# TABLE OF CONTENTS

1  FORWARD ........................................................................................................................................7

2  ADMINISTRATION ...........................................................................................................................8

   2.1 Description ....................................................................................................................................8

   2.2 Facilities .........................................................................................................................................8

      2.2.1 LTRC Main Office Building ..................................................................................................8

      2.2.2 Transportation Training and Education Center (TTEC) .......................................................8

      2.2.3 DOTD Pavement Research Facility (PRF) ...........................................................................9

2.3 Authority For LTRC ........................................................................................................................9

      2.3.1 Purposes of LTRC ...................................................................................................................9

      2.3.2 Function and Duties of LTRC ................................................................................................9

      2.3.3 Funding ..................................................................................................................................10

      2.3.4 Contractual Agreements .......................................................................................................10

      2.3.5 Policy Committee ..................................................................................................................10

      2.3.6 Peer Exchange Process .........................................................................................................10

2.4 Organizational Structure ..............................................................................................................11

      2.4.1 Office of the Director ............................................................................................................11

      2.4.2 Research Section (DOTD Section 19) ................................................................................12

      2.4.3 Technology Transfer and Training Section (DOTD Section 33) ...........................................13

      2.4.4 LTRC Organizational Chart ................................................................................................13

2.5 Research Project Life Cycle ..........................................................................................................14

2.6 LTRC Project Management and Tracking System ......................................................................15

2.7 EEO Statement ............................................................................................................................15

2.8 Terms and Definitions ..................................................................................................................16

3  DEVELOPMENT OF ANNUAL WORK PROGRAM ....................................................................20

   3.1 Research Problem Identification ................................................................................................20

      3.1.1 Problem Statements ..............................................................................................................20

      3.1.2 Research Problem Identification Committee .........................................................................20

      3.1.3 Research Advisory Committee (RAC) ...............................................................................21

   3.2 Annual Work Program .................................................................................................................21

      3.2.1 Budget Categories ................................................................................................................21

      3.2.2 Funding Source ....................................................................................................................22
3.2.3 LTRC Program Management ........................................................................................................ 22
3.2.4 Annual Work Program Sheets .................................................................................................... 23
3.2.5 RPIC Priority List ......................................................................................................................... 24
3.2.6 Work Program Approval .............................................................................................................. 24
3.2.7 Work Program Modifications ........................................................................................................ 24
3.2.8 Work Program Process Flow Chart .............................................................................................. 24
3.3 Development and Approval of Research Proposals ........................................................................ 26
  3.3.1 Project Manager Proposal Development Responsibilities .............................................................. 26
  3.3.2 PRC Chairman Responsibilities .................................................................................................. 26
  3.3.3 PRC Research Proposal Development Responsibilities ................................................................. 27
  3.3.4 Development of Proposals .......................................................................................................... 27
  3.3.5 Proposal Form and Content ......................................................................................................... 28
3.4 Review and Approval of Research Proposals .................................................................................... 33
4 CONDUCT OF RESEARCH PROJECTS .............................................................................................. 34
  4.1 Study Identification .......................................................................................................................... 34
  4.2 Contractual Agreements .................................................................................................................. 35
    4.2.1 Awards to Louisiana Universities ................................................................................................. 35
    4.2.2 Awards to Research Consultants ................................................................................................. 35
    4.2.3 External Awards to LTRC ........................................................................................................... 35
  4.3 Project Management ........................................................................................................................... 35
    4.3.1 Project Manager Responsibilities ................................................................................................. 35
    4.3.2 PRC Chairman Responsibilities .................................................................................................. 36
    4.3.3 PRC Responsibilities .................................................................................................................. 36
  4.4 Meetings .............................................................................................................................................. 36
    4.4.1 Kick-Off Meeting ......................................................................................................................... 36
    4.4.2 Progress Meetings ........................................................................................................................ 37
    4.4.3 Close-out Meeting ....................................................................................................................... 37
  4.5 Contract Modifications ....................................................................................................................... 37
    4.5.1 Re-budgeting .................................................................................................................................. 37
    4.5.2 Project Modification ..................................................................................................................... 38
  4.6 Fiscal Procedures .................................................................................................................................. 38
    4.6.1 Fiscal Year ..................................................................................................................................... 38
    4.6.2 Reimbursement of Expenditures ................................................................................................. 39
4.6.3  Cost Records.................................................................................................................. 40
4.6.4  Auditing.......................................................................................................................... 40
4.6.5  Budget Modifications .................................................................................................... 40
4.7  Progress Reports .............................................................................................................. 41
4.7.1  Biannual Progress Report ............................................................................................. 41
4.7.2  Project Task Reports .................................................................................................... 41
4.7.3  Interim Report .............................................................................................................. 42
4.8  Travel ................................................................................................................................. 42
4.9  Equipment ........................................................................................................................ 42
4.9.1  LTRC Equipment ......................................................................................................... 42
4.9.2  Nonexpendable Equipment .......................................................................................... 43
4.9.3  Expendable Equipment ................................................................................................ 43
4.9.4  Disposition of Nonexpendable Equipment .................................................................. 43
4.10  Computer Software ........................................................................................................ 44
4.11  Progress Inspections ...................................................................................................... 44
4.12  Patent Rights .................................................................................................................. 44
4.13  Correspondence ............................................................................................................. 44
4.14  Papers, Articles, and Presentations ................................................................................ 44
4.15  Deliverables ..................................................................................................................... 44
4.16  Files and Records .......................................................................................................... 45
4.17  Close-Out, Termination, or Suspension ........................................................................ 46
4.17.1  Project Completion ..................................................................................................... 46
4.17.2  Early Termination or Suspension .............................................................................. 46
5  PUBLICATIONS .................................................................................................................... 47
5.1  General Requirements .................................................................................................... 47
5.2  Final Reports .................................................................................................................... 48
5.3  Papers, Articles, and Presentations ................................................................................ 49
5.4  Theses and Dissertations ............................................................................................... 49
5.5  Project Capsules .............................................................................................................. 49
5.6  Interim Reports .............................................................................................................. 49
5.7  LTRC Technical Summary ............................................................................................. 50
5.8  Technical Assistance Reports ......................................................................................... 50
5.9  Synthesis Reports ........................................................................................................... 50
6.5.1 Issuance of Memoranda ................................................................. 57
6.5.2 Formal Presentations/Publications ............................................ 57
6.5.3 News Releases ........................................................................ 58
6.5.4 Development and/or Delivery of Formal Training Materials ... 58
6.5.5 Demonstration or Pilot Projects .................................................. 58
6.5.6 Development of Study Proposals .............................................. 58
6.5.7 Personal Contact .................................................................... 58
6.5.8 LTRC Web Site ...................................................................... 58
6.6 Tracking of Results .................................................................... 58
6.6.1 LTRC Biannual Progress Report ............................................. 58
6.6.2 Implementation Summary Report ............................................ 58
6.6.3 Implementation Performance Measures ................................ 59

7 Appendix A - LTRC Authorizing Legislation: Title 48 ..................... 60
7.1 PART VI-B. LOUISIANA TRANSPORTATION RESEARCH CENTER ... 60
7.2 PART XIII-A. EMPLOYMENT OF CONSULTANTS .......................... 63
<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>LTRC Problem Statement Solicitation Form (1909)</td>
<td>68</td>
</tr>
<tr>
<td>C</td>
<td>Annual Research Work Program Form (1901)</td>
<td>70</td>
</tr>
<tr>
<td>D</td>
<td>LTRC Proposal Review Form (1910)</td>
<td>71</td>
</tr>
<tr>
<td>E</td>
<td>Research Proposal Template (1913)</td>
<td>72</td>
</tr>
<tr>
<td>F</td>
<td>Research Task Order Form (1914)</td>
<td>76</td>
</tr>
<tr>
<td>G</td>
<td>Typical Contract Template</td>
<td>77</td>
</tr>
<tr>
<td>H</td>
<td>Kick-Off Meeting Checklist</td>
<td>87</td>
</tr>
<tr>
<td>I</td>
<td>Research Project Modification Agreement Form (1907)</td>
<td>88</td>
</tr>
<tr>
<td>J</td>
<td>Monthly Invoice for Research Projects Form (1918)</td>
<td>90</td>
</tr>
<tr>
<td>K</td>
<td>Disposition of Non-expendable Equipment Form (1920)</td>
<td>91</td>
</tr>
<tr>
<td>L</td>
<td>Biannual Research Progress Report Form (1903)</td>
<td>92</td>
</tr>
<tr>
<td>M</td>
<td>Out-of-State Travel Approval Request Form (1917)</td>
<td>94</td>
</tr>
<tr>
<td>N</td>
<td>Notice-of-Project Completion Template Form (1921)</td>
<td>95</td>
</tr>
<tr>
<td>O</td>
<td>Project Evaluation Form</td>
<td>96</td>
</tr>
<tr>
<td>P</td>
<td>LTRC Publication Guidelines</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>22.1 Final Reports</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>22.2 Final Report Checklist</td>
<td>126</td>
</tr>
<tr>
<td></td>
<td>22.3 Synthesis Reports</td>
<td>127</td>
</tr>
<tr>
<td>Q</td>
<td>Notification of Submission of Papers Form (1908)</td>
<td>137</td>
</tr>
<tr>
<td>R</td>
<td>Technical Summary</td>
<td>138</td>
</tr>
<tr>
<td>S</td>
<td>Report Distribution Checklist Form (1912)</td>
<td>140</td>
</tr>
<tr>
<td>T</td>
<td>Public Document Submission Form</td>
<td>142</td>
</tr>
<tr>
<td>U</td>
<td>Research Assessment and Implementation Report Form (1902)</td>
<td>143</td>
</tr>
<tr>
<td>V</td>
<td>Technology Transfer Travel Approval Request Form (1922)</td>
<td>144</td>
</tr>
</tbody>
</table>
1 FORWARD

The purposes of this manual are as follows:

- To define the policies and procedures for the Louisiana Transportation Research Center (LTRC) research and technology transfer (T²) program and its various functions.
- To ensure that all research and T² is conducted, managed, documented, and implemented in conformance with legal requirements and policies of LTRC, the Louisiana Department of Transportation and Development (DOTD), and the Federal Highway Administration (FHWA).
- To ensure that the programs, projects, and products generated by LTRC are provided for the benefit of DOTD, its employees, and other transportation agencies and users.
- To guide research administrators and managers in the successful and efficient initiation, conduction, and implementation of research, development, and technology transfer activities necessary in connection with the planning, design, construction, management, and maintenance of highway, public transportation, and intermodal transportation systems.
- To guide research administrators and managers in the successful and efficient initiation, conduction, and implementation of study, research, and training on the engineering standards and construction materials for transportation systems described in the bullet above, including the evaluation and accreditation of inspection and testing and the regulation and taxation of their use.

This manual is intended for LTRC employees as well as individuals and agencies conducting contract research for LTRC. The first chapter explains the organization, staffing, and purpose of the center. The remainder of the manual is organized to follow the development of a research project from the initial writing of problem statements and proposals to the approval, conduct, deliverables, and implementation of research studies. Samples of forms, LTRC Publication Guidelines for report preparation, and an LTRC Cooperative Research Agreement are provided in the appendixes of this manual and may also be found on the LTRC website. A list of terms is given in Chapter 2.
2 ADMINISTRATION

2.1 DESCRIPTION

The Louisiana Transportation Research Center (LTRC) is a cooperative research, technology transfer, education, and training center administered jointly by the Louisiana Department of Transportation and Development and Louisiana State University. LTRC merges the resources of state and government, universities, and private industry to identify, develop, and implement new technology and provide educational services to improve the state and national transportation system. The primary goal of LTRC is to improve the transportation system in both Louisiana and the nation by conducting research, disseminating information, and assisting state and local transportation agencies.

Created by the Louisiana legislature in 1986, LTRC conducts short-term and long-term research while providing a variety of technical assistance, training, continuing education, technology transfer, and problem-solving services to DOTD and the transportation community.

Located near the College of Engineering on LSU’s campus in Baton Rouge, Louisiana, LTRC provides researchers and students access to state-of-the-art laboratories and research equipment, as well as the full resources of LSU as a Carnegie Designated Doctoral/Research Extensive Institution. LTRC houses over 75 employees and up to 30 students in three facilities. The 25,300-square-foot LTRC Main Office Building includes six research laboratories, a conference room, and offices. The 14,000-square-foot state-of-the-art Transportation Training and Education Center (TTEC) includes a lectern auditorium, two classrooms, a conference room, a computer teaching laboratory, a library, and offices, and serves as a resource center for the entire transportation community. The DOTD Pavement Research Facility (PRF) is located in Brusly, Louisiana, across the Mississippi River from Baton Rouge and includes two full-scale accelerated loading machines and an office building.

In addition to its affiliation with LSU, LTRC fully participates with other Louisiana universities to meet the practical and academic needs of the transportation industry in such areas as engineering, law, business and management, basic sciences, planning, and environmental studies.

2.2 FACILITIES

2.2.1 LTRC Main Office Building

Louisiana Transportation Research Center
4101 Gourrier Avenue
Baton Rouge, LA 70808-4443

2.2.2 Transportation Training and Education Center (TTEC)

LTRC Transportation Training and Education Center
4099 Gourrier Avenue
Baton Rouge, LA 70808-4443
2.2.3 DOTD Pavement Research Facility (PRF)
DOTD Pavement Research Facility
2865 Northline Road
Port Allen, LA 70767

The official address for both postal and other LTRC deliveries is at the LTRC Main Office.

Tel: (225) 767-9131
Fax: (225) 767-9108
E-mail: ltrc@ltrc.lsu.edu
Website: www.ltrc.lsu.edu

2.3 Authority for LTRC
LTRC was created in the 1986 regular session of the Louisiana Legislature via Act 137 (originating as Senate Bill No. 520), which was approved on June 26, 1986. This legislation (amended 1988, 1995) established the purposes and functions of LTRC in addition to the basis for administration and funding of the organization. The original and amended acts incorporated into Louisiana Revised Statute RS 48:105 are provided in Appendix A.

2.3.1 Purposes of LTRC
• Establish cooperation between all parties with concern for the enhancement of the transportation system of the state of Louisiana.
• Introduce new technology.
• Enhance higher education in the general transportation field.
• Benefit Louisiana economically by enhancing job opportunities.
• Promote research, technology transfer, and training.

2.3.2 Function and Duties of LTRC
• To develop and conduct a nationally recognized short-range and long-range transportation research program in order to implement more efficient planning, design, construction, operation, and maintenance practices, and to enhance traffic safety.
• To offer education and training programs in both fundamental and state-of-the-art practices in transportation and related areas by offering training courses, demonstration projects, and conferences.
• To develop, implement, and refine a technology transfer program that shall provide a mechanism for conveying modern transportation systems practices and procedures to municipalities and parishes.
• To maintain cooperative relationships with the Transportation Research Board, the research divisions of other state highway and transportation departments, universities, and national and international technical associations and agencies.
• To report and publish research findings that contribute to fundamental knowledge and facilitate the implementation of enhanced technologies, which may result in more economical practices in transportation systems engineering.
• To provide DOTD with short-term problem solving assistance.
2.3.3 Funding
The funding for the LTRC program is supported primarily by DOTD and FHWA. Part of these funds is derived through the Federal Highway Administration's State Planning and Research (SP&R) Program, Surface Transportation Program (STP), and other FHWA grant sources. Other federal and self-generated funding may be procured. Funding may also be provided by interagency transfer or other DOTD sections.

The LTRC research program as a whole is funded on a fiscal-year authorization. This authorization is composed of the anticipated fiscal year expenditures of individual research projects and program management line items as developed in the Annual Work Program (Section 3.2).

2.3.4 Contractual Agreements
In accordance with Louisiana RS 48:105, LTRC may enter into contractual agreements only with the approval of the Secretary of DOTD or his/her designee, and said agreements must conform to the contracting policies of DOTD.

2.3.5 Policy Committee
The LTRC Policy Committee is composed of eleven members: the Director of LTRC, three appointed by the Secretary of DOTD, one from each of the six public universities that have a college of engineering with a civil engineering department and that is appointed by the president or chancellor of the respective university, and one member who is the dean of a college of engineering of a nonpublic institution of higher education selected by the committee from a list submitted by the Louisiana Association of Independent Colleges and Universities. The FHWA is an invited observer of the committee. The chairman of the Policy Committee is elected by the committee. The term of office for Policy Committee members is two years. The committee meets at least twice a year to review the activities of LTRC. The major responsibilities of the Policy Committee are to coordinate the transportation research program by:

- Reviewing and recommending research and technology transfer programs
- Reviewing and recommending fiscal year budgets
- Reviewing the activities and progress of research programs

2.3.6 Peer Exchange Process
Federal regulations (23 CFR 420 Subpart B) require that each State Department of Transportation must agree to peer reviews of its Research, Development, and Technology Transfer (RD&T²) management process to be eligible for managing State Planning and Research (SP&R) funds. The FHWA interprets the peer meetings to be more of an exchange of information regarding the various practices used by states to manage their RD&T² programs. A peer exchange must be conducted a minimum of once every five years. The intent is to enhance research programs with a sharing of ideas. The peer exchange teams are generally composed of state research managers, FHWA, and university or industry personnel.

The peer exchange will be charged with examination of the LTRC management processes described in this manual, reviewing best practices of the research work, including the
solicitation, selection, contract process, project progress, staff training, and technology transfer activities, and assessing the overall effectiveness of the program and its implementation process. In addition, other topics of specific interest will be addressed during the exchange. The peer exchange team will develop a written report of its findings for LTRC. The report will be presented to the DOTD Secretary, DOTD Chief Engineer, and FHWA Louisiana Division Administrator.

2.4 **ORGANIZATIONAL STRUCTURE**

The administration of LTRC's activities is provided by the center's Director and Associate Directors.

**Director** - The Director of the Louisiana Transportation Research Center is the Chief Administrative Officer of LTRC and is directly responsible to the DOTD Chief Engineer. The Director is also functionally responsible to the Dean, College of Engineering, Louisiana State University in matters as related to LSU staff.

**Associate Director, Research** - The Associate Director of the Louisiana Transportation Research Center administers the state and federally funded research programs of DOTD as appointing authority of the DOTD Research Section. The Associate Director, Research, is responsible to the Director of LTRC.

**Associate Director, Technology Transfer and Training** - The Associate Director of the Louisiana Transportation Research Center administers the state and federally funded T² program of DOTD as the appointing authority of the Technology Transfer and Training Section. The Associate Director, Technology Transfer, is responsible for the technical and leadership training activities of DOTD and is responsible to the Director of LTRC.

**Associate Director, External Programs** - The Associate Director of External Programs coordinates university-based research programs funded by non-DOTD sources, administers these research projects on a case-by-case basis, and facilitates development of multi-campus/multi-disciplinary initiatives in support of DOTD. The Associate Director, External Programs, is responsible to the Director of LTRC.

**Group Administrator** - The LTRC Group Administrator has responsibility and authority over a staff of LTRC engineers and technicians of a general technical area to which an individual research project is assigned.

**Project Manager** - An LTRC staff employee with responsibility and authority to act as a liaison between the Contractor and LTRC in guiding, inspecting, and monitoring the contractual and technical progress of a research or training project.

**Technology Transfer Engineer** - An LTRC staff employee with responsibility for technology transfer, training, and implementation assistance activities.

2.4.1 **Office of the Director**

The Office of the Director includes the Director, Administrative Assistant, and the LTRC business office.
2.4.2 Research Section *(DOTD Section 19)*

LTRC’s research section is organized in three major groups:

**Materials Research Group**
- Asphalt Research Unit
- Concrete Research Unit
- Engineering Materials Characterization and Research Facility (EMCRF)
- Structures Research

**Pavements & Geotechnical Research Group**
- Pavement Research Unit
- Pavement Research Facility
- Geotechnical Research Unit
- Geotechnical Engineering Research Laboratory (GERL)

**Special Studies Research Group**
- Planning & Intermodal (PLAN)
- Intelligent Transportation Systems Lab
- Louisiana Center for Transportation Safety (LCTS)

In addition to laboratories equipped to conduct research in soils, pavements, concrete, and asphalt materials, the following are part of LTRC’s comprehensive research facilities:

**DOTD Pavement Research Facility (PRF):** The PRF conducts research on long-term performance of pavements subject to heavy loads. The PRF houses two accelerated loading devices, the ALF and the ATLAS 30, capable of applying truck loading to full-scale pavement test sections. The ALF device is a 100-ft. long, 55-ton, frame and wheel assembly that models one half of a single axle and the load is adjustable from 9,750 lb. to 18,950 lb. per load application. The ATLAS 30 is a 65-ft. long I-beam device designed to apply a rolling load of up to 30,000 lb. to a pavement surface through dual truck tires.

**Engineering Materials Characterization and Research Facility (EMCRF):** The EMCRF at LTRC conducts basic and applied research that is related to characterization and performance of transportation materials. The EMCRF is equipped with state-of-the-art equipment to fundamentally characterize transportation materials. This includes two MTS materials test systems and Superpave binder and mixture equipment.

**Geotechnical Engineering Research Laboratory (GERL):** The GERL conducts basic and applied research related to foundations for bridges, earthworks, and other structures. The laboratory provides state-of-the-art capabilities to assess the engineering properties of geosynthetic reinforced systems, chemically modified soils, and other geomaterials used in transportation.

**Intelligent Transportation Systems (ITS) Laboratory:** The purpose of the ITS lab is to develop and demonstrate procedures that successfully transform existing ITS data into useful information, and then pass the procedures on to agencies in order to apply them on a routine basis.
2.4.3 Technology Transfer and Training Section (*DOTD Section 33*)

**Workforce Development:** In support of a commitment to a safe and efficient transportation infrastructure, LTRC reaches out to the individual working in the transportation industry to provide specialized and intensive job-specific training and education. The education and training program internally develops and manages maintenance and construction training materials and programs; coordinates seminars, workshops, and conferences for continuing education and professional development; and contracts with the private and public sectors for unique training/education needs.

As part of its commitment to higher education, LTRC coordinates several programs that support civil engineering students and graduates:

The statewide *DOTD Engineer Resource Development Program* provides structured rotational training for entry-level DOTD engineers.

The *Cooperative Education Program for Civil Engineers* is a joint endeavor of DOTD and Louisiana universities to employ full-time students to perform engineering work and receive practical experience in transportation engineering.

The *DOTD Support Program for Senior Projects in Civil Engineering* encourages civil engineering students to pursue transportation as a field of study and consider DOTD as a potential employer while enhancing the civil engineering departments in the Louisiana higher education system.

**Transportation Training and Education Center (TTEC):** Located adjacent to LTRC, TTEC houses a lecture facility, a computer-based training classroom, library, two general classrooms, a conference room, and offices. Each of these is equipped with state-of-the-art education and training equipment and distance learning/video-conferencing capabilities.

Through TTEC, LTRC is expanding the scope and availability of training, thereby serving a larger population. Offerings range from job-related training for transportation technicians to continuing education for engineers. TTEC is also available for representatives of state and local governments, consultants, contractors, and other industry personnel.

