7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Software to create the reports, a Users Manual, a training module, and a report describing the project.

8. Describe how will this project be implemented at UDOT.

Training will be conducted, Users Manuals distributed, software submitted to the PM staff, and reports added to each section plan.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

The reports should be useful for 10 years or longer. Users will include Maintenance Engineers, PM Engineers, Maintenance personnel, Safety Coordinators, Project Managers, and designers.

10. Describe the expected risks, obstacles, and strategies to overcome these.

There are problems when information from various databases is extracted for use. Users will need to have a basic understanding of how to interpret the information contained in the reports.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Dave Blake and Traffic & Safety staff, region staff responsible for projects and programs within the roadway.

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $40,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Doug Anderson		
B) Dave Blake		
C) Robert Clayton		
D) Glen Ames		
E) Ed Rock		
F) Bill Lawrence		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

MPOs could benefit from the information. Some city and county governments could use the information. Enforcement agencies could use the data if we choose to include information such as DUI related crashes, speed related accidents, truck crashes, etc.

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Cross-Asset Analysis: fair comparison among asset classes No.:06.05-2

Submitted By: Glen Ames E-mail: glenames@utah.gov

1. Briefly describe the problem to be addressed:

UDOT is currently able to perform a cross-asset analysis where benefit-cost ratios are calculated and projects are recommended from the software. However, we must re-examine how we are calculating and comparing the benefits of a bridge project vs. a pavement project. We must ensure that the scale is not tipped too far in favor of one or the other so that the results of the analysis can have good integrity.

Strategic Goal: ☒ Preservation ☐ Operation ☐ Capacity ☒ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Document the methodology of calculating and comparing benefit/cost ratios that are fair and balanced among various asset classes such as pavement, bridges and maintenance.
2. Together with Deighton Associates, document how to implement the changes within dTIMS-CT Enterprise

3. List the major tasks required to accomplish the research objective(s): Estimated person-hours: 400 hours

1. Examine how UDOT is currently performing the cross asset analysis, including how the benefit/cost ratios are calculated and compared (40 hours)

2. Research what other transportation agencies in the world are doing in the area of cross-asset analysis and how they are comparing benefits between different asset classes. (40 hours)

3. Develop and recommend a better way of calculating/comparing the benefit/cost ratios between various asset classes (80 hours)

4. Create a document describing the process of comparing the benefit/cost ratios between various asset classes and how to implement this in dTIMS-CT (work with Deighton Associates on the dTIMS-CT portion). (40 hours)

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Aug 2006 – Sep 2006: Step 1 and 2

Oct 2006 – Nov 2006: Step 3

Dec 2006: Step 4

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project

Small: ☒ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative：

☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University, but will need to work with the consultant from Deighton Associates

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

A document describing the process of comparing the benefit/cost ratios between various asset classes and how to implement this in dTIMS-CT (work with Deighton Associates on the dTIMS-CT portion).

8. Describe how will this project be implemented at UDOT.

The recommended methodology from the project will be incorporated into the model used within the dTIMS-CT software.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

UDOT will have a better way to compare the benefit/cost ratios among asset classes, which will give the Asset Management System more integrity and repeatability.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Recommendations must be approved by TRANSMAT

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Glen Ames, Asset Management Engineer

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): 200 hrs x $100/hr = $20,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Glen Ames	UDOT	965-4953
B) Jeff Zavitski	Deighton Associates	905-697-2644
C) TRANSMAT	UDOT	965-4000
D)		
E)		
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

RESEARCH PROBLEM STATEMENT

Problem Title: UDOT Database Integration **No.:** 06-05.3

1. Briefly describe the problem to be addressed:

The Department has several differing databases that collect and store a lot of the same information. This collection and storage of data should be merged into one database.

Strategic Goal: x Preservation x Operation 9 Capacity x Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. An independent study to look at the databases in use and being developed.
2. Determine those that collect and store the same information.
3. Recommendation on how to merge, store and access the information.
4.
5.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Obtain a list and complete a review of Department databases. (40hrs)
2. Determine common information. (120 hrs)
3. Study and recommend how to merge, store and access the information. (120 hrs)
4.
5.
6.
7.

4. How will this project be implemented? (e.g. training, equipment, software, hardware, field demos, workshops, etc.)

X Improved asset 9 Crashes reduced 9 Environmental benefit X Enhanced efficiency 9 Other

Long term implementation based on recommendations of the study.

(Please fill out other side of sheet as well.)

5. What deliverable(s) would you like to see? (e.g. useable technical product, technique, policy, procedure, specification, standard, software, training tool, etc.)

Useable report with recommendations.

6. Who in the Department could be the direct end-users of this study's results?

All who manage and use databases. ISS Department.

7. How could the Department benefit from implementing the results of this study?

It will give the Department an outside opinion and direction regarding database collection and storage. It will give the Department an overall view of what effort will be required and what is possible in migrating and merging duplicate information currently in differing databases.

8. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $20,000

9. List the potential champions (people interested in and/or willing to participate in the Technical Advisory Committee for this study):

Name	Organization/Division/Region	Phone	Attended UTRAC?
A) Gary Kuhl	UDOT/Program Development/Complex	964-4552	Yes
B) Bill Lawrence	UDOT/Program Development/Complex	965-4560	Yes
C) Michelle Verucchi	UDOT/Program Development/Complex	965-4490	?
D)			
E)			
F)			
G)			

10. Identify other Utah agencies or groups that may have an interest in supporting this study:

9 City 9 County 9 MPO 9 Research Organization 9 Private Industry 9 University 9 Other

List names:

11. Identify other regional/national agencies or groups that may have an interest in supporting this study:

9 FHWA 9 USGS 9 EPA 9 NCHRP 9 TCRP 9 State DOT=s 9 Other

List names:

RESEARCH PROBLEM STATEMENT

Problem Title: PRIORITIZATION OF BICYCLE AND PEDESTRIAN IMPROVEMENTS **No.: 06-05.4**

1. Briefly describe the problem to be addressed:

Interest has been growing for several years, at UDOT, among local communities, and with the public at large, in providing new facilities to safely accommodate bicycles and pedestrians along state highway corridors. The interest is driven by a desire to improve safety, increase bicycle tourism opportunities, facilitate healthy activity for residents, and potentially slow growth in the demand for automobile travel. SAFETEA-LU has mandated the Safe Routes to School program. To address these needs, UDOT has added specific bike and pedestrian information to its Manual of Instructions and the Preconstruction design checklist. Much progress has been made at the project-implementation level, but there is still much to be done at the strategic level of planning and project selection.

While UDOT has large volumes of data on motor vehicle usage available for its roadway project selection process, very little exists for bicycle or pedestrian usage, beyond some crash statistics. Within the past year, UDOT has begun collecting some bike and pedestrian counts, (one was completed lat year in Cedar City and three more are planned for 2006 in Sandy, Logan, and at Parley's Crossing) but we still need a prioritization procedure. A small, but significant amount of funding is available each year for bicycle- and pedestrian-related improvements. As popularity grows, additional funds may also become available. A systematic, cost-effective process is needed to determine the location of needed improvements statewide and to prioritize needs on long-term and annual bases so these funds may be used in the most effective manner. Such a procedure would also be very helpful if additional funds were to be identified from federal, state, local, or private sources.

Strategic Goal: Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Recommend a procedure for identifying bicycle and pedestrian needs statewide and prioritizing projects to meet those needs over the period covered in the UDOT long-range transportation plan. Include recommendations on data type and amount to be collected and on cost-effective collection techniques.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Literature search and other research to determine what other states, metropolitan planning organizations, and cities are using to assess their bicycle/pedestrian facility needs and how they prioritize spending on those facilities.

2. Evaluate the various data collection/analysis tools available and make recommendation on what UDOT should use.

3. Determine if it is appropriate to use some kind of warrant for each facility. If so, recommend a warrant analysis.

4. Recommend a procedure to prioritize the implementation of improvements to the state highway system to address bike and pedestrian needs, so that a financially responsible project-based long-range pedestrian and bicycle plan may be developed.

5. Identify stakeholders and potential funding sources for these improvements.

4. How will this project be implemented? (e.g. training, equipment, software, hardware, field demos, workshops, etc.)

The developed procedure would be used annually to prioritize corridors for addition/upgrade of sidewalks, ped overpasses, bike lanes, widened shoulders, etc. It would also be used in preparing a true long range plan for pedestrian and bicycle facilities on and parallel to the state highway system, focusing on the areas of greatest safety need, highest current and latent demand, and other pertinent factors. This will be a cooperative effort. Maximum 1-yr study.

5. What deliverable(s) would you like to see? (e.g. useable technical product, technique, policy, procedure, specification, standard, software, training tool, etc.)

Procedure for identifying and prioritizing bicycle and pedestrian needs associated with the state transportation system.

6. Who in the Department could be the direct end-users of this study's results?

Planning, Project Development, Region Preconstruction, Region Construction

7. How could the Department benefit from implementing the results of this study?

The new procedure derived from the study would allow UDOT to plan and program projects to serve pedestrian and bicycle need and to do so in a logical, systematic, and repeatable fashion.

8. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $20K

9. List the potential champions (people interested in and/or willing to participate in the Technical Advisory Committee for this study):

Name	Organization/Division/Region	Phone	Attended UTRAC?
A) Kevin Nichol	UDOT Planning	965-3853	Y
B) Sharon Briggs	UDOT Planning	964-4564	N
C) Todd Hadden	UDOT Systems Planning & Programming		Y
D) Michael 'Kaz' Kaczorowski	UDOT Planning		Y
E) Jory Johner	WFRC		N
F) Jim Price	Mountainland Assn of Governments		N
G) Theron Jeppson	UDOH – Bike/Ped		N
H) Roland Stanger	FHWA		
I) Stakeholder Rep	Biking Industry		

10. Identify other Utah agencies or groups that may have an interest in supporting this study:

Alliance for Cardiovascular Health – UDOH
Utah Division of Parks & Recreation
Salt Lake Mayor's Bicycle Advisory Committee (MBAC)
Salt Lake County Bicycle Advisory Committee
Weber Pathways, Provo Bicycling Committee, Utah Travel Council
Bingham Cyclery, Bonneville Touring Club, Cache Trails Coalition, Parley's Rails, Trails and Tunnels Coalition (PRATT)
Three Rivers Trail Foundation, Mountain Trails Foundation, Color Country Cycling Club
Utah Transit Authority
PTA
Utah Bicycle Coalition

11. Identify other regional/national agencies or groups that may have an interest in supporting this study:

FHWA
State DOT's
USDA Forest Service
National Park Service
REI
Adventure Cycling Association
Association of Pedestrian and Bicycle Professionals
Bikes Belong, International Walk To School, National Center for Bicycling and Walking, Walkable Communities Inc.
America Bikes, America Walks

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Asset Tracking – (construction history) No.: 06.05-5 (also see 06.03-2)

Submitted By: Gary Kuhl & Bill Lawrence & Mike Marz E-mail: Gkuhl@utah.gov Blawrence@utah.gov

1. Briefly describe the problem to be addressed:

UDOT does not have a defined process to capture information about the changes we make to our roadways. Many database systems need to be continuously updated to reflect changes made each year.

A standardized method(s) needs to be created that can be completed by anybody doing Maintenance or Construction that makes a change to the system that will capture what was done, where it was done, when it was done & how much it cost.

A more involved process needs to be developed to take this information and make it available to those database managers to update their data.

This would initially capture the data needed to update the Reference System, Plan for Every Section and Pavement Management databases, as well as the Maintenance Features Inventory and HPMS database. Changes such as adding a lane, changing the median width, placing a chip seal or overlay, and many others could all be recorded and made available from one location.

2. List the research objective(s) to be accomplished:

1. Formalize a procedure to regularly obtain the as constructed or maintenance information or changes that occur to the roadway.
2. Identify a standard regarding what information should be recorded.
3. Develop or use a current system to enter and store this data.
4. Create reporting methods that will make this information available for use in a convenient way.

3. List the major tasks required to accomplish the research objective(s): Estimated person-hours

1. Form a UDOT QIT to identify what information is needed to update the various databases.
2. Create a form(s) to record these changes.
3. Identify who should enter this information.
4. Create a procedure(s) to follow for data entry.
5. Design a system to manage and report this information.
6. Hire a consultant capable of creating and/or updating the needed database and reporting system, or purchase some off the shelf software.
7. Test the system.
8. Train the users on how to access the system to enter and retrieve information.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Should be completed by July 1, 2007

5. Indicate type of research and / or development project this is:

X Research Project

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

In house staff with software consultant.

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

A software application to enter, manage & report the information, with links to current UDOT databases. User documentation & training. A report describing the project.

