
Bryan	05/02/07	41	155	196	13	0	13	**209**
Fort Worth	07/02/07	72	295	367	108	0	108	**475**
Houston [1]	08/23/07	0	0	0	0	0	0	**0**
Pharr	06/23/06	133	813	946	1,268	0	1,268	**2,214**
San Antonio	09/13/05	632	667	1,299	2,109	0	2,109	**3,408**
Total		**878**	**1,930**	**2,808**	**3,498**	**0**	**3,498**	**6,306**

(b) As of 12/31/2008

District	Started	Active Requests as of 12/31/2008			Closed Requests as of 12/31/2008			Total
		At TxDOT	At Installation Owner	Subtotal	At TxDOT	At Installation Owner	Subtotal	
Bryan	05/02/07	68	476	544	156	0	156	700
Fort Worth	07/02/07	108	752	860	856	0	856	1,716
Houston [1]	08/23/07	87	510	597	118	0	118	715
Pharr	06/23/06	86	1,367	1,453	2,577	0	2,577	4,030
San Antonio	09/13/05	332	1,677	2,009	3,414	0	3,414	5,423
Total		**681**	**4,782**	**5,463**	**7,121**	**0**	**7,121**	**12,584**

[1] Although the Houston District was active in 2007, the district only started accepting online requests in 2008.

The distribution of installation requests among installation owners was not uniform, continuing the trend observed at the end of 2007. As a reference, Table 3 shows the distribution of requests by installation owner as of December 31, 2008. Within individual installation owners, the distribution of installation requests among registered users was also not uniform. As a reference, Table 4 shows the distribution of installation requests submitted by individual users as of December 31, 2008, along with the corresponding installation owner and TxDOT district associations.

Table 3. Distribution of Requests by Installation Owner as of December 31, 2008.

Installation Owner	Requests Submitted to TxDOT District					Total	%
	Bryan	Fort Worth	Houston	Pharr	San Antonio		
AT&T-Texas	85	391	256	626	2,070	3,405	27.06
CPS Energy					1,375	1,378	10.95
AEP Texas				1319	21	1,346	10.70
Time Warner Cable				519	780	1,299	10.32
Verizon	49	73	58	59	101	308	2.45
Magic Valley Electric Cooperative				224		227	1.80
North Alamo Water Supply Corp.				210		209	1.66
Oncor Electric Delivery	38	192				207	1.64
CenterPoint Energy	19		134		55	184	1.46
Texas Gas Service		16		157		178	1.41
New Braunfels Utilities		138				135	1.07
Time Warner Cable Dallas					138	132	1.05
Brownsville Public Utilities B	34	98	15		17	126	1.00
Embarq				119		121	0.96
Guadalupe Valley Telephone Co.					105	117	0.93
Atmos Energy	35	81			13	98	0.78
Valley Telephone Cooperative				48	48	94	0.75
City of McAllen				82		90	0.72
Phonoscope			92			85	0.68
City of Edinburg		96				81	0.64
San Antonio Water System				77		80	0.64
Texas Midstream Gas Services, LLC					81	77	0.61
Entergy Texas, Inc.	41		23			77	0.61
United Cooperative Services		67				59	0.47
Mid-South Synergy	43		15			58	0.46
Tri-County Electric Cooperative, Inc.		69				54	0.43
Other	356	495	122	590	619	2,359	18.75
Total	**700**	**1,716**	**715**	**4,030**	**5,423**	**12,584**	**100**

Table 4. Distribution of Requests by Individual Registered Users as 12/31/2008.

Individual User Installation Owner Affiliation	Submitted to TxDOT District	No. of Requests	% of Total Requests
Time Warner Cable	Pharr	514	4.08
AT&T-Texas	San Antonio	514	4.08
Time Warner Cable	San Antonio	262	2.08
Time Warner Cable	San Antonio	249	1.98
Time Warner Cable	San Antonio	244	1.94
AT&T-Texas	Pharr	146	1.16
AT&T-Texas	San Antonio	122	0.97
Texas Gas Service	Pharr	119	0.95
Oncor Electric Delivery	Fort Worth	111	0.88
AT&T-Texas	Pharr	100	0.79
AT&T-Texas	Pharr	97	0.77
North Alamo Water Supply Corp.	Pharr	96	0.76
Guadalupe Valley Telephone Co.	San Antonio	92	0.73
AEP Texas	Pharr	93	0.74
AEP Texas	Pharr	91	0.72
AT&T-Texas	San Antonio	90	0.72
AT&T-Texas	San Antonio	83	0.66
AT&T-Texas	San Antonio	82	0.65
North Alamo Water Supply Corp.	Pharr	82	0.65
AEP Texas	Pharr	80	0.64
Other		9,317	74.02
Total		**12,584**	**100**