**Local Technical Assistance Program (LTAP):** A cooperative effort of DOTD, the Federal Highway Administration, and LSU, LTRC’s LTAP provides a diverse collection of experience and knowledge for local governments. The Louisiana LTAP center, one of 57 centers nationwide, travels the entire state presenting seminars, short courses, and workshops on current trends and techniques in the transportation industry.

2.4.4 LTRC Organizational Chart

The chart shown in Figure 2-1 relates the basic functional relationships of LTRC staff positions. See the LTRC website for a detailed list of unit responsibilities along with LTRC personnel indicating titles and contact information: www.ltrc.lsu.edu
2.5 **RESEARCH PROJECT LIFE CYCLE**

There are several phases in a research project management plan that begins with the generation of a research idea and hopefully leading toward the successful deployment of the research findings. The LTRC project life cycle that generally defines the management of the research program includes the following phases:

- Development of a Problem Statement
- Initiation of a Research Project
- Conduct of the Research
- Dissemination of Research Results
- Deployment of Research Solutions

Figure 2-2 provides a flow chart of the research project life cycle at LTRC. The research team and the research project managers are heavily engaged during this time, conducting the research tasks and
performing management oversight. The Research Assessment and Implementation Report, represented by the red line, is the formal linking of the beginning of the project work with the implementation or deployment expectations of DOTD.

2.6 **LTRC Project Management and Tracking System**

The Project Management and Tracking System (PMTS) is a relational database system used to manage and track LTRC research and technical assistance projects through the project cycle. All project information is entered and retrieved from the database through a webpage using individual user logins. In addition to storing project information digitally, the system offers reports and business data analysis enabling LTRC project management and associated business processes to be more efficient.

PMTS documentation and user manuals are available on the LTRC website. Access to the PMTS is restricted to LTRC staff and Principal Investigators on active projects. Restricted access to input and review data is controlled by user login and password with limited functionality based on user roles defined in PMTS.

Access to the PMTS can be made through the LTRC website under the Research homepage or at [http://projectmanagement.ltrc.lsu.edu/](http://projectmanagement.ltrc.lsu.edu/).

2.7 **EEO Statement**

The Louisiana Transportation Research Center assures equal opportunity for all qualified persons without regard to race, color, religion, sex, national origin, age, handicap, or marital status in participation, treatment, employment in the programs and activities that LTRC operates. The implementation of all research programs shall be in accordance with the policy of the Federal Highway Administration to ensure compliance with Title VI and VII of the Civil Rights Act of 1964, as amended by the Equal Opportunity Act of 1972, Federal Executive Order 11246, the Federal Rehabilitation Act of 1973, as amended, the Vietnam Era Veteran’s Readjustment Assistance Act of 1974, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1972, and the requirements of the Americans with Disabilities Act of 1990. Anyone having questions or complaints regarding equal opportunity at LTRC should
2.8 **TERMS AND DEFINITIONS**

**Applied Research** - Means the study of phenomena to gain knowledge or understanding necessary for determining the means by which a recognized need may be met; the primary purpose of this kind of research is to answer a question or solve a problem.

**Annual Work Program** - The schedule of tentative LTRC research activities planned to be undertaken or continuing in one fiscal year (July 1 through June 30).

**Basic Research** - Means the study of phenomena, and of observable facts, without specific applications towards processes or products in mind; the primary purpose of this kind of research is to increase knowledge.

**Contract** - The basic contract under which research is conducted for LTRC by a Contractor. The term contract as used herein refers to the combination of documents which shall include the Research Proposal, Request for Proposals, Cooperative Research Agreement and Task Order, Legal Contract, and LTRC Manual of Research Procedures, as applicable, which constitute the legal basis for a research study.

**Contractor** - Any agency, institution, organization, individual, or other party that has entered into a signed agreement with LTRC/DOTD to conduct research or provide training.

**Cooperative Research Agreement** - A contract between LTRC/DOTD and a Louisiana research university, which forms the legal basis for individual research projects for the specified period. Individual studies during the period of the contract are activated and approved by task order.

**CFR, Title 23** - Code of Federal Regulation, Title 23; the source document for rules and regulations governing transportation research activities involving federal funds, and which is published by the Federal Highway Administration.

**Development** - Means the systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes.

**Direct Cost** - Expenses that include but are not limited to salaries, wages, fringe benefits, equipment, supplies, travel, reproduction, services, and equipment rental.

**DOTD** - The Louisiana Department of Transportation and Development, P.O. Box 94245, Baton Rouge, Louisiana 70804-9245

**FHWA** - The Federal Highway Administration of the U.S. Department of Transportation, whose rules are administered by the FHWA Louisiana Division Office, 5304 Flanders Drive, Suite A Baton Rouge, LA 70808, (225) 757-7600
Indirect Costs - Costs for general and research administration and overhead incurred in the research project for which no charge is made elsewhere in the study.

LSU - The Louisiana State University and Agricultural and Mechanical College, Baton Rouge, LA 70803.

LTRC - The Louisiana Transportation Research Center, 4101 Gourrier Avenue, Baton Rouge, LA 70808.

NCHRP - National Cooperative Highway Research Program, a pooled fund program directed toward the solution of problems of national significance sponsored by the state highway agencies and FHWA and administered by the Transportation Research Board (TRB), National Academy of Sciences, Engineering and Medicine.

Nonexpendable Equipment - Equipment having a useful life of more than one year and an acquisition cost of more than $1000 per unit.

Notice to Proceed - Written notice from the department authorizing the date that a research Contractor (not under a cooperative research agreement) may proceed with the research project for a specific period of time to accomplish the objectives of the study.

Peer Exchange - The process by which LTRC partners with other state transportation, FHWA representatives, academics, and other transportation partners to share information on the research and implementation process toward the result of improving such processes.

LTRC Policy Committee - An appointed committee with responsibility for advising and assisting the Director in the coordination of the research, education, and training programs by reviewing activities and recommending policies, research projects, and program funding levels; and by reviewing and assessing both the implementation of research results and the overall effectiveness of programs.

Pooled Fund Project - A Transportation Pooled Fund (TPF) Program project funded by several federal, state, regional, or local transportation agencies, academic institutions, foundations, or private firms to solve a regional or national transportation-related problem, research, planning, and technology transfer activities.

Principal Investigator (PI) - The person principally in charge of and accountable for a research project whose duty is to plan and coordinate the work in accordance with the approved work plan and report the results. The Principal Investigator for contract research shall be a staff member of the Contractor having technical competence and responsible charge in the field in which the research is being conducted.

LTRC Project Management and Tracking System (PMTS) - A web-based system created to manage and track LTRC research projects, business processes, resources, and deliverables. The system was designed to accomplish the management processes outlined in the LTRC Manual of Research Procedures.

LTRC Technical Report Review Panel - An internal panel chaired by the Technology Transfer Engineer created to provide an independent technical review of research reports. In addition
to the Technology Transfer Engineer, the panel consists of one full-time research associate and one DOTD Staff Engineer generally from a working group not associated with the research topic.

Problem Statement - A concise description of the transportation related problem(s) for which solutions through research are deemed feasible.

Project Review Committee (PRC) - An advisory committee appointed by the Director with a major responsibility for assisting the LTRC Project Manager in the development of acceptable research problem statements, requests for proposals, review of research proposals, oversight of approved research projects, and implementation of findings.

Records - The official paper or evidence that documents the findings, data collected, work-time spent, and monies expended for each individual research project.

RD&T activity* - Means a basic or applied research project or study, development and technology transfer activity.

Research – Means a systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research can be basic or applied.

Research Advisory Committee (RAC) - An advisory committee appointed by the Director to review, prioritize, and rate research problem statements selected by RPICs. This committee is composed of key DOTD technical staff and field personnel as well as a FHWA representative.

Research in Progress (RIP) - A database managed by the Transportation Research Board containing active research projects.

Research Project Modification Agreement - An addendum to the contract document which authorizes the modification or continuation of a research study with respect to time, budget, personnel, objective, scope, or work plan.

Research Problem Identification Committee (RPIC) - Advisory committees appointed by the Associate Director, Research, and composed of DOTD employees, academics, governmental agencies, and other transportation industry representatives, with responsibility for developing, reviewing, and prioritizing research problem statements.

Research Study/Project - An individual research investigation having the limited scope of supplying, implementing, or confirming a specific theory, design, or data.

Synthesis Study/Project - An individual investigation on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. A synthesis provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

Research Proposal - A document that establishes the necessity for a research undertaking, clearly defines the objectives, provides a detailed work plan for achieving the objectives with cost estimates and time schedules, and indicates how the research findings are expected to be used and implemented.
Request for Proposals (RFP) - An RFP is a document prepared to solicit formal research proposals from prospective researchers.

Secretary - The Secretary of the Louisiana Department of Transportation and Development.

State Planning and Research Program (SP&R) - The FHWA State Planning and Research Program; Part II is managed by LTRC.

Study Budget - The total funds allocated for the accomplishment of an individual study for the period of time specified.

Supplemental Agreement - Mutually consented agreement that modifies, but does not replace, an existing agreement or contract required to alter an existing contract not under a Cooperative Research Agreement.

Task Order - The contract document that authorizes approval and initiation of an individual research project between LTRC and a university (Contractor) under the provisions of the Cooperative Research Agreement.

Technology Transfer - Means those activities that lead to the adoption of a new technique or product by users and involves dissemination, demonstration, training, and other activities that lead to eventual innovation.

Transportation Research Board (TRB) - One of seven major divisions of the National Research Council— a private, nonprofit institution that is the principal operating agency of the National Academies in providing services to the government, the public, and the scientific and engineering communities. The National Research Council is jointly administered by the National Academies of Sciences, Engineering, and Medicine.

Transport Research International Documentation (TRID) - An integrated database that combines the records from TRB’s Transportation Research Information Services (TRIS) Database and the OECD’s Joint Transport Research Centre’s International Transport Research Documentation (ITRD) Database. TRID provides access to more than one million records of transportation research worldwide.

Transportation Research Information Services (TRIS) - Transportation Research Information Service, a computerized storage and retrieval system operated by Transportation Research Board containing abstracts of completed research.

LTRC Website - www.ltrc.lsu.edu

Work Plan - The section of the study proposal that contains the detailed description of the methods and procedures (including approved modifications), which will be used to conduct the study.

*RD&T activities cease to be eligible for SPR Subpart B funds upon completion of testing, evaluation, and dissemination under Technology Transfer as appropriate, and/or if they no longer meet the definitions listed above.*
3 DEVELOPMENT OF ANNUAL WORK PROGRAM

3.1 Research Problem Identification

Research problems are identified through a biennial solicitation of problem statements from the transportation community at large. Problem statements received by LTRC in this process are assigned to Research Problem Identification Committees (RPIC) for rating according to need and implementation potential. The top problem statements from each RPIC are then submitted to the Research Advisory Committee, who also evaluates the problem statements according to need and implementation, resulting in a priority list used by LTRC to determine funding. This priority list is incorporated in the LTRC Annual Work Program.

In addition to the biennial solicitation, unsolicited problem statements may be submitted to the Director through the LTRC website at any time.

3.1.1 Problem Statements

The problem statement is a concise description of a transportation-related problem for which solutions through research are deemed feasible. Problem statements are to be submitted through the LTRC website and the PMTS. Problem statements are welcomed by LTRC at any time; however, they are formally solicited from LTRC, DOTD, universities, and transportation industry representatives biennially. The statements are ranked by Research Problem Identification Committees (RPIC) and the Research Advisory Committee (RAC) for funding. The form, content, and purpose of a problem statement (Appendix B) are described as follows:

A. PROBLEM TITLE – A concise, descriptive title of the problem.
B. PROBLEM STATEMENT – A brief statement of problem, including some indication of its magnitude and impact on the highway program.
C. RESEARCH PROPOSED – A brief description of the research, development, or evaluation activities proposed to resolve the problem.
D. PROBLEM IMPLEMENTATION OF RESULTS – A brief description should state how it is anticipated that the results of the proposed research will be applied. This description should include a statement of the anticipated benefits from solving the problem.

3.1.2 Research Problem Identification Committee

RPICs will be formed to assist the LTRC staff in the formulation and refinement of problem statements. Members of RPICs shall be appointed by the Associate Director, Research subject to the approval of the Director from the personnel of LTRC, DOTD, FHWA, universities, and private industry. Selection shall be based upon the expertise and interest of each individual relative to the technical subject matter. The RPICs are chaired by an appointed DOTD member with an LTRC staff member serving as facilitator. RPIC members shall discuss the pertinent facts of the proposed research and shall receive copies of the problem statements, along with any additional information to assist them in the decision-making process. RPIC meetings are open to non-voting participation during the problem statement discussions. Problem statement authors are encouraged to attend the meetings to
provide a brief overview. The RPIC’s responsibility is to develop a refined problem statement or recommend disposition of the problem statement if research is not deemed a viable solution. In addition, each RPIC, as technical experts may develop additional problem statements according to DOTD needs. Each member will rate each problem statement based on need and implementation potential. Each committee shall provide a priority list of problem statements.

3.1.3 Research Advisory Committee (RAC)
Members of the RAC shall be appointed by the Director and be comprised of the RPIC chairs, DOTD administrator level staff, and an FHWA representative, with expertise appropriate to the technical areas included in the problem statements. The RAC shall be chaired by the LTRC Associate Director, Research. Each problem statement will be presented to the RAC by the RPIC chair or LTRC facilitator of the sponsoring RPIC. The problem statements will be evaluated based on research need and implementation potential. A resulting RPIC Priority List will be recommended for inclusion in the annual work program (AWP).

3.2 Annual Work Program
The AWP is the schedule of tentative LTRC research and technology transfer and training activities planned to be undertaken in one fiscal year. The scheduled period coincides with the fiscal year for both LTRC and DOTD for the period beginning July 1 of each year and ending June 30 of the following year.

Research projects may be conducted by LTRC staff or through contract and will address local, regional, and/or national problems such as exploratory, survey, feasibility studies; experimental construction incorporating new products or procedures studies; or implementation efforts.

The annual work program is formulated based on studies identified from the following:

- Continuing ongoing projects
- RPIC Priority List Projects
- Additional research needs follow-up projects recommended by existing PRCs
- Emerging technologies/issues in direct response to immediate problems of DOTD
- Research support line items

3.2.1 Budget Categories
A summary section by budget category shall provide a ready reference for the program as a whole. Research projects will be categorized by budget category as follows:

- FHWA
- State
- Federal (non-FHWA)
- Self-generated
- Interagency Transfer
- Other DOTD Sections
3.2.2 Funding Source
Funding for studies will be further identified by funding source within a budget category. Examples of funding sources within established budget categories may be as follows:

- FHWA
  - SP&R: TTF-Fed/TTF-Reg (80% / 20%)
  - STP: TTF-Fed (100%)
  - SP&R: Pooled Funded: TTF-Fed (100%)
  - LTAP: TTF-Fed/TTF-Fed (50% / 50%)
  - *(FHWA Grants Acronym)*: TTF-Fed (100%)
- State
  - State: TTF:Reg (100%)
- Federal
  - National Science Foundation
  - Corp of Engineers
  - US Agriculture
- Self-generated
  - NCHRP
  - *(private industry name)*
- Interagency Transfer
  - *(Agency name)*
- Other DOTD Sections
  - Safety: TTF-Fed
  - Operations: TTF-Reg

3.2.3 LTRC Program Management
LTRC staff may charge to appropriate LTRC line items are follows:

3.2.3.1 Research Section (19)
- Program Management (XX-1PM)
  - Overall program management (restricted to LTRC administrators and support staff, i.e., Director, Associate Directors, Group Administrators, etc.)
- Technical Research Surveillance (XX-1TRS)
  - Management of LTRC research project contracts
  - Preparation of research proposals
  - Participation on LTRC Project Review Committees
  - Participation on RPIC and RAC committees
  - Participation in external research technical advisory panels (NCHRP, FHWA Pooled Fund Research Project Panels, etc.)
- Technology Transfer & Research Implementation (XX-1TTRI)
  - Research Implementation Activities
  - Technology Transfer Seminars
  - Participation in external technology transfer/training activities (TRB meetings, technical conferences, workshops, etc.)
- Equipment Management (XX-1EQM)
  - Routine and unscheduled laboratory maintenance
3.2.4.1 Proposed Research Projects
Development of a work program sheet is the first step required to move a project from a problem statement into a formal research study. The project status is labeled as proposed
and subject to the approval process defined in Chapter 4. The project budget is estimated and subject to revision during the proposal development stage. Proposed study work program sheets may only be submitted by LTRC staff.

3.2.4.2 Ongoing Research Projects
Work program sheets for ongoing research projects shall be submitted by the Principal Investigator through the LTRC PMTS website by March 15 of each year.

3.2.5 RPIC Priority List
The AWP shall include the RPIC priority list of research problem statements developed for the upcoming fiscal year. Each RPIC priority list is used for two annual FY work programs.

3.2.6 Work Program Approval
The LTRC Policy Committee reviews the annual work program and provides recommendations to LTRC Director.

The AWP is submitted to the FHWA Louisiana Division for review and approval of the FHWA funded portion of the work program. The AWP is submitted to FHWA by May 15 each year.

Upon approval of FHWA, the AWP is submitted to the DOTD Chief Engineer for approval to meet the requirements of Title 48:286 (Appendix A) for authorization to hire consultants.

3.2.7 Work Program Modifications
Research studies may be added to the annual work program throughout the fiscal year to address emerging issues, priority projects, or externally awarded grants, etc. Individual work program documents shall be submitted to the DOTD Chief Engineer for review and approval. Additionally, FHWA funded studies must be submitted to the FHWA Division Office as annual work program modifications.

3.2.8 Work Program Process Flow Chart
The process for development and approval of the work program is depicted in Figure 3-1.
Biennial Solicitation of Problem Statements
LTRC, DOTD, University, Industry, Government

RPIC
Rate/Review/Prioritize

RAC
Rate/Review/Prioritize

LTRC
Disposition of Problem Statements
Tech Transfer/
Design/
Construction/
Memos/EDSM

Defer to next
RPIC

Biennial Solicitation for two
Annual Work Programs

LTRC Management
Review

Contract

Internal

Unsolicited
Problem Statement

Internally
Generated

Emerging Technology
Emergent Issues

PRC
Recommendation

Annual Work Program
Developed

Policy Committee
Review & Approval

FHWA
Review & Approval

Approved Annual Work Program
Publish & Distribute

Figure 3-1 Annual Work Program Development Process
3.3 **Development and Approval of Research Proposals**

Each research study will be assigned a project manager who is responsible for project initiation, monitoring progress, overseeing technical issues, PRC/DOTD coordination, and overall surveillance of the research study. The project manager is generally an LTRC Staff Engineer with technical expertise in the study area.

A PRC will be established when funding becomes available for a project included in the annual work program. The PRC will act in an advisory capacity to LTRC, DOTD, and the Policy Committee throughout the life of a project, including implementation activities. The PRC shall be composed of technical experts or users relative to the project objective and scope. The PRC is generally composed of five or more members from DOTD, FHWA, local entities, professional associations, industry, and academia.

A PRC chairman shall be appointed by the Director to act as project champion for the feasibility of the study and implementation of the results. The Project Manager, in collaboration with the PRC chairman, shall recommend PRC members to the Director for approval.

3.3.1 **Project Manager Proposal Development Responsibilities**

The Project Manager’s responsibilities include:

- Works as the direct liaison between the PRC and research team; communicates panel decisions to the research team; serves as a conduit for all information flowing between the PRC as a whole or individual committee members and the research team
- Schedules all PRC meetings and takes meeting notes and minutes
- Conducts preliminary literature searches to understand and support the need for the proposed research
- Develops draft requests for proposals and preliminary cost estimates in relationship to the proposed research plan
- Facilitates PRC review of proposals and makes recommendations for the selection of the selected proposal
- Rates proposals using the Proposal Review Form (Appendix D)
- Prepares the contract and other documents as needed for proposal approval

3.3.2 **PRC Chairman Responsibilities**

In addition to the PRC responsibilities in Section 3.3.3, the Chairman’s responsibilities include:

- Works with Project Manager to identify technical panel members and makes sure they have the time and are willing and able to serve on the technical panel
- Presents scope of work and business case information to PRC for approval
- Presents business case for the project and the proposal that the technical panel recommends for funding
- Chairs all PRC meetings
- Encourages active participation by all panel members
- Helps the panel reach consensus
3.3.3 PRC Research Proposal Development Responsibilities

The problem statement forms the basis for scoping the project. The PRC will be responsible with assisting the Project Manager in the development of the project objective, scope and expected deliverables. Responsibilities of the PRC members during research proposal development include but are not limited to the following:

- Attend PRC meetings
- Review problem statement
- Validate the need and implementation potential
- Define the objective and scope
- Determine support needs
  - Access to data
  - Available facilities
  - DOTD support (construction or personnel)
- Identify potential research teams
  - LTRC in-house researchers vs. external researchers
  - University or consultant
    - Request for proposals vs. non-competitive selection (develop justification for non-competitive selection)
- Assist in the development of the RFP for those problem statements selected for contract research
- Review proposals
- Suggest improvements to proposals
- Rate proposals using the Proposal Review Form (Appendix D)

3.3.4 Development of Proposals

Projects approved in the annual work program that have been identified by LTRC for funding are developed into research proposals.

**Research Proposal** – A research proposal is a document that establishes the necessity for a research project, clearly defines the objectives, provides a detailed work plan for achieving the objectives defines the deliverables, and indicates how the research findings are expected to be implemented.

**Support Proposal** – A proposal developed to support a lead research project by providing personnel support, facilities for testing, equipment, data collection, and/or other activities related to the lead research project. Support studies may also be developed to provide DOTD matching funds for other external federal or state funded research.

Proposals may be developed through the following processes:

3.3.4.1 Competitive Solicitation through RFP

The RFP is a document prepared to solicit proposals from prospective contract researchers. RFPs are advertised in the following manner:

A. Open solicitation – An RFP is advertised through the DOTD Consultant Services Section and open to all universities and public or private research contractors. LTRC’s mission
includes the support of higher education in Louisiana. Consultant and out-of-state institutions submitting proposals are encouraged, although not required, to cooperate and collaborate with Louisiana universities for the purpose of sharing of knowledge and increasing transportation expertise in the academic community.

B. Louisiana university solicitation – An RFP is distributed to Louisiana universities through the LTRC Policy committee and is open only to Louisiana university researchers.

3.3.4.2 Non-competitive Selection
A. Proposal by LTRC Staff – LTRC/DOTD research personnel may offer research proposals at any time when the project is approved in the annual work program as proposed studies.
B. Proposal by a Louisiana University – LTRC/DOTD may contract directly with a Louisiana University through its Cooperative Research Agreement at any time when the project is approved in the annual work program as a proposed study.
C. Proposal by External Contract – LTRC/DOTD may contract directly with a private or public research Contractor when approved for non-competitive selection by the DOTD Secretary as allowed in Louisiana RS 48:292 (Appendix A).