8. Describe how will this project be implemented at UDOT.

A procedure will be followed to enter changes thru a web-based form(s). As needed reports will provide database managers with updated changes to keep various databases up to date. System enhancements could automate the database updates.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

System changes will be recorded timely and accurately creating a history of what we did. Annual tracking can be automated.

10. Describe the expected risks, obstacles, and strategies to overcome these.

There needs to be consistency in data entry, both in actually doing it & in what gets recorded.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Bill Lawrence & Mike Marz

Pavement management & Planning Statistics

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $30,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone
A)	Gary Kuhl	Systems Planning & Programming	
B)	Bill Lawrence	Systems Planning & Programming	
C)	Jerry Arnold	Systems Planning & Programming	
D)	Llyod Neely	Maintenence	
E)	Darrel Giannonatti	Construction	
F)			
G)			

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

Other DOTs interested in managing their Assets.

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Data Management System for Systems Planning and Programming **No.: 06-05.8**

Submitted By: Matthew Swapp **E-mail: mswapp@utah.gov**

1. Briefly describe the problem to be addressed:

We are need of a data management system for all of the various data items collected and referred to by customers of the Systems Planning and Programming Division. The Goal of this project would be to develop a data management system to meet the needs of our division.

Strategic Goal: ☐ X Preservation ☐ X Operation ☐ X Capacity ☐ X Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Research what has been done in other states.

2. Analyze other states systems and compare to our needs

3. Develop and implement a system for use in Systems planning and Programming

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Research

2. Analysis

3. Development

4. Implementation

5.

6.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

18 Month Contract

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ X Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative：
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

Consultant

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Management System, Users Guide, Training

8. Describe how will this project be implemented at UDOT.

Approval and acceptance at various management levels
Funding, personnel , and management arranged
Project implemented and updated on a fixed schedule

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

Data will be made more accessible to all customers.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Cost and manpower effort to maintain.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Matt Swapp / Kim Schvaneveldt / Ahmad Jaber

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $ 40,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Kim Schvanelveldt	Planning Section	
B) Ahmad Jaber	Systems Planning and Programming	
C) Bill Lawrence	Traffic Statistics	
D)		
E)		
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: Other UDOT Region Offices and Division Offices

2006 RESEARCH PROBLEM STATEMENT

Problem Title: An Evaluation of Toll vs. HOT Lane Facilities **No.: 06-05.9**

Submitted By: Grant Schultz (BYU) **E-mail:** gschultz@byu.edu

1. Briefly describe the problem to be addressed:

Over the past few years UDOT has initiated a statewide study to evaluate the potential for implementing various managed lane techniques including: 1) reversible lanes, 2) high occupancy vehicle (HOV) lanes, 3) high occupancy toll (HOT) lanes, 4) fast and intertwined regular (FAIR) lanes, and 5) toll facilities. The results of this study provided the background on managed lane technologies available for consideration in the state as well as some of the issues associated with the implementation of such lanes, including Legislation to allow UDOT the ability to use managed lanes.

The purpose for this research project is to advance the concept of toll facilities in the state of Utah by comparing, contrasting, and identifying the pros and cons of regular toll lanes vs. high occupancy toll (HOT) lanes. This would include a summary and discussion of the impacts on traffic, expected revenue projections, and implementation details (i.e., what is required to manage each technique).

Strategic Goal: ☐ Preservation ☐ Operation ☒ Capacity ☐ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Prepare a summary of the state of the practice for Toll and HOT lanes.
2. Prepare a summary of the pros and cons for Toll vs. HOT lanes.
3. Identify the traffic impacts, revenue projections, and implementation details for Toll and HOT lanes.

3. List the major tasks required to accomplish the research objective(s): 12 – 18 months **Estimated person-hours 1,600**

1. Literature review to identify the pros and cons of the Toll facilities.
2. Survey state DOTs and research agencies that are currently using and managing Toll and HOT lanes.
3. Summarize survey results.
4. Estimate revenue projections and summarize implementation details.
5. Prepare a summary of results (research document) as well as a presentation of these results for UDOT.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Coordinate with UDOT on current Toll projects to identify critical time periods for analysis. Once these time periods have been identified, begin research project and evaluation. Anticipated timeframe 12 to 18 months.

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative :
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University in consultation with Consultant on current related UDOT projects and UDOT Staff.

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)
The deliverables expected from this project would include a report outlining the comparison of Toll vs. HOT lanes and a presentation for UDOT staff summarizing the results.

8. Describe how this project will be implemented at UDOT.
This project will be implemented at UDOT through the planning program by providing information on Toll and HOT lanes that can be utilized in corridor project evaluations.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.
UDOT will benefit from this project as the groundwork will be set for planning and operations to consider Toll and HOT lanes in future corridor projects.

10. Describe the expected risks, obstacles, and strategies to overcome these.
No known risks.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results): Ahmad Jaber

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3):$30,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Grant Schultz	Brigham Young University	(801) 422-6332
B) Matt Swapp	UDOT Planning	
C) Russ Robertson	FHWA	
D)		
E)		
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: WFRC, MAG.

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Alternative Light wavelengths for Automated Pavement Distress Data Collection **No.: 06.05-10**

Submitted By: Chris Glazier **E-mail:**cglazier@utah.gov

1. Briefly describe the problem to be addressed:

High Intensity light used to illuminate pavement during automated distress data collection pose serious hazards to the surrounding drivers. The bright flashes or strong light can cause visual interference and distraction, even temporary blindness. Perhaps light spectrum beyond the visible range can easily provide the illumination required for accurate data collection an at the same time remove the potential hazard to drivers.

2. List the research objective(s) to be accomplished:

1. Acquire pavement images with multi spectral and hyper-spectral cameras.

2. Find appropriate signature wavelengths that provide data for automated distress detection

3.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Search existing pavement publications for information

2. Search for appropriate camera functionality

3. Take sample images

4. Run test images through SmartPDA software

5.

6.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

no schedule

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project
Small: ☒ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative：
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)? University/consultant

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Report showing wavelengths most appropriate outside visible spectrum

Make model and cost of cameras and lens

8. Describe how will this project be implemented at UDOT. When UDOT puchases upgrades to Photolog Van, new pavement image data collection technology should be incorporated.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be. Better, Faster, safer, cheaper and more accurate pavement distress data.

10. Describe the expected risks, obstacles, and strategies to overcome these.
Perhaps No camera is suitable, perhaps no wavelength of light provides proper illumination.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Bill Lawence and Chris Glazier

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3):

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Gary Kuhl		
B Russ Scovil		
C) Doug Anderson		
D)		
E)		
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

2006 RESEARCH PROBLEM STATEMENT

Problem Title: GIS Project Tracking Website **No.: 06.05-11**

Submitted By: Ed Rock **E-mail:** erock@utah.gov

1. Briefly describe the problem to be addressed:

One of the criticisms that UDOT receives from the pubic is why we don't have better coordination between our construction projects. Sometimes this happens because transportation funding is controlled by politics and we have little control over that process. However, on other occasions this criticism is valid and could be improved if we did better planning. Unfortunately, most of the tools we use in UDOT to manage preconstruction and construction projects do not allow the projects to be viewed simultaneously in a graphical view. For example ePM is a great tool but lacks a graphical way to show projects.
We need a better tool. We need to develop a tool to graphically display all UDOT projects (both preconstruction & construction projects) in a using a GIS web environment. This would allow project managers, PICS, media, local governments, contractors, and the public to view all projects and do better planning. The user could choose to view projects on a map by type or construction, year, PM, RE, etc. The map could allow the user to click on the road to go to the Project website. ACCURATE preconstruction and construction schedules could be view (i.e, when will construction be finished, when will it be advertised).

Strategic Goal: ☐ Preservation ☒ Operation ☒ Capacity ☐ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Develop a GIS website to display all preconstruction and construction projects. The GIS website would allow users to query projects based on various criteria and then display the results on an interactive map.

2. Evaluate how much the product is being used, if it is improving how we do business, & if it is of value to our external customers and partners.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Use GIS to develop a Transportation Explorer website. (1500 hours)

2. Link GIS website to ePM and PDBS databases. The would involve a effort to clean up those database so that it is GIS compatible. It could also require creating some new fields in ePM. (1500 hours)

3. Link map to project websites. (40 hours)

4. Provide training on how to use the system. (40 hours)

5. Evaluate how much the product is used and if it is improving our planning process. (80 hours)

4. Outline the proposed schedule (when do you need this done, and how we will get there):

GIS Web Development – 6 months
Modify/Clean Database – 3 months
Implementation & Product Evaluation – 6 months
Report on project effectiveness.

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☒ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative :
☐ Other _____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

UDOT ETS has already started to develop a pilot version of this concept for Region Two using an AJ web developer and Chris Glazier's time. If funded, we could continue this effort and expand it Statewide by hiring AJs and involving ePM staff/resources.

Page 2

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

GIS Project Tracking Website (GIS ePM)

8. Describe how will this project be implemented at UDOT.

Develop the GIS Project Tracking website, train users, and allow them to use and evaluate the system.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

PMs, Preconstruction Engineers, and planning can see graphically all upcoming and current projects and make better planning decisions. It would allow these groups to show ePM and PDBS data on a map.

UDOT management (Region Directors, etc) could use the tool to keep better track of projects.

PICs, the public, local governments, and the media could use the tool to see keep track of projects and find out project status/information.

10. Describe the expected risks, obstacles, and strategies to overcome these.

1. Product goes unused or underused.

2. Clean up ePM & PDBS databases to be GIS compatible and program some features (data fields) into ePM. This will require coordination and buyoff by ePM & PDBS management.

3. Rely on PMs and others to keep the database current.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results):

Ed Rock - ETS

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $95,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone
A)	Chris Glazier	ETS - GIS	965-4381
B)	Becky Stromness	ePM	964-4518
C)	Joe Kammerer	Region Two Project Management	
D)			
E)			
F)			
G)			

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

Consultants, AGC

2006 RESEARCH PROBLEM STATEMENT

Problem Title: 3D Photolog **No.:** 06.05-12

Submitted By: Ed Rock **E-mail:** erock@utah.gov

1. Briefly describe the problem to be addressed:

UDOT has an existing photolog system. The system is useful but has limited applications because the images can only be viewed in one direction and are not taken at frequent enough intervals for certain needs.

Immersive Media can provide camera system that creates a photolog movie that allows the user to pan the camera all directions (up, down, 360 degrees). The system takes 30 frames per second, so the user can see all features along the roadway. It is literally like having a 3D movie of our roadways.

The system costs $120,000.

If we purchase this system and implement the technology, we could take our photolog system to a whole new level and increase the number of people who would use the system.

Strategic Goal: ☐ Preservation X Operation X Capacity X Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Replace our existing photolog system by purchasing the Immersive Media 3D Photolog system.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Purchase the Immersive Media Camera system. ($120,000)

2. Train UDOT employees how to use the system. (80 hours)

3. Purchase necessary network and computer hardware infrastructure to house the data. ($10,000 estimated)

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Purchase Immersive Media Camera System
Train existing Photolog employees how to use the system.
Begin logging state routes using new system

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project X Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative ☐ Other _____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

Use existing UDOT Staff.

Page 2

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)
Immersive Media 3D Photolog System

8. Describe how will this project be implemented at UDOT.

Replace existing 2D photolog system

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

Designers could collect existing conditions from the office. This would reduce field visits and save time. For remote design projects this time savings could be substantial. It would reduce the risk of exposure to being out in traffic to collect data. Data could be collected from a computer in the office by panning the camera.

Maintenance and operations can review existing field conditions and inventory our system from the office, saving time and exposure.

Planners could use the system to get knowledge of existing roadway system.

The 3D photolog movies of our system could be a valuable tool in the event of a natural disaster.

10. Describe the expected risks, obstacles, and strategies to overcome these.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results):

Ed Rock - ETS

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $130,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone
A)			
B)			
C)			
D)			
E)			
F)			
G)			

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Crash Data Mining - Safety Effectiveness of Roundabouts in Utah No.: 06.06-1

Submitted By: Prof. Mitsuru Saito E-mail: msaito@byu.edu

1. Briefly describe the problem to be addressed:

Since roundabouts were implemented in Utah several years have passed and they are now ready for in-depth crash analysis. In a previous study done by Prof. Saito, we focused on developing design guidelines and crash analysis was excluded due to the lack of "after" data. Now that crash data of "after" years are available and they need to be analyzed to evaluate whether roundabouts are truly effective in reducing frequency and severity of crashes at intersections. A NCHRP 3-65 "Roundabouts in the United States" is scheduled to be completed in February this year and new nationwide data set and crash analysis models will be available. This study takes advantage of the new findings for the NCHRP study and compares how the roundabouts in Utah are performing in safety improvement.