At any given time, the status of an installation request could be one of the following: submitted/under review, approved/pre-construction, construction, post-construction, and archived. Table 5 shows the number of installation requests that reached the status listed. For example, in the case of the San Antonio District, of the 3,408 requests that installation owner users submitted through UIR as December 31, 2007 (and therefore reached a review status), 2,967 requests reached an approved/pre-construction status, 2,102 requests reached a construction status, 1,777 requests reached a post-construction status, and 1,777 requests reached an archived (completed) status. By comparison, of the 5,423 requests that installation owner users submitted through UIR as of December 31, 2008, 4,808 requests reached an approved/pre-construction status, 3,348 requests reached a construction status, 2,854 requests reached a post-construction status, and 2,878 requests reached an archived (completed) status.

Table 5. Number of Installation Requests that Have Reached Status Listed.

(a) As of 12/31/2007

TxDOT District	Status						
	Submitted	Approved/ Pre-construction	Construction	Post-construction	Archived		
					Completed	Rejected	Withdrawn
Bryan	209	168	44	14	7	0	6
Fort Worth	475	411	141	91	79	11	18
Pharr	2,214	2,026	1,514	1,317	1,110	5	153
San Antonio	3,408	2,967	2,102	1,777	1,777	87	245

(b) As of 12/31/2008

TxDOT District	Status						
	Submitted	Approved/ Pre-construction	Construction	Post-construction	Archived		
					Completed	Rejected	Withdrawn
Bryan	700	637	272	181	142	0	16
Fort Worth	1,716	1,614	957	825	788	17	57
Houston	715	632	137	89	88	20	14
Pharr	4,030	3,749	2910	2,544	2,276	9	304
San Antonio	5,423	4,808	3,348	2,854	2,878	5	436

Assuming a system under equilibrium, over time the number of installation requests that enter the system (through the submission step) should be roughly the same as the number of installation requests that exit the system (through the archival step). As Table 5 shows, the number of requests that reached an archived status at each district was considerably lower than the number of requests submitted, although for districts that had a longer history of UIR implementation (Pharr and San Antonio), the relative difference was not as noticeable as for the Bryan, Fort Worth, and Houston Districts. For all districts, there was a noticeable drop in the number of requests that reached a construction status compared to the number of requests that reached an approved/construction status. A closer examination of the corresponding installation request data revealed that many installation owners received approval of their proposed installation request but did not notify TxDOT two business days prior to starting construction. This failure to notify TxDOT in a timely fashion has an impact on the effectiveness of the installation request review and inspection process.

IMPACT ON SYSTEM RESOURCES

Of particular interest is the impact on file storage usage. Other impacts such as bandwidth and hardware component usage are more difficult to measure and are probably not meaningful considering that many external factors influence that impact.

The researchers did not have access to the web server that hosts UIR at TxDOT. As a result, it was not possible to measure the total file storage impact, e.g., in terms of the total number of files on the server associated with the installation requests. However, the Oracle database contained information about attachments that users uploaded, including file name and size. Although incomplete (because UIR generates certain files for which the corresponding file size is not stored in the database), that information is useful because it provides an idea of the type and typical file size that users upload.

As of December 31, 2008, on average, the database included 6.8 events per installation request. The average number of attachments per request was 1.2. The average file attachment was 445 kilobytes in size. Users uploaded files in a variety of formats (Table 6). The most popular file formats were Adobe® Portable Document Format (PDF) (.pdf), Bentley® MicroStation™ (.dgn), Autodesk® AutoCAD® (.dwg), and Joint Photographic Experts Group (JPEG) (.jpg or .jpeg).

Table 6. Attachment File Statistics as of December 31, 2008.