3.3.4.3 Specialty Services under $50,000
LTRC/DOTD may send notice of a proposed contract for specialty services to firms that, to its knowledge, have experience in such services. Such notice must provide a minimum of 10 business days for submittal of responses. After the time period provided in the notice, LTRC/DOTD shall review any responses and may contract directly for those specialty services, including, but not limited to specialized testing, for amounts less than $50,000 with approval of the LTRC Director.

3.3.4.4 Externally Awarded Proposal
LTRC/DOTD may contract directly with a research funding agency (NCHRP, NSF, etc.) as a research Contractor or part of a research team. LTRC will develop an LTRC research proposal for review and approval as defined in Section 3.4. Members of the research team on the LTRC/DOTD proposal will receive a 3rd party funding contract.

3.3.5 Proposal Form and Content
This section provides the basic requirements for the form, sequence, and content of the research proposal. The proposal template is found in Appendix E. The proposal shall contain, but not be limited to, the following essential elements:

**PART I- IDENTIFICATION**

The title sheet, which includes the amount of funding requested; duration of the project in months with beginning and ending dates indicated; a concise descriptive title for the proposed study; the name and business address of the organization that will conduct the work; the major subdivision of that organization responsible for the research and the name, title, mailing address, telephone number, email address, and signature of the Principal Investigator.

**PART II – APPROVAL**
For LTAC use in the process of approval of the proposal, as noted in Section 3.4.

PART III – AMOUNTS REQUESTED FOR PROJECTS

This part of the proposal requires an itemized list of the funds requested for the proposed research by types of expense, total costs, and fiscal year (July 1 through June 30). If Sub-Consultants/Entities are used, the Prime Consultant/Entity must perform a minimum of 51 percent of the work for the overall project.

A. PERSONNEL –

1. University Proposals: List the names, positions, and percentage of time (based on a 40-hour work week) to be spent on the project for all persons involved in the research, including PI, Co-PI, research staff, and graduate students, if applicable. When the percentage time spent on the project varies with a given period (e.g., spring, fall, summer), the individual periods and appropriate percentage time shall be listed separately for each. The amounts requested for each person listed must not exceed the proportion of total salary computed from the percentage time spent on the project for that person. The salaries used as the basis for computing individual personnel costs shall be exclusive of the cost of employee benefits; however, that percentage used by the contracting agency to compute employee benefits shall be shown where indicated on the form and costs computed and included in totals. Graduate assistance stipends are allowed. Tuition reimbursement or tuition remission rates applied to stipends are not allowed. Personnel costs for report editing services are acceptable charges to be included in the study proposal. These costs must be itemized separately in the proposal.

2. Consultant Proposals: List the names, positions, and number of hours spent on the project for all persons involved in the research, including PI, Co-PI, and support staff. The salaries used as the basis for computing individual personnel costs shall be exclusive of the cost of employee benefits. However, that percentage used by the contracting agency to compute overhead (employee benefits, indirect costs and profit) shall be shown as indirect costs on the form and costs computed and included in totals. The proposal shall include a Work Plan which sets forth on an average the estimated staff-hours for each skill classification that will be utilized to perform the work required.

B. NON-EXPENDABLE EQUIPMENT - Itemize only non-expendable equipment that is to be purchased specifically for the performance of the study. Non-expendable equipment includes any items having a useful life of more than one year and an acquisition cost of more than $1000 per unit.

C. CONSUMABLE SUPPLIES - This item includes the estimated cost of all expendable equipment, materials, and supplies. Any item for which the cost exceeds $500 must be listed individually.

D. TRAVEL - Itemize expenses for trips to be made in connection with the research project and state the purpose of the trip. Expenses incurred for out-of-state travel should be
listed separately from those for in-state travel. Funds budgeted for travel shall be limited to what is necessary for the conduct of the research. See Section 4.8 for additional details. Funds shall not be budgeted for conference, convention, or seminar travel. See Chapter 6 for travel request procedures for the dissemination of research results at conferences.

E. OTHER EXPENSES - Itemize all miscellaneous expenses associated with the project that are not included in the agency’s computation of indirect cost, such as those required for reference materials, copying, computer time and software, photography, etc. All costs to be incurred for equipment rental or use of subcontractors/consultants associated with the project should be listed in this section.

F. TOTAL DIRECT COST - The sum of total estimated costs for items (A) through (E).

G. MODIFIED TOTAL DIRECT COST - Modified Total Direct Cost (MTDC) includes all direct salaries and wages, applicable fringe benefits, materials and supplies, services, travel, and up to the first $25,000 of each subaward (regardless of the period of performance of the subawards under the award). MTDC excludes equipment, capital expenditures, rental costs, participant support costs, and the portion of each subaward in excess of $25,000.

H. TOTAL INDIRECT COST - This item is intended to provide reimbursement for general and research administration and overhead expenses incurred by the contracting agency in the prosecution of the research project for which no charge is made elsewhere in the study. Indirect costs shall be distributed to MTDC. The actual percentage used and method of application shall be described in the proposal and shall be verifiable through audits by DOTD, FHWA, or their representative.

1. Universities - The indirect percentage used shall not exceed 25 percent.
2. Consultants - The indirect percentage used shall be the auditable overhead rate.

I. TOTAL COSTS - The sum of total estimated costs for direct and indirect costs, items (F) and (H).

PART IV – BIOGRAPHICAL SKETCHES

Provide brief biographical sketches for the professional personnel indicated by Part III, Section (1), to be actively engaged in the study so that required expertise can be determined.

PART V – TITLE VI STATEMENT

This portion of the proposal shall include a statement that the agency or Contractor will comply with the provisions contained in Title VI of the Civil Rights Act of 1964.

PART VI – PROPOSED RESEARCH

This portion of the proposal is the basic guide to the study containing the detailed description of the approach the PI intends to employ to complete the study and its potential for implementation. This portion shall contain the following elements in the sequence indicated:

A. PROBLEM STATEMENT - Proposer’s understanding of the problem to be solved through research.

B. OBJECTIVES OF RESEARCH - Provide concise statements to describe the specific aims of the work proposed and relate them to long-term goals.
C. METHODOLOGY - This section should describe the details of the researcher’s approach to solving the problem:

1. WORK PLAN - LTRC is seeking the insight of proposers on how best to achieve the research objectives. Proposers are expected to describe research plans that can be realistically accomplished within the constraints of available funds and contract time. Proposals must present the researcher’s current thinking in sufficient detail to demonstrate their understanding of the problem and the soundness of their approach. For each phase of the proposed research, itemize and discuss the tasks necessary to fulfill the objectives. Task descriptions are intended to provide a framework for conducting the research. In general, the following items should be considered for inclusion in the work plan:
   - A preliminary literature search should be accomplished and demonstrated in the discussion.
   - The discussion should include principles or theories to be used; devices, processes, materials, or systems to be developed; possible solutions to the problems; critical experiments to test the applicability of the theory; the type and range of variables to be used or considered; and the methods of data analysis to be used including statistical methods.
   - The methodology, including data required, for conducting an implementation assessment/cost benefit analysis should be presented.
   - The preparation of the final report should be acknowledged. A draft final report should be scheduled for delivery at least 90 days prior to the project completion date to permit time and charges for revisions.

2. WORK SCHEDULE - A time chart in the format shown in Figure 3-2 shall indicate the proposed time schedule of completion for each task (and subtask when applicable) discussed in part (a). This should include periodic PRC meetings, preparation of progress, interim (if applicable) and final reports and other deliverables. The work schedule shall include 90 days for PRC review of the draft final report.

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Literature Review</td>
<td>X</td>
</tr>
<tr>
<td>NDS Data Exploration</td>
<td>X</td>
</tr>
<tr>
<td>Identify Surrogate Measures of Distraction</td>
<td>X</td>
</tr>
<tr>
<td>Develop Distraction Index Model</td>
<td>X</td>
</tr>
<tr>
<td>Final Report</td>
<td>X</td>
</tr>
<tr>
<td>PRC review of Final Report</td>
<td>X</td>
</tr>
</tbody>
</table>

*Figure 3-2 Sample Research Study Work Schedule*

3. STAFFING PLAN - The responsibilities and time allocation of personnel to the required tasks should be briefly stated for each fiscal year for the duration of the project. Also include a table or chart indicating personnel by task with hours or percent of time and cost per task.
i. The proposal shall include a list of current and anticipated commitments on other work to be performed by principal research staff during the planned duration of this project.

ii. Any support relative to use of facilities, personnel, data, or access of information that is anticipated to be required from LTRC or DOTD shall be specifically detailed in the proposal.

4. DELIVERABLES - List all products that will be delivered during the research project. All products required for implementation must be included as project deliverables. Unless otherwise directed in the RFP or Scope of Work, if applicable, deliverables will always include the following items as products:
   i. Biannual Progress Reports (See Section 4.7.1)
   ii. Task Reports: Task reports are due by the end of the month following the completion of the task according to the timeline established in the proposal
   iii. Final Report, including and implementation and cost/benefit analysis, as applicable
   iv. Technical Summary (See Section 5.7)
   v. Final Presentation
   vi. Additional product deliverables may also include the following:
      - Reports
      - Manuals
      - Specifications
      - IT components or software
      - Training materials
      - Photographs
      - Video or other audio/visual materials
      - Detail drawings

J. FACILITIES TO BE USED - The facilities and major equipment at the disposal of the proposing agency that are to be used in the conduct of the study should be described.

K. STATE OF THE KNOWLEDGE
   1. PREVIOUS WORK BY RESEARCHERS - The researchers should list and describe briefly any previous work they have done pertinent to the proposed study. Personal publication on the subject area or closely related work should be cited. (List no more than five). It should be demonstrated that previous work has not attempted to solve the problem using the same approach.
   2. RESULTS OBTAINED BY OTHERS - Describe the results of the literature search for information on the findings of others pertinent to the proposed study. The findings available through TRID are required for all studies, as a minimum.
   3. SIGNIFICANCE OF RESEARCH - The importance of the proposed work should be explained in this section. Adequate explanation must be given about how the proposed research will extend, modify, or refine the previous work of others.

L. IMPLEMENTATION - An assessment by the researcher of the areas of potential application of anticipated research findings. The form in which the findings might be reported (mathematical model or formula, test procedure, specification, design
procedure, etc.) should be described. The specific area of practice that would be changed by the findings and those organizations or groups that might benefit from the new technology should be identified. The responsibility for and means of technology transfer relative to the study should be proposed when possible.

**M. AMOUNTS REQUESTED** - Provide justification for the itemized amounts shown in Part III for nonexpendable equipment, equipment rental, travel, and other items. It is required that the manner in which indirect costs are calculated and applied be stated.

**PART VII – LIST OF REFERENCES**

A numerical list of references used in the text of the proposal should be included in the order referred to in the text.

3.4 **REVIEW AND APPROVAL OF RESEARCH PROPOSALS**

The sequence of events necessary to obtain approval of a research proposal is described below:

A. **PRC** - reviews and rates proposals using the LTRC Proposal Review Form No. 1910 (Appendix D) within 14 days of reception.

B. **Associate Director, Research** - recommends acceptance, rejection, or revision of the study.

C. **Director** - recommends acceptance, rejection, or revision of the study.

D. **Policy Committee Chair** - recommends acceptance, rejection, or revision of the study.

E. **Directorate Sponsor for Implementation** - Each proposal will be sponsored by the appropriate DOTD Office Head. By recommending approval, the Directorate Head acknowledges that if the research is successful, solutions will be implemented.

F. **Secretary, DOTD** - Proposals recommended for approval by the Chair of the Policy Committee shall be submitted to the Secretary of DOTD for review and approval. This is the final step in the approval process.
4 CONDUCT OF RESEARCH PROJECTS

Requirements outlined in this manual for research conducted or sponsored by LTRC will apply to all research projects regardless of their funding source.

4.1 STUDY IDENTIFICATION

An LTRC research project number is assigned for recordkeeping and indicates the fiscal year in which the study is approved in the annual work program, the LTRC program area, and the sequence number of the project for that fiscal year. An example is LTRC Project Number 15-1GT. The problem statement for this study was initiated in fiscal year 14-15; the program area is Geotechnical; and this was the first project assigned to this technical area in that fiscal year. In addition, a state-assigned Statistical Internal Order (SIO) number will be assigned by DOTD for fiscal tracking and payment purposes.

LTRC Group Codes are as follows:

- **Research Support Line Item Codes:**
  - PM: Program Management
  - TRS: Technical Research Surveillance
  - TA: Technical Assistance
  - LFT: Research Laboratory and Field Test Support
  - NPE: New Product Evaluation
  - TTRI: Technology Transfer and Research Implementation
  - EQM: Equipment Management
  - SSE: DOTD Staff Support for Research

- **Research Program Area Codes:**
  - GT: Geotechnical
  - P: Pavements
  - B: Bituminous (Asphalt)
  - ST: Structures
  - C: Concrete
  - SS: Special Studies
  - SA: Safety
  - PF: Pooled Fund (Louisiana lead)
  - PFE: Pooled Fund (External lead)
  - TIRE: Technology Innovation & Research Exploratory

- **Technology Transfer and Training**
  - TSQ: Technology Transfer Program and Operations
  - SWD: DOTD Staff Support for Workforce Development
  - WD: Workforce Development
  - TTRF: Technology Transfer Registration Fees
  - LTAP: Local Technical Assistance Program
  - COOP: DOTD CO-OP Program
  - WDC: Workforce Development Contracts
4.2 **Contractual Agreements**

4.2.1 **Awards to Louisiana Universities**
For Louisiana universities with an executed cooperative research agreement, proposals approved by the Secretary will be issued a Task Order (Appendix F) by LTRC. The Task Order will include the investigative agency, study length, and funding, along with the research parties. The Task Order will indicate the starting date and serve as the notice to proceed with the study. No work may begin until the Task Order has been issued. All Task Orders issued by LTRC are cost reimbursable contracts for specific services, not grants.

4.2.2 **Awards to Research Consultants**
For private consultants or universities without a cooperative research agreement, a contract will be prepared by LTRC upon proposal approval by the Secretary. Upon signature of the contract by both parties, a notice to proceed will be issued. Consultants and business entities, including non-profit corporations, shall be registered with the Secretary of State in order to be able to work in Louisiana prior to award of contract. [http://www.sos.la.gov/tabid/1011/Default.aspx](http://www.sos.la.gov/tabid/1011/Default.aspx)

A typical contract template for research (e.g., out-of-state university template, private consultant) is included in Appendix G.

4.2.3 **External Awards to LTRC**
Upon notice of receipt of a contract award to LTRC from an external funding agency, the PI will develop a LTRC research proposal to be approved by the Secretary. The approval process will be as defined in Section 3.4.

4.3 **Project Management**

4.3.1 **Project Manager Responsibilities**
The Project Manager will review all invoices, progress reports, interim and final reports, and requests for changes in contract time and funding. The Project Manager should be contacted prior to preparing monthly invoices if the research investigator or the agency business office is uncertain about how specific expenditures should be invoiced. This will help avoid unnecessary delays in providing reimbursement for work accomplished, equipment purchased, and other budgeted items. The Project Manager’s responsibilities include:

- Provides technical advice and guidance
- Helps in the identification of field test locations or sections by coordinating with Districts and/or other offices or agencies as needed
- Schedules meetings such as a kick-off meeting, PRC status meetings as required, a close-out meeting, and results presentations
- Develops and distributes PRC meeting minutes
- Ensures projects stay within scope, time, and budget, and addresses issues in a timely fashion
- Completes Project Manager section of Biannual Report
- Reviews task reports, biannual progress reports, interim reports, and research documents, providing comments as appropriate
- Makes recommendations to LTRC administrators and directors regarding modifications to project scope, budget, and time
- Reviews and evaluates subject matter content within interim and draft reports to assess the accomplishment of project objectives and goals
- Coordinates implementation activities of the research project
- Assists in the assessment of implementation activities, progress, and results
- Rates the overall effectiveness of the research team in the delivery of the contracted services

4.3.2 PRC Chairman Responsibilities
In addition to PRC responsibilities in Section 4.3.3, the Chairman’s responsibilities include:

- Chairs all PRC meetings
- Encourages active participation by all PRC members
- Helps the PRC reach consensus
- Serves as the liaison between DOTD practitioners and LTRC project manager and research team
- Serves as the primary champion of implementation activities if project is successful

4.3.3 PRC Responsibilities
The PRC responsibilities in reference to an on-going research project include, but are not limited to, the following:

- Attends the kick-off meeting to review work plan with the PI
- Attends periodic meetings to provide feedback to the PI
- Reviews task reports, biannual progress reports, interim reports, and research documents, providing comments as appropriate
- Assists in development of implementation strategies, progress, and activities
- Reviews and evaluates subject matter content within the interim and draft final report to assess the accomplishment of project objectives and deliverables
- Completes the project satisfaction survey
- Assists in the assessment of implementation activities, progress, and results

4.4 MEETINGS

4.4.1 Kick-Off Meeting
Prior to the starting date of the study, the Project Manager will arrange a kick-off meeting with the research investigator and the PRC to review such items as study objectives, the time sequence of activities scheduled, and equipment or travel needs. The meeting will provide
an opportunity for discussion of concerns or comments as well as administrative and reporting requirements previously outlined by the PRC, unless these items have been resolved. The meeting will also enable the investigator to have questions answered concerning administrative details. Specific attention toward potential implementation activities will also be discussed. The LTRC Kick-Off Meeting Checklist included in Appendix H should be used as a reference to conduct the meeting.

4.4.2 Progress Meetings
While a study is ongoing, the PRC will meet as required to meet the needs of the study, but shall meet a minimum of one time per year.

4.4.3 Close-out Meeting
At the conclusion of the study, usually upon delivery and review of the draft final report, a project close-out meeting will be required to include a presentation of the research findings by the PI to the PRC. Research recommendations and implementation assessment and strategies will be updated.

4.5 CONTRACT MODIFICATIONS
During the conduct of a study, it may become necessary to modify the original study proposal. All such proposal changes affecting the budget, time, personnel, objective, scope, and work plan shall be justified by the Principal Investigator, subject to the approval of LTRC, and should be directed to the Project Manager. The Principal Investigator or investigators as shown in the proposal shall not be changed without prior LTRC approval, which shall not be unreasonably withheld. Failure to obtain prior approval from LTRC for a contract modification, when required, may result in the disallowance of costs. However, the Contractor may request retroactive approval; such approval or disapproval shall be at the discretion of the Director.

No changes or modifications shall be permitted to be made in the last 90 days of a contract unless such changes are determined to be necessary by LTRC.

4.5.1 Re-budgeting
Except as noted below, contractors are permitted to re-budget within and between major direct cost categories in the approved budget to meet unanticipated requirements. For the re-budgeting items listed below, prior approval of the LTRC/DOTD is required:

1. Payment of supplemental compensation
2. Domestic travel costs that exceed the budgeted amount by more than 25 percent or $500, whichever is greater.
3. Foreign travel (outside Canada or the US and its possessions)
4. Purchase of equipment (prior approval is not required for a different make or model included in the approved budget)
5. Equipment maintenance or repair of equipment approved for purchase
6. Subcontracting a substantive portion of programmatic work not included in the approved budget
Prior approval of LTRC is also required when cumulative transfers among major direct cost categories exceed or are expected to exceed 10 percent of the current total budget as last approved by LTRC or $10,000, whichever is less. The PI shall notify the LTRC Project Manager of re-budgeting that does not exceed this threshold; said notification is not subject to audit review nor is approval of LTRC required.

4.5.2 Project Modification
All project modifications shall be requested using the Research Project Modification Agreement form (Appendix I) and initiated by the Principal Investigator, approved by the university or institution research head, and submitted to LTRC for approval. Required information to be provided for revisions to proposal categories shall include, but not be limited to, the following:

- Budget: Attach a revised budget sheet
- Time: Attach a revised research study work schedule
- Personnel: Attach a personnel biography
- Scope/Work Plan: Attach revised tasks with appropriate descriptions and revised work schedule

For in-house studies and those conducted by Louisiana universities under a cooperative agreement, approval by the Director of the project modification form will constitute an executed contract modification.

For external contracts, not subject to a cooperative agreement, upon receipt of the project modification form and approval of the Director, a Supplemental Agreement to the original contact will be developed and executed upon signature by both parties.

4.6 Fiscal Procedures

4.6.1 Fiscal Year
The LTRC fiscal year is defined as a 12-month period starting July 1 of each year and terminating on June 30 of the following year. Research project budgets are approved on the basis of expenditures by fiscal year as follows:

- The PI shall provide the budget for the current fiscal year when the project is initiated to the Project Manager at the project kick-off meeting.
- Subsequent fiscal years will be provided by the PI in the Annual Work Program sheet.
- Adjustments to the fiscal year budget shall be made and documented for approval with the January biannual report.

Expenditures in excess of the amount allocated for a fiscal year will not be reimbursed unless prior arrangements for extension of funds have been made. The LTRC Project Manager is responsible to notify the PI should the fiscal year budget or budget adjustment not be approved.
The overall effectiveness of the LTRC research program is predicated on accurate estimations and expenditures of individual project budget projections. It is imperative for research contractors to provide reasonable fiscal year budget projections to LTRC.

4.6.2 Reimbursement of Expenditures

Claims for reimbursement of contract research expenditures shall be submitted on a monthly basis via the monthly invoice form shown in Appendix J. Contractors may request LTRC approval of other invoice formats. Alternate invoice formats must contain the appropriate expenditure distribution and itemization as provided in the LTRC form to be considered.

Claims received by LTRC on or prior to the tenth day of the month following the month of the expenditures will generally be authorized for reimbursement in the month received and paid within 30 days.

The monthly invoice form shall contain the information in the following subsections (attach to invoice form when additional space is required).

A. **Identification** – The study shall be identified by title, state SIO number and research project number, research agency, and period for which the invoiced charges were incurred.

B. **Equipment** – The cost of nonexpendable equipment as defined in Section 3.3.5 (having an acquisition cost of more than $1000 per unit and useful life of more than one year) or rental charges shall be listed, along with the voucher number, date of payment, description of equipment, number of items, and total costs. Fees for rentals included in the proposal budget or authorized by LTRC should be listed in this section.

Nonexpendable equipment or rental charges for equipment not included in the proposed budget shall require the approval of the LTRC Project Manager prior to incurring the expense. Payment shall not be allowed for costs of service and repairs on equipment owned and normally maintained by the Contractor.

The *Disposition of Non-expendable Equipment* Form (Appendix K) shall be submitted to LTRC with the invoice to include a copy of the manufacturer’s invoice indicating serial and model number.

C. **Materials, Rentals, and Services** – List individually any expendable equipment, consumable material, or supply item purchased for the project which exceeds $500. Computer software is normally budgeted as a supply item. However all computer software purchased with study funds, if approved in the proposal, shall become the property of LTRC upon completion of the study. List and identify costs incurred for computer charges, reproductions and copying, telephone use, and other services associated with the project. List only those items that are not included in the computation of the agency’s indirect cost percentage.