2. List the research objective(s) to be accomplished:

1. Evaluate the effectiveness of roundabouts in crash reduction
2. Compare Utah's crash data with the nationwide data and evaluate their crash reduction models

3. List the major tasks required to accomplish the research objective(s): Estimated person-hours: 800 hrs

1. Literature search on safety improvement by roundabouts, especially NCHRP 3-65 report
2. Collect crash records, before and after installation of roundabouts in Utah
3. Conduct statistical analysis and develop prediction models and compare the results with NCHRP 3-65 data
4. Evaluate safety effectiveness of roundabouts
5. Write a final report

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Start in June 2006, Complete in April 2006

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative :
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)? University

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)
A final report discussing safety effectiveness of roundabouts

8. Describe how will this project be implemented at UDOT.

Use as a reference for evaluating future roundabouts.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.
Additional information on selection of roundabouts. The final beneficiaries are the public.

10. Describe the expected risks, obstacles, and strategies to overcome these.
No risks.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Robert Hull

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $20,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Doug Anderson	UDOT R&D	801-965-4377
B) Rob Clayton	T & S	
C) John Leonard	T&S	
D)		
E)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:
Utah cities and counties

2006 RESEARCH PROBLEM STATEMENT

Problem Title: An Analysis of Median Crossover Crashes in Utah **No.: 06.06-4**

Submitted By: Rob Clayton (UDOT)and Grant Schultz (BYU) **E-mail:** robertclayton@utah.gov gschultz@byu.edu

1. Briefly describe the problem to be addressed:

The purpose of this project is to evaluate median crossover crashes on the interstate freeway system in the state of Utah. Specifically, this project will evaluate crossover crash rates at interchange vs. non-interchange locations. It is theorized that crossover crashes on interstate facilities are higher at interchange locations when compared to non-interchange locations. Initial review of 10 years of data has indicated that there does seem to be a propensity for the rate to increase at interchanges. There is a need, therefore, to evaluate this topic in more detail to identify if a problem does exist and to identify mitigation factors to address this issue if the rates are, in fact, significantly higher at one location over another.

Strategic Goal: ☒ Preservation ☒ Operation ☒ Capacity ☒ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Evaluate crash rates at interchange vs. non-interchange locations in Utah to determine if rates are higher at one location vs. another.
2. Review research in other states to determine if others have found this to be true (the state of Florida, for example, has implemented a policy to install concrete barriers for ½ mile before and after every interchange as a result of research conducted in that state).
3. Identify contributing factors to the differences observed.
4. Make recommendations on mitigation measures to aid in reducing trends observed.

3. List the major tasks required to accomplish the research objective(s): 12 months **Estimated person-hours 1,200**

1. Literature review on safety at interchange vs. non-interchange locations.
2. Data collection on the interstate system within the state at interchange and non-interchange locations for both rural and urban settings.
3. Evaluate the data collected to establish trends in crash data. Assuming that rates are higher at interchange locations, identify why it is happening (e.g., merge/diverge, fatigue); where it is happening (e.g., rural/urban, upstream/downstream); and when it is happening (e.g., day/ night, rain/snow, etc.).
4. Compare Utah results with data collected in the literature review for other states.
5. Identify mitigation factors and make recommendations for improvement.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

It is recommended that this project begin in late Fall 2006, early Winter 2007 with the literature review and data collection and carry through the summer of 2007 with recommendations.

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☒ Development Project

Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative :

☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University and UDOT Staff joint participation.

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

The deliverables expected from this project would include a report outlining the literature review, data collection, and evaluation results and conclusions. From the report produced, mitigation measures would be recommended (assuming a problem is identified)along with recommendations for monitoring of the mitigation measures.

8. Describe how this project will be implemented at UDOT.

This project will be implemented at UDOT through the Traffic & Safety Division. This research will help UDOT Traffic & Safety to identify high crash locations in and around interchanges and to establish a plan to address these issues.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

UDOT will benefit from this project through an increase in safety at possible high crash locations.

10. Describe the expected risks, obstacles, and strategies to overcome these.

No known risks.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results):

Robert Clayton, Traffic & Safety (801) 965-4521

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $30,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone
A)	Grant Schultz	Brigham Young University	(801) 422-6332
B)	Robert Hull	UDOT Traffic & Safety	(801) 965-4273
C)			
D)			
E)			
F)			
G)			

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: TRB, NCHRP, ITE

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Traffic Impact Analysis Training (Permitting, Safety, Design) **No.: 06.06-5**

Submitted By: Tim Boschert (UDOT)and Grant Schultz (BYU) **E-mail:** tboschert@utah.gov gschultz@byu.edu

1. Briefly describe the problem to be addressed:

The purpose of this project is to develop a training process to supplement and aid in the effective implementation of a unified statewide traffic impact analysis (TIA) process as part of Utah Administrative Rule, R930-6. Educational materials would be established and taken from Region to Region to train UDOT personnel, local area government officials, local area Consultants and Developers, and other interested parties on the benefits and process of performing and analyzing traffic impacts of proposed developments. The training would help these individuals to follow the guidelines in Utah Administrative Rule, R930-6, relating to access management, design, and operations. In conjunction with the development of the training process and materials, all end users would be invited to suggest input to the process and training guide. Internal training would be developed first, followed by secondary education for the end users of the process.

The purpose for this training is to educate and inform all parties on the importance of TIAs as they are an integral part of the development of safe and efficient transportation systems. It is critical that the state of Utah be at the forefront in developing long-term preservation of businesses, access, and safety of the traveling public. TIAs play an integral part in this process and must be understood by all interested parties to be effective.

Strategic Goal: ☒ Preservation ☒ Operation ☒ Capacity ☒ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Development of a training analysis process to help users and customers understand the process and role of traffic analysis.
2. Train Region personnel and external users on the proper use of the TIA guidelines and the importance of TIAs in this process.
3. Provide additional guidance to Region Traffic Engineers, Permits Officers, Project Mangers, Designers, and Consultants to ensure consistency statewide.

3. List the major tasks required to accomplish the research objective(s): 18 months **Estimated person-hours 1,600**

1. Literature review and focus groups to establish the state of the practice on TIA training, evaluation, and implementation.
2. Identify key concepts from the access management process to form the basis of the training program.
3. Develop training materials for both TIA guidelines and process and analysis of the studies.
4. Provide materials for a self contained training tool as well as a regular rotation for future training statewide.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

It is recommended that this project begin in late Fall 2006, early Winter 2007 with the development of the training materials. A draft training module would be unveiled by late Spring 2007 and the training program established for the Summer of 2007. Training would be undertaken during the summer months with feedback provided and recommendation made on future training.

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☐ Development Project

Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University and UDOT Staff joint participation with input from focus groups comprised of the end users (UDOT and other participants).

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

The deliverables expected from this project would include: 1) a process and manual for performing and analyzing TIAs, 2) a set policy for training to ensure appropriate users receive the training, 3) implementation of a training process to be included in the UDOT Design Manual, and 4) establishment of a rotational process to update training and ensure consistent coverage statewide.

8. Describe how this project will be implemented at UDOT.

This project will be implemented at UDOT jointly through the Project Development and Traffic & Safety programs. The result of this development will be extremely useful in ensuring that Department personnel from all division understand the importance of a uniform analysis process and how they can benefit from the program and aid the Department in providing a safer and more efficient transportation system. Outreach and education will be necessary across several UDOT divisions: Planning, Project Development, Traffic & Safety, and Right of Way (Permitting).

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

UDOT will benefit from this project in all divisions though a unified understanding and process of TIAs, their role, and the benefits that they can provide. Excepted will be an increased efficiency of performance and analysis resulting from a standardized format. Consultants will also benefit through the standardization as will local government officials and others who participate.

10. Describe the expected risks, obstacles, and strategies to overcome these.

No known risks.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results):

Tim Boschert, UDOT Planning (801) 965-4175

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $35,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone
A)	Grant Schultz	Brigham Young University	(801) 422-6332
B)	Darin Duersch	UDOT Region 1 Traffic Engineer	(801) 620-1607
C)	Kris Peterson	UDOT Region 2 Traffic Engineer	(801) 975-4827
D)	Doug Bassett	UDOT Region 3 Traffic Engineer	(801) 227-8019
E)	Troy Torgerson	UDOT Region 4 Traffic Engineer	(435) 893-4707
F)			
G)			

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: TRB Access Management Committee, NCHRP, Consultants, ITE

RESEARCH PROBLEM STATEMENT

Problem Title: Testing and Evaluation of Non-Intrusive RWIS Instruments **No.: 06.06-6**

Submitted By: Ralph Patterson **E-mail: ralphpatterson@utah.gov**

1. Briefly describe the problem to be addressed:

UDOT is looking for alternative methods of measuring pavement surface conditions(i.e., moisture content, temperature and chemical etc…) to the current practice of using roadway pucks. These technologies/methodologies should be less intrusive to the road surface than the ones currently employed, while supplying the same level of information presently available.

Strategic Goal: ☐ Preservation ☐ Operation ☐ Capacity ☐ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Develop a non-intrusive method for detecting pavement temperatures and eutectic points of the road way surface.

2. Develop alternatives to measuring pavement temperature and chemical content other than using roadway pucks: The intent is to determine if there is a more maintainable, less expensive, and easier to install technology that will provide the information currently provided by the RWIS-ESS puck sensors.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Literature search/Vendor interviews (40 hours)

2. Existing product testing utilizing previous deployed RWIS sites (250 hours)

3. Enhancement or development of instrumentation to satisfy the above goals (960 hours)

4.Report (10pages) on findings and recommendations for deployment of said instrumentation (40 hours)

5.

6.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Spring 2005 conduct literature search and vendor interviews
Summer 2005 Product/methodology development, purchase current technologies to be tested
Fall 2005 Test existing technologies, continued product/methodology development
Winter 05/06 Test products/methodologies
Spring 2006 generate report with findings and recommendations

5. Indicate type of research and / or development project this is: Combination of Evaluation and Development

Large: ☐ Research Project ☒ Development Project
Small: ☒ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative : ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

Consultant

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Useable instrument as well as a report on recommendations for alternative methodologies to current practice

8. Describe how will this project be implemented at UDOT.

This product/methodology will be integrated into the sensor array on existing RWIS sites

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

Historically, when road rehab has been done in locations where surface pucks are located, the pucks are no longer useable and we have to install new ones. In addition we then cut into the new pavement (chip seal etc) to reinstall the pucks. A non intrusive device will let us keep the sensors longer, while leaving the integrity of the road surface intact. Both maintenance and construction will benefit from this change in procedure.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Data assimilation into the current architecture will be a challenge, since NTCIP standards for surface conditions are not fully developed

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results): Ralph Patterson

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $135,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone	Attended UTRAC?
A)	Mark Parry	ITS Traffic Management Division	887-3768	
B)				
C)				
D)				
E)				
F)				
G)				

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

2006 RESEARCH PROBLEM STATEMENT

Problem Title: SCATS (Sidney Coordinated Adaptive Traffic System) Evaluation No.: 06.06-7

Submitted By: David Kinnecom E-mail: dkinnecom@utah.gov

1. Briefly describe the problem to be addressed:

A SCATS traffic adaptive traffic signal system is being installed in 12 intersections in summit County as a pilot project. The Research Division has funded the first phase of an evaluation study to determine if this technology should be used elsewhere by UDOT.

The Research Division funding was supplemented by funding from Mountain Plains Consortium. Additional funding from MPC will be available beginning July 1, 2006.

2. List the research objective(s) to be accomplished:

1. Complete evaluation of the SCATS project.

2.

3.

3. List the major tasks required to accomplish the research objective(s): Estimated person-hours

1. Conduct "after" studies.

2. Compare "before" and "after" results.

3. Document change to stops, and delay.

4. Determine cost benefit.

5. Identify and document institutional and technical challenges and issues in design, construction, manintenance and operation of the system.

6.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Complete by September , 2006.

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project
Small: X Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative : ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University of Utah (They have conducted first phases of the project.)

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Report

8. Describe how will this project be implemented at UDOT.

The results will be used by UDOT in deciding where to use this technology in the future.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

If the SCATS technology is successful, it will be installed elsewhere and will improve operation and coordination of traffic signals. Beneficiaries are the traveling public.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Limited risk, since this is completion of the final phase of a study that is underway.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): David Kinnecom

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $50,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Richard Manser	Traffic Management Division	
B) Mark Parry	Traffic Management Division	
C) Bryan Chamberlain	Traffic Management Division	
D) Mark Taylor	Traffic Management Division	
E) Dr. Peter Martin	University of Utah	
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

University of Utah, Mountain Plains Consortium

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Seismic Vulnerability and Emergency Response of UDOT Lifelines **No.: 06.06-8**

Submitted By: Steven Bartlett, Peter Martin, Steve Burian **E-mail: bartlett@civil.utah.edu**

1. Briefly describe the problem to be addressed:

Earthquakes pose a significant risk to UDOT's transportation infrastructure. This infrastructure is needed after a seismic event to provide emergency response, recovery and reconstruction functions. It is important that the transportation network perform these vital functions in a timely manner to reduce loss of life, property and commerce following a major earthquake.