File Type	File Extension	Count	File Size (Bytes)		
			Average	Maximum	Minimum
Adobe PDF	.pdf	10,899	360,902	5,216,461	714
Bentley MicroStation Drawing	.dgn	2,689	308,998	5,162,496	10,568
Autodesk AutoCAD Drawing	.dwg	1,880	420,730	4,376,415	11,553
JPEG	.jpg or .jpeg	614	631,456	4,001,346	14,148
Microsoft® Word®	.doc	295	188,393	3,600,384	2,014
Microsoft Excel®	.xls	273	35,585	316,928	15,360
Bitmap	.bmp	232	1,720,228	5,170,230	124,802
Adobe Tagged Image File Format (TIFF)	.tif	125	750,279	4,512,055	14,828
Microsoft PowerPoint®	.ppt	101	85,408	4,383,232	14,336
Portable Network Graphics (PNG)	.png	51	446,476	1,734,742	13,533
Graphics Interchange Format (GIF)	.gif	28	628,364	2,673,852	14,267
Autodesk AutoCAD Drawing Interchange File (DXF)™	.dxf	26	63,815	717,581	10,395
Microsoft Visio®	.vsd	17	595,516	2,547,200	28,160
Text	.txt	6	4,458	10,309	326

LESSONS LEARNED AND RECOMMENDATIONS

In 2008, there was consolidation in the use and acceptance of UIR by TxDOT and utility company users. For the most part, in the five districts where UIR is active (Bryan, Fort Worth, Houston, Pharr, and San Antonio), users now consider UIR part of the normal utility permitting business process. At the same time, the researchers have continued to hear comments from other

districts in the sense that TxDOT should continue with the implementation of UIR on a statewide basis as soon as possible.

In 2008, there was a significant growth in the number of registered users and installation requests processed through the system. For example:

- The total number of registered utility companies grew from 309 to 515 (i.e., a 67 percent increase).
- The total number of registered utility company users grew from 1,507 to 2,470 (i.e., a 64 percent increase).
- The total number of registered TxDOT users grew from 327 to 387 (i.e., an 18 percent increase).
- The total number of installation requests submitted through the system grew from 6,306 to 12,584 (i.e., a 100 percent increase).

Because the statewide implementation of UIR did not proceed in 2008 as originally intended, most of the recommendations included in the implementation report (*1*) still apply. For completeness, this section includes a summarized version of those recommendations, reformatted for clarity when needed, e.g., to take into consideration new realities such as the regional support centers (RSCs) (*4*).

As TxDOT moves forward with a statewide implementation, it will be important not just to maintain the current system, but also to adopt a long-term strategy that allows for the continuous improvement of the system to help ensure its long-term viability. Recommendations to achieve this goal include the following:

- follow a systematic approach for the implementation of UIR at other districts around the state with a focus on "training the trainers," while ensuring compatibility with the new regionalization structure;
- maintain UIR software and conduct knowledge transfer based on user feedback and needs;
- provide technical support to region, district, and installation owner users; and
- introduce additional changes in business practice to support the UIR implementation.

A more detailed description of each recommendation follows.

Follow Systematic Approach for Implementing UIR at Other Districts

Implementing UIR at other TxDOT districts will require careful planning, execution, and follow-up. Two critical components of this process are preparing UIR to enable users to use the system and training those users.

Preparing UIR

Enabling a district within UIR involves adding records to certain database tables, primarily those that include TxDOT district office data and permit workflow activity data. The UIR user manual (*3*) contains a detailed description of the tables that need new records. The user manual also includes a complete UIR maintenance schedule, which includes various administrative functions, the level of responsibility (district or division), and the frequency with which those functions should be carried out. Examples include clearing/deleting incomplete installation request records, monitoring user accounts (both TxDOT and installation owners), and monitoring system performance.

To support the new TxDOT region-based structure, it will be necessary to introduce changes to UIR, as well as the UIR user manual, training materials, and other UIR documents. For example, according to current plans, reception, routing, approval (or denial), and archival of installation requests would occur at the region level (*4*). Currently, those functions within UIR take place at the district level.

Training Users

To optimize the process, the training effort should focus on "training the trainers" at each region and district where UIR is being implemented. The researchers were very involved in providing training to both TxDOT officials and installation owner users during the testing phase (*1*). This exercise was useful and productive. However, in the long term a different training approach focusing on "training the trainers" (where the trainers are certain region and/or district officials who manage the utility permitting process at those levels) is expected to be more cost-effective, under the assumption that those officials can train other users (both TxDOT users and installation owner users).