D. **Personnel Costs** – Include the names of authorized personnel and the corresponding charges showing hourly or monthly rate, number of hours or percentage of time worked on the project, and the percentage used for employee benefits.
E. **Travel Costs** – Costs incurred for authorized travel shall include the name of the traveling party, destination, dates, and purpose of the travel. Refer to Section 4.8 for the details of conditions under which travel is authorized. Travel costs shall be reimbursed in accordance with Louisiana Division of Administration Policy and Procedures Memorandum 49 (The State General Travel Regulations [http://www.doa.louisiana.gov/osp/travel/travelpolicy.htm](http://www.doa.louisiana.gov/osp/travel/travelpolicy.htm)).

F. **Indirect Costs** – The total of all costs included on the invoice shall be shown, with the percentage used for indirect costs indicated. Indirect costs shall be computed in accordance with 3.3.5 Part III G. When sub-contracts are used in the conduct of research, each sub-contractor shall provide a separate budget including direct and indirect costs. Indirect charges by the prime Contractor for the sub contract costs will be limited to the first $25,000, unless the majority of work by the sub-contractor is at the prime’s facilities. In that case, the prime Contractor can charge only indirect costs on the sub-contractor’s direct costs. Indirect costs for private consultants shall be as defined in Section 3.3.5 Part III H.

G. **Balance** – The fiscal status of the project shall be indicated by completing this portion of the invoice.

H. **Certification** – The invoice shall be certified correct and just by affixing the signature of the contract agency's auditor.

4.6.3 **Cost Records**
The Contractor and its subcontractors shall maintain all books, documents, papers, accounting records, and other evidence pertaining to costs incurred relative to the project and shall make such materials available at their respective offices during the contract period and for three years from the date of final payment under this contract, for inspection by the DOTD and/or Legislative Auditor, and when federally funded, the U.S. General Accounting Office, or any other authorized representative of the federal government under state and federal regulations effective the date of the contract. Copies thereof shall be furnished if requested.

4.6.4 **Auditing**
DOTD may conduct an audit of the research Contractor prior to the initiation of a research project and upon termination of the project; however, DOTD may conduct an audit at any time deemed necessary.

4.6.5 **Budget Modifications**
A. **Total Project Budget** – Requests for changes in an approved research project which affects funding shall be in accordance with Section 4.5.2.

B. **Fiscal Year Budget** – Fiscal year budgets for research studies are established in the annual work program sheet submitted by the Principal Investigator. Request to change this budget may be submitted to the Project Manager for approval. Request to change the fiscal year budget must also be included in the December Biannual Progress Report.
4.7 **PROGRESS REPORTS**

4.7.1 **Biannual Progress Report**

Biannual Progress Reports are designed to ensure that progress agrees substantially with the research proposal and to indicate changes that have been made from the original work plan. A Biannual Progress Report shall be prepared by the Principal Investigator for the periods ending June 30 and December 31. These reports shall be submitted to the LTRC Project Manager through the PMTS website by July 15 and January 15 of each year during the duration of the study. The Principal Investigator shall submit biannual progress reports until the draft final report is approved by the Project Manager to be submitted for final editorial review by the LTRC editor. The Project Manager shall provide comments by July 31 and January 31. The Project Manager shall continue to submit manager comments to the biannual reports until a Notice-of-Completion is provided to the PI of acceptance of final deliverables. These reports shall contain sufficient information to enable the LTRC Project to evaluate the progress and possible future course of the study.

The following should be included, as indicated on the biannual progress report form shown in Appendix L:

A. **Study Identification** – Provided by the PMTS

B. **Budget Status** – Budget status shall include the total amount projected to be invoiced to the project by the end of the reporting period. It should also include any requested change to the fiscal year budget. It is of utmost importance that the PI project the fiscal year budget as accurately as reasonably possible based on the anticipated work schedule.

C. **Accomplishments This Period** – Identify overall progress and briefly discuss technical achievements by task completed over the period represented by the report. Total percentage of work completed on each task is also required. Detail any proposed modifications of the work plan and advise when a formal request for approval will be made. Include any problems on which assistance is needed, changes in personnel, or equipment needs. Explain problems with respect to funding, progress, time, or delays in study tasks.

D. **Proposed Activities Next Period** – Describe the work by task planned for the next reporting period. State the expected date of the Interim or Final Report if it will be submitted during the next period. Describe anticipated changes in scope, time, budget, etc.

E. **LTRC Manager’s Assessment** – This portion of the biannual report should be completed by the LTRC Project Manager monitoring the project. Information regarding study progress and accomplishments resulting from PRC meetings will be documented in this section.

F. **Implementation Assessment** – The technology transfer manager will provide information regarding benefits and recommended implementation strategies. Items that can be immediately implemented should be identified.

4.7.2 **Project Task Reports**

Project Task Reports are prepared as required in the RFP and project proposal by the Principal Investigator. Task reports should be more oriented toward technical progress and
accomplishments. The reports must be written in sufficient detail such that they could be a chapter or an appendix in the final report. Task reports are due by the end of the month following the completion of the task according to the timeline established in the proposal.

4.7.3 **Interim Report**

An Interim Report is to be submitted as outlined in the research proposal or upon request of LTRC. The report will present a complete documentation of all technical data and analysis, including results achieved.

4.8 **TRAVEL**

Travel charged to a research project shall be limited to what is necessary for the conduct of the research. Travel for conference, convention, or seminars is not allowed in the budget of a research project. Authorized travel made in connection with a research project shall be reimbursable under the following conditions:

A. **In-State Travel** – Travel within the confines of the state of Louisiana necessary to the routine duties required for completion of the project and for which provision is made in the approved study budget.

B. **Out-of-State Travel/Non-Routine Travel** – For travel outside the confines of Louisiana including travel to Louisiana from another state is allowed when included in the approved study budget with LTRC approval. A written request using the Out-of-State Travel Approval Request Form (Appendix M) shall be submitted for LTRC approval at least three weeks prior to the anticipated date of departure. Such requests shall include the name(s) of person(s) making the trip, purpose of the trip, anticipated dates of travel, and an itemization of costs to be incurred.

C. **Travel for Dissemination of Research Results** – Travel reimbursement for dissemination of research results in connection with a research project at conferences, convention, or seminars may be requested from LTRC as defined in Section 6.5.2.

4.9 **EQUIPMENT**

All equipment owned by the Contractor and not included in the approved study budget for purchase or rental is considered routine equipment and shall be available for use on the project without charges of any nature made against the project. The cost of wear and tear, maintenance, service, operation, insurance, and depreciation are to be addressed in the indirect costs specified in the approved study budget.

4.9.1 **LTRC Equipment**

The use of LTRC equipment and facilities by contract researchers shall be limited to what is specifically detailed in the proposal. When the use of such equipment and facilities is not stated in the study proposal, a written request must be sent to the Director detailing the specific equipment, timeline, LTRC staff support, and justification necessary to accomplish the objectives of the research project. If approved, the conditions under which LTRC equipment and facilities may be used shall be determined by the Director.
4.9.2 Nonexpendable Equipment
All nonexpendable equipment, devices, or systems either built or purchased are the property of LTRC/DOTD. All computer software and reference publications purchased with study funds shall become the property of LTRC/DOTD whether budgeted as non-expendable equipment or supplies.

For purposes of property control inventory, and in accordance with Title 34.307 of the Louisiana Administrative Code, non-expendable equipment includes all items of movable property having an “original” acquisition cost, when first purchased by the state of Louisiana, of $1000 or more. The term “movable” distinguishes this type of equipment from equipment attached as permanent part of a building or structure. The term “property” distinguishes this type of equipment from “supplies,” with supplies being consumable through normal use in no more than one year’s time. This category of equipment includes items fabricated for the study from items charged to the study budget and meeting the above definition.

4.9.3 Expendable Equipment
Those minor items of equipment not meeting the definition of non-expendable equipment are considered as having no residual value upon termination of the study and become the property of the Contractor.

4.9.4 Disposition of Nonexpendable Equipment
All nonexpendable equipment purchased or built using study funds becomes the property of LTRC/DOTD. Each piece of equipment or computer software purchased for the research project shall be assigned an inventory number in accordance with Louisiana Title 34.307 and DOTD property control procedures. The Principal Investigator shall submit the Disposition of Nonexpendable Equipment Form (Appendix K) to the LTRC Project Manager along with the invoice to include a copy of the manufacturer’s invoice indicating serial and model number within 30 days of receipt of equipment. LTRC shall maintain this form in the project files for the study.

During the conduct of the research, the Principal Investigator shall make the equipment available for inspection for inventory purposes in accordance with Louisiana Division of Administration and DOTD property control procedures.

Upon completion of the study, the Contractor shall make disposition of the equipment in accordance with directions of LTRC as follows:

A. Transfer To LTRC – The equipment (including service manuals, accessories, tools, wiring diagrams, service history, and condition of equipment, etc.) shall be transferred to LTRC.

B. Transfer To Another Project – At the discretion of LTRC, the equipment may be transferred to another LTRC research project for subsequent use. In this event, the amount of the residual value of the equipment, as determined by LTRC, shall be credited to the original study project and charged to the project to which it is transferred.
4.10 **Computer Software**

Computer programs developed by a Contractor as a result of LTRC sponsorship of a research project are the property of LTRC and shall be modified as directed by LTRC for compatibility with LTRC/DOTD equipment.

4.11 **Progress Inspections**

During the progress of a research project, representatives of LTRC, DOTD, and FHWA (for federally funded studies) shall have the right to inspect the progress of the work and the facilities used by the Contractor in the conduct of the study. They shall be provided reasonable access to all personnel associated with the study.

4.12 **Patent Rights**

The proprietary rights of any special equipment or procedures developed as a result of a research project, unless otherwise defined in the proposal, shall be governed by the following, which shall be physically incorporated in all contracts.

For any patentable discoveries or inventions that should result from the Contractor’s work other than discoveries or inventions that are deliverable under the contract, all rights accruing from such discoveries or inventions shall be the sole property of the Contractor. However, the Contractor hereby grants to all state highway and/or transportation departments, local public agencies, the United States Government, and all contractors for any of the foregoing when such contractors are performing work under contract for the aforementioned entities, an irrevocable, non-exclusive, nontransferable, and royalty-free license to practice each invention in the manufacture, use, and disposition, according to law, of any article or material, and in the use of any method that may be developed as a part of the work under the research contract.

The Contractor shall notify LTRC of its intent to file a patent on work developed as a result of a research project.

4.13 **Correspondence**

Unless otherwise indicated, all correspondence, forms, reports, invoices, and other documentation for a research project should be directed to the appropriate LTRC Project Manager.

4.14 **Papers, Articles, and Presentations**

For publication of papers, articles, and presentation prior to the end of the project and acceptance of the final report, see Section 5.3.

4.15 **Deliverables**

All products are expected to be of exceptional quality. All deliverables shall be submitted first in draft format. Draft deliverables are the Contractor’s vision of the complete and final deliverables. All draft deliverables must be spell checked and reviewed by a person.
proposals must address deliverable quality and how quality will be guaranteed. (i.e., use of editing staff and/or peer reviewer)

Subsequent draft deliverables will be submitted within two weeks following receipt of LTRC comments.

For each deliverable, a line item response to each comment is required.

Deliverables are considered drafts until a project Notice- of-Completion is received.

LTRC reserves the right to withhold invoice payments for delinquent deliverables, including task order reports, as defined in the proposal.

When an acceptable final report or other required deliverables cannot be submitted to LTRC by the completion date of the study, the Principal Investigator shall submit a request for a time extension not to exceed 90 days. If the deliverables are not submitted within the approved time extension period, a stop order will be issued on any other LTRC study the researcher is conducting, and the researcher will be barred from submitting other proposals until the final report is received. If all of the above actions fail to result in submission of deliverables, consideration will be given to citing the study for lack of compliance and requesting return of the funds expended or a negotiated portion thereof.

A 15 percent retainage fee may be imposed on contract invoices to ensure compliance with these requirements. LTRC reserves the right to withhold 15 percent of the total amount invoiced on the project at any time during the study until all required deliverables have been submitted and accepted by LTRC.

4.16 Files and Records

Responsibilities for the maintenance and ownership of files and records are as follows:

A. LTRC – Subsequent proposals and all records of PRC meetings, evaluations, and correspondence pertaining to each proposal and problem statement will be maintained in this file. The file shall be identified by the research project number to be assigned if and when the project is approved.

B. Contractor – The Contractor shall maintain records of all data, findings and conclusions, reports, and other evidence and supporting documentation pertaining to the study in accordance with generally accepted research practice. Accounting records shall be maintained to support all costs invoiced for the project (see Section 4.6.3). These records shall be kept up-to-date and made available to representatives of LTRC, DOTD, and FHWA during the course of the study and for a period of three years from the date of final payment to the Contractor for completion of the project.

C. Ownership of Documents and Records – All data collected by the Contractor and all documents, notes, drawings, tracings and files collected or prepared in connection with work completed, except the Contractor’s personnel and administrative files shall become the property of LTRC/DOTD and the LTRC/DOTD shall not be restricted in any way whatever in its use of such material, except as specified in Louisiana R.S. 38:2317.
No public new releases, technical papers, or presentations concerning the Contractor’s work may be made without prior written approval of the LTRC/DOTD.

4.17 **CLOSE-OUT, TERMINATION, OR SUSPENSION**

4.17.1 **Project Completion**

Research contracts (or task orders) shall become effective from the date of execution and shall be binding upon the parties until the work has been completed by the Contractor in accordance with the terms of the research contract (or task order), research proposal, and any supplemental or modification agreements, and accepted by LTRC, and all payments and conditions have been met. Further, the contract shall remain in effect until LTRC has issued final acceptance of the services provided. Upon approval by the Director for publication of the final report, acceptance of all deliverables, and all invoices paid, the Project Manager will issue a Notice-of-Completion (Appendix N) to the contracting agency.

Upon a notice-of-completion, the Project Manager will complete the Project Evaluation Form (Appendix O). The form shall be placed in the project files for reference in consideration of future work of the research team for LTRC. The rating will only apply to future LTRC research contracts and will not be used in reference to future DOTD pre-construction contracts.

4.17.2 **Early Termination or Suspension**

The contract (or task order) may be terminated earlier under any of the following conditions:

1. By mutual agreement and consent of the parties hereto
2. By LTRC/DOTD as a consequence of the failure of the Contractor to comply with the terms, progress or quality of work in a satisfactory manner, proper allowance being made for circumstances beyond the control of the Contractor
3. By either party upon failure of the other party to fulfill its obligations as set forth in the contract
4. By the LTRC/DOTD due to the departure for whatever reason of any principal member or members of the research team as defined in the proposal
5. By satisfactory completion of all services and obligations described herein
6. By the LTRC/DOTD giving 30 days’ notice to the consultant in writing and paying compensation due for completed work.

Upon termination, the Contractor shall deliver to LTRC/DOTD a report in complete detail of all findings and all obtained data for LTRC/DOTD’s use as well as copies of all records of the work compiled to the date of termination and LTRC/DOTD shall pay for all costs incurred in full for all work accomplished, including non-cancelable obligation up to the date of termination.

If for any reason, LTRC/DOTD wishes to suspend the contract, it may do so by giving the Contractor 30 days’ written notice of intent to suspend. The Contractor shall, at expiration of the 30 days from the date of the notice of intent to suspend, stop all work on the Project. Work shall resume no later than 30 days after LTRC/DOTD provides the Contractor with a notice of intent to resume work.

The Contractor shall not have the authority to suspend work on the contract.
5 PUBLICATIONS

The publications and electronic media development program serves as the voice of LTRC through publishing, multimedia development, and video/audiovisual production. As the communications bridge between research and the scientific community and training and the employee, LTRC disseminates research results, facilitates technology transfer, explores new training methods, and produces effective training materials.

5.1 GENERAL REQUIREMENTS

LTRC will be responsible for the publication of all reports funded solely by DOTD. Research reports from projects conducted by LTRC funded by other agencies/entities shall follow the publication requirements of the funding agency. The following provisions shall govern publication of resultant data from each contract research project.

1. The author shall be free to copyright material developed under each contract, with the provision that the Contractor hereby grants to all state highway and/or transportation departments, the United States Government, local public agencies, and all contractors for any of the foregoing when such contractors are performing work under contract for the aforementioned entities, an irrevocable, non-exclusive, nontransferable, and royalty-free license to reproduce, publish or otherwise use, and to authorize others to use the work for Government purposes.

2. Either party to this contract may initiate a request for publication of the final or interim reports or any portions thereof. Technical papers, articles, and submissions for review to technical journals, prepared for submission prior to approval of the final report required under the contract, must be submitted to the LTRC/DOTD for approval prior to publication. In the event of failure of agreement between the LTRC/DOTD and the Consultant relative to publication of the final report, or of any progress reports during the contractual period, either party reserves the right to publish independently in which event the non-concurrence of the other party shall be set forth as technical comments in the report in a clearly identified section such as “sponsor’s comments,” or “Consultant’s comments.” Following publication of the final report under a contract, no approvals are required from LTRC/DOTD for subsequent publications, as noted below in item 4.

3. Both parties to the agreement shall have equal responsibility to review and approve material for publication prior to publication of the final report, except that the LTRC/DOTD reserves the right initially to publish the final report. PI is required to address all comments with a written response to said comments.

4. After acceptance of the final report, the Consultant and the LTRC/DOTD are free to use the data and results without restriction except as noted above in item 2. Whenever the Consultant uses the data and the results, due credit will be given to the LTRC/DOTD and all other funding agencies.

5. All technical publications by LTRC and/or the Contractor shall contain a disclaimer statement similar to the following:
The contents of this report reflect the view of the author(s) who is (are) responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Louisiana Transportation Research Center, the Louisiana Department of Transportation and Development, or the Federal Highway Administration (FHWA funded only). This report does not constitute a standard, specification, or regulation.

6. Publication by either party shall give credit to the other party and to FHWA, unless, due to failure of agreement on any report of the study, the FHWA or either of the parties to the contract requests that its credit acknowledgment be omitted. When research is not supported by federal funding, the above credit requirement pertaining to FHWA does not apply.

5.2 Final Reports

Final reports are required to provide final documentation of the technical findings of the research study. Final reports should be written with the transportation practitioner as the primary target audience. However, the report should be inclusive of all data, analysis, and references as necessary to provide proper records for responsible documentation of study results.

The body of the final report shall not exceed 100 pages unless approved in writing by the LTRC Project Manager prior to submission of the draft report. There will be no limit to the number of pages allowed for the appendixes of the report. LTRC reserves the right to publish in hard copy only the body of the final report. Theses or dissertations, or portions thereof, will not be accepted as final reports.

All research reports shall be prepared in accordance with the publication “LTRC Publication Guidelines,” which can be found in Appendix P and is available for download on the LTRC website: http://www.ltrc.lsu.edu/pdf/2009/pub_guidelines_final.pdf. A checklist to ensure a report meets all LTRC Publication Guidelines can also be found online: http://www.ltrc.lsu.edu/pdf/checklist.pdf. It is the responsibility of the PI to ensure that all reports submitted have been previously edited by an outside source. It is strongly encouraged to include an editorial review in the budget and timeline to be used prior to submittal of the draft report to LTRC. Reports submitted needing substantial editing or not in compliance with the guidelines will be returned immediately. The LTRC editorial process will not require the PI to make changes that alter the scientific and technical content and interpretation of the research.

A draft of the final report will be submitted to LTRC in electronic form three months prior to the ending date of the study. This three-month period shall be accounted for in the study proposal work plan and budget. This will allow LTRC and the PRC ample time to review the report and provide comments to the Principal Investigator. The Principal Investigator should then be able to make needed corrections to the report prior to exhausting study time and funding. The report will present a complete documentation of all technical data gathered, analysis performed, and results achieved. The accepted final report shall be submitted in both hard-copy and electronic formats.
After acceptance of the final report, the Contractor and LTRC are free to use the data and results without restriction except as otherwise noted in this manual. Whenever the Contractor uses the data and the results, due credit will be given to LTRC and all other funding agencies.

The author shall be free to copyright material developed under each contract, other than with the provision that the Contractor hereby grants to all state highway and/or transportation departments, local public agencies, the United States Government, and all contractors for any of the foregoing when such contractors are performing work under contract for the aforementioned entities, an irrevocable, non-exclusive, nontransferable, and royalty-free license to reproduce, publish or otherwise use, and to authorize others to use the work for Government purposes.

All project reports will be submitted to the appropriate LTRC Project Manager.

5.3 PAPERS, ARTICLES, AND PRESENTATIONS
The presentation of study findings by formal papers, articles, or bulletins prior to the end of the project and acceptance of the final report shall not be made without the prior approval of LTRC. Notification of Submission of Papers Form (Appendix Q) shall be used to request approval for such publications. All such publications and presentations shall contain disclaimer statements similar to that given in Section 5.1. The sponsoring agencies shall be credited and copies submitted to LTRC prior to presentation or publication.

5.4 THeses AND DISSERTATIONS
Prior approval of LTRC is not required for publication of theses and dissertations. The website link to all theses and dissertations that are a result of research projects sponsored by LTRC shall be furnished to the Director when posted, and the sponsorship of LTRC shall be acknowledged. Theses and dissertations are not acceptable in lieu of other reporting requirements.

5.5 PROJECT CAPSULES
When a research study begins, a project capsule is published that outlines the need for the research, the study's objectives and methodology, and the potential for future implementation. The project capsule for each project shall be developed by the Technology Transfer Engineer Manager for all projects immediately following approval of the proposal. LTRC will publish and distribute the project capsules as approved by the Director.

5.6 INTERIM REPORTS
Interim Reports are generally for internal documents for use by the Principal Investigator and PRC to assess and evaluate the status of the research process and product. Interim reports may be used to provide for early disclosure of significant findings which may be implemented or problems with which the staff of LTRC, DOTD, or the FHWA may be able to assist. The interim report may be published as required by the proposal or as required by LTRC.
5.7 **LTRC Technical Summary**
A technical summary for each study shall be prepared by the Principal Investigator at the conclusion of the study with the draft final report. A sample is provided in Appendix R. The summary in electronic format should not exceed two, single-spaced, typed pages and should include the following elements:

A. **REPORT TITLE AND AUTHOR**
B. **INTRODUCTION** - Identify the researchers and research agency and summarize the study. The cooperation of the FHWA and joint coordination with other funding agencies shall be acknowledged, as appropriate.
C. **STUDY OBJECTIVES**
D. **SCOPE**
E. **METHODOLOGY**
F. **CONCLUSIONS AND RECOMMENDATIONS**
G. **IMPLEMENTATION STATEMENT/PLAN**
H. **STUDY CONTACT(S)** - name, title, address, telephone number
I. **FUNDING SOURCE**
J. **DISCLAIMER STATEMENT** - in accordance with Section 5.1.

The LTRC Engineer Administrator/Manager shall include a copy of the technical summary at the time of the request for the PRC review of the draft report and indicate whether statewide, nationwide, or other distribution of the technical summary is intended.

5.8 **Technical Assistance Reports**
LTRC's research section often provides technical assistance to DOTD in the way of new product evaluations, forensic analyses, collection and analysis of field information, and problem-solving services that do not warrant a formal research study. The technical assistance report documents these efforts and is published at the discretion of the Director. A TA report is not required to follow the final report format of a formal research project.