This study proposes to focus on two key aspects: 1) seismic vulnerability of the transportation system and 2) emergency response. Risk assessment, traffic modeling and loss estimation techniques will be applied to the transportation network to determine vulnerability of the system and lifelines that most be protected, maintained or upgraded to perform emergency response and recovery functions. The results of vulnerability study will also be used to develop emergency response strategies/activities to aid in pre and post-event planning.

The study will first start in Salt Lake County and then later encompass the Urban Wasatch Front.

Strategic Goal: ☐ Preservation ☒ Operation ☐ Capacity ☒ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Assess the seismic vulnerability of UDOT infrastructure using a systems approach.
2. Identify and prioritize UDOT's lifeline corridors and facilities using a risk based approach
3. Help UDOT develop a plan/program to protect/maintain/improve critical lifeline corridors
4. Help UDOT develop emergency response strategies/activities to enhance emergency response and recovery.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours: 2000 to 3000**

1. Apply the FHWA seismic risk assessment model to Salt Lake Valley to estimate potential earthquake damage resulting from earthquake strong motion, liquefaction, fault rupture, earthquake-induced landslides and mass movement.
2. Use UDOT traffic models to assess the disruption to the system from earthquake damage: including user and economic losses and delays results from the damage.
3. Determine the losses for a scenario earthquake (rupture of the Salt Lake City segment of the Wasatch fault) and other nearby events using risk assessment.
4. Identify key corridors and facilities that should be targeted from improvement, upgrade, or replacement.
5. Help UDOT develop emergency response activities that minimize the disruption and restore the system to a serviceable capacity and added these activities to the emergency response plan.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

One year proposed schedule for completion of Salt Lake County

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☐ Development Project

Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University of Utah Civil and Environmental Dept. and the U of U Traffic Lab

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

1. Technical summary report
2. ARC GIS hazard assess,emt and traffic models
3. Implementation/Emergency Response plan for planning, traffic operations and safety.

8. Describe how this project will be implemented at UDOT.

1. Results of the study can be used for future planning and maintenance activities and funding of these activities
2. Traffic model can be used for other types of assessment (spills, floods, landslides, etc.)
3. Modifications/adaptations to UDOT's emergency response plan and activities

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

1. Reduction in seismic vulnerability and risk
2. A well-planned assessment and emergency response plan that includes realistic earthquake scenarios, damage and response to that damage.
3. Identification of key lifeline corridors and strategies to maintain, improve or upgrade these corridors.
4. A risk assessment/cost-benefit model that can be used for maintenance and planning purposes

10. Describe the expected risks, obstacles, and strategies to overcome these.

None. The proposed methods have already been developed by FHWA and the national center for earthquake engineering research. Traffic models have already been developed for the study area. This project will combine these models to develop the study and emergency response activities.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results):

Richard Clarke, Division of Maintenance
Walter Steinvorth, Division of Planning
Shana Lindsey, Division of Research

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $20k to $30k

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Bob Carey	DPE-DES	538-3784
B) Barry Welliever	Utah Seismic Safety Commission	welliver2@einк.net
C) Gary Christenson	Utah Geologic Survey	537-3304

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

MPC

THE MPC WILL BRING MATCHING MONEY (DOLLAR PER DOLLAR) FOR THIS STUDY.

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Validation of RappidMapper, Inc.'s LD3 Software Technology No.: 06.06-9

Submitted By: Frank Algarin, RappidMapper, Inc E-mail:

1. Briefly describe the problem to be addressed:

RMI has been in business for over three years with a focus of bringing this technology to the point that it is ready for the market. Proven and tested we are now focused on bringing this technology to the market. This proposal is for Public Safety in concert with the Department of transportation to rent the LD3 equipment and software needed to conduct a validation and viability test of the LD3 technology.
Terrestrial LD3 Scanning captures real world conditions of data that is more accurate and more easily visualized resulting in higher confidence in analysis and presentations. The benefits of this new-generation of tools and methods will be more accurate, faster, better, cheaper and lower-risk execution of work; better quality control; high quality visualization of projects for public acceptance and better documentation of existing and interim conditions to minimize litigation risks.

2. List the research objective(s) to be accomplished:

Conduct a validation and viability test of the RappidMapper LD3 technology via the following:

- Use of LD3 Camera for Data capture of real world data.
- Providing Dimensional data with an order of magnitude greater accuracy than LIDAR.
- 3D real world photo quality scenes in LD3 file format.
- Software to view and freely navigate in the image.
- Software that allows for planning and measurement of the scene.
- Training of personnel in operation of LD3 Camera.
- Training of personnel in the use of LD3 Designer software.

3. List the major tasks required to accomplish the research objective(s): Estimated person-hours

Training-RMI will provide training for Public Safety personnel on the operation of the LD3 Camera. The training will consist of:

- Camera setup.
- Camera software operation.
- Analyzing scene conditions for best capture of data i.e. weather, light conditions, etc.

RMI will provide training for Public Safety personnel on the use of the LD3 Designer software. The training will consist of:

- Navigation of virtual real world scene.
- How to acquire metric information.
- How to select information to move to a data base or CAD system.
- How to bring in 3D models for what if scenarios.

Software-LD3 Designer, The LD3 Designer software will allow the following functions:

- Allow for zoom in- out (the traditional camera directions should be used here; zoom, pan, tilt, truck) without noticeable loss of image fidelity of captured data.
- A user will be able to navigate smoothly through the scene- controlling the position, orientation, zoom, and velocity of a virtual camera moving through the scene.
- A user can save point images.
- A user with two clicks of a mouse can get the direct distance and angel between a pair of virtual marker points.
- A user with a single click of the mouse can get the global position and altitude of any point on the image
- A user can import 3DS objects.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Study will last 7 months.

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative：
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

UDOT staff

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

An understanding of the effectiveness of the technology

8. Describe how will this project be implemented at UDOT.

Technology will be used to capture existing data for use in the Preconstruction process.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

More accurate data collection for use in project visualization applications in public presentations.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Higher cost and a change in the way we have done things.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results):

Robert Hull

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $90,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Shana Lindsey	UDOT/Director of Research	
B)		
C)		
D)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

Dept. of Public Safety

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Automated Delay Estimates & other MOE's for Traffic Signals **No.: 06.06-10**

Submitted By: Mark Taylor & Dave Kinnecom **E-mail:** Marktaylor@utah.gov; dkinnecom@utah.gov

1. Briefly describe the problem to be addressed:

Develop algorithm and hardware to automatically measure delay and possibly other Measures of Effectiveness (MOE's) by time-of-day, and implement the algorithm and hardware on a test basis at signalized intersections. Some of the additional MOE's may include: determining arrival percentages on green/yellow/red, vehicle occupancy, vehicle classification, and vehicle volume. Intersection approach delay and movement delay are primary MOE's to be measured.

2. List the research objective(s) to be accomplished:

1. Develop algorithm to effectively measure delay and other MOE's.

2. Determine software and hardware options to collect delay and other MOE's by time-of-day automatically.

3. Develop procedures and field test the product(s) (automated MOE's) at signalized intersections for loops, video, and radar detectors.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours (600)**

1. Refine scope with TAC-technology & MOE's.

2. Develop logic to effectively and accurately measure delay and other MOE's.

3. Evaluate existing hardware capabilities and new alternatives for collecting data.

4. Develop algorithm to use automated MOE's with UDOT's detectors (inductive loops, video, and radar)

5. Develop procedures on how the automated MOE's can be installed or used in a user friendly and quick format.

6. Field Test and Calibrate the automated MOE's by comparing the automated MOE's with manually measured MOE's.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Schedule is open. We can get there by first developing the algorithms, which may be just mathematical, evaluate alternatives for collecting data, then decide how to collect the information and analyze it.

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project x Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University and possibly vendors.

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Algorithms, software, hardware, and procedures on how to set up automated MOE's for various different types of UDOT detectors.

8. Describe how will this project be implemented at UDOT.

Algorithm will be tested and refined. Once accepted, UDOT will decide whether to integrate into existing software packages and systems or run as a stand-alone application.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be. There are several benefits in developing automated MOE's, including: a) The ability to collect easily measured conditions in the field. Knowing what is really going on will assist UDOT in adjusting and fine-tuning traffic signal operations and making necessary geometric decisions. b)Automated MOE's will greatly assist in the calibration and validation of traffic signal models. c) Signal Operations, Traffic Engineers, and Transportation Planners will all benefit from this development.

10. Describe the expected risks, obstacles, and strategies to overcome these.
Development of software and hardware can be risky if to complex, however, if kept simple is better. Need to brain storm and develop good algorithms.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Mark Taylor, UDOT Traffic Signal Systems Engineer

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): (600 hours) $30,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A)	Dave Kinnecom, Traffic Operations Center	887-3707
B)	Bryan Chamberlain, Traffic Operations Center	887-3723
C)	Chris Siavrakas, Traffic Operations Center	887-3620
D)	Professor Mitsuru Saito, Brigham Young University	422-6326
E)		
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: Cities, Counties who operate traffic signals. UDOT planning and consultants who develop traffic models.

RESEARCH PROBLEM STATEMENT

Problem Title:	Highway Advisory Radio – Evaluation, Standardization, & Innovation	No.: 06.06-11
Submitted By:	Chris Siavrakas - TOC	E-mail: csiavrakas@utah.gov

1. Briefly describe the problem to be addressed:

Highway Advisory Radio is gaining new momentum as a tool to deliver complex information about Incidents, Special Events, and Construction information to the traveling public. As we look to expand the utilization of HAR, we need to understand how the future of Radio Communication is changing with technology. We also need a better understanding of the limitations of HAR, with current technology. One of the most difficult aspects of HAR is understanding its effectiveness. Without administering costly roadside polls, it is difficult to adequately summarize both quantitatively and qualitatively the user benefit of HAR.

Strategic Goal: ☐ Preservation ☒ Operation ☒ Capacity ☒ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Evaluate Current and Emerging Technology associated to HAR

2. Establish a cost/benefit ratio for portable and permanent HAR

3. Standard Guidelines for selecting location and display to the public

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Determine a cost/benefit ratio for both permanent and portable HAR applications 200

2. Present Radio band limitations/overlaps and new technologies (Satellite Radio, In-Vehicle radio break in) 160

3. Present best methods for alerting traffic to turn on HAR (sign/flasher design) 160

4. Review Web-based expansion that allows the HAR message to be heard from the internet 160

5. Prepare Draft and Final of Report – Publish ?????

6. Presentation Preparation & Presentation meeting 120

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Week 1-Identify Team members-delegate tasks – TAC Meeting
Week 2-5 - Preliminary Search and compilation of other programs lessons learned –TAC meeting
Week 6-8 – Begin specific tasks
Week 9 – TAC meeting –progress update/stearing check
Week 10-13 Complete Tasks
Week 14 – Final TAC meeting
Week 15-16 Publish Report
Week 17 – Present Deliverables/Findings to UDOT

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project
Small: ☒ Research Evaluation ☒ Experimental Feature ☒ New Product Evaluation ☒ Tech Transfer Initiative ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

-HAR Design Standard

-Training/Presentation Session

-HAR Planning and Operating Guideline (not a MANUAL)

8. Describe how will this project be implemented at UDOT.

As we seek to expand user information tools, we need an evaluation of current systems and future potential trends to provide like service.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

UDOT will be able to better manage public resources to improve traffic flow quality for Incidents, Special Events, and Construction activities. Improving this feature directly effects the publics ability to make informed choices about their trip planning options.

10. Describe the expected risks, obstacles, and strategies to overcome these.

We may not be able to establish a confident cost-benefit ratio due to the strong variability of the audience. The ability of the audience to react correctly to a HAR message and to be able to measure their reaction will be challenging.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results):

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $20,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone	Attended UTRAC?
A)	Chris Siavrakas-TOC		887-3620	
B)	Sam Sherman -TOC		887-3744	
C)	Bryan Chamberlain - TOC		887-3723	
D)				
E)				
F)				
G)				

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

Airports, Marinas, Parks

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Characterization of shear strength and mechanics of landslides in the Manning Canyon Shale. **No.:** 06.07-1

Submitted By: Francis X. Ashland, P.G., Utah Geological Survey **E-mail:** francisashland@utah.gov

1. Briefly describe the problem to be addressed:

Landslides and marginal slope stability in hillslopes underlain by the Manning Canyon Shale pose a significant challenge to design of highway cuts, fills, and structures. Uncertainties exist in shear strength and mechanics (movement and deformation behavior) of landslides in the Manning Canyon Shale. Uncertainties in shear strength may be related to a combination of factors including differences in landslide displacement and degree of weathering, the presence/absence of prior tectonic deformation of the shale, sample randomness and distribution, sample moisture condition, and type of testing. Uncertainties in landslide mechanics may be related to factors such as landslide shape and geometry, pore pressure distribution, displacement-induced changes in shear-strength, deformation partitioning in a slide mass, structural complexity and internal interaction, and activity path (the change in state from active sliding to dormancy). Limit equilibrium slope-stability analyses used as a basis of design may or may not incorporate these uncertainties, and where the uncertainties are not considered, performance of engineered construction may vary from the design limits or estimated performance criteria, and/or unanticipated failures may occur.