Training the trainers would typically involve scheduling a round of training sessions to teach specific TxDOT officials how to use UIR. The training sessions should emphasize both installation owner and TxDOT interfaces, under the assumption that the TxDOT officials receiving training would be responsible for training and interacting with installation owner officials once UIR is active in their regions and districts.

Experience during the testing phase demonstrated that acceptance and effectiveness in the use of UIR increased with the level of participation of critical TxDOT personnel in the initial training. Because of their involvement in the utility permitting process, it will be critical for the following TxDOT region and district personnel (or their equivalent) to participate in the initial training sessions:

- region utility permit personnel,
- district maintenance director,
- district right of way administrator,
- district utility agents,
- district area engineers,

- district maintenance supervisor,
- district security administrator, and
- district central design personnel.

The commitment of district engineers to implement UIR will also be a critical requirement for the successful implementation of the system. Although security administrators are not involved in the utility permitting process, their participation is important because they will be responsible for managing TxDOT user accounts and for providing technical support to users (mainly in areas related to hardware and software access issues).

Although TxDOT will decide the final implementation schedule for each region and district, it is reasonable to assume a phased implementation schedule. As part of this process, it will be critical to devise strategies to make the process as efficient as possible, e.g., by inviting district representatives by region for a web-based introduction to the system, followed by the on-site training sessions discussed earlier. Because the five districts where UIR has been introduced and tested are in the eastern half of the state (San Antonio, Pharr, Bryan, Fort Worth, and Houston), the implementation schedule for the remaining 20 districts will likely involve "filling in the blanks" first and then moving progressively toward the west/northwest. Discussions with TxDOT officials suggested the following district implementation schedule:

- Phase 1 would include Wichita Falls, Dallas, Paris, Atlanta, and Tyler.
- Phase 2 would include Brownwood, Waco, Lufkin, Beaumont, and Yoakum.
- Phase 3 would include Laredo, San Angelo, Abilene, Austin, and Corpus Christi.
- Phase 4 would include El Paso, Odessa, Lubbock, Amarillo, and Childress.

An alternative implementation schedule that follows RSC boundaries would be as follows:

- Phase 1 would include districts within the North RSC (headquartered in Fort Worth): Wichita Falls, Dallas, Paris, Atlanta, Tyler, Waco, and Brownwood.
- Phase 2 would include districts within the East RSC (headquartered in Houston): Lufkin and Beaumont.
- Phase 3 would include districts within the South RSC (headquartered in San Antonio): Laredo, Austin, Yoakum, and Corpus Christi.
- Phase 4 would include districts within the West RSC (headquartered in Lubbock): El Paso, Odessa, Lubbock, Amarillo, Childress, Abilene, and San Angelo.

The initial training would address the training needs during the implementation of the system throughout the state. However, it would also be advisable to maintain a continuous UIR training program to address long-term training needs, e.g., in situations where new officials (or officials

who have transferred from other TxDOT units) are assigned the responsibility to review or process utility installation requests.

To assist in the UIR training effort, the researchers developed a user manual and a set of training materials (*2*, *3*). The user manual exists in two formats: a printable version in PDF format and a fully interactive online help system that is available through the UIR user interface. For convenience, there are two versions of the user manual: one version covers the utility permitting process from an installation owner user's perspective and is therefore geared toward installation owner users, and a second version covers both installation owner and TxDOT needs (divided for convenience into two parts: Part A – installation owner users and Part B – TxDOT users).

The training materials include presentations in Microsoft PowerPoint format, as well as presenter notes and participant handouts, both in PDF and printout format. There are three types of presentation materials:

- general introduction presentation (16 slides);
- overview presentation (10 slides) followed by online demonstration and training; and
- standalone presentation (276 slides), which may be useful in situations where Internet access is either difficult or not possible.

For the training activities to be effective, it will be critical to use instructors who are thoroughly familiar with UIR (including TxDOT and installation owner interfaces, UIR workflow logic, structure, and problems that users tend to encounter). Instructors must also be familiar with the TxDOT utility permitting process and the various rules and regulations that govern utility accommodation on the state right of way. They should be familiar with various UIR system components (e.g., data model and database). The instructors could be designated TxDOT employees. However, if internal resources are not available or if it is not possible or feasible to schedule training events to address user needs effectively in a timely fashion, it would be strongly advisable to rely on an external agency to assume that responsibility.