5.9 **Synthesis Reports**
Synthesis projects develop reports on current knowledge and practice, in a compact format, without the detailed directions found in manuals or exploratory work found in formal research projects. Each report provides a compendium of the best practices that were acceptable within the limitations of the knowledge available at the time of its preparation. The synthesis report format shall be as defined in Appendix P.

5.10 **LTRC Annual Report**
An annual report consisting of the activities of LTRC will be submitted to the LTRC Policy Committee, Secretary, and LSU Dean, College of Engineering as required is Title 48:105. The report shall address the activities and achievements of the center and provide an assessment of the extent to which the center is fulfilling its functions.
5.11 **PUBLICATION REVIEW AND APPROVAL PROCESS**

Unless otherwise required in the proposal, draft final reports are due 90 days prior to the end date of the project. The Principal Investigator shall submit an original draft report in hard copy and in electronic format to the LTRC Project Manager.

Upon receipt of draft report, the Project Manager shall review the report to assure the contents meet the basic format, quality, and reporting requirements. The review and approval process is as shown in Figure 5-1.

5.12 **DISTRIBUTION**

The distribution of all final, interim, summary, project capsules, and technical summary reports shall be distributed electronically as noted in the Report Distribution Checklist (Appendix S) as approved by the Editor, Implementation Engineer, LTRC Manager, LTRC Administrator, Associate Director, Research, and the Director.

Twenty hard copies of all publications are to be submitted to the Louisiana State Library for the Louisiana Public Document Depository Program using the Document Submission Form (Appendix T). In addition, all publications that are distributed electronically are to be submitted via email to [docs@state.lib.la.us](mailto:docs@state.lib.la.us) in PDF format.
Figure 5-1 LTRC Publication Review and Approval Process
6 RESEARCH ASSESSMENT AND IMPLEMENTATION

6.1 GENERAL INFORMATION
Each research activity is undertaken with the specific intent of eventually providing solutions to transportation problems or generating useful information. The findings of each study must be carefully assessed to determine those which offer potential benefits if implemented. Implementation is the logical follow-up and application of research results to provide the basis for adopting solutions and innovations into practice. It is the primary goal of LTRC to develop and manage a research program which emphasizes implementable products. The two criteria used in the selection and ranking of research problem statements are (1) importance of the problem to the Louisiana transportation community and (2) implementation potential, on an equal ranking basis. Research study proposals are required to contain clearly identified products. Implementable products often fall into one or more of the following categories: (1) products that are of immediate interest to the funding agency, which provide the basis for decision-making; (2) products that identify the reasons for underlying causes or data relationships which may be used to explain, improve, or develop processes; and (3) products that enhance the ability of researchers to conduct research.

The typical objective of the implementation phase of research is to create an atmosphere leading to improvement, to encourage efficiency, and to reduce costs. Successful implementation of findings requires a determined effort by both the research community and the potential user, who must be convinced of the applicable benefits.

6.2 RESPONSIBILITY FOR IMPLEMENTATION
The LTRC Engineer Administrator/Project Manager and the Technology Transfer Engineer have joint responsibility for insuring that study findings with potential for application are implemented. The strategies for implementation should be determined in conjunction with the Project Review Committee and the Principal Investigator, and recommended to the Associate Directors for Research and Technology Transfer. The feasibility of implementation should be documented in accordance with Section 6.4 and recommendations formally submitted using the Research Assessment and Implementation Report (RAIR) (Appendix U). Research projects should be cost-effective, and the anticipated benefits are of paramount importance to the justification and continuation of research activities.

In accordance with the DOTD Secretary’s direction, each proposal must be recommended for approval by a DOTD Office Head as Implementation Sponsor. Such recommendation commits the sponsor to ensure that successful research products/deliverables are implemented. Should the Sponsor not choose to implement successful research, he/she must address his/her reasons to the Secretary in writing.

A Research Assessment and Implementation Report shall be completed by the Project Manager in conjunction with the PI, PRC, and Technology Transfer Engineer.
6.3 **OBSTACLES TO IMPLEMENTATION**

In most cases, deployment of research results will not automatically occur with the publication of a research report. Without engaged thought and a targeted deployment strategy, the research report will often die on the shelf. There are many obstacles to implementation, as depicted in Figure 6-1. The obstacles can be internal within DOTD or external beyond the influence of the research team or practitioner. Identifying and understanding these obstacles at the beginning of the research project life cycle can greatly increase the chances of achieving a successful research project. Providing the research team with the knowledge of these obstacles may greatly influence the project work program and deliverables. Unfortunately, waiting until the research project is completed to understand these potential roadblocks will decrease the potential for successful deployment.

![Figure 6-1 Obstacles to Implementation](image)

6.4 **RESEARCH ASSESSMENT AND IMPLEMENTATION REPORT (RAIR)**

LTRC employs a Research Assessment and Implementation Report (RAIR) (Appendix U) process to increase the chances of successful deployment of its research results. The process formally aligns the objective of a research project developed by the Principal Investigator with the expectations and implementation strategies of the end user. The RAIR process begins at the initiation of the research project and extends beyond the completion of the research work through deployment results. The process provides a better understanding of the deliverables and implementation products necessary for successful adoption of the research results into practice.

The PRC will remain active beyond the end of the research project end date through the implementation process as defined in the RAIR.
The development of the implementation strategy begins in the Conduct of Research phase with the first draft of the RAIR. It is imperative that the implementation strategy be considered early in the project. The RAIR is first reviewed at the kick-off meeting between the PRC and research team to achieve a clear understanding between the scope and deliverables of the research proposal and the anticipated deployment strategy needed for successful implementation. The RAIR is reviewed and updated at each subsequent PRC meeting.

The RAIR development process begins with the assumption that the research will be successful and that the results of the research will be implementable. The report begins as a planning document to generate discussion on how the results of a successful project would be moved into standard practice. Who are the key decision-makers? What deliverables/tools will be necessary? How will the benefits be defined? Not all components of the RAIR sections will be known at the beginning of a research project. The information is continually reviewed and updated at PRC meetings during the conduct of the research as the research outcome becomes more defined. The responsibility for development and updating and tracking of the RAIR document is with the Project Manager in cooperation with the PRC with input from the Principal Investigator and Technology Transfer Engineer.

The RAIR consists of a series of topics and questions designed to provide guidance and insight to the PRC and research team for development of a successful implementation strategy. The questions are presented as an aid and are not intended to be all inclusive. Individual sections of the RAIR are described in further details as follows:

6.4.1 Project Identification Information
- Project Numbers
- Project Title
- Principal Investigator
- PRC Committee Members
- Project Manager
- Technology Transfer Engineer

6.4.2 Objectives
Describe the expected objectives/deliverables/products of this research.

6.4.3 Implementation Recommendations
Provide the implementation recommendations as developed by the Project Review Committee.
- Do the study findings have potential application?
- Are the results practical for application to the transportation system or some other area?
- Do the findings show no conclusion but suggest other research needed?
6.4.4 Potential Impact
Describe potential impact of the recommendations in terms of cost, efficiency, safety, convenience, aesthetics, etc. Describe required changes to existing specifications, standards, procedures, etc.
- Will the findings have impact on the state of the art?
- Will the findings result in the application of new specifications, standards, or design procedures?
- Will the findings result in revision of existing specifications, standards, or design procedures?
- Will the findings result in the modification, development, and use of materials or equipment?
- Will the findings show other positive benefits such as reduced costs, greater efficiency, safer highways, greater convenience, aesthetics, etc.?
- What will be the economic result of applying the findings to the transportation and/or other applicable systems?

6.4.5 Target Audience
List whomever you want to reach, their primary interest, and your objective in reaching them.
- Who will benefit from this research?
- Where in the transportation or other applicable area can the findings be applied?
- Who will benefit from the findings?

6.4.6 Strategies and Tactics
Describe practical areas of application. List the activities required for implementation, including resource needs. Consider needs for training, multimedia, and marketing.
- What strategies would be most effective in implementation?

6.4.7 Timeline
Create a schedule for each discrete strategy or tactic.

6.4.8 Implementation Responsibility
Define roles and responsibilities of all personnel involved in the implementation effort. Identify who will be the decision-makers to implement results of the research.

6.4.9 Evaluation
Identify methods for evaluating the implementation effort.
- How will benefits be quantified or assessed?

6.5 IMPLEMENTATION PRODUCTS
Communicating the value of research projects will also enhance implementation efforts. Decision-makers often do not have the time available to read lengthy research reports. Their interest is in the bottom-line effect of the implementation to the organization and transportation system. Will it make the Department more efficient? Will it save lives? Will it save money? Demonstrating the benefits of implementation will significantly increase the chances of successful adoption of the deployment.
The method of relating the potential benefits of study findings to the appropriate individuals or groups must be carefully considered. The following implementation strategies should be considered:

**LTCR Publications** - The following LTCR publications will be considered for Technology Transfer purposes:

- Project Capsule
- Interim Reports
- Final Reports
- LTCR Technical Summaries - These are required for each study upon completion and may be generated during the study when appropriate.
- Technology Transfer - The applicability of findings for inclusion in the LTCR Technology Today and Technology Exchange Newsletters should be considered.
- Implementation Brochures
  - Implementation Impacts
  - Implementation Fact Sheets
  - Implementation Updates

Distribution of reports should be based upon the applicability of findings to DOTD and other state and federal transportation agencies, academic institutions, industry and allied organizations, professional technical organizations, state public libraries, and local cities, parishes, and rural governmental entities which may benefit. For all research undertaken with federal funding, it is required that each interim report and final report be submitted to the federal source stated in the report distribution checklist.

### 6.5.1 Issuance of Memoranda

Recommendations may be made by memoranda to incorporate findings into transportation or other applicable systems by their inclusion into specifications, standards, procedures or techniques for design, planning, construction, maintenance or administrative functions. In addition, the appropriate LTCR Engineer Administrator/Manager shall prepare a memorandum to the appropriate DOTD Office Head for the distribution of each interim report, final report, and technical summary published.

### 6.5.2 Formal Presentations/Publications

Study findings may be implemented through formal presentations or papers by the researchers at conferences and seminars, articles in technical trade journals, meetings, and demonstrations for potential users.

Funding for dissemination of research results is available upon request subject to LTCR approval based on available funds and benefit of the travel to the state of Louisiana. Travel for presentations at conferences, conventions, seminars, implementation meetings may be requested using the Technology Transfer Travel Request Form (Appendix V). The travel must include justification as it related a specific LTCR research project. LTCR may limit the amount of travel granted to researchers for each research project based on the project results, implementation benefits, and number of times travel has been previously approved.
Travel reimbursement will be direct to the traveler subject to the State of Louisiana Travel Regulations and Division of Administration rules. Technology transfer travel will not be charged directly to research project funds.

Foreign travel will not be allowed without approval of the Secretary.

6.5.3 News Releases
News releases shall be coordinated through the Director’s office.

6.5.4 Development and/or Delivery of Formal Training Materials
Either written or audiovisual training presentations should be initiated when necessary to implement findings.

6.5.5 Demonstration or Pilot Projects
Findings may be incorporated into a project for further evaluation.

6.5.6 Development of Study Proposals
Findings may warrant further research or evaluation in the study area.

6.5.7 Personal Contact
The importance of personal contact with those individuals who may implement findings and benefit from them cannot be overemphasized. The use of seminars and workshops are encouraged. Dissemination at Construction, Maintenance, District Lab Engineers quarterly meetings is encouraged where appropriate.

6.5.8 LTRC Web Site
LTRC capsules, technical summaries, interim and final reports, and brochures will be posted on the LTRC web site.

6.6 TRACKING OF RESULTS
A culture of implementation needs to be encouraged within the philosophy and processes of an organization. Tracking research performance measures relays the importance of deployment to the both the employees of an organization and to the research team.

6.6.1 LTRC Biannual Progress Report
The LTRC Biannual Progress Report is submitted by the Principal Investigator to keep the PRC and Project Manager abreast of the status of the project. Included in the biannual report is a section labeled Assessment of Benefits and Recommended Implementation Strategies. This section is completed by the LTRC Technology Transfer Engineer with input from the Project Manager. It is developed as a summary of the RAIR document. As the biannual report is submitted through the LTRC Project Management System, the implementation assessment field is used as an implementation summary for the life of the implementation process from project imitation through determination of implementation outcome.

6.6.2 Implementation Summary Report
The summary report is maintained for ease of review of its program and is presented annually to DOTD leadership and the LTRC Policy Committee. The implementation
assessment field in the biannual report provides the initial input for this report. The implementation summaries are updated by the LTRC Technology Transfer Engineer for a minimum of five years after the project end date or until full implementation is achieved.

6.6.3 Implementation Performance Measures
LTRC categorizes its implementation status with five different classifications from project initiation through five years after the project’s end date.

- **Project/Implementation in Progress**
  Projects are classified in this status code from the start date through a minimum of five years after the end date. This category may be used to link continuing/Phased projects or demonstration/pilot projects that may extend beyond the five-year minimum.

- **Implementation Recommended**
  Projects are classified in this status code upon a recommendation from the PRC that the results warrant deployment by DOTD. Acceptance of a PRC recommendation to not make a change due to the research may also be considered an implementation success.

- **Implementation Complete**
  Projects are classified in this status code upon adoption of the results into practice by DOTD. The outcome of the implementation has been documented in the Implementation Summary Report (i.e., specification change, process change, project application, etc.).

- **Not Implemented**
  Projects are classified in this status code when the project did not produce any implementable outcome. Projects not implemented in the five-year implementation window will be closed as not implemented unless it is linked to a successive phased project or follow-up implementation project/activity.

- **No Implementation Expected**
  Projects are classified in this status code upon project initiation when the objective of the project clearly is accepted without an implementation outcome. These projects could include basic research, syntheses, exploratory, technical assistance, support projects to other tracked research projects, etc.
7.1 **PART VI-B. LOUISIANA TRANSPORTATION RESEARCH CENTER**

§105. **Louisiana Transportation Research Center**

A. The Louisiana Transportation Research Center, hereinafter referred to as "LTRC", is hereby created as a cooperative research and technology transfer unit administered jointly by the Department of Transportation and Development, hereinafter referred to as the "department", and Louisiana State University and Agricultural and Mechanical College, hereinafter referred to as the "university". The domicile of the LTRC is Baton Rouge, Louisiana.

B. The purposes of the LTRC are as follows:

1. Establish cooperation in the mutual efforts toward improvement of the transportation systems of the state of Louisiana.
2. Introduce new technology.
3. Enhance higher education in the general transportation field.
4. Benefit Louisiana economically by enhancing job opportunities.

C. The functions and duties of the LTRC are as follows:

1. To develop and conduct a nationally recognized short and long range research program in transportation systems in order to implement more efficient design, planning, maintenance, operation, and construction practices and to enhance traffic safety.
2. To offer educational and training programs in both fundamental and state-of-the-art practice in the field of transportation systems and related areas by offering training sessions, short courses, demonstration projects, and conferences funded by the department and the United States Department of Transportation-Federal Highways Administration.
3. To develop and implement a technology transfer program funded by the United States Department of Transportation and the department which shall provide a mechanism for conveying modern transportation systems practices and procedures to municipalities and parishes.
4. To establish cooperative relationships with the Louisiana Transportation Research Board, the research divisions of other highway and transportation departments, other universities, and national and international technical associations and agencies.
5. To report and publish research findings which contribute to fundamental knowledge and facilitate the implementation of enhanced technology which may result in more economical practices in transportation systems.

D. The activities of the LTRC will be funded by the department funds, part of which is funded with federal highway planning and research funds. The funding of LTRC shall be contingent upon the availability of federal highway and research funds as appropriated by the Louisiana Legislature.
E. The projects funded for research organizations other than LTRC shall have project account numbers appropriate to that organization and shall be administered in accordance with that organization's policies.

F. LTRC may enter into contractual agreements only with the approval of the secretary of the department, or his designee, and said agreements must conform with contracting policies of the department.

G.(1) A LTRC policy committee shall be established and charged with advising and making recommendations to the LTRC as well as reviewing and recommending research and technology transfer programs to be pursued by the center, reviewing and recommending fiscal year budgets, and reviewing the activities and progress of the center. The committee shall meet at least twice a year. It shall be composed of eleven members, one of whom shall be the director of LTRC, three who shall be appointed by the secretary, one from each of the six public universities that have a college of engineering with a civil engineering department appointed by the president or chancellor of the respective university and one member who shall be a dean of a college of engineering of a nonpublic institution of higher education selected by the committee from a list submitted by the Louisiana Association of Independent Colleges and Universities. The Federal Highway Administration shall be invited to appoint an observer. The director of LTRC shall be an ex officio member of the committee.

(2) The term of office of members of the policy committee shall be for two years; however, in order to assure continuity, two of the initial members appointed by the chancellor and two of the initial members appointed by the secretary shall be appointed to serve for three years. Thereafter each member shall be appointed to a two-year term. Committee members may be reappointed.

(3) No salaries shall be paid the members of the LTRC policy committee, but said members shall be reimbursed for their expenses as per Division of Administration regulations.

(4) The officers of the LTRC policy committee shall be a chairman, a vice chairman, and a secretary, all elected by the committee.

(5) Should a vacancy occur on the LTRC policy committee, that member shall be replaced in the same manner in which that particular member was appointed.

(6) The director of LTRC shall be chosen by the secretary of the department and the LTRC policy committee from a slate of nominees submitted by a search committee, which search committee shall be selected by the LTRC policy committee.

(7) The director shall annually develop fiscal year programs designed to implement the functions of LTRC described above, and to meet the funding commitments to the university, also specified above. The director shall administer the day-to-day activities of the LTRC. The director shall submit an annual written report on the activities of the center to the policy committee, to the dean of the college of engineering at the university, and to the secretary of the department by March fifteenth of each year. The annual reports shall address the activities and achievements of the center and provide an assessment of the extent to which the center is fulfilling its functions.

(8) The personnel of the LTRC shall consist of full-time classified employees of the department and faculty, staff, and students of the university. University employees will be participating in specific projects, but their activities shall not be limited to those being funded by
or under the administration of LTRC. Short-term appointments may also be made to provide assistance on specific problems or to work on short-term research projects. The university's personnel policies and benefits shall apply only to its personnel. Likewise, the personnel policies and benefits of the department shall apply to the department personnel. In accordance with its academic personnel policies and regulations, the university may utilize and recognize the department's professional personnel as active members of its academic community.

H. (1) The principal office of the LTRC shall be the Transportation Research Center building located on Gourrier Avenue on the grounds of Louisiana State University and Agricultural and Mechanical College in Baton Rouge, Louisiana, provided to the LTRC by the university.

(2) The LTRC shall carry, for the mutual protection of the university and the department, with an appropriate loss payable clause in favor of the university, as their interest may appear, a public liability insurance policy. In addition, the department shall, at its expense, maintain a worker's compensation policy in the minimum amount necessary to meet the requirements of the Louisiana Worker's Compensation Act in regard to any work performed by the department on the premises.

(3) The university shall not transfer, assign or sublease said building or any part thereof to any person or persons, corporation or corporations as long as the LTRC is a functional entity. In the event the LTRC becomes nonfunctional, the department shall have first opportunity to lease the building should the university decide to lease it.

(4) If the building shall be destroyed or damaged by fire, storm, or other casualty, the university shall restore the building to substantially its former condition as promptly as is reasonably possible.


105.1. Transportation Training and Education Center Fund; creation

A. The Department of Transportation and Development may assess reasonable registration fees to participants in transportation education courses offered by the Louisiana Transportation Research Center (LTRC) Transportation Training and Education Center.

B. The secretary shall promulgate rules and regulations in accordance with law to effectuate the provisions of this Section, to implement a registration fee policy, and to provide for the uses and disposition of the fees collected. All fees collected pursuant to this Section and the rules and regulations promulgated by the secretary shall be deposited into the LTRC Transportation Training and Education Center Fund as provided for in Subsection D of this Section.

C. The rules and regulations may authorize the chief engineer or his duly authorized representative to assess reduced fees for governmental personnel and faculty and staff of colleges and universities, provided those entities meet all state and federal requirements for a fee reduction.

D. There is hereby created, as a special fund in the state treasury, the LTRC Transportation Training and Education Center Fund, hereinafter referred to as the "fund". After compliance with the requirements of Article VII, Section 9(B) of the Constitution of Louisiana, relative to the Bond Security and Redemption Fund, an amount equal to the monies received by the state treasury pursuant to the provisions of Subsections A and B of this Section and rules and
regulations adopted by the Department of Transportation and Development shall be deposited into the fund. The monies so deposited shall be used to defray the expenses of the LTRC Transportation Training and Education Center in connection with the development, contracting, delivery, and administration of the center's transportation training program. Monies in the fund shall be invested by the state treasurer in the same manner as monies in the state general fund, and interest earned on the investment of such monies shall be credited to the fund after compliance with the requirements of Article VII, Section 9(B) of the Constitution of Louisiana. Excess monies over and above the expenses of the center shall be distributed to workforce development programs and projects within the Department of Transportation and Development. All unexpended and unencumbered monies in the fund at the end of any fiscal year shall remain in the fund for use in subsequent fiscal years.


7.2 PART XIII-A. EMPLOYMENT OF CONSULTANTS

§285. Purpose

It is the purpose of this Part to prescribe the policy of the Department of Transportation and Development and other grantee agencies applicable to employment of consultants for construction and preconstruction engineering services, research, planning, environmental, and other activities by a competitive process and a noncompetitive process, except those services under the authority of R.S. 39:1481 through 1526, R.S. 48:250.2, R.S. 48:250.3, and R.S. 48:292.1.


§286. Retaining of consultants warranted; authorization

A. There are three conditions which shall warrant the retention of the services of consultants by the department:

(1) The magnitude of the work involved in a project is determined to be so taxing to the department's available manpower that it will be necessary to defer other essential work if the work is performed by the department staff.

(2) The work required by a project is determined to be of such a specialized nature that the department will be required to go outside its own staff for experts in the appropriate fields to accomplish the work.

(3) The time frame within which the work must be completed is determined to be such that the department cannot undertake the work and maintain its program on schedule.

B.(1) When it is determined by any department section that consulting services are warranted, the section head shall submit a recommendation to the chief engineer, assistant secretary for operations, assistant secretary for planning and programming, or assistant secretary of public works, hurricane flood protection, and intermodal transportation, whichever is applicable to the project, stating the need and the supportive reasons for the services, including a description of the project and the estimated cost of the work to be performed.

(2) The chief engineer, assistant secretary for operations, assistant secretary for planning and programming, or assistant secretary of public works, hurricane flood protection, and
intermodal transportation, whichever is applicable to the project, shall decide if the need to use consultants for professional services for a project is warranted based upon information provided by the section head and the criteria established by Subsection A of this Section.

(3) Approval, when granted, shall be considered as being of a general nature, including not only the obvious components of the project which are immediately identifiable, but also ancillary components identified at any time during the life of the project. An additional selection process shall be used for ancillary components when the total of such ancillary components amounts to more than seventy-five percent of the original contract.