2. List the research objective(s) to be accomplished:

1. Define the range, particularly the lower bound of the range, in shear strength of deformed clay zones in the Manning Canyon Shale.

2. Characterize the pattern of landslide deformation and movement in landslides in the shale.

3. Identify controlling factors on landslide mechanics that help bracket uncertainties.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Compile and summarize existing data on shear strength and mechanics of landslides in Manning Canyon Shale, including data on landslide displacement, changes in the rate of movement, seasonal pore pressure fluctuations, and ground deformation. 200 hours

2. Measure shear strengths of remolded samples of landslide-sheared Manning Canyon Shale using ring shear testing. 80 hours (USGS)

3. Conduct detailed geologic mapping of landslide deformation, monitor landslide movement, measure profiles, construct geologic cross sections, and perform slope-stability analyses to constrain cross sections. 320 hours

4. Analyze data and prepare report. 200 hours

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Anticipated study period: January 1 to December 31, 2007
January-March: compile shear strength and landslide mechanics data
April: prepare interim report on compiled data; install survey points for GPS surveying (landslide movement monitoring)
May-August: conduct geologic mapping, profiling, and movement monitoring; collect soil samples for shear strength testing
September-November: conduct shear strength testing (USGS, Golden, CO); final landslide movement monitoring measurements; prepare draft technical report
December: finalize report

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project
Small: x Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation x Tech Transfer Initiative : ☐
Other _____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

Utah Geological Survey, Geologic Hazards Program in cooperation with the U.S. Geological Survey, Landslide Hazards Program

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)
Deliverable is a final technical report summarizing results that includes tabulated shear strength data, detailed landslide deformation maps, landslide movement plots, and seasonal pore pressure plots.

8. Describe how will this project be implemented at UDOT.
Report will be a supplemental document to assist the Geotechnical Division with design review for ongoing construction projects and possible reference document for future repair and landslide stabilization projects.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.
Report will provide basis for more realistic and cost-effective design, repair, and stabilization options as well as a basis for estimating design performance.

10. Describe the expected risks, obstacles, and strategies to overcome these. Documented slow movement rates in some landslides in the Manning Canyon Shale may preclude detection of movement over the short duration of the study period. Continued monitoring by the UGS in these areas beyond the study period may provide data on movement, but would not be documented in the final technical report. Sample availability is in part a function of drilling and exposures made by others in construction projects (Provo Canyon) and in other excavations. Sheared Manning Canyon Shale has been recently exposed in some 2005 landslides (such as the Sage Vista Lane landslide, Cedar Hills).

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Leslie Heppler (Geotechnical Division)

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $20,000 (UTRAC amount) plus ($12,700 UGS Cost share) – approx 60/40 cost share

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Gary Christenson	Utah Geological Survey	537-3304
B) Rex Baum	U.S. Geological Survey, Landslide Hazards Program	(303) 273-8610
C) Daniel Horns	Utah Valley State College	863-8582
D) Darin Sjoblom	Utah Department of Transportation	964-4474
E)		
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: U.S. Geological Survey, Landslide Hazards Program; Utah Division of Emergency Services

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Assessment of impacts to infrastructure along State Routes 167 and 226 due to landslides in the Norwood Tuff. **No.:** 06.07-2

Submitted By: Francis X. Ashland, P.G., Utah Geological Survey **E-mail:** francisashland@utah.gov

1. Briefly describe the problem to be addressed:

Landslides continue to impact State Routes 167 and 226 and associated infrastructure in western Morgan County and southeastern Weber County. Impacts include damage to highway pavement, cut slopes, drainage ditches, and buried utilities (Questar Gas). State Route 226 (Snowbasin Road) crosses two large landslides, the Bear Wallow and Green Pond slides, that remain recurrently active despite mitigation to reduce the impacts on the highway. Since 2001, numerous landslides have formed along north-facing cut slopes, some of which have required local stabilization (buttresses). Landslides along State Route 167 (Trappers Loop Road) include slides in cut slopes and slides below embankments. A 2004 slide that forced the relocation of a Questar Gas line, reactivated and enlarged in size in 2005. Upslope enlargement of the landslide encroaches on the toe of a south-facing highway embankment. Whereas ongoing landsliding poses a continuing challenge for maintenance of the two highways as well as a potential safety hazard to the public, it also is an opportunity to examine landslide mechanics and processes in the Norwood Tuff, perhaps one of the weakest geologic units in Utah. The new data and information will support future design of inevitable repairs to the highways and their infrastructure.

2. List the research objective(s) to be accomplished:

1. Define the lower bound of the range in shear strength of deformed clay zones in the Norwood Tuff.

2. Characterize the impacts to cut slopes and associated infrastructure in the Norwood Tuff by continuing landsliding and associated erosion.

3. Identify controlling factors (climatic, deformational, and hydrologic) on landslide mechanics that can be used to forecast future impacts on the highways.

4. Examine the process of landslide enlargement in the Norwood Tuff to define possible impacts to the highways.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Measure shear strengths of remolded samples of landslide-sheared Norwood Tuff using ring shear testing. 80 hours (USGS)

2. Conduct detailed geologic mapping of landslide deformation, monitor landslide movement, measure profiles, construct geologic cross sections, and perform slope-stability analyses to constrain cross sections. 300 hours

3. Develop a time sequence model for landsliding in cut slopes in the Norwood Tuff. 80 hours

4. Develop a landslide enlargement model for slides in the Norwood Tuff. 100 hours

5. Summarize in final technical report. 120 hours

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Anticipated study period: September 1, 2006 to August 31, 2007
September-November: conduct geologic mapping, profiling, and movement monitoring; collect soil samples for shear strength testing
September-June: collect climatic and ground-water data
November-January: conduct shear strength testing (USGS, Golden, CO);
February-March: prepare draft technical report
April-July: conduct geologic mapping, profiling, and movement monitoring;
July-August: finalize report

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project
Small: x Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

Utah Geological Survey, Geologic Hazards Program in cooperation with the U.S. Geological Survey, Landslide Hazards Program

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)
Deliverable is a final technical report summarizing results that includes tabulated shear strength data, impact assessment data, detailed landslide deformation maps, landslide movement plots, cut-slope landslide sequence data, and landslide enlargement model.

8. Describe how will this project be implemented at UDOT.

Report will be a possible reference document for future repair and landslide stabilization projects.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

Report will provide basis for assessing long-term performance of highway infrastructure along State Routes 167 and 226 and for realistic and cost-effective future design, repair, and stabilization options.

10. Describe the expected risks, obstacles, and strategies to overcome these. Documented slow movement rates in some landslides in the Norwood Tuff may preclude detection of movement over the short duration of the study period. Continued monitoring by the UGS in these areas beyond the study period may provide data on movement, but would not be documented in the final technical report. Sample availability is in part a function of exposures in natural landslides.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Leslie Heppler (Geotechnical Division)

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $15,000 (UTRAC amount) plus $9,400 (UGS cost share) – approx 60/40 cost share

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Gary Christenson	Utah Geological Survey	537-3304
B) Rex Baum	U.S. Geological Survey, Landslide Hazards Program	(303) 273-8610
C) Austin Rowser	Morgan County Engineer	(801) 845-4094
D) Daniel Horns	Utah Valley State College	863-8582
E) Darin Sjoblom	Utah Department of Transportation	964-4474
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: U.S. Geological Survey, Landslide Hazards Program; Utah Division of Emergency Services; Morgan County

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Investigation for Utah County Liquefaction Hazard Maps **No.: 06.07-4**

Submitted By: Travis Gerber and Steven Bartlett **E-mail:** bartlett@civil.utah.edu tgerber@byu.edu

1. Briefly describe the problem to be addressed:

The Utah Liquefaction Advisory Group is currently pursuing funding from the United States Geological Survey (USGS) as part of the NEHRP (National Earthquake Hazards Program) with a project to develop the next generation of liquefaction hazard maps for Utah County. That proposal is an extension in Utah County of a similar project now in progress for the Salt Lake Valley. While relatively abundant data exists in Salt Lake Valley due to extensive land development and reconstruction of the I-15 corridor, less subsurface data exists in Utah County. To help supply the data needed in Utah County, it is proposed that additional CPT sounding data be gathered at locations of particular interest to UDOT (e.g., potential locations for future transportation corridors and interchanges). By participating in the NEHRP program, UDOT will benefit directly from the mapping project by having subsurface data at key locations (bridges, interchanges, new corridors) that will lead to site-specific estimates of liquefaction triggering, lateral spreading, and ground settlement. Additionally, the data will also provide preliminary indications of subsurface conditions, thus making subsequent geotechnical explorations for future UDOT facilities more effective.

Strategic Goal: ☐ Preservation ☐ Operation ☐ Capacity ☐ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1) Obtain CPT soundings for liquefaction hazard assessments at various locations of interest to UDOT within Utah County (UDOT funded part).
2) Estimate liquefaction triggering, lateral spread and ground settlement at these locations (NEHRP funded part).
3) Produce regional maps for Utah County (NEHRP funded part).

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Meet with UDOT Planning and Project Development Personnel to identify locations that are of interest to them (bridges, interchanges, new construction, etc.).
2. Develop an investigation plan for the sites, balancing available budget with the number of sites, site geology, and CPT depths.
3. Perform CPT soundings (approximately 20).
4. Provide data to UDOT and Utah Liquefaction Advisory Group for further use in creating Liquefaction Hazard Maps.
5. At completion of mapping project, provide estimates of probabilistic liquefaction triggering, lateral spreading, and ground settlement.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Schedule depends upon the number of sites, individual site geology, and the depths investigated. For CPTs ranging in depth from 50 to 100 feet, it is anticipated that 2 to 4 sounding could be completed in a day. Given a budget in the range of $20k to $30k, it is anticipated that 14 to 21 soundings could be performed. While CPT sounding can be made year-round, spring and summer time would be preferable.

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project
Small: ☒ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative：
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University (since this is where the NEHRP-sponsored liquefaction hazard mapping is being performed)

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

CPT data and accompanying report from NEHRP project.

When the liquefaction hazard maps are complete, copies of the maps and supporting documentation.

8. Describe how this project will be implemented at UDOT.

CPT sounding data will go to the UDOT Region Project Managers and the Geotechnical group to be used as appropriate in future projects.

The liquefaction hazard estimates from the mapping project will go to the Region, along with the Structures and Geotechnical groups as appropriate in design and construction related activities.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

In leveraging the funding from NEHRP, UDOT will benefit directly from the mapping project by having site-specific estimates of probabilistic liquefaction triggering, lateral spreading, and ground settlement. Additionally, the data will also provide preliminary indications of subsurface conditions, thus making subsequent geotechnical explorations for future UDOT facilities more effective.

10. Describe the expected risks, obstacles, and strategies to overcome these.

The scope of the project is flexible to accommodate needs and budget, but will be finalized with input of the TAC. Project is dependant upon NEHRP funding to develop the hazard maps.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Grant Gummow

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $30k to $40k

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Barry Solomon	Utah Geological Survey	
B) Les Youd	Consultant	
C) Clifton Farnsworth	Region 3 Construction	
D) Mark Petersen	United States Geological Survey	
E)		
F)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

UGS, Utah Liquefaction Advisory Group, NEHRP (USGS)

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Biotechnical Stabilization and the use of Phreatophytes No.: 06.07-07

Submitted By: LA Heppler E-mail: lheppler@utah.gov

1. Briefly describe the problem to be addressed:

What are the long-term effects to Slope Stability Factor of Safety with the use of Phreatophytes? What is the impact to the material characteristics? What is the impact to pore pressure? What is the impact of root reinforcement?

Strategic Goal: ☒ Preservation ☐ Operation ☐ Capacity ☐ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Measure the effects of planting Phreatophytes on poor soil sites such as slumps and landslides.
2.
3.