To support the UIR training effort, it would be advisable to involve the TxDOT Human Resources Division's Training, Quality, and Development (TQD) Section. TQD maintains a comprehensive course catalog and manages training programs that address a wide range of needs throughout the department. Depending on the specific case, TQD might decide to rely on TxDOT instructors or hire an external contractor. In general, it is common to rely on external contractors for cases that require highly specialized technical knowledge and expertise, which would be the case with the UIR training effort. In general, adding courses or programs to the TxDOT course catalog involves completing a number of activities, including the following:

- evaluate existing related courses (none, since UIR is a new development for which there is no predecessor);
- develop a justification for the new course or program, which includes identifying objectives, expected outcomes, need, audience, expected duration, agenda, type of course, teaching methodology, description, potential developers, potential instructors, costs, funding sources, and marketing approach; and

- submit Form 1951 (Request for New Training) to TQD and give a presentation to the Standard Committee on Training (SCOT).

The information provided in this section as well as the user manual and training materials (*2*, *3*) can be used to prepare Form 1951 in support of a UIR training program at TQD.

Maintain UIR Software and Conduct Knowledge Transfer

The implementation report (*1*) described several recommended UIR enhancements that would need to be implemented to ensure the long-term viability of the system. In 2008, the researchers implemented some of those enhancement areas, mainly the need to update the installation request form (Form 1082) and the need to optimize the reporting tool.

There are several pending enhancement areas. For convenience, these areas are divided into high-priority areas, mid-priority areas, and low-priority areas, as follows:

- High-priority areas:
    - Two-business-day notification and traffic control plans
    - Mapping component
    - PDF generation component
    - UIR system management interface
    - Inter-district installation request submissions
- Mid-priority areas:
    - Special comment function
    - Aggregate reporting options for managers
    - Highway reference offset data capture
    - Archived installation request management
- Low-priority areas:
    - Office addresses versus individual user addresses
    - Single point versus two points to represent installation request locations
    - "Frequently asked questions" tool
    - Page optimization
    - Consultant account management

To assist in this process, the researchers strongly recommend the establishment of a UIR task force (composed of district, region, and/or division representatives), which would determine the priority and urgency of specific enhancement areas and would guide the future direction and development of the system. This task force would also establish guidelines and protocols for the transfer of knowledge to TxDOT officials, in particular those officials who have critical responsibilities for the operation, maintenance, and future of the system.

The researchers also strongly recommend the official designation of a TSD employee to coordinate all matters related to UIR with TSD. In 2008, the researchers developed a good, efficient working relationship with TSD officials for the implementation of needed UIR updates. However, this relationship was somewhat "ad hoc" because of the lack of an official UIR manager at TSD. Designating this manager would offer numerous advantages, including serving as a "system" point of contact for the UIR task force and serving as a point of contact with the group in charge of developing and testing UIR updates.

Provide Technical Support to Users

UIR is a complex system with many active users, each one having different needs, issues, and requirements. Experience during the testing phase demonstrated that district and installation owner users experienced problems in certain areas where the online process differed from the traditional paper-based approach, in particular how to deal with user account issues, file uploading issues, use of the interactive mapping component, and client computer compatibility issues. Experience also demonstrated that an expedited response to user requests was critical to ensure user acceptability.

In 2008, technical support consisted of two tiers, where the first tier (i.e., the first response) was usually the responsibility of individual districts and the second tier (which became active if the first response was not sufficient) was the responsibility of the researchers. It would be advisable to continue and, as needed, expand the two-tier technical support approach used in 2008, as follows:

- **First tier (or first response)**. This tier is the responsibility of region and/or district officials. The purpose of the first tier technical support is to assist users in situations that require a good working knowledge of the UIR interfaces (but not necessarily of "back-office" UIR system components such as database tables or the web-based mapping component). Most technical support needs would fall under the first tier category. This type of support will likely include a combination of phone and email response methods.

- **Second tier**. This tier is the responsibility of technicians who have a thorough knowledge of the system, including user interfaces, database components, source code, and business processes. The purpose of the second tier technical support is to assist users in situations where the first tier technical support does not solve the problem. This type of support will likely include a combination of phone, email, and web-based response methods. The technicians responsible for the second tier could be TxDOT information technology employees (either at the region or division level). However, if internal resources are not available or if it is not possible or feasible to provide the technical support that users need in a timely fashion, it would be strongly advisable to rely on an external agency to assume that responsibility.