(4) When it is determined by the chief engineer, assistant secretary for operations, assistant secretary for planning and programming, or assistant secretary of public works, hurricane flood protection, and intermodal transportation, whichever is applicable to the project, that there is a need for an outside consultant, the selection shall be made in accordance with the provisions of this Part.


§287. Advertisement; solicitation list; response procedures
A. A notice of intent to select a firm for performing consultant services and to request responses from qualified firms and teams shall be advertised by posting it on the department's Internet website. The department shall maintain a solicitation list of consultant firms and teams. The department shall send an email notice to consultant firms and teams on its solicitation list to notify of the posting of an advertisement for consultant services on the department's Internet website. In the case of planning, research, or other specialty services, the department or the Louisiana Transportation Research Center may send notices to firms which, to the knowledge of the department or the Louisiana Transportation Research Center, may have experience in such services.

B. Notices shall be advertised a minimum of ten business days prior to the deadline for receipt of responses.

C. If the department deems that the number of responses received is inadequate, the project may be readvertised using additional media or publications in an attempt to solicit additional responses.

D.(1) The advertisement shall detail all information to be submitted in response to the advertisement. In all cases, a properly completed current department response form shall be submitted by applicants. The response forms shall be made available by the department. If additional information to that provided by the response form is required, it shall be so noted in the advertisement.

(2) The applicant shall transmit the response form and any other required information, to the department prior to the deadline shown in the advertisement. Responses which do not meet the requirements provided for in this Subsection shall not be considered. The department shall consider false or misrepresented information furnished in response to the advertisement as grounds for rejection.

E. There shall be no advertisement when noncompetitive selection is utilized.

289. Compliance with Civil Rights Act of 1964
   A. Department personnel when selecting consultants and contractors who are doing business with the department shall comply with Title VI of the Civil Rights Act of 1964, as amended to provide that no person in the United States shall, on the basis of race, color, sex, or national origin, be excluded from participation in any program or activity receiving federal financial assistance.
   B. As prescribed in Title 49 of the Code of Federal Regulations Part 26, the department shall ensure that maximum opportunity is afforded to socially and economically disadvantaged individuals to compete for and participate in consultant contracts.


§291. Selection procedure; evaluation teams
   A. Except for research projects, an evaluation team consisting of five department personnel … The consultant contract services administrator, or his designee, shall report the results of the evaluation team members to the secretary for all projects except Louisiana Transportation Research Center projects. (Not applicable to LTRC)
   B. The Louisiana Transportation Research Center project selection procedure shall be in accordance with the Louisiana Transportation Research Center "Manual of Research Procedures" for Louisiana Transportation Research Center projects.


§292. Noncompetitive negotiation selections
   A. In special and rare circumstances, noncompetitive selection may be utilized. These circumstances include, but are not limited to:
      (1) Specialty contracts where the necessary expertise is available only from one or a few sources.
      (2) The extension of services by the original consultant required on a project for which the contract has been satisfactorily completed and closed out at an earlier date.
      (3) Contracts requiring immediate action.
   B. The section head, after ascertaining the need for a noncompetitive selection, shall request approval from the secretary or his authorized designee through the chief engineer, assistant secretary for operations, assistant secretary for planning and programming, or assistant secretary of public works, hurricane flood protection, and intermodal transportation, whichever is applicable to the project, to engage a specific firm to perform the required services. The request shall be in written form containing the following information:
      (1) The justification for a noncompetitive selection.
      (2) The recommended firm and the reason for the recommendation.
      (3) The type of contract recommended.
      (4) The approximate cost.
   C. For federal aid projects, the noncompetitive selection shall be submitted to the appropriate federal agency for approval at an early stage.
   D. For research projects, the determination for noncompetitive selection shall be based upon a recommendation by the Louisiana Transportation Research Center to the secretary and documented as required in R.S. 48:292(B).

§293. Competitive selection
A. (1) Except for Louisiana Transportation Research Center projects, upon termination of the deadline for receipt of responses, the evaluation committee team shall ... (Not applicable to LTRC)
   C. (1) The Louisiana Transportation Research Center shall utilize the selection criteria and weighting factors in its "Manual of Research Procedures" and any special evaluation criteria and weighting factors specified in the advertisement required to meet particular project needs to evaluate responses to requests for proposals for research consultants.
      (2) The director of the Louisiana Transportation Research Center shall recommend to the secretary or authorized designee the final selection of the consultant as determined by review procedures of the research project review committee and center director in accordance with its "Manual of Research Procedures".
D. The written records produced during the evaluation and selection process are subject to the Public Records Act, R.S. 44:1 et seq.


294. Contract types
A. The department shall utilize either cost plus fixed fee with a maximum limitation, cost per unit of work, specific rates of compensation, or lump sum contracts for either competitive or noncompetitive selections. The fee shall either be negotiated or predetermined. In general, negotiated cost plus fixed fee contracts are used for larger projects with more complex and difficult to determine scopes of services, and pre-determined lump sum fee contracts are used for smaller projects with easier to determine scopes of services.
   B. Procedures for utilizing negotiated lump sum fee, cost per unit of work, specific rates of compensation, or cost plus fixed fee with maximum limitation contracts shall be as follows:
      (1) Advertisement as required by this Part shall include, but not be limited to the following:
         (a) Length and description of project.
         (b) Services required.
         (c) Material or information to be furnished by the department.
         (d) General information and an outline of the selection process, including the criteria/categories used to evaluate the responses and the weighting factors for each.
      (2) Except for Louisiana Transportation Research Center projects, after a consulting firm has been chosen, such firm shall be invited to submit a proposal within a time limit. Construction and preconstruction proposals shall conform to the "Consultant Contract Services Manual". Research proposals shall conform to the Louisiana Transportation Research Center's "Manual on Research Procedures". This proposal shall be analyzed by the technical personnel of the involved units and a pre-award audit may be obtained.
      (3) The technical review personnel shall negotiate any differences between the man-hour estimates of the department and the consultant firm. Should attempts at agreement between
the department and the consultant be unsuccessful, negotiations shall be terminated and another selection shall be made. This process will continue until agreement is reached with a firm or team.

(4) Fees will be based on the negotiated man-hours, the audited salary and overhead rates of the firm or team subject to the department's salary and overhead maximums, the designated contingency percentage, and the computed fixed fee. The department's standard fixed fee computation includes consideration for complexity, overall fee size, and magnitude of the firm's overhead.

(5) The contract will be executed following agreement on the required work effort. The firm shall have ten business days from the date of mailing to execute and return the contract to the department. Should the firm fail to timely execute and return the contract, the department may either select another firm from the original respondents or republish the notice of intent.

C. Procedures for utilizing non-negotiated predetermined lump sum fee, cost per unit of work, specific rates of compensation, or cost plus fixed fee with a maximum limitation shall be as follows:

(1) Advertisement as required by the Part shall include, but not be limited to the following:

(a) Length and description of project.
(b) Services required.
(c) Material or information to be furnished by the department.
(d) Fees by phase of work.
(e) General information, including an outline of the selection process, including the criteria/categories used to evaluate the responses and the weighting factors for each.

(2) Fees shall be determined by using the department's man-hour estimate, the latest average of applicable wage rates, and the latest average overhead, together with a contingency where appropriate and a profit computed in accordance with the department's standard procedure. These fees shall not be subject to further negotiation.

(3) The contract will be executed following notification of selection. The selected firm shall have ten business days from the date of mailing to execute and return the contract to the department. If the firm fails to timely execute and return the contract, the department shall select another firm from the original respondents or republish the notice of intent.

8 APPENDIX B - LTRC PROBLEM STATEMENT SOLICITATION FORM (1909)

<table>
<thead>
<tr>
<th>LTRC USE ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBLEM STATEMENT NO. 13-063</td>
</tr>
<tr>
<td>DATE OF RECEIPT 1/10/2013</td>
</tr>
</tbody>
</table>

LTRC PROBLEM STATEMENT SOLICITATION

1. PROBLEM TITLE:
(GIVE A BRIEF AND APPROPRIATE NAME TO THE PROBLEM YOU ARE PROPOSING)
Evaluating Louisiana New Continuity Detail for Girdor Bridges

2. PROBLEM STATEMENT:
(BRIEFLY DESCRIBE THE PROBLEM YOU ARE PROPOSING)
The new Bridge Design Manual (BDM) in Louisiana will include a different continuity detail for girdor bridges. Other than continuous reinforcement in the bridge deck over supporting piers, the new detail does not call for continuity diaphragms. This is different from the continuity detail in previous versions of the BDM, which called for a continuity diaphragm, albeit a bond breaker such as asphaltic materials had to be applied on girdor ends to allow relative movement between the girdors and the continuity diaphragms. In 2008, designers of the John James Audubon Bridge utilized a different detail that uses positive moment reinforcement as recommended by NCHRP Report 519 to achieve full system continuity. LTRC sponsored a project (08-1ST) that monitored the performance of the new detail under long-term and live load effects.

It is proposed that the performance of the new detail in the BDM be monitored in a manner similar to that used in LTRC Project No. 08-1ST. The information from this project will assist in validating the proposed design method for the new detail. Furthermore, comparison between the performance of this detail and other ones will be performed.

3. PROPOSED RESEARCH:
(DESCRIBE THE APPROACH YOU/ENVISION TO SOLVE THE PROBLEM)
In this proposal, a new continuity detail that will be the standard detail in Louisiana Bridge Design Manual will be evaluated. Similar to LTRC Project 08-1ST, a field monitoring approach will be adopted to achieve the project’s objectives. These objectives can be summarized in evaluating the performance of the new detail, validate the proposed design procedure, and compare its performance to others.

It is expected that the research would ultimately deliver:
- an instrumentation plan for a bridge utilizing the new detail,
- analysis and interpretation of monitoring data under long-term and live load effects, and
- a design method for the new detail that is validated using monitoring data.

Understanding the behavior of the continuity detail, which is extensively used through projects employing line girdors, is of utmost importance. Many bridges have suffered from premature deterioration because of problems arising from detailing. It is expected that the appropriate amount of reinforcement will be established using the project results. As a result, girdor end cracking, which may lead to corrosion of reinforcement or reduction in shear strength, will be eliminated to avoid such detrimental effects and allow the bridge to achieve their design life with minimal maintenance costs.

4. POTENTIAL IMPLEMENTATION AND BENEFIT:
(DESCRIBE HOW YOU FORESEE THE RESULTS WILL BE IMPLEMENTED AND HOW THE TRANSPORTATION COMMUNITY WILL BENEFIT. HIGHER PRIORITIES WILL BE GIVEN TO STATEMENTS WITH SIGNIFICANT IMPLEMENTATION POTENTIAL)
The thorough understanding of the continuity detailing using field monitoring data and in light of results from previous projects will assist in the successful implementation of the new detail in the BDM. It is expected
that the majority of new bridges will employ the new continuity detail. Bridge engineers will be able to design bridges employing the new continuity detail with confidence, and the state will benefit from building new bridges that are more sustainable as a result of the reduced maintenance costs that will be incurred with the implementation of the new continuity detail.

5. **SUBMITTED BY:**

<table>
<thead>
<tr>
<th>NAME</th>
<th>Ayman M. Okeil</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFFILIATION</td>
<td>Louisiana State University</td>
</tr>
<tr>
<td>TELEPHONE #</td>
<td>225-578-7048</td>
</tr>
<tr>
<td>EMAIL</td>
<td><a href="mailto:aokeil@lsu.edu">aokeil@lsu.edu</a></td>
</tr>
</tbody>
</table>

**PLEASE SUBMIT TO:** LTRC DIRECTOR, 4101 GOURRIER AVE. BATON ROUGE, LA 70808
### Title:
Field Demonstration of New Bridge Approach Slab Designs and Performance

### Project Status:
Completed

### Funding Source:
SPR: TT-Fed/TT-Reg

### Budget Category:
FHWA

### SJC:
30000116

### Project Start Date:
8/1/2008

### Completion Date (original):
8/1/2011

### Completion Date (revised):
9/30/2014

### Research Project Number:
05-1GT

### Research Agency:
LTRC

### Principal Investigator:
Dr. Murad Abu-Farsakh

### BUDGET STATUS

<table>
<thead>
<tr>
<th>Total Budget</th>
<th>Estimated 2013-2014 Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost</td>
<td>$393,176</td>
</tr>
<tr>
<td>(original)</td>
<td>$310,000</td>
</tr>
<tr>
<td>(revised)</td>
<td></td>
</tr>
<tr>
<td>Est. Expended to Date</td>
<td>$287,900</td>
</tr>
<tr>
<td>FY 2012 - 2013 Budget</td>
<td></td>
</tr>
<tr>
<td>FY Funds</td>
<td>$39,500</td>
</tr>
<tr>
<td>(original)</td>
<td>$29,000</td>
</tr>
<tr>
<td>(revised)</td>
<td></td>
</tr>
<tr>
<td>Est. FY Expenditure</td>
<td>$29,000</td>
</tr>
<tr>
<td>Salaries</td>
<td>$42,000</td>
</tr>
<tr>
<td>Equipment (expendable)</td>
<td></td>
</tr>
<tr>
<td>Equipment (non-expendable)</td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

### PURPOSE AND SCOPE

This project implements the findings from two LTRC Projects: "The Rideability of a Deflected Bridge Approach Slab" (02-2GT) and "Determination of Interaction between Bridge Concrete Approach Slab and Embankment Settlement" (03-4GT). It will also study such major causes of extra settlement from the collapsible behavior of embankment soils and its relation with construction methods, the erosion control of embankment, the settlement of native ground as embankment foundation and its control, and etc. In this project, lab and field tests will be conducted for soil deformation. Field-testing sections of bridge concrete approach slabs will be built and their performance will be monitored and analyzed so that final recommendation can be made to LADOTD on the bump issue at bridge ends. These bridge approach slabs tested are based on new design from the Bridge Design Section in comply with the recommendations from the two finished research projects.

### FISCAL YEAR 2012 - 2013 ACCOMPLISHMENTS

- Conducted more literature review relevant to the research project;
- Analyzed the collected data from two truck load tests on the approach slabs at Bayou Courtbrouleu Bridge;
- Designed and developed the instrumentation and testing plan for the two approach slabs at Bayou Lacassine Bridge; and
- Purchased the instrumentation for the Bayou Lacassine Bridge approach slab, waiting for the start of construction.

### FISCAL YEAR 2013-2014 PROPOSED ACTIVITIES

- Install the geogrid reinforcement layers and other instrumentations beneath the East and west approach slabs at Bayou Lacassine Bridge once construction started;
- Install sister bar strain gauges within the approach slab structure at Bayou Lacassine Bridge;
- Conducted truck load test on both approach slabs at Bayou Lacassine Bridge, and monitor collect data from the instrumentations during the test; and
- Look for new bridge approach slab embankment sites for instrumentation and monitoring.
# 10 Appendix D - LTRC Proposal Review Form (1910)

## LOUISIANA TRANSPORTATION RESEARCH CENTER

**Proposal Review Form**

<table>
<thead>
<tr>
<th>LTRC PROJECT NO.</th>
<th>INDIVIDUAL RATING PROPOSAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Submitted By:**

**Principal Investigator:**

**University / Consultant:**

### Please rate each proposal individually and provide your assessment of rating points for each category. Total the rating points in item F.

<table>
<thead>
<tr>
<th>Category</th>
<th>Rating Points</th>
<th>Total Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.</strong> Concept and Objective of the Work (10 pts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Proposal reflects conceptual understanding of problem demonstrated by:</td>
<td>5 max</td>
<td></td>
</tr>
<tr>
<td>a. Literature search provided to avoid duplication of effort?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Background of the problem adequately described?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Are the objectives and scope proposed?</td>
<td>5 max</td>
<td></td>
</tr>
<tr>
<td>a. Clear and easy to understand?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Likely to produce the deliverables required?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B.</strong> Research Plan and Approach (20 pts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Is the overall procedure or methodology adequately described appropriate to the study?</td>
<td>10 max</td>
<td></td>
</tr>
<tr>
<td>2. Are the experimental methods and/or data analysis techniques adequately described and appropriate to the study?</td>
<td>10 max</td>
<td></td>
</tr>
<tr>
<td><strong>C.</strong> Budget and Time Schedule (20 pts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Is the budget reasonable for scope, personnel, travel, etc. necessary to accomplish objectives?</td>
<td>10 max</td>
<td></td>
</tr>
<tr>
<td>2. Is the time schedule appropriate to accomplish the work described?</td>
<td>10 max</td>
<td></td>
</tr>
<tr>
<td><strong>D.</strong> Personnel (30 pts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. What is your evaluation of the qualifications, experience and management ability of the principal investigator and support staff relative to their specific assignments?</td>
<td>20 max</td>
<td></td>
</tr>
<tr>
<td>2. Is the appointment of personnel level (time allocated) to accomplish specific tasks appropriate and realistic?</td>
<td>10 max</td>
<td></td>
</tr>
<tr>
<td><strong>E.</strong> Facilities and Equipment (10 pts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. In your estimation, are available facilities and equipment listed adequate to accomplish study requirements?</td>
<td>5 max</td>
<td></td>
</tr>
<tr>
<td>2. Is need for purchase or rental of equipment listed adequately documented and justified?</td>
<td>5 max</td>
<td></td>
</tr>
<tr>
<td><strong>F.</strong> Implementation Plan (10 pts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Are the deliverables for the project adequately described to provide a reasonable expectation of successful implementation?</td>
<td>5 max</td>
<td></td>
</tr>
<tr>
<td>2. Does the implementation plan include a reasonable methodology and effort to quantify the benefits of implementation?</td>
<td>5 max</td>
<td></td>
</tr>
</tbody>
</table>

### Overall Point Total

<table>
<thead>
<tr>
<th>Is Proposal Acceptable</th>
<th>Accept</th>
<th>Accept with modifications noted below</th>
<th>Reject</th>
</tr>
</thead>
</table>

### Comments

*Your comments below will be helpful to assist LTRC in making final decisions. Attach continuation sheets for additional comments, if necessary. (List deficiencies in proposal and improvements required)*

---

*Revised 1910 Rev 0515*
# Appendix E - Research Proposal Template (1913)

## Louisiana Transportation Research Center Research Proposal

### Part I: General Information

<table>
<thead>
<tr>
<th>1. Amount Requested (Same as Part II)</th>
<th>2. Duration of Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>Anticipated Start Date</td>
</tr>
<tr>
<td></td>
<td>Duration in Months</td>
</tr>
<tr>
<td></td>
<td>To be completed by LTRC</td>
</tr>
<tr>
<td></td>
<td>Actual Start Date</td>
</tr>
<tr>
<td></td>
<td>Ending Date</td>
</tr>
</tbody>
</table>

### Part II: Title of Research Proposal

### Part III: Name and Business Address of Proposer

#### Individual, Institution, Firm, or Corporation

### Part IV: Telephone Number and Extension of Business Office

### Part V: Telephone Number and Mailing Address of Principal Investigator

### Part VI: Major Subdivision That Will Conduct Research

### Part VII: Name and Title of Co-Principal Investigator

### Part II: Approval

<table>
<thead>
<tr>
<th>1. Recommended by the Associate Director, LTMC, Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tyson D. Rupnow, Ph.D., P.E.</td>
</tr>
<tr>
<td>Date</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Recommended by the Director, LTMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samuel B. Cooper, Jr., Ph.D., P.E.</td>
</tr>
<tr>
<td>Date</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Recommended by Chairman, LTMC Policy Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christopher P. Knotts, P.E.</td>
</tr>
<tr>
<td>Date</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Recommended by Implementation Sponsor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shawn D. Wilson, Ph.D.</td>
</tr>
<tr>
<td>Date</td>
</tr>
</tbody>
</table>

Approved Modifications: [LTMC Use Only]
<table>
<thead>
<tr>
<th>ITEM</th>
<th>Percent of Time on Project</th>
<th>FUND (Unit/Cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Tot, Proj. Cost</td>
</tr>
</tbody>
</table>

1. PERSONNEL

- Total Salaries and Wages
- Plus _____ % for Employee Benefits
- Plus _____ % for Graduate Student Benefits
- Total Personnel Costs

2. NON-EXPENDABLE EQUIPMENT

- Total Non-Expendable Equipment

3. CONSUMABLE SUPPLIES

- Total Consumable Supplies

4. TRAVEL

- Total Travel

5. OTHER EXPENSES

- Total Other Expenses

6. TOTAL DIRECT COSTS

7. MODIFIED TOTAL DIRECT COSTS

8. TOTAL INDIRECT COSTS
   (Attach documentation to substantiate indirect cost rate used and method of application in Part VIII)

9. TOTAL COSTS (TOTAL OF 6 & 7)
### Part IV - BIOGRAPHICAL SKETCHES

Provide brief sketches for professional personnel already selected who are to be actively engaged in this project. The following questions should be completed with co-principal researcher immediately following principal researcher, followed by other professional personnel.

<table>
<thead>
<tr>
<th>NAME OF PRINCIPAL INVESTIGATOR</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE OF BIRTH</td>
<td>PLACE OF BIRTH</td>
</tr>
<tr>
<td>SEX</td>
<td>CITIZENSHIP</td>
</tr>
<tr>
<td>🌐 US</td>
<td>🌐 OTHER (SPECIFY)</td>
</tr>
</tbody>
</table>

#### EDUCATION

<table>
<thead>
<tr>
<th>DEGREE</th>
<th>INSTITUTION CONFERRING</th>
<th>FIELDS</th>
<th>YEAR</th>
</tr>
</thead>
</table>

#### OTHER RESEARCH TRAINING AND EXPERIENCE, PARTICULARLY IN AREA COVERED BY THIS APPLICATION

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>NATURE</th>
<th>YEAR</th>
</tr>
</thead>
</table>

#### FIELDS OF PRESENT MAJOR SCIENTIFIC INTEREST IN ORDER OF CHOICE

<table>
<thead>
<tr>
<th>NAME OF CO-PRINCIPAL INVESTIGATOR</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE OF BIRTH</td>
<td>PLACE OF BIRTH</td>
</tr>
<tr>
<td>SEX</td>
<td>CITIZENSHIP</td>
</tr>
<tr>
<td>🌐 US</td>
<td>🌐 OTHER (SPECIFY)</td>
</tr>
</tbody>
</table>

#### EDUCATION

<table>
<thead>
<tr>
<th>DEGREE</th>
<th>INSTITUTION CONFERRING</th>
<th>FIELDS</th>
<th>YEAR</th>
</tr>
</thead>
</table>

#### OTHER RESEARCH TRAINING AND EXPERIENCE, PARTICULARLY IN AREA COVERED BY THIS APPLICATION

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>NATURE</th>
<th>YEAR</th>
</tr>
</thead>
</table>

#### FIELDS OF PRESENT MAJOR SCIENTIFIC INTEREST IN ORDER OF CHOICE


<table>
<thead>
<tr>
<th>PART V</th>
<th>TITLE VI STATEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The attention of the proposed research contracting agency or institution is directed to the need to comply with the requirements of Title VI of the Civil Rights Act of 1964.</td>
</tr>
<tr>
<td></td>
<td>(Name of Contracting Agency) acknowledges that we are aware of the requirements of Title VI and will not discriminate on the basis of race, creed, sex, or national origin and will endeavor to involve the members of minority groups in the conduct of the proposed contract research study.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TECHNICAL RESEARCH PROPOSAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Details of the proposed plan and other necessary data shall be typed (double-spaced) in accordance with the sequence and requirements defined in Chapter 3.3 of the LTRC Research Procedure Manual. Continue numbering pages in sequence for the entire proposal using the continuation sheet.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PART VI</th>
<th>SUMMARY OF PROPOSED RESEARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Appendix F - Research Task Order Form (1914)

**Louisiana Department of Transportation and Development**

**Louisiana Transportation Research Center**

## Research Task Order Form (1914)

<table>
<thead>
<tr>
<th>Task Order No.:</th>
<th>Effective Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contract Time:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Issuing Agency (For Whom Work Performed):</th>
<th>Cooperating Agency (Work Performed By):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Research Project No.:</th>
<th>Research Project Title:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Funds Available: Not to Exceed $</th>
<th>(See Detailed Proposed Budget As Attached)</th>
</tr>
</thead>
</table>

The Cooperating Agency agrees to perform all the services set forth in the attached proposal for the consideration stated herein. The rights and obligations of the parties to this Task Order shall be subject to and governed by the Research Agreement dated __________.