3. List the major tasks required to accomplish the research objective(s): Estimated person-hours

1. Access laboratory mud tanks - Define variables, define constants (40 hrs)
2. Create a poor quality of soil in a lab mud tank, divide tank into 2 sections. Run lab tests on material properties (40hrs)
3. Plant one section of the tank with a phreatophytes such as Coyote willows and leave the other half with no vegetation (20 hrs)
4. Let grow (provide acceleration-grow lights, fertilizer) (6 months – manpower would only be 1 hour per week - 30 hrs)
5. Tilt tank and document soil characteristics when failure occurs on both cases. Run lab tests on failed material (40hrs)
6. Compile data and write report. (80hrs)

4. Outline the proposed schedule (when do you need this done, and how we will get there):

As plants need time to grow…the time frame is not critical. Total time frame 1year…actual research hours 250 hours.

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project

Small: ☒ Research Evaluation Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative : ☐

Other _____

7. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

USU already has mud tanks and student work forces

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.) A proven recommendation that planting phreatophytes in problem soils is worth the cost.

8. Describe how will this project be implemented at UDOT. New construction and retrofit existing problem areas

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be. Reduce routine maintenance of some cut slopes and possibly save UDOT the cost of an expensive landslide repair.

10. Describe the expected risks, obstacles, and strategies to overcome these. Doesn't increase the cohesion and phi of the soil. Future studies could include which specific phreatophytes work the best in the different specific UT soil types.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results): LA Heppler

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): 250hrs X $45 = $12,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone	Attended UTRAC?
A) Leslie Heppler	Geotechnical Division – Complex	965-4318	Yes
B) Keith Brown	Geotechnical Division – Complex	965-4234	Yes
C) Grant Gummow	Geotechnical Division – Complex	965-4307	Yes
D) Blaine Leonard	Research – Complex	965-4115	Yes
E) Francis Ashland	UGS-DNR	537-3380	Yes
F) Ira Bickford	Maintenance - Complex	965-4119	Yes
G) Lars Anderson	Environmental Manager R-2	887-3470	Yes

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:
Idaho DOT has expressed interest in the past

2006 RESEARCH PROBLEM STATEMENT

Problem Title:	Nonlinear Dynamic Behavior of Soils at a Major Structure	**No.: 06.07-8**
Submitted By:	James A. Bay	**E-mail: jim.bay@usu.edu**

1. Briefly describe the problem to be addressed:

A preliminary study performed for the USGS NEHRP program found that Lacustrine silty-clays found at shallow depths exhibit behavior that is more linear than that predicted by commonly used generic empirical models. This means that we might be under-predicting the ground shaking that will occur during seismic events. This proposal is to make some deeper borings at one or more bridge structure to obtain undisturbed soil samples, and perform resonant column testing on the sample to evaluate their nonlinear behavior. Then to compare the ground shaking predicted using the measured and empirical nonlinear properties.

Strategic Goal: ☐ Preservation ☐ Operation ☐ Capacity X☐ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Measure the nonlinear dynamic properties of soil at the site of a major structure.

2. Determine if significantly different levels of ground shaking are obtained using measured rather than generic empirical nonlinear soil properties.

3.

3. List the major tasks required to accomplish the research objective(s):	**Estimated person-hours**
1. Obtain undisturbed soil samples	80 hrs
2. Measure nonlinear behavior of soils	320 hrs
3. Predict ground shaking using measured and empirical nonlinear properties	80 hrs
4.	
5.	
6.	

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Summer 2006 obtain soil samples

September-December 2006 perform resonant-column tests on soil samples.

January-February 2007 perform Shake analyses

February-April 2007 prepare report

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University with the assistance of UDOT

Page 2

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.) 1) Report on the project findings, 2) modulus reduction and damping curves for one major bridge structure site, and 3) a recommendation regarding the use of generic empirical nonlinear dynamic soil properties in site specific ground shaking studies.

8. Describe how will this project be implemented at UDOT.

The results of this project will be a clear recommendation regarding the use of generic empirical nonlinear dynamic soil properties for lacustrine clays along the Wasatch Front. If significant differences in ground shaking are not found in predictions using measured soil behavior, then this project will validate current site specific design procedure. However if significant differences are found, then it will be recommended that Wasatch Front data be compiled to establish empirical predictions specific to this region.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

This project will either validate current site specific design procedures, or recommend a course of action to obtain better sites specific ground shakings.

10. Describe the expected risks, obstacles, and strategies to overcome these.
Drilling, sampling and testing procedures used in this work are routine. No significant obstacles are anticipated.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Darin Sjoblom

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $24,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A)		
B)		
C)		
D)		
E)		
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: USGS, UUSS

2006 RESEARCH PROBLEM STATEMENT

Problem Title:	Measured low-strain site response at a major structure	**No.: 06.07-9**
Submitted By:	James A. Bay	**E-mail: jim.bay@usu.edu**

1. Briefly describe the problem to be addressed:

Site specific predictions of ground shaking require both an accurate characterization of the soil layers underlying the site and an accurate characterization of the depth to bedrock. Those two factors will affect the resonant frequency of the site. Unfortunately, very little good data exist on deep soils and depth to bedrock in the Salt Lake and surrounding valleys. One simple way to validate deep models used in analysis is to measure the low-strain dynamic site response of a site. This can be done using small shakers to excite the site. This proposed work is to select one site and use both a very small electro-magnetic shaker and a larger rotating eccentric mass shaker to measure the site response. To evaluate the feasibility of using this technique in routine seismic analysis.

Strategic Goal: ☐ Preservation ☐ Operation ☐ Capacity X☐ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Determining the feasibility of using small shakers to validate deep soil models at the sites of major structures.

2.

3.

3. List the major tasks required to accomplish the research objective(s):	**Estimated person-hours**
1. Measure site response using small electromagnetic shaker	32 hrs
2. Measure site response using rotating eccentric mass shaker	120 hrs
3. Evaluate results	32 hrs
4.	
5.	
6.	

4. Outline the proposed schedule (when do you need this done, and how we will get there):

June 2006 shake site using electro-magnetic shaker

July-August shake site using rotating eccentric mass shaker

September-October 2006 evaluate results and write report

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☐ Development Project
Small: ☒ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative
☐ Other _____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University with the assistance of UDOT

Page 2

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.) 1) Report on the project findings, 2) A recommendation regarding the use of small shakers for verifying deep soil models at the site of major structures

8. Describe how will this project be implemented at UDOT.

This project could result in specific recommendations for quick, easy and inexpensive measurements of site response that can be performed at bridge sites. These are not direct measurements of deep soil properties and depth to bedrock, but they can be used to validate models used in analysis.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

This project in will result in improved confidence in predicted ground shaking at bridge sites.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Ambient noise levels might interfere with low-strain measurements at bridge sites. Signal processing and averaging techniques will be used to minimize the effects of noise.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Darin Sjoblom

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $7,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A)		
B)		
C)		
D)		
E)		
F)		
G)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: USGS, UUSS

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Investigation of Past and Present Corrosion Monitoring, Evaluation, and Mitigation of Bridge Decks **No.:06.08-3**

Submitted By: Marv Halling, Paul Barr **E-mail: halling@cc.usu.edu**

1. Briefly describe the problem to be addressed:

The corrosion of Bridge Decks in the State of Utah is one of the biggest ongoing problems for UDOT Construction and Maintenance. This problem requires a cooperative approach from the bridge design, construction, and maintenance areas in order to be effective.
In the past, UDOT has employed various methods for the reduction of corrosion in Bridge decks. Although much can be "borrowed" from the experience of other states, this problem statement is directed at looking at past efforts and outcomes of these efforts.

2. List the research objective(s) to be accomplished:

1. To begin to collect information on whether corrosion measurement instrumentation is practical and useful to UDOT.

2. To investigate corrosion mitigation methodologies that have been employed in the past.

3.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Prioritize the inventory of bridges with corrosion problems. 40

2. Survey the corrosion resisting methods that have been utilized in the past. 20

3. Identify two or more types of structures with the worst corrosion problems. 10

4. Purchase and install very limited corrosion monitoring systems on two identified bridges. 20

5. Collect data for 4 years, and evaluate the usefulness of the collected information. 80

6.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Tasks 1-4 . . . . . 6 months
Task 5. . . . . 4 years

5. Indicate type of research and / or development project this is:

Large: X Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative：
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Improved design and maintenance methods.

8. Describe how will this project be implemented at UDOT.

The obtained data from this project will be used for minimizing the corrosion problem in the future.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

This type of data will be valuable for decision making in the future

10. Describe the expected risks, obstacles, and strategies to overcome these.

Although the instruments and data loggers will be both small and cheap to install, the issues with installation will likely take a significant effort.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Boyd Wheeler

12. Estimate the cost of this research study including implementation effort . 20 K labor, 15 K equipment = $35,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone
A	Todd Jensen		
B)	Dave Nazare		
C)	Dave Eicksenberger (sp?)		
D)			
E)			
F)			
G)			

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: FHWA,

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Dynamic Analysis of Integral Bridge Pier System **No.:**06.08-4

Submitted By: Paul Richards (Assistant Professor, BYU) **E-mail:** prichards@et.byu.edu

1. Briefly describe the problem to be addressed:

The connection between a steel girder system and concrete column is critical for earthquake resistance. The seismic performance of existing details has not been fully investigated using dynamic loading.

2. List the research objective(s) to be accomplished:

1. Establish the performance and adequacy of typical integral bridge connections in Utah under expected earthquake loading

2. Develop recommendations for improved performance and economy for future connections integrating data from the proposed analyses and findings from other studies.

3.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Review of "typical" details for integral bridge connections 40

2. Modeling of representative details using ABAQUS. Full dynamic analysis used to investigate performance 1000

3. Correlation of modeling techniques with existing experimental data 200

4. Data analysis and report writing 400

5.

6.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

Project could be completed within one year.

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative：
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

1. Evaluation of expected performance of existing integral connections
2. Improved details and design methodology for integral bridge connections

8. Describe how will this project be implemented at UDOT.

1. Research report will be used as resource for disaster planning and future design

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

Benefits:
1. Awareness of how current connections will perform to help in disaster planning
2. Potential cost savings if more economical connection with improved performance can be developed

10. Describe the expected risks, obstacles, and strategies to overcome these.

One potential obstacle is model verification. This obstacle will be overcome using a correlation study to verify modeling techniques using experimental data that has been generated for similar connection types. With verified techniques, the connections of interests can be analyzed with confidence.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results):

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $30,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone
A)			
B)			
C)			
D)			
E)			
F)			
G)			

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

2006 RESEARCH PROBLEM STATEMENT

Problem Title: Develop overhead sign structure standard drawings — No.:06.08-5

Submitted By: Jason Phillips — E-mail: jphillips@hwlochner.com

1. Briefly describe the problem to be addressed:

Currently in Utah each individual overhead sign structure is geometrically designed, structurally designed and then construction drawings and details are developed.
This problem statement proposes to establish design criteria for and to develop standard structural drawings for overhead sign structures.

Strategic Goal: ☐ Preservation ☐ Operation ☐ Capacity ☒ Safety (Check all that apply)

2. List the research objective(s) to be accomplished:

1. Investigate and establish parameters to develop design zones for various wind load conditions throughout the state.
2. Evaluate typical UDOT details to verify they meet current industry standards.
3. Establish a design philosophy and design criteria.
4. Proceed with design and develop standard structural drawings for overhead sign structures.

3. List the major tasks required to accomplish the research objective(s): — **Estimated person-hours**

1. Meet to discuss and establish UDOT/Consultant design and review team	10
2. Establish design criteria	20
3. Develop standard designs for 25 different cantilever and 10 different full-span sign panel and span length combinations	1200
4. Review team to comment on design and detailing	200
5. Finalize standard drawings and design	200
6. Develop general notes and methodology for application	50
7. Approve drawings	10

4. Outline the proposed schedule (when do you need this done, and how we will get there):

obtain funding, select design and review team – April/May 2006
develop design – summer 2006
review design – fall/winter 2006
approve standard drawings - winter 2006/2007
apply to projects and save UDOT money - 2007 and on

5. Indicate type of research and / or development project this is:

Large: ☐ Research Project ☒ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

Consultant

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)
Standard structural drawings ready for use for various wind loads, dimensions and sign panel sizes and configurations for full span and cantilever sign structures.

8. Describe how this project will be implemented at UDOT.
Designers will develop signing plans and establish the location, height and size of overhead sign panels and the sign structure. The designer will then apply this geometric information to the standard overhead sign structural drawing to establish the "line and column" and associated structural information required for the established sign geometry. Labor associates with development, review and approval of custom structural design of each individual overhead sign structure will be eliminated.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.
Project staffing, budgets and delivery schedules will directly realize the benefit. Design and review time will be reduced. Construction costs will decrease as fabricators work from standard fabrication details instead of custom individual designs.