Introduce Additional Changes in Business Practice

The regionalization initiative will likely result in changes to utility-related business practices beyond those discussed in the previous sections. Two specific areas that might affect the statewide UIR implementation are as follows:

- **Utility Accommodation Rules (UAR)**. The current rules assume an administrative structure based on districts and divisions to manage the accommodation of utilities on the state right of way (*5*). The researchers recommend undertaking a review of the UAR, as well as other relevant chapters in Title 43 of the Texas Administrative Code, to determine potential impacts resulting from the implementation of the RSCs that might warrant revisions to the administrative code. A review of other related documents, e.g., the *ROW Utility Manual* (*6*), would also be advisable.

- **Special provisions and specifications**. Although UIR supports the use of different special provisions for individual districts (because this is the current business practice at TxDOT), using standardized terms of reference is highly desirable. Recent research documented a wide range of problems resulting from the current practice (including lack of content integrity, oversimplification of requirements, and conflicts with the UAR and TxDOT's own construction specifications) (*7*). The same research also provided several recommendations to improve practices, including rationalizing the use of special provisions (i.e., using special provisions to amend the UAR or TxDOT's specifications following standardized procedures), standardizing the special provision format, and ensuring consistency with legal terminology and standards. These recommendations are compatible with the new regionalization approach.

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APPENDIX – MAJOR ISSUES ADDRESSED IN 2008

This appendix lists all the major issues the researchers addressed in 2008. Table 7 describes each issue, along with a control date that represents, in most cases, the date the researchers submitted the corresponding system updates to TSD.

Table 7. Summary of Issues Addressed in 2008.

No.	Date	Brief Problem Description
1	02/13/2008	The SEGMENT layer used on the UIR mapping component has incorrect maintenance section information for several highway segments in the Pharr District. These highway segments have maintenance section 03 (which does not exist in the Pharr District) and should be reassigned to maintenance section 04. Note: The SEGMENT layer was generated using data from the TxDOT RHiNo file. This modification only involves the SEGMENTS layer used by the UIR map component. **Request type:** • Source code change request: **No** • Controlled data change request: **No** • Relational database service request: **No**
2	02/19/2008	UIR users reported two cases (installation requests FTW20080128170055 and FTW20080116145025) in which users successfully submitted the requests but the requests did not appear listed in UIR. In addition, in the confirmation emails generated automatically by UIR, the control section and route information was missing. To investigate these cases and other related issues, it is necessary to access the Oracle database so that a system administrator can find out what causes the missing requests. A structured query language (SQL)-based tool on the UIR interface is necessary for system administrators to run queries on several important database tables such as permit, permit event, and permit event location without physically touching the database. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
3	03/05/2008	Several users experienced a problem with UIR in which utility company users submitted an installation request but then the request was "lost" and could not be seen on any UIR screen. Right after utility company users finish submitting an installation request (and certainly after database records are updated and emails sent), an acknowledgment message on grey background appears on the screen. Reloading this acknowledgment page causes records on some of the tables (including Permit Event) to be deleted. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**

Table 7. Summary of Issues Addressed in 2008 (Continued).

No.	Date	Brief Problem Description
4	03/05/2008	When an authorized TxDOT user purges an installation request or a utility company user deletes an incomplete request, UIR does not completely delete all the associated records, leaving orphan records in some tables. The orphan records do not currently affect system performance. However, in the long term, it is advisable to keep a clean database. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
5	03/06/2008	A TxDOT user tried to upload a new special provision document to UIR, but the system returned an error. The error was due to a foreign key constraint on the TEMP_PRMT_EVNT_ATCHMT table referencing the PRMT table. In the past, the TEMP_PRMT_EVNT_ATCHMT table was only used to store attachments associated with utility permits. In late 2007, the researchers modified the code so that TEMP_PRMT_EVNT_ATCHMT could also be used to store special provisions. This modification was intended to optimize the database structure so that the system performance could be improved. However, the foreign key constraint was left undeleted without its impact on uploading special provision files being noticed. **Request type:** • Source code change request: **No** • Controlled data change request: **No** • Relational database service request: **Yes**
6	04/10/2008	The SEGMENTS layer used on the UIR mapping component has incorrect maintenance section information for several highway segments as reported by UIR users (the SEGMENTS layer was generated using data from the TxDOT RHiNo file). The files associated with the SEGMENTS layer need to be replaced. This modification only involves the SEGMENTS layer used by the UIR mapping component. Modifications on either UIR system files or the UIR database are not required. **Request type:** • Source code change request: **No** • Controlled data change request: **No** • Relational database service request: **No**
7	05/15/2008	A TxDOT official could not route an amendment request (which happens after approval) to a TxDOT engineer working in a design office because the original UIR workflow did not include that option. Based on discussions with TxDOT officials, TTI has modified the UIR workflow chart to enable routing amendment requests to several other office types such as the design office, traffic operations office, construction project management office, mobility initiative office, and right of way office. To apply these changes, it is necessary to add the new office records to the PRMT_WRKFL_ACTV table. **Request type:** • Source code change request: **No** • Controlled data change request: **Yes** • Relational database service request: **No**