<table>
<thead>
<tr>
<th>Approved By (Authorized Signature of Issuing Agency):</th>
<th>Approved By (Authorized Signature of Cooperating Agency):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Typed Name: Harold R. Paul</th>
<th>Typed Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>Date:</td>
</tr>
<tr>
<td>Title: Director</td>
<td>Title:</td>
</tr>
</tbody>
</table>

Form 1914 Rev. 02/08
STATE OF LOUISIANA
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
CONTRACT FOR RESEARCH SERVICES
LTRC PROJECT NO. __________, SIO NO. __________

THIS CONTRACT made and entered into this ______ day of ____________, 2012, by and between the Louisiana Department of Transportation and Development, Louisiana Transportation Research Center, hereinafter referred to as "LADOTD/LTRC," and CONSULTANT NAME AND ADDRESS, hereinafter referred to as "Consultant."

Under Authority granted by Part XIII-A of Title 48 of Louisiana Revised Statutes, the LADOTD/LTRC has elected to engage the Consultant to perform, and the Consultant agrees to perform the services described in the Scope of Contract Services under the terms and conditions, and for the compensation as stated in this Contract.

ENTIRE AGREEMENT

This Contract together with the advertisement of the Request for Proposals (RFP) dated ____________, the Consultant research proposal including work hour and compensation submitted and approved by LADOTD/LTRC, the LTRC Manual of Research Procedures, Publication Guidelines, and any attachments and exhibits are specifically incorporated herein by reference and constitute the entire agreement between the parties with respect to the subject matter. However, in the event of a conflict between the terms of this Contract and the referenced documents, this Contract governs.

PROJECT IDENTIFY

LTRC Project No. __________ and Statistical Internal Order No. ___________ has been assigned to this special services contract. All invoices and correspondence in connection with this contract shall be identified by these project numbers.

SCOPE OF CONTRACT SERVICES

Project specific: project objective.

The following tasks (all as specified in detail in the Consultant's proposal and made a part of this contract) shall be performed under this project:

List tasks by title

The Consultant will be responsible for performing the services as ordered by DCTD/LTRC in accordance with the terms of this contract under the direct administration of a DOTD/LTRC “Project Manager” who will be identified when the work is authorized in the Notice to Proceed.
DELIVERABLES

Deliverables for this contract will include:

Project specific.

CONTRACT TIME

The consultant shall proceed with the services specified herein after the execution of this Contract and upon written Notice-to-Proceed (NTP) from the LADOTD/LTRC and shall be completed within ____ calendar months, which includes review time. The delivery schedule for all project deliverables will be established by the Project Manager.

COMPENSATION

Compensation to the Consultant for services rendered in connection with this Contract shall be made on the basis of a cost plus fixed fee with a maximum limitation of $______.

The Consultant shall submit monthly invoices which shall be in accordance with the LTRC Manual of Research Procedures for work accomplished towards the completion of project tasks.

PAYMENT

Payments to the Consultant for services rendered by the Consultant shall be made per the schedule provided above. The payments shall be based on a standard certified correct invoice. Invoices reflecting the amount and value of work accomplished to the date of such submission shall be submitted directly to the Project Manager. The invoice shall also show the total of previous payments on account of this contract, and the amount due and payable as of the date of the current invoice.

A principal member of the Consultant to whom the contract is issued must sign, date, and certify the invoice for correctness. The original and three copies of each invoice shall be submitted to the Project Manager.

Upon receipt and approval of each invoice, the LADOTD/LTRC shall check the invoice for correctness and return if required; upon acceptance and approval of a standard certified correct invoice, for services satisfactorily performed, the LADOTD/LTRC shall pay the amount shown to be due and payable within 30 calendar days, in accordance with Louisiana R.S. 48: 251.5.

PUBLICATION OF DATA

The following provisions shall govern publication of resultant data from each contract research project.

(1) The author shall be free to copyright material developed under each contract, other than with the provision that the contractor hereby grants to all state highway and/or transportation departments, local public agencies, the United States Government, and all contractors for any
of the foregoing when such contractors are performing work under contract for the aforementioned entities, an irrevocable, non-exclusive, nontransferable, and royalty-free license to reproduce, publish or otherwise use, and to authorize others to use the work for Government purposes.

(2) Either party to this contract may initiate a request for publication of the final or interim reports or any portions thereof. Technical papers, articles, and submissions for review to technical journals, prepared for submission prior to approval of the final report required under the contract, must be submitted to the LADOTD/LTRC for approval prior to publication. In the event of failure of agreement between the LADOTD/LTRC and the Consultant relative to publication of the final report, or of any progress reports during the contractual period, either party reserves the right to publish independently in which event the non concurrence of the other party shall be set forth as technical comments in the report in a clearly identified section such as “sponsor’s comments,” or “Consultant’s comments.” Following publication of the final report under a contract, no approvals are required from LADOTD/LTRC for subsequent publications, as noted below in item 4.

(3) Both parties to the agreement shall have equal responsibility to review and approve material for publication prior to publication of the final report, except that the LADOTD/LTRC reserves the right initially to publish the final report.

(4) After acceptance of the final report, the Consultant and the LADOTD/LTRC are free to use the data and results without restriction except as noted above in item 2. Whenever the Consultant uses the data and the results, due credit will be given to the LADOTD/LTRC and all other funding agencies.

(5) All reports published by the LADOTD/LTRC and/or the Consultant shall contain a disclaimer statement as provided in the LTRC Manual of Research Procedures.

(6) Publication by either party shall give credit to the other party and to all other funding agencies unless, due to failure of agreement on any report of the study, any funding agency or either of the parties to this agreement requests that its credit acknowledgement be omitted.

**PATENT RIGHTS**

The proprietary rights of any special equipment or procedures developed as a result of this project shall be governed by the following provisions.

For any patentable discoveries or inventions that should result from the Consultant’s work other than discoveries or inventions that are deliverable under the contract, all rights accruing from such discoveries or inventions shall be the sole property of the consultant. However, the consultant hereby grants to all state highway and/or transportation departments, local public agencies, the United States Government, and all contractors for any of the foregoing when such contractors are performing work under contract for the aforementioned entities, an irrevocable, non-exclusive, nontransferable, and
royalty-free license to practice each invention in the manufacture, use, and disposition, according to law, of any article or material, and in the use of any method that may be developed as a part of the work under the research contract. The Consultant shall notify LTRC of its intent to file a patent on work developed as a result of a research project.

**CONTRACT CHANGES**

Minor revisions in the described work shall be made by the Consultant without additional compensation as the work progresses. Considerations for minor revisions have been included in the compensation computations. If the LADOTD/LTRC requires more substantial revisions or additional work which the consultant believes warrants additional compensation, the Consultant shall notify the LADOTD/LTRC in writing within thirty (30) days of being instructed to perform such work.

If the LADOTD/LTRC agree that the required work is necessary and warrants additional compensation, the Contract shall be changed by a *Supplemental Agreement* or by an *Extra Work Letter*. The Consultant shall not commence any additional work until written authority to proceed has been given by the LADOTD/LTRC. An Extra Work Letter shall be utilized in cases when the additional compensation is small and the work does not constitute a change in scope. The cumulative value of all extra Work Letters shall not exceed 10% of the cumulative value of all contract compensation exclusive of Extra Work Letters (original contract compensation plus all Supplemental Agreements). In all other cases wherein the LADOTD/LTRC agrees that the required work is necessary and warrants additional compensation, a Supplemental Agreement shall be utilized.

If the LADOTD/LTRC disagrees that additional compensation is due for the required work it shall be the Consultant’s responsibility to perform the work and adhere to the procedures set forth in the Claims and Disputes provisions of this Contract.

**OWNERSHIP OF DOCUMENTS**

All data collected by the Consultant and all documents, notes, drawings, tracing and files collected or prepared in connection with this work, except the Consultant’s personnel and administrative files, shall become and be the property of the LADOTD/LTRC and the LADOTD/LTRC shall not be restricted in any way whatever in its use of such material, except as specified in Louisiana R.S. 38:2317.

No public news releases, technical papers, or presentations concerning this project may be made without prior written approval of the LADOTD/LTRC.

**TERMINATION OR SUSPENSION**

This contract shall become effective from the date of execution and shall be binding upon the parties until the work has been completed by the Consultant in accordance with the terms of this Contract and accepted by the LADOTD/LTRC, and all payments and conditions have been met. Further, this Contract shall remain in effect until the LADOTD/LTRC has issued final acceptance of the services provided for herein. However, this Contract may be terminated earlier under any or all of the following conditions:
1. By mutual agreement and consent of the parties hereto.
2. By the LADOTD/LTRC as a consequence of the failure of the Consultant to comply with
   the terms, progress or quality of work in a satisfactory manner, proper allowance being
   made for circumstances beyond the control of the Consultant.
3. By either party upon failure of the other party to fulfill its obligations as set forth in this
   contract.
4. By the LADOTD/LTRC due to the departure for whatever reason of any principal
   member or members of the Consultant’s firm.
5. By satisfactory completion of all services and obligations described herein.
6. By the LADOTD/LTRC giving thirty (30) days notice to the Consultant in writing and
   paying compensation due for completed work.

Upon termination, the Consultant shall deliver to the LADOTD/LTRC a report in complete detail of
all findings and all obtained data for the LADOTD/LTRC’s use as well as copies of all records of the
work compiled to the date of termination and the LADOTD/LTRC shall pay in full for all work
accomplished up to the date of termination.

If for any reason, the LADOTD/LTRC wishes to suspend this Contract, it may do so by giving the
Consultant thirty (30) days written notice of intent to suspend. The Consultant shall, at expiration of
the thirty (30) days from the date of the notice of intent to suspend, stop all work on the Project.
Work shall resume no later than thirty (30) days after the LADOTD/LTRC provides the Consultant
with a notice of intent to resume work.

The consultant shall not have the authority to suspend work on this Contract.

CLAIMS AND DISPUTES

The Consultant’s failure to provide the required written notification pursuant to the provisions of the
Contract Changes section of this contract shall be deemed a waiver of any and all claims for
additional compensation.

When the Consultant has timely filed notice pursuant to the provisions of the Contract Changes
section of this contract, the Consultant shall submit the entire claim and supporting documentation to
the LTRC Director within thirty (30) days of the notice. The LTRC Director shall submit the claim
to the LTRC Policy Committee (hereinafter, “the Committee”) for review.

The Consultant shall be notified in writing of the Committee’s recommendation, and, if accepted by
the Consultant and approved by the Chief Engineer and FHWA, if applicable, the parties hereto
shall execute a Supplemental Agreement based upon said recommendation. If the Committee’s
recommendation is not accepted by the Consultant, the Consultant may file a written appeal to the
Chief Engineer. The decision of the Chief Engineer shall be final, and the Consultant shall be
notified in writing of the Chief Engineer’s decision, which is final and unappealable.

INSURANCE REQUIREMENTS
During the term of this Agreement, the Consultant shall carry professional liability insurance in the amount of $1,000,000. This insurance shall be written on a “claims-made” basis. The Consultant shall provide or cause to be provided a Certificate of Insurance to the DOTD showing evidence of such professional liability insurance.

INDEMNITY

The Consultant agrees to indemnify and save harmless the LADOTD/LTRC against any and all claims, demands, suits, and judgments of sums of money (including attorney’s compensation and cost for defense) to any party for loss of life or injury or damage to persons or properties arising out of, resulting from, or by reason of, any negligent act or omission by the Consultant, its agents, servants, or employees while engaged upon or in connection with the services required or performed by the Consultant hereunder.

CLAIMS FOR LIENS

The Consultant shall hold the LADOTD/LTRC harmless from any and all claims for liens for labor, services or material furnished to the consultant in connection with the performance of its obligations under this Contract.

COMPLIANCE WITH LAWS

The Consultant shall comply with all applicable Federal, State and Local laws and ordinances, as shall all others employed by it in carrying out the provisions of this Contract.

COMPLIANCE WITH CIVIL RIGHTS ACT

The Consultant agrees to abide by the requirements of the following as applicable: Title VI and VII of the Civil Rights Act of 1964, as amended by the Equal Opportunity Act of 1972, Federal Executive Order 11246, the Federal Rehabilitation Act of 1973, as amended, the Vietnam Era Veteran’s Readjustment Assistance Act of 1974, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1972, and Consultant agrees to abide by the requirements of the Americans with Disabilities Act of 1990.

Consultant agrees not to discriminate in its employment practices, and willrender services under this contract without regard to race, color, religion, sex, national origin, veteran status, political affiliation or disabilities.

Any act of discrimination committed by Consultant, or failure to comply with these statutory obligations when applicable shall be grounds for termination of this contract.

COVENANT AGAINST CONTINGENT FEES

The Consultant warrants that it has not employed or retained any company or person, other than a bona fide employee working solely for the Consultant, to solicit or secure this contract, and that it has not paid or agreed to pay any company or person, other than a bona fide employee working

82
solely for the Consultant, any fee, commission, percentage, brokerage fee, gifts, or any other consideration, contingent upon or resulting from the award or making of this contract. For breach or violation of this warranty the LADOTD/LTRC shall have the right to annul this contract without liability, or, in its discretion to deduct from the contract price or consideration, or otherwise recover, the full amount of such fee, commission, percentage, brokerage fee, gift or contingent fee.

No legislator or person who has been certified by the Secretary of the State as elected to the legislature or member of any board or commission, members of their families or legal entities in which the legislator, person or board or commission member has an interest, may derive any benefit from this Contract or share in any part of the Contract in violation of Louisiana Code of Governmental Ethics (LSA R.S. 42:1101, et seq.)

CODE OF GOVERNMENTAL ETHICS

The consultant acknowledges that Chapter 15 of Title 42 of the Louisiana Revised Statutes (R.S. 42:1101 et seq., Code of Governmental Ethics) applies to the consultant in the performance of services called for in this contract. The consultant agrees to immediately notify the state if potential violations of the Code of Governmental ethics arise at any time during the term of this contract.

DISADVANTAGED BUSINESS ENTERPRISES REQUIREMENTS

It is the policy of the Federal Highway Administration that disadvantaged business enterprises, or DBE, as defined in 49 CFR 26, shall have the maximum opportunity to participate in the performance of contracts financed in whole or part with federal funds; consequently, the DBE requirements of 49 CFR 26 apply to this Contract.

The Consultant agrees to ensure that DBE, as defined in 49 CFR 26, have the maximum opportunity to participate in the performance of this Contract and any subcontracts that may be let. In this regard, the Consultant shall take all necessary and reasonable steps in accordance with 49 CFR 26 to ensure that DBE have the maximum opportunity to compete for and perform services relating to this Contract. Furthermore, the Consultant shall not discriminate on the basis of race, color, national origin, or sex in the performance of this Contract.

Failure to carry out the above requirements shall constitute a breach of this Contract. After proper notification by the LADOTD/LTRC, immediate remedial action shall be taken by the Consultant as deemed appropriate by the LADOTD/LTRC or the Contract shall be terminated. The option shall rest with the LADOTD/LTRC.

The above requirements shall be physically included in all subcontracts entered into by the Consultant.

SUBLETTING, ASSIGNMENT OR TRANSFER

This Contract, or any portion thereof, shall not be transferred, assigned, or sublet without the prior written consent of the LADOTD/LTRC. In the event the Consultant does elect to sublet any of the services required under this Contract, it must take affirmative steps to utilize Disadvantaged
Business Enterprises (DBE) as sources of supplies, equipment, construction, and services. Affirmative steps shall include the following:

1. Including qualified DBE on solicitation lists.
2. Assuring that DBE are solicited whenever they are potential source.
3. When economically feasible, dividing total requirements into smaller tasks or quantities so as to permit maximum DBE participation.
4. Where the requirement permits, establishing delivery schedules which shall encourage participation by DBE.
5. Using the services and assistance of the Small Business Administration, the Office of Disadvantaged Business Enterprise of the Department of Commerce, and the Community of Services Administration as required.

COST RECORDS

The Consultant and its subcontractors shall maintain all books, documents, papers, accounting records and other evidence pertaining to cost incurred relative to this project. Costs shall be in accordance with 48 CFR 31 of the (FARS), as modified by the DOTD’s audit guidelines, and which are incorporated herein by reference as if copied in extenso. The FARS is available for inspection through www.transportation.org. Records shall be retained until such time as an audit is made by LADOTD/LTRC or the Consultant is released in writing by LADOTD/LTRC’s Audit Director, at which time the Consultant may dispose of such records. The Consultant shall, however, retain such records for a minimum of three (3) years from the date of payment of the last invoice under this contract or the release of all retainage for this contract, whichever occurs later, for inspection by the LADOTD/LTRC and/or Legislative Auditor, and the FHWA or General Accounting Office (GAO) under State and Federal Regulations as of the date of this Contract.

SUCCESSORS AND ASSIGNS

This contract shall be binding upon the successors and assigns of the respective parties hereto.

TAX RESPONSIBILITY

The Consultant hereby agrees that the responsibility for payment of taxes on the payments received under this contract shall be its obligation.

JOINT EFFORT

This Contract shall be deemed for all purposes prepared by the joint efforts of the parties hereto and shall not be construed against one party or the other as a result of the preparation, drafting, submittal or other event of negotiation, drafting, or execution of the Contract.

SEVERABILITY

If any term, covenant, condition, or provision of this Contract or the application thereof to any
person or circumstance shall, at any time or to any extent, be invalid or unenforceable, the remainder of this Contract or the application of such term, covenant, condition or provision to persons or circumstances other than those as to which it is held invalid or unenforceable, shall not be affected thereby, and each term, covenant, condition, and provision of this Contract shall be valid and enforced to the fullest extent permitted by law.
IN WITNESS WHEREOF, the parties have caused these presents to be executed by their respective officers thereunto duly authorized as of the day and year first above written.

WITNESSES:

__________________________________________
Witness for First Party

__________________________________________
Witness for First Party

NAME OF CONSULTANT

BY: ________________________________
Authorized Person
Title

####

Federal Identification Number

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION
AND DEVELOPMENT

__________________________________________
Witness for Second Party

__________________________________________
Witness for Second Party

RECOMMENDED FOR APPROVAL:

BY: ________________________________
Division Head
14 Appendix H - Kick-Off Meeting Checklist

- Introductions
- Project Manager Responsibilities
- PRC Chairman Responsibilities
- PRC Responsibilities
- LTRC Manual of Research Procedures
- University Master Agreement / Consultant Contracts
- Review of Proposal
  - Objectives
  - Tasks
  - Timelines
  - Support
  - Deliverables
- Project Meetings & Correspondence
- Project Management & Tracking System
- LTRC Website & Downloads
- Monthly Invoice Form
- Project Capsule
- Biannual Reports
  - PI responsibilities
    - Task Accomplishments
    - Task Proposed Activities
    - Fiscal Year Budget Revisions
  - Manager Comments
  - Implementation Comments
  - PRC Review
- Annual Work Program
  - Total Budget Expenditures
  - Fiscal Year Budget Projection
  - Accomplishments
  - Proposed Activities
- Travel
  - Conduct of business
  - Out of State Travel Request
  - LTRC Technical Transfer Support (Conference Presentations)
- Project Modification Agreement
- Budget Adjustments
- Equipment
  - Purchases
  - Rental
  - Disposition of Equipment
- Requests for Publication Approval
- Final Report
  - Draft Due Date
  - Size Limitations
  - Publication Format
  - Report Template
  - Report Quality (including editing)
  - Report Review Process
  - Distribution
- Technical Summary
- PRC Closeout Process Survey
- Project Closeout Process and Timeline
- Principal Investigator / Research Entity Rating
- Research Assessment & Implementation Report
- DOTD/LTRC Performance Measures
## Research Project Modification Agreement Form

**LOUISIANA TRANSPORTATION RESEARCH CENTER**

**RESEARCH PROJECT MODIFICATION AGREEMENT**

<table>
<thead>
<tr>
<th>STUDY NAME</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SUBMITTING AGENCY</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>DATE:</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PRINCIPAL INVESTIGATOR</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CURRENT CONTRACT COST</th>
<th>CURRENT COMPLETION DATE</th>
<th></th>
</tr>
</thead>
</table>

**DESCRIPTION AND REASON FOR PROPOSED MODIFICATION:** (ATTACH ADDITIONAL SHEETS AND REQUIRED DOCUMENTS AS NECESSARY)

**CONTRACT TIME REVISION**

<table>
<thead>
<tr>
<th>INCREASE</th>
<th>DECREASE</th>
<th>NUMBER OF MONTHS</th>
<th></th>
</tr>
</thead>
</table>

**CONTRACT COST REVISION**

<table>
<thead>
<tr>
<th>INCREASE</th>
<th>DECREASE</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>REVISED COMPLETION DATE</th>
<th>REVISED Y. COST</th>
<th>REVISED TOTAL CONTRACT COST</th>
<th></th>
</tr>
</thead>
</table>

* (INCLUDES INDIRECT COST FOR EACH AMOUNT)

**TYPE OF MODIFICATION**

- The proposed modification comprises a change in this study with regard to:
  - Budget
  - Time
  - Scope
  - Work Plan
  - Personnel

* (ATTACH REVISED BUDGET, REVISED TIME SCHEDULE, OR WORK PLAN)

**IT IS MUTUALLY AGREED TO PERFORM AND ACCEPT THE ABOVE MODIFICATIONS TO THE ORIGINAL CONTRACT REQUESTED BY:**

**RECOMMENDED BY:**

<table>
<thead>
<tr>
<th>PRINCIPAL INVESTIGATOR</th>
<th>DATE</th>
<th>LTREC PROJECT MANAGER</th>
<th>DATE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LTREC GROUP ADMINISTRATOR</th>
<th>DATE</th>
<th>LTREC ASSOCIATE DIRECTOR, RESEARCH</th>
<th>DATE</th>
</tr>
</thead>
</table>

**APPROVED BY:**

<table>
<thead>
<tr>
<th>ASSOCIATE VICE-CHANCELLOR, RESEARCH OR INSTITUTION RESEARCH HEAD</th>
<th>DATE</th>
<th>LTREC DIRECTOR</th>
<th>DATE</th>
</tr>
</thead>
</table>
### PART III AMOUNTS REQUESTED FOR PROJECT (For period of time indicated in Part 1 item 2)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Percent of Time on Project</th>
<th>FUNDS (Unit Grant)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FY 2014</td>
</tr>
<tr>
<td>1. PERSONNEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time Salaries and Wages</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plus ___% for Employee Benefits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plus ___% for Graduate Student Benefits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Personal Costs</td>
<td></td>
</tr>
<tr>
<td>2. NON-EXPENDABLE Non-human</td>
<td>Time non-expendable equipment</td>
<td></td>
</tr>
<tr>
<td>3. CONSUMABLE SUPPLIES</td>
<td>Time Consumable Supplies</td>
<td></td>
</tr>
<tr>
<td>4. TRAVEL</td>
<td>Time Travel</td>
<td></td>
</tr>
<tr>
<td>5. OTHER EXPENSES</td>
<td>Time Other Expenses</td>
<td></td>
</tr>
<tr>
<td>6. TOTAL DIRECT COSTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL INDIRECT COSTS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Attach documentation to substantiate indirect cost rate used and method of application in Part VIII)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL COSTS (SUB Total)</td>
<td></td>
</tr>
</tbody>
</table>
# 16 Appendix J - Monthly Invoice for Research Projects Form (1918)

### Louisiana Transportation Research Center | Monthly Invoice for Research Projects

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Date of Payment</th>
<th>Voucher Number</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
</table>

### 2. Materials, Rentals, and Services

<table>
<thead>
<tr>
<th>Description</th>
<th>Date of Payment</th>
<th>Voucher Number</th>
<th>Quantity</th>
<th>Amount</th>
</tr>
</thead>
</table>

### 3. Personnel Costs

<table>
<thead>
<tr>
<th>Name</th>
<th>Hourly or Monthly Rate</th>
<th>Hours or Hours per Month</th>
<th>Charge</th>
</tr>
</thead>
</table>

### 4. Travel

<table>
<thead>
<tr>
<th>Description</th>
<th>Mileage</th>
<th>Rate per Mile</th>
</tr>
</thead>
</table>

### Summary of Invoiced Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
</table>

**FY Funds Cannot Be Exceeded Without Authorization**

“I certify that the above billing is correct and just and that neither payment nor credit has been received.”