10. Describe the expected risks, obstacles, and strategies to overcome these.
Soil parameters are different at each project site. Foundation assumptions will be stated and if soil conditions are outside of the established parameters a specific foundation will need to be designed.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): BOYD WHEELER

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $150,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone
A)	DEGEN LEWIS	ASSISTANT TRAFFIC ENGINEER, UDOT REGION 3	801-222-3401
B)	BRIAN BYRNE	STRUCTURAL ENGINEER – HW LOCHNER	860-513-4003
C)			
D)			
E)			
F)			
G)			

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study: UDOT Traffic and safety and pre-construction

RESEARCH PROBLEM STATEMENT

Problem Title: Critical Slope for Trench Drain Installations **No.:**06.09-3

Submitted By: UDOT Central Hydraulics; Michael Fazio **E-mail:** mfazio@utah.gov

1. Briefly describe the problem to be addressed:

Trench or Line Drains are drainage systems that are preformed or prefabricated of various materials, including polyethylene. They are usually 6 to 12-inches wide and can be as long as needed. The drains are usually installed on or near the edge of paved roads where they collect run-off from off the road surface. Some of these products can be very hydraulically efficient. Their design seems especially applicable on roads with a nearly flat longitudinal slope, where sometimes puddles form on the shoulders because of poor drainage capacity.

Several trench drains systems have been installed in Utah. At this time, some installations are all clogged with debris. In some installation, weeds are growing in the drain where all the debris was collected. Most debris comes from the winter snow removal operation. During winter snow removal, salt and sand is spread on the roadway surface to improve pavement friction. The salt and sand is moved by the tire action and pavement cross slope to the edges of the road where the drains are. As the debris enters the drains, it builds up, occluding the drain. The sand applied during the snow season, along with other silt and debris, finds its way into storm water systems causing a loss of capacity in the system. This loss can potentially cause the excessive spread of water into the traveled roadway, which may lead to vehicles hydroplaning.

This research study would investigate the reason of the drain clogging and help us determine the most effective slope and shape of trench drain that would induce self-cleansing velocities from sediment found on Utah roadways.

2. List the research objective(s) to be accomplished:

1. Research reasons for the trenches clogging.

2. Develop minimum standard requirements that would reduce the potential for the trench drains to clog.

3. Prepare standard specification and drawings for the department.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Investigate current installations. 2. Set-up lab experiment using various types of drains at various slope and debris loading. 3. Collect information to determine minimum requirements for slope, width, opening. 4. Prepare report. 5. Prepare Standard Details and Specifications.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

The research should be completed in a year.

5. Indicate type of research and / or development project this is:

Large: X Research Project ☐ Development Project

Small: ☒ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative : ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University with water lab.

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

A final report with all needed findings to prepare standard specifications.
Standard Specifications.
Standard Drawings.

8. Describe how will this project be implemented at UDOT.

A new UDOT's Standard Specification and drawing for the use of the Departments Engineers and consultants when designing trench drain systems.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

This study will allow the optimal design of trench drains producing a more effective roadway drainage system. An efficient drainage system will provide safer driving conditions and reduce maintenance costs related to cleaning out the systems. The traveling public is the ultimate beneficiary.

10. Describe the expected risks, obstacles, and strategies to overcome these.

At this time there is no expected risks associated with the research.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results): Michael Fazio, Denis D. Stuhff UDOT Central Hydraulics

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): ABT would be willing to participate materially and financially to the completion of this study. The cost to the Department could vary from $10,000 to $30,000.

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone	Attended UTRAC?
A)	Michael Fazio	UDOT Central Hydraulics	**801-957-8556**	X
B)	Tim Ularich	UDOT Central Hydraulics	**801-965-4038**	X
C)				

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

RESEARCH PROBLEM STATEMENT

Problem Title: Calibration of Curve Numbers (CN) for estimating runoff in rural ungaged streams in Utah **No.:06.09-4**

Submitted By: Michael Fazio **E-mail: mfazio@utah.gov**

1. Briefly describe the problem to be addressed:

The NRCS method and relative Curve Numbers has not been researched properly. The model is so robust and stable that it is useful even when the values used are non-optimal. In Utah our NFF regional regression equations handle small to mid-sized "undeveloped" catchments only in Hydrologic Study Regions 1, 6 and 8. Hydrologic Study Region 1 is the high altitude region. The error of Hydrologic Study Region 6 is so high it is reported in log units and the equivalent years of record for some recurrence intervals of interest are measured in only fractions of a year. The runoff curve number approach would provide an alternate simple method which would allow us to better evaluate NFF design flows and to also estimate flows in disturbed and developing basins. Other regional regression equations have lower limits or minimum sizes of drainage for which these equations apply ranging from 1300 to 3600 acres .... leaving a simple Hydrologic tool "gap" that must be filled by other methodologies such as the runoff curve number approach.

The method should be improved or enhanced for best use in Utah. For best achievable accuracy, these CN's should be "adjusted" for our arid & semi-arid climate zones. By picking gaged basins, CN's could be determined based on regional Utah data. One logical set of parameters to use would be easily identified biomes or vegetation types such as: Montane, Pinyon-Juniper, Sagebrush, Shadscale, Creosote Bush & Saline Desert Zones. (The Texas Department of Transportation (TxDOT) completed a similar research entitled "Climatic Adjustments of Natural Resource Conservation Service (NRCS) Runoff Curve Numbers: Final Report", Report No. 0-2104-2 by David Thompson et al of Texas Tech University)

The usefulness of this kind of basic fundamental research work to the orderly and economic development of the infrastructure is by itself very significant. No other similar models are as simple (essentially only one lumped parameter), useful (can be used in both developed and undeveloped catchments), and stable (you have to work harder to mess up) of the runoff curve number approach for catchments greater than 200 to 300 acres (the generally recommended upper limit for the rational formula Q = CiA method).

2. List the research objective(s) to be accomplished:

1. Calibrate CNs in for all Utah Hydrologic Regions.
2. Present all calibrations in a report, showing methods of calibration and location where numbers were calibrated.
3. Present calibrated numbers in a format that can be used in WMS.
4. Provide training on how to use CN to all UDOT designers.

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

Task1 – Collect historical rainfall/runoff data to adjust for Utah topography and climatology.
Task 2 – Provide database of rainfall/runoff events that can be used in this and future research.
Task 3 – Provide a report on feasibility of using it to develop regionally adjusted CN factors for Utah will be created. Included in this report will be a recommended plan of action and associated limitations.
Task 4 – Provide calibrated CNs in format that can be used in WMS.
Task 5 – Provide training for UDOT designers on how to use the method and the CNs.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

One year completion.

5. Indicate type of research and / or development project this is:

Large: [x] Research Project [ ] Development Project
Small: [ ] Research Evaluation [ ] Experimental Feature [ ] New Product Evaluation [ ] Tech Transfer Initiative : [ ] Other _____

Page 2

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Report with calibrated CNs, CNs formatted for use in WMS, Training for designers.

8. Describe how will this project be implemented at UDOT.

UDOT Designers will use the calibrated numbers to estimate runoff at stream crossings.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

A better estimate of flow at stream crossings for sufficient culvert/bridge capacity.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Insufficient data for the calibration of the CN numbers.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results): *Michael Fazio, Denis Stuhff, Tim Ularich*

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $35,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone	Attended UTRAC?
A) Brandon Tucker	Region One Hydraulics Engineer		
B) Daryl Friant	Region 4 Hydraulics Engineer		
C) Marwan Farah	Region 2 Hydraulics Engineer		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

State of Utah Engineer's Office

USACOE

Other Local Agencies

RESEARCH PROBLEM STATEMENT

Problem Title: ***Calibration of time parameters and synthetic unit hydrograph coefficients for Utah watersheds*** No.:06.09-5

Submitted **By** **Sanja Perica, University of Utah** E-mail: perica@eng.utah.edu

1. Briefly describe the problem to be addressed:

Because of the importance of runoff timing, most hydrologic models require a watershed characteristic that reflects the runoff travel time. The most frequently used time parameters in hydrologic models are the time of concentration and the lag time. Time parameters for hydrographs for ungaged watersheds are usually estimated using empirical formulas. For example, a lag time is defined in terms of the physical characteristics of the watershed, such as drainage area, channel length and channel slope. However, most of these formulas have been based on very limited data and should be used with considerable caution for watersheds in which physical characteristics are different from those of the watersheds used to calibrate the formula and that are outside the geographic region for which the formula was developed. For example, the widely used Kirpich's formula for lag time was developed based on a study of small agricultural watersheds in Tennessee. The hydrographs developed using the commonly used NFF Regression Equations default to parameters developed for Georgia. No studies are available for semi-arid Utah watersheds. It is no surprise that when tested on a watershed in Utah (Red Butte Canyon, 7.2 mi^2), lag time estimates for the watershed varied from 12 minutes to 7 hours, depending on the formula used.

2. List the research objective(s) to be accomplished:

1. ***Major objective***: To develop reliable estimates of lag time and time of concentration parameters for typical Utah watersheds.

2. To provide regional estimates of empirical coefficients used in most accepted synthetic unit hydrograph methods; such as a peaking coefficient needed for Snyder's synthetic unit hydrograph method and a storage coefficient used in Clark's method.

3. To create a regional synthetic unit hydrograph to be used in hydrologic models, such as HEC-HMS (HEC-1), for rainfall-runoff transformation

3. List the major tasks required to accomplish the research objective(s): Estimated person-hours

1. Develop a database of short-interval (5-, 10-, 15-min) rainfall and runoff data for as many rural watersheds in Utah as possible.

2. Use watershed modeling system (WMS) software to estimate a number of physiographic characteristics of each watershed that will be explored as possible predictors of time parameters.

3. Estimate lag time and time of concentration parameters based on collected rainfall-runoff events.

4. Develop empirical equations that will relate lag time parameter to selected watershed characteristics.

5 Use HEC-HMS program to calibrate empirical coefficients of two existing and widely used synthetic unit hydrograph methods, or, if feasible, develop a new synthetic unit hydrograph for the region.

6. Depending on the number of watersheds that will be available for analysis, a regional analysis, or separation of watersheds based on land uses, may be attempted.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

It is estimated that approximately 18 months will be needed to complete the project:
6 months for data collection, quality control and database development
6 months for HEC-HMS and WMS runs
6 months for model calibration.

5. Indicate type of research and / or development project this is:

Large: X Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative：
☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Short Manual containing practical examples, demonstrating how to apply these coefficients to common problems.

8. Describe how will this project be implemented at UDOT.

The Manual will be distributed to Region Roadway Designers & Hydraulic Engineers and incorporated into the Departments Hydraulic Manual of Instruction for the use of Consultants and others doing drainage designs for the Department.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

The availability of Regionally calibrated hydrographs will allow flood routing and the optimal sizing of drainage structures. This will minimize both structure costs and environmental impacts.

10. Describe the expected risks, obstacles, and strategies to overcome these.

Selection of appropriate Regionally representative gaged drainage basins. Using the knowledge of Statewide conditions, which have been acquired by previous Regression Equation work within Utah, and bounding States will facilitate this problem.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results):

Denis Stuhff, UDOT Hydraulic Engineer.

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3):$57,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone	Attended UTRAC?
A)	Dr. Sanja Perica	University of Utah		X
B)	Michael Fazio	UDOT Central Hydraulics		X
C)	Tim Ularich	UDOT Central Hydraulics		X
D)	Jerry Channey	UDOT Environmental Division		X
E)				
F)				
G)				

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

RESEARCH PROBLEM STATEMENT

Problem Title: Assessing ownership and location of storm drains and sewer within UDOT Right of Way **No.:**06.09-6

Submitted By: Michael Fazio **E-mail:** mfazio@utah.gov

1. Briefly describe the problem to be addressed:

Many storm drains and sewers have been installed in UDOT Right of Way in urban areas, by UDOT and local government, to collect storm water and provide a safer ride for the public. Some of these systems are falling in disrepair, becoming a potential danger to the public because of failure. Just last year, during the spring thaw and rains, at least 4 storm drains failed in the Wasatch front. Storm drain failures usually come unexpectedly and cause a lot of damage. To prevent unexpected failures, the Department needs to be aware of the conditions of the infrastructure and provide necessary repairs. We have four types of systems in UDOT's Right of Way: 1. Systems of known ownership, where the owner provides needed regular maintenance of the system. The condition of these systems is usually good. 2. Systems of known ownership where the owner is not providing needed maintenance because of lack of funds or inaccessibility. 3. Systems where the ownership is contested and/or ignored. Local government believe the systems belong to UDOT and do not provide necessary repairs and likewise UDOT personnel sometimes believes some systems do not belong to UDOT so they do not provide needed maintenance. 4. Unknown system. Systems that were placed long time ago and have been forgotten.
This study focuses especially on the last two types, but the final product will include all the systems in UDOT's ROW. The study will provide knowledge of outfall location for the NPDES II requirement to map all storm drain outfall into waters of U.S. It will provide a structure for future development permit issues.