Table 7. Summary of Issues Addressed in 2008 (Continued).

No.	Date	Brief Problem Description
8	05/15/2008	During the original UIR database design, TTI included the TEMP_PRMT_EVNT_ATCHMT table to temporarily store information about attachments associated with installation requests. In late 2007, TTI modified UIR to enable the use of the TEMP_PRMT_EVNT_ATCHMT table to support special provision uploading needs (which are not associated with utility installation permit events). This modification was intended to optimize UIR by eliminating redundant code that resulted in a generic temporary file uploading component. However, the names of the table and its attributes were not updated to reflect their expanded role. In addition, two foreign key constraints (PRMT_ID and PRMT_EVNT_NBR) were left undeleted without their impact on the special provision uploading process being noticed. It is necessary to update this table and a few associated system files. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **Yes**
9	05/15/2008	In an earlier modification (02/22/2008), TTI proposed adding a UIR SQL query tool. Follow-up discussions with TxDOT TSD officials indicated that it is necessary to delete the "Create or Replace" and "Drop" options and limit the number of records retrieved using the "Select" option. This modification deletes the two SQL tool options including "Create or Replace" and "Drop" and adds the following warning message to the UIR interface: Hint: To reduce the number of records retrieved, include a "WHERE ROWNUM<=___" clause. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
10	05/15/2008	When an installation owner user logs into UIR and opens an installation request that the user has submitted, the URL displayed in the address bar contains the ID of the installation request. If the user replaces the ID with the ID of an installation request submitted by another user, the user would be able to open that installation request and view its contents. A similar situation happens with UIR user account information, since the user ID is included in the URL and a user might view and potentially edit the account information of another user by replacing the user ID. Note: This situation can only happen when both users are either installation owner users or TxDOT users (i.e., the code already prevents an installation owner user from viewing or editing TxDOT user account data). **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**

Table 7. Summary of Issues Addressed in 2008 (Continued).

No.	Date	Brief Problem Description
11	05/15/2008	TxDOT users suggested the following improvements to the UIR Reports function: • enable generating reports by request type; • enable querying all historically submitted requests within the same district; • add the number of retrieved requests on the generated reports; • improve the Export to .csv function to enable a user to export a report to Microsoft Excel; and • enable users to generate reports by either initial or latest submission date. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
12	05/15/2008	Certain TxDOT officials experienced problems when attempting to approve new UIR account applications. After clicking the Approve New Account button to complete the approval, UIR appeared not to be responding, particularly when the Internet connection speed was slow (the problem was not evident when the Internet speed was high). After the user clicked other links, the browser displayed an Error on Page icon on the lower left corner of the browser window. It is necessary to add a warning message asking users to wait until the page is fully loaded. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
13	05/15/2008	On 09/09/2007, TTI modified the new user registration procedure (at that time, TTI had not migrated UIR to TxDOT yet). To notify UIR users about the modification, TTI added the following warning message on the new user registration page: Attention: the procedure to create new user accounts has changed as of 09/09/2007. This warning message is no longer necessary. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
14	05/15/2008	TxDOT users reported a problem during the request PDF generation process, where the second page of the PDF file displays an Oracle error message (although the data have been correctly stored in the database). The problem occurs so rarely that TTI could not replicate it through testing. Nonetheless, TTI optimized queries in some system files to improve reliability. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**

Table 7. Summary of Issues Addressed in 2008 (Continued).