2. List the research objective(s) to be accomplished:

1. Document ownership of all storm drains installed within UDOT's ROW
2. Organize information in database and Arcinfo
3. Distribute information to interested parties

3. List the major tasks required to accomplish the research objective(s): **Estimated person-hours**

1. Collect all documents about installation of storm drain systems in UDOT's ROW, including agreements, maps, and any other pertinent document.
2. Review documents and records that have storm drain installation for applicability.
3. Place all relevant information in database and arcinfo.
4. Field-verify installation or consult with maintenance stations supervisors to verify existence of system or find our of unmapped systems.
5. Up-date database and arcinfo
6. Meet with local officials and region manager to present findings.

4. Outline the proposed schedule (when do you need this done, and how we will get there):

This project may take up to two years.
Phase 1A, Collect all information from documents (1 year)
1B, Place information in database (consequent and consecutive of phase IA)
1C, Verify information collected (2 months)
2, Map information (3 Months)
3, Distribute information (3 months)

5. Indicate type of research and / or development project this is:

Large: ☒ Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative : ☐ Other_____

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?

University or consultant may be able to complete this work. Since it is labor intensive, universities may be able to provide a more cost efficient service than consultants.

7. What deliverable(s) would you like to receive at the end of the project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

Database with all the storm drain within UDOT ROW inventoried.

System mapped in arcinfo for the region personnel use.

8. Describe how will this project be implemented at UDOT.

Malignance personnel will use this to identify the systems to maintain. Permitting officers and region engineer need to know and understand what is the existing system capacity to be able to add more flow to their systems.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.

The ultimate beneficiaries will be the public. The region hydraulic and maintenance engineer, the permitting officers and maintenance personnel will greatly benefit by knowing what the system is, where it is and who owns it. It will simplify the permitting process to add new systems to what is existing and provide direct access to important information to decision-makers.

10. Describe the expected risks, obstacles, and strategies to overcome these.

The major obstacles will be finding all that is out there. I do not perceive and risks or other obstacles at this time.

11. List the key UDOT Champion of this project (person who will help Research steer and lead this project, and will participate in implementation of the results): Michael Fazio, Marwan Farah, Shawn Debenham, John Higgins, Paul Egbert, Kris Peterson.

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): $20,000 - $50,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

	Name	Organization/Division/Region	Phone	Attended UTRAC?
A)	Rick Olsen	Salt Lake County	468-3731	
B)	Paul Hawker	Utah County	851-8603	
C)				
D)				
E)				
F)				
G)				

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:

The major cities and counties on the Wasatch front.

APPENDIX A

WORKSHOP AGENDA

-AGENDA-
UTRAC WORKSHOP 2006

Salt Lake Community College-Miller Campus
9750 South 300 West
Sandy, Utah

Tuesday, March 21, 2006

Registration & Continental Breakfast: Karen G. Miller Conference Center (KGMC)
7:30 am - Noon ***Workshop Registration***

Introductory Plenary Session: KGMC
8:30 am - 9:30 am ***Welcome – Rukhsana Lindsey, Director of Research***
Keynote Address – John Njord, UDOT Executive Director
Research Program Status – Blaine Leonard, Research Project Manager
Workshop Instructions - Blaine Leonard, Research Project Manager

Morning Break: KGMC-Main Foyer
9:30 - 10:00 am ***Workshop sponsored break***

First Breakout Session: KGMC and Miller Professional Development Center(MPDC)
10:00 am - 11:45 pm ***Problem presentations, discussion, and first prioritization voting***
(See map for room assignments)

Workshop sponsored lunch: KGMC
11:45 - 1:30 pm ***Lunch***
Presentation of Trailblazer Award – Rukhsana Lindsey, Dir. of Research
Award of Door Prizes – Barry Sharp, New Products Coordinator

Second Breakout Session: KGMC and MPDC
1:30 pm - 3:00 pm ***Problem Statement Refining: Objectives, Tasks, Benefits, Implementation***

Afternoon Break: KGMC Main Foyer
3:00 pm - 3:30 pm ***Workshop sponsored break, Networking on Problem Statements***

Third Breakout Session: KGMC and MPDC
3:30 pm – 4:30 pm ***Problem Statement refinement & discussion:***
Deliverables, Tasks & Budget
Final Prioritization Voting
Completion of Workshop Feedback and Evaluation

Adjourn Workshop: 4:30 pm

APPENDIX B

WORKSHOP ATTENDEES

UTRAC 2006 ATTENDEES

Mr. Steven Acerson
UDOT REGION 3
Group 2

Mr. Glen Ames
UDOT SYSTEMS PLANNING
Group 5

Mr. Douglas Anderson
UDOT RESEARCH
Group 3

Mr. Lars Anderson
UDOT REGION 2
Group 4

Ms. Linda Anderson
FHWA
Group 4

Dr. Loren Anderson
UTAH STATE UNIVERSITY
Group 7

Mr. Scott Andrus
UDOT REGION 3
Group 1

Mr. Francis Ashland
UTAH GEOLOGIC SURVEY
Group 7

Dr. Paul Barr
UTAH STATE UNIVERSITY
Group 8

Dr. Steve Bartlett
UNIVERSITY OF UTAH
Group 7

Dr. Jim Bay
UTAH STATE UNIVERSITY
Group 7

Mr. Austin Baysinger
UDOT SYSTEMS PLANNING
Group 3

Mr. Ken Berg
UDOT RESEARCH
Group 6

Mr. Tim Biel
UDOT MATERIALS
Group 3

Mr. Jon Bischoff
UDOT GEOTECHNICAL
Group 7

Mr. Ben Blankenship
ASH GROVE CEMENT
Group 3

Mr. Doyt Bolling
UTAH T2 CENTER
Group 3

Mr. Hugh Boyle
MICHAEL BAKER
Group 8

Mr. Keith Brown
UDOT GEOTECHNICAL
Group 7

Mr. Steve Call
FHWA
Group 5

Mr. Jerry Chaney
UDOT ENVIRONMENTAL
Group 4

Mr. Dan Church
PARSONS BRINCKERHOFF
Group 8

Mr. Rob Clayton
UDOT TRAFFIC & SAFETY
Group 6

Mr. Ryan Cole
IGES
Group 7

Mr. Ray Cook
UDOT STRUCTURES
Group 8

Mr. Jim Cox
UDOT REGION 3
Group 3

Mr. J. R. Duncan
ASH GROVE CEMENT
Group 3

Mr. Paul Egbert
UDOT
Group 4

Mr. David Eixenberger
UDOT STRUCTURES
Group 8

Mr. Todd Emery
FHWA
Group 3

Mr. Clifton Farnsworth
UDOT REGION 3
Group 7

Mr. Michael Fazio
UDOT HYDRAULICS
Group 9

Mr. Wayne Felix
UDOT REGION 1
MATERIALS
Group 3

Mr. Liam Fritzgerald
UDOT MAINTENANCE
Group 2

Mr. Larry Gay
UDOT REGION 4
Group 3

Dr. Travis Gerber
BRIGHAM YOUNG
UNIVERSITY
Group 7

Mr. Darrell
Giannonatti
UDOT CONSTRUCTION &
MATERIALS
Group 1

Mr. Brad Giles
WAVETRONIX
Group 6

Mr. Chris Glazier
UDOT ISS
Group 10

Mr. Jim Golden
UDOT REGION 3
Group 1

Mr. Kevin Griffin
UDOT REGION 1
Group 2

Mr. Grant Gummow
UDOT GEOTECHNICAL
Group 7

Dr. Spencer Guthrie
BRIGHAM YOUNG
UNIVERSITY
Group 3

Mr. Todd Hadden
UDOT
Group 5

Dr. Marv Halling
UTAH STATE UNIVERSITY
Group 8

Mr. Corbett Hansen
KLEINFELDER
Group 7

Mr. Logan Harris
WAVETRONIX
Group 6

Mr. Rex Harris
UDOT REGION 1
Group 10

Mr. Dal Hawks
UDOT REGION 4

Ms. Debbie Heim
UDOT RESEARCH
Group 9

Ms. Leslie Heppler
UDOT GEOTECH
Group 7

Mr. Jim Higbee
UDOT GEOTECHNICAL
Group 7

Dr. Rollin Hotchkiss
BRIGHAM YOUNG UNIV
Group 9

Mr. Daniel Hsiao
UDOT RESEARCH
Group 8

Mr. Robert Hull
UDOT TRAFFIC AND
SAFETY
Group 6

Mr. Ahmad Jaber
UDOT SYSTEMS PLANNING
Group 5

Mr. Peter Jager
UDOT TRAFFIC & SAFETY
Group 6

Mr. Brent Jensen
UDOT ENVIRONMENTAL
Group 4

Ms. Rae Ann Jensen
UDOT RESEARCH

Mr Terry Kenney
USGS
Group 9

Mr. Cameron Kergaye
UDOT PROJECT
DEVELOPMENT
Group 5

Mr. Dave Kinncom
UDOT TOC - ITS
Group 6

Mr. Gary Kuhl
UDOT SYSTEMS PLANNING
Group 3

Mr. Bill Lawrence
UDOT SYSTEMS PLANNING
Group 5

Mr. Blaine Leonard
UDOT RESEARCH
Group 7

Ms. Shana Lindsey
UDOT RESEARCH
No Group

Mr.Vincent Liu
UDOT
Group 6

Kelly Lund
FHWA
Group 5

Mr. Carlos Machado
FHWA
Group 5

Mr. Clark Mackay
UDOT REGION 4
Group 1

Mr. Shane Marshall
UDOT ENVIROMENTAL
Group 4

Mr. Mike Marz
UDOT
Group 5

Mr. Raeleen Maxfield
UDOT CONSULTANT
SERVICES

Ms. Mitzi Mcintyre
UTAH CHAPTER ACPA
Group 3

Mr. Jim Mcminimee
UDOT PROJECT
DEVELOPMENT

Mr. John Miller
UDOT REGION 2
Group 8

Mr. Richard Miller
UDOT PROJECT
DEVELOPMENT
Group 10

Mr. John Njord
UDOT EXECUTIVE
DIRECTOR
No Group

Mr. L. Scott Nussbaum
UDOT REGION 1
Group 2

Ms. Esther Olsen
UDOT RESEARCH
No Group

Ms. Michelle Page
UDOT REGION 2
Group 1

Mr. Randy Park
UDOT REGION 2

Mr Ralph Patterson
UDOT TRAFFIC MANAGEMENT
Group 6

Dr. Joe Perrin
UNIVERSITY OF UTAH
Group 6

Mr. Kris Peterson
UDOT REGION 2
Group 6

Mr. Brian Phillips
UDOT REGION 3
Group 2

Mr. Jason Phillips
HW LOCHNER

Mr. Brad Price
RB&G ENGINEERING
Group 7

Mr. Greg Punske
FHWA
Group 4

Mr. George Ramjoue
WASATCH FRONT REGIONAL COUNCIL
Group 5

Mr. Eric Rasband
UDOT
Group 5

Dr. Larry Reaveley
UNIVERSITY OF UTAH
Group 8

Mr. Paul Richards
BRIGHAM YOUNG UNIV
Group 8

Mr. Matt Rink
UDOT STRUCTURES
Group 8

Dr. Kyle Rollins
BRIGHAM YOUNG UNIV
Group 7

Dr. Pedro Romero
UNIVERSITY OF UTAH
Group 3

Dr. Keri Ryan
UTAH STATE UNIV
Group 8

Dr. Mitsuru Saito
BRIGHAM YOUNG UNIV
Group 6

Dr. Grant Schultz
BRIGHAM YOUNG UNIV
Group 5

Mr. Brent Schvaneveldt
UDOT REGION 3

Mr. Kim Schvaneveldt
UDOT PLANNING
Group 5

Mr. Ernie Scott
INTER-MOUNTAIN LABS
Group 2

Mr. Barry Sharp
UDOT RESEARCH
Group 2

Mr. Sam Sherman
ITERIS
Group 6

Mr. Darin Sjoblom
UDOT GEOTECH
Group 7

Mr. Roland Stanger
FHWA
Group 6

Dr. Aleksandar Stevanovic
UNIVERSITY OF UTAH
Group 6

Mr. Matthew Swapp
UDOT SYSTEMS PLANNING
Group 5

Mr. Peter Tang
UDOT TRAFFIC & SAFETY
Group 6

Mr. Everett Taylor
FHWA
Group 8

Mr. Rodney Terry
UDOT REGION 1
Group 3

Mr. Tom Twedt
BIO-WEST
Group 4

Mr. Karl Verhaeren
UDOT CONSTRUCTION
Group 1

Mr. Abdul Wakil
UDOT RESEARCH
Group 5

Mr. Paul West
UDOT ENVIRONMENTAL
Group 4

Mr. Boyd Wheeler
UDOT STRUCTURES
Group 8

Mr. Robert Wight
UDOT REGION 2
Group 1