No.	Date	Brief Problem Description
15	07/31/2008	TxDOT users from several divisions are not able to submit feedback using the UIR interface. Originally, the feedback function was intended for use at the district level (i.e., all feedback would go to a designated district administrator). Because division users are not affiliated with districts, those users would receive an error message when attempting to submit feedback. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
16	08/15/2008	The reporting function on UIR stopped working. The function failure was caused by a combination of an inefficient SQL query used to generate reports and the amount of data accumulated in the UIR database. This modification will allow the reporting function to work correctly with the current database. TTI will further optimize the queries and interface of the Reports function in the near future and provide an upgrade of the function to permanently solve the performance issue. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
17	10/31/2008	This modification addresses performance and usability issues of the reporting function, as documented in issue 16 (submitted 08/15/2008). This issue includes a modification to the reporting interface, optimization of the SQL queries used by the function, and development of a more efficient mechanism to display the generated reports. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **Yes**
18	10/31/2008	Earlier this year, the TxDOT Information Systems Division changed its name. Several UIR database entries need updating (which can be done using the UIR interface). There are also two UIR system files that currently point to the old name, which need to be updated. **Request type:** • Source code change request: **Yes** • Controlled data change request: **Yes** • Relational database service request: **No**

Table 7. Summary of Issues Addressed in 2008 (Continued).

No.	Date	Brief Problem Description
19	12/02/2008	A TxDOT user reported that, when an installation request was routed to some users, UIR did not send out emails to those users. These users had previously set their email settings not to receive emails. Later they changed their settings to receive emails, but UIR did not send emails to them after that change. The cause was the use of obsolete code in some system files pertaining to email. TTI also found that the following four fields in the TXDOT USER PROFILE and UTILITY COMPANY USER PROFILE tables were no longer needed and should be dropped (because a different table, USER EMAIL NOTIFICATION, handles that functionality): • NEW USER EMAIL FLAG • NEW PERMIT EMAIL FLAG • PERMIT STATUS EMAIL FLAG • OFFICE CHANGE EMAIL FLAG **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **Yes**
20	12/02/2008	During testing, TTI found that when a utility user attempts to create a new account with a login ID that already exists, UIR highlights the login ID field and shows a yellow error bar at the bottom of the page without displaying an error message. **Request type:** • Source code change request: **Yes** • Controlled data change request: **Yes** • Relational database service request: **No**
21	12/02/2008	During testing, TTI found that the Manage TxDOT Units function for TSD security administrators did not work correctly. While using the Manage TxDOT Units menu item, when a TSD administrator clicks a user account to view that account, UIR shows the administrator's home page instead of the selected user's account information. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**

Table 7. Summary of Issues Addressed in 2008 (Continued).

No.	Date	Brief Problem Description
22	12/02/2008	Some TxDOT users noticed that the Send To dropdown list on the Conduct Action page did not list any users when using the Tab key to navigate through the different dropdown lists. However, the users did not have the same problem when using the mouse to navigate the page. When a TxDOT user tried to assign an inspector to an installation request, UIR listed all inspectors in the selected office on the Inspector Selected dropdown list regardless of their account status. The dropdown list should only list active inspectors (i.e., filtering out inspectors who are inactive, permanently inactive, and out of office). TxDOT does not allow consultants to submit installation requests. UIR disables the Submit button in Step Six for consultants. However, UIR does not display a message advising consultants how to proceed. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**
23	12/31/2008	In December 2008, TxDOT approved the use of a new request form (Form 1082). As requested by TxDOT, it is necessary to implement the December 2008 version of Form 1082 in UIR. **Request type:** • Source code change request: **Yes** • Controlled data change request: **Yes** • Relational database service request: **No**
24	12/31/2008	At the end of 2008, TxDOT upgraded its main website. This upgrade made some links provided under Other Resources in UIR obsolete. In addition, the Texas Commission on Environmental Quality (TCEQ) changed the address of a link that had been provided under Other Resources in UIR. It is necessary to update all these links. On the TxDOT interface, when a TxDOT security administrator creates a new user account using a login ID that has been used by an existing user, UIR shows an error message reading "Could not find message." The correct error message should read "The Login ID selected (<NewLoginID>) already exists. Select a different Login ID." The latest UIR help system was submitted to TxDOT along with other project deliverables in November 2008. However, both the test and production servers at TxDOT still display an older, obsolete version of the help system. **Request type:** • Source code change request: **Yes** • Controlled data change request: **No** • Relational database service request: **No**