By: ____________________________

Auditor: ____________________________

P. I. E.: ____________________________

Form 1911 Rev. 1001
## APPENDIX K - DISPOSITION OF NON-EXPENDABLE EQUIPMENT FORM

### Louisiana Transportation Research Center

**DISPOSITION OF NONEXPENDABLE EQUIPMENT**

In accordance with Louisiana Title 34.337 items to be inventoried. All items of movable property having an "original" acquisition cost, when first purchased by the state of Louisiana, of $1,000 or more, must be placed on the statewide inventory system. The term "movable" distinguishes this type of equipment from equipment attached as a permanent part of a building or structure. The term "property" distinguishes this type equipment from "supplies" with supplies being consumable through normal use in no more than one year’s time.

<table>
<thead>
<tr>
<th>UNIVERSITY / CONSULTANT</th>
<th>PRINCIPLE INVESTIGATOR</th>
<th>ACCOUNT NO.</th>
<th>PURCHASE ORDER / INVOICE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LTTC PROJECT NO.</th>
<th>S/N NO.</th>
<th>STUDY TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCRIPTION OF ITEM</th>
<th>LOCATION (BUILDING / ROOM)</th>
<th>MAKE / MODEL</th>
<th>SERIAL NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE OF PURCHASE</th>
<th>PURCHASE PRICE</th>
<th>NAME AND CONTACT INFORMATION FOR PERSON RESPONSIBLE FOR ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Some equipment need to be tagged for inventory. Y/N?

If no justification, not to tag for inventory.

### FOR PROPERTY COORDINATOR

<table>
<thead>
<tr>
<th>RECEIVED BY</th>
<th>DATE RECEIVED</th>
<th>DOT TAG NO.</th>
<th>DATE ENTERED IN SAP</th>
<th>AMN NO. (OVER $5,000.00)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PRINCIPAL INVESTIGATOR SIGNATURE:**

**PROJECT MANAGER SIGNATURE:**

**APPROVED BY (NAME AND TITLE):**

**DATE:**

**DATE:**

**DATE:**

FORM 1920 (Rev 1/15)
# LTRC Biannual Research Progress Report

**For Period Ending: 12/31/2014**

## Title:

Feasibility of using Local Public Transit Resources for Evacuations and Other Unscheduled Needs

## Funding Source:

SPR: TT-Fed/TT-Reg

### Research Project Details:

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Original Start Date</th>
<th>Revised Start Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>30001506</td>
<td>11/05/2013</td>
<td>02/04/2015</td>
</tr>
</tbody>
</table>

## Research Agency:

LTRC

### Completion Dates:

<table>
<thead>
<tr>
<th>Original End Date</th>
<th>Revised End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/30/2015</td>
<td>06/30/2015</td>
</tr>
</tbody>
</table>

## Principal Investigator:

Dr. Chester Wilmot

### Total Budget:

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Budget</td>
<td>$170,000</td>
</tr>
<tr>
<td>Total Cost (original)</td>
<td>$204,617</td>
</tr>
<tr>
<td>Total Cost (revised)</td>
<td></td>
</tr>
<tr>
<td>Total Expenditures</td>
<td></td>
</tr>
</tbody>
</table>

### Fiscal Year Budget:

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiscal Year Funds (original)</td>
<td>$135,604</td>
</tr>
<tr>
<td>Fiscal Year Funds (revised)</td>
<td>$104,000</td>
</tr>
<tr>
<td>Fiscal Year Expenditures (to date)</td>
<td>$70,000</td>
</tr>
</tbody>
</table>

## BUDGET STATUS

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Funds Expended (%)</td>
<td>63%</td>
</tr>
<tr>
<td>Time Expended (%)</td>
<td>70%</td>
</tr>
<tr>
<td>Progress (%)</td>
<td>70%</td>
</tr>
</tbody>
</table>

## PART I PRINCIPAL INVESTIGATOR

**Accomplishments this period (use additional sheets if necessary) (include any problems on which assistance is needed)**

### Task 1: Identify means to secure collaboration among transit providers

Pilot survey resulted in a 24% response rate after 3 reminder calls. An incentive was determined to be needed to improve response. A cover letter endorsing the survey was also obtained from the Secretary of Health and Hospitals in Louisiana and this was included in the survey for agencies sponsored by DHH.

### Task 2: Develop inventory of resources

The list of transit providers, or organizations that contract with providers to provide transit services to special needs or human needs patrons, has been vetted and cleaned. Survey was mailed to recipients on 01/15/2015. Deadline for returns is February 15, 2015. Three reminders will be sent at 1-week intervals after initial mailing.

### Task 3: Establish demand for service

A modified dasymmetric method of population migrations has been developed and applied in New Orleans on a test basis. A paper on the topic was submitted to the 2015 TRB Annual Meeting Conference and a poster presentation on the paper was presented at the TRB meeting on January 13, 2015.

### Task 4: Create GIS query program

Initial test queries established. Further queries still to be developed.

### Task 5: Demonstrate the program in a test case

0%

### Task 6: Prepare final report

0%
Proposed activities next period (use additional sheets if necessary)

<table>
<thead>
<tr>
<th>Task 3: Establish demand for service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use system developed for New Orleans to estimated spatial distribution of population in coastal parishes by time of day.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task 4: Create GIS query program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop query system to satisfy common queries.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task 5: Demonstrate the program in a test case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical spill test case will be conducted in New Orleans.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task 6: Prepare final report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft final report will be prepared and submitted to PRC.</td>
</tr>
</tbody>
</table>

PART II. LTRC MANAGER'S COMMENTS

A modification was requested and approved to add 4 months to the project to account for delays affiliated with getting the surveys approved by DOTD management.

PART III. LTRC TECHNOLOGY TRANSFER MANAGER'S COMMENTS

The purpose of this project is to investigate the feasibility of using local public transit resources for emergency purposes. The product of this research will be an online GIS-based information system that can be accessed by emergency managers during an event to determine type, number, and location of transit resources. Procedures for securing these transit resources during an emergency will be determined (or developed), including incentives for participation and/or means for appropriate compensation.
## 19 Appendix M - Out-of-State Travel Approval Request Form (1917)

<table>
<thead>
<tr>
<th>Louisiana Transportation Research Center</th>
<th>LTRC Use Only</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OUT-OF-STATE TRAVEL APPROVAL REQUEST</strong></td>
<td></td>
</tr>
<tr>
<td>(To be used for out-of-state travel funds requested for conduct of research tasks for ongoing projects. Not to be used for conference travel requests)</td>
<td></td>
</tr>
</tbody>
</table>

### PART 1 TRAVEL REQUESTED

<table>
<thead>
<tr>
<th>1. PERSON(S) REQUESTING TRAVEL:</th>
<th>2. UNIVERSITY/AGENCY:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. ADDRESS:</th>
<th>4. DESTINATION ITINERARY:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. DATE OF DEPARTURE:</th>
<th>6. DATE OF RETURN:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. PURPOSE OF TRAVEL (E.G. CONFERENCE ATTENDANCE/PRESENTATION, SITE VISIT, ETC.):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8. EXPLANATION: EXPLAIN HOW THIS IS RELATED TO THE PROJECT TO BE CHARGED</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9. LTRC PROJECT NO.:</th>
<th>10. PROJECT TITLE:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 11. TOTAL COST OF TRAVEL (INDICATE YES IF TRAVEL WILL BE REIMBURSED BY THIRD PARTY AND NO STATE CHARGES MADE): |
|-------------------------------------------------------------------------------------------------------------|---|
|                                                                                                            |   |

<table>
<thead>
<tr>
<th>12. IS THIS A BUDGETED ITEM?</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES  NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13. IF NOT A BUDGETED ITEM, EXPLAIN:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### PART 2 APPROVAL

<table>
<thead>
<tr>
<th>RECOMMENDED BY GROUP MANAGER:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDED FOR APPROVAL BY ASSOCIATE DIRECTOR, RESEARCH:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>APPROVED BY DIRECTOR, LTRC:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMENTS FOR DISAPPROVAL:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
LOUISIANA TRANSPORTATION RESEARCH CENTER
4101 Gourrier Avenue
Baton Rouge, Louisiana 70808

Date

NOTICE OF COMPLETION
Project Title
LTRC Project No. ???
SIO NUMBER No. ???

Dear ???,

Please be notified by this memorandum that the services performed for the Department under the captioned project as set forth in the contract/task order dated ??? between you and the Department of Transportation and Development has been satisfactorily completed and accepted by the Department. The necessary services under this contract/task order are complete.

Sincerely,

Harold R. Paul, P.E.
Director, LTRC

Project Manager
Project Files
# Appendix O - Project Evaluation Form

## Louisiana Transportation Research Center

### Project Evaluation Form

<table>
<thead>
<tr>
<th>LTRC Project No.</th>
<th>S10 No.</th>
<th>Completed by:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Research Project Title</th>
<th>PI Institution:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Co-Principal Investigators (if any):</th>
</tr>
</thead>
</table>

The purpose of this form is to identify the strengths and weaknesses in the performance of the research project. Please be as objective as possible when completing the form as the information will assist LTRC in improving the project management process. A rating of 1 or 5 must include comments justifying the selection.

<table>
<thead>
<tr>
<th>Poor - Satisfactory - Excellent</th>
</tr>
</thead>
</table>

1. Were the overall project objectives met?  
   Comments:  
   1 __ 2 __ 3 __ 4 __ 5 __

2. Was the research team responsive to requests/inquiries from the project manager/PRC?  
   Comments:  
   1 __ 2 __ 3 __ 4 __ 5 __

3. Were the fiscal year project expenditures in line with the expenditures projected in the AWP and biannual reports?  
   Comments:  
   1 __ 2 __ 3 __ 4 __ 5 __

4. Was the project completed on schedule?  
   Comments:  
   1 __ 2 __ 3 __ 4 __ 5 __

5. Were the deliverables (bi-annual reports, task reports, final report, etc) submitted in a timely manner?  
   Comments:  
   1 __ 2 __ 3 __ 4 __ 5 __

6. Was the final report thorough and technically correct?  
   Comments:  
   1 __ 2 __ 3 __ 4 __ 5 __

7. Was the final report delivered in an editorially acceptable form?  
   Comments:  
   1 __ 2 __ 3 __ 4 __ 5 __

8. Would you consider the PI for future work?  
   Comments:  
   1 __ 2 __ 3 __ 4 __ 5 __

Other comments about the project that might be helpful?  
   Comments:  

96
22.1 Final Reports

LTRC Publication Guidelines

Publication Basics
A research study is not complete until the results have been published. Communicating research results in an accurate, logical report is just as important as the research itself. This document is probably the only way in which recognition of the researcher’s work can be achieved, and a permanent record of those achievements can be established. This guide presents some of the requirements for writing interim and final reports and provides solid information for the creation of all written materials to be published by LTRC.

Organization
Research reports are written to serve as a basis of decision and action. The expert opinion of the report writer is therefore required in the form of recommendations; these recommendations should be the core of the report. It is then important that the whole report be put together to contribute to the single end of giving weight to the recommendations.

Creating a good written report involves these five main steps:

1. Preliminary analysis
2. Assembling data
3. Organizing data
4. Effective writing

The fact that three of these steps occur before the actual writing is an accurate indication of the importance of preparation and execution. The preparatory steps represent at least three-fourths of the job. If the writer thoroughly understands the research problem in advance, the actual writing will almost take care of itself. While the form and content of the research report is fairly defined, all good writing conforms to the basic structure of introduction, exposition, and resolution. The following are some references that you will find useful in your writing:


Preliminary Analysis
The first step in writing is to identify exactly what you hope to accomplish, or what your purpose is. If you are writing a report, this question will already have been answered by the research study proposal. Then ask yourself what the chief components of the problem are. Remember that no part of the preliminary analysis—the statement of purpose, scope, or plan of procedure—is necessarily final. In the course of the investigation, you must always expect the unexpected, and when it arrives, you may have to change your course accordingly.
**Assembling Data**
The work of assembling data will vary with the type of report. For any study, the preliminary assembling of data will consist of a literature search.

To gather information, you can begin at the library home page at http://www.ltrc.lsu.edu/library.htm. Here you can contact the LTRC librarian by utilizing the “Chat with Library” function and access the library catalog. LTRC also offers a “Research Links” page at http://www.ltrc.lsu.edu/library-research-links.html, which lists resources and databases available for research. As LTRC subscribes to new services, they will be listed on this page, ensuring correct and current information.

Additional resources in addition to LTRC:
TRIS ONLINE/NTL Integrated Search: http://ntlsearch.bts.gov/tris/index.do
TRB Research In Progress: http://rip.trb.org/

Once the literature search is accomplished, the next step is to begin on a laboratory and/or field investigation according to the proposed work plan. Although this collection of data will follow the proposed work plan, it may be necessary to change this pattern during the course of the investigation. For example, it may become necessary to make a statistical evaluation of a certain phase of the study. In this case, it will be almost mandatory to revise the pattern of data collected. In general, data accumulation will depend on the type of methods of analysis (statistical, graphical, empirical, etc.).

**Organizing Data**
Once the collection of information is complete, it’s time to bring order to the process. In organizing data, a sense of relative values is fundamental. What facts are the most significant? What is their significance? It is not easy to set aside facts and statistics, which have been laboriously obtained, simply because they obscure the view of more important matters. But unless this cutting is done, the people for whom the report is intended will not be able to understand it.

Arrange the facts coherently and in order of significance. You should be guided by the reader’s point of view. What does he want to know, and how can it be presented for his clearest understanding? Very few authors are experienced or talented enough to write a cohesive report without making a preliminary outline. Even something as basic as the list of the 20 parts of a report presented on page 14 brings direction and order to the process of writing. You are strongly encouraged to assemble your writing based on a comprehensive outline of the information that can be found on page 14.

**Effective Writing**
The qualities of style essential to a well-written report are correctness, clarity, and conciseness.

*Correctness* is attained principally by using words correctly. Choose words with care, and consider all the implications of your choice to ensure that you are conveying your intended meaning.

*Clarity* is writing that is easy to understand with a lack of insignificance. It reduces confusion and gives a clear expression—be clear and to the point.
Conciseness is expressing or covering a great deal in only a few words. It’s being brief in form but thorough in scope. Never say in three words what could be stated with one.

Correctness
Punctuation. Punctuate correctly. Reference later parts of this manual or consult a style manual if in doubt. Parts of this guide are derived from the United States Government Printing Office Style Manual and other style manuals generally accepted as authoritative by publishers, such as the Chicago Manual of Style and the Franklin Convey Style Guide.

Style. To achieve uniformity and consistency in publications, the LTRC editorial staff uses certain standard reference works for guidance. In matters of spelling, definition, and compounding of words, Webster’s Third International Dictionary (Unabridged) is generally followed. Published standards of scholarly organizations are accepted in questions of usage of technical terms. For technical and engineering usage, refer to the McGraw Hill Dictionary of Scientific and Technical Terms and the Wiley Dictionary of Civil Engineering and Constructions. Other matters of style and usage are based on published documents that are widely accepted as authoritative (e.g., Chicago Manual of Style and United States Government Printing Office Style Manual).

Clarity
Your Audience. Keep in mind the requirements of the prospective reader. Your reader may not be interested in specific details or may only be interested in specific aspects of your research. In either case, including all raw data is not necessary or desirable. It can be filed and made available to support your findings if questions arise.

Sentences. Write short sentences. Twenty words are about the average sentence length for business and technical writing. Each sentence should contain one complete thought. Also, try to use a variety of sentence types and lengths to keep the reader interested.

Paragraphs. Paragraphs should represent logical divisions of the subject matter. There should always be a good reason for putting a group of sentences in a particular order. Use connectives (since, although, etc.), connective adverbs (however, nevertheless, moreover, etc.), and transitional phrases (on the other hand, in the next place, in addition to, etc.) to create flow between sentences within paragraphs.

Sequence. The report must be in logical order. (This is where an outline is essential.) Every sentence and paragraph must logically follow the preceding one. Logic is the guide that readers will use to follow the writer’s thoughts. Without it, the reader will quickly lose interest in the writing.

Conciseness
Avoid verbosity. Ideally, the report should be less than 100 pages. It is not necessary to include all the raw data, although, it is necessary to write out the first draft of a report completely. However, any good writer knows that disciplined pruning is always necessary to eliminate the repetition of words and thoughts. The secret of good writing is to strip every sentence to its cleanest components. Cut out every long word that could be a short word, every adverb that carries the same meaning as the verb, and
every unnecessary sentence and paragraph. Your writing will be more forceful by virtue of what is left out.

*Use Strong Verbs.* In order to shorten sentences and express direct messages, try to avoid simple verbs, such as is, are, was, were, can, could, has, had, have, do, did, done, make, use, come, etc. While these are commonly used verbs necessary to communicate, they are sometimes used too often making sentences wordy and overall weak.

Avoid: It can be seen in Figure 2 how the structure behaves under pressure.

Use: Figure 2 shows how the structure behaves under pressure.

*Avoid False Subjects.* False subjects tend to make sentences longer and often mask the sentence’s true subject. Eliminate terms such as “it is” or “there are” to be more concise.

Avoid: It is observed that the predicted values were comparable with the measured values.

Use: Investigators observed that the predicted values were comparable with the measured values.

Avoid: There are two dogs in the car. Use: Two dogs are in the car.

*Use the active voice.* Active voice is generally more precise and less wordy than the passive voice. The active voice takes the form of “A does B”; the passive takes the form of “B is done [by A].”

Readers prefer active sentences. In active sentences, the actor (the subject) comes before the action (the verb); the sentence is shorter, more forceful, and more confident:

Passive: The test equipment will be monitored by scientists.

Active: Scientists will monitor the test equipment

Passive voice can be used when you don’t want the subject or actor to be known or if you are unsure:

The failure happened because the sand was not loaded properly.

Passive voice is acceptable when you need to make a smooth transition. Sometimes, in order for readers to grasp concepts, keywords from separate sentences need to be close together:

To estimate the $M_r$, state agencies used different approaches. One of these approaches is the use of empirical correlations with physical properties of tested soils.

Make sentences active by restricting the sentence and turning the clause around:

Passive: The results are outlined in Figure 5.
Active: Figure 5 outlines the results.
Passive: Specifications were provided by design engineers.
Active: Design engineers provided specifications.

Change the verb to make a sentence active:

Passive: The results were achieved after the second attempt.
Active: The results occurred after the second attempt.

Avoid jargon. Jargon is the bane of too much writing There are two types of jargon: technical terms and obscure, pretentious language marked by long words and redundancy. Technical terminology is sometimes difficult to avoid. If such terminology is known by all of your intended readers, then there is no problem. However, if such terms may not be known to any part of your potential audience, then they should be defined the first time they are used. The second type of jargon—inflated, pretentious language—should always be avoided.

Editing
Once you complete the report and technical standard page and have it edited by an outside source first, you will submit the entire document to your project manager. It is strongly encouraged to include an editorial review in the budget and timeline to be used prior to submittal of the draft report to LTRC. From there, your project manager will submit an electronic copy and a hard copy to be edited by LTRC’s publication staff.

To reduce the number of edits, authors should detailed and precise in correcting the edits made. This will result in quick editing, and the report will get prepped for final production faster.

Look for these proofreading symbols throughout your report to understand what changes need to made:

Proofreading Symbols Meaning

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>^</td>
<td>insert</td>
</tr>
<tr>
<td>^</td>
<td>insert a comma</td>
</tr>
<tr>
<td>¶</td>
<td>begin a new paragraph</td>
</tr>
<tr>
<td>¬¶</td>
<td>do not begin a new paragraph</td>
</tr>
<tr>
<td>.</td>
<td>add a period here</td>
</tr>
<tr>
<td>_</td>
<td>Delete</td>
</tr>
<tr>
<td>strikeout</td>
<td>Delete work or phrase</td>
</tr>
<tr>
<td>^</td>
<td>insert a hyphen</td>
</tr>
<tr>
<td>^</td>
<td>insert a dash</td>
</tr>
<tr>
<td>–</td>
<td>make upper case</td>
</tr>
<tr>
<td>/</td>
<td>make lower case</td>
</tr>
<tr>
<td>∪</td>
<td>reverse these items</td>
</tr>
<tr>
<td>→</td>
<td>close up a space</td>
</tr>
<tr>
<td>⊇</td>
<td>Insert a space</td>
</tr>
<tr>
<td>SP</td>
<td>spelling</td>
</tr>
</tbody>
</table>
It is the writer’s responsibility to present LTRC with a final copy of the report, typed in the most current template version found at http://www.ltrc.lsu.edu/publications.html, and produced with a high quality printer on good quality paper. In addition to submitting a hard copy, an electronic copy must also be submitted.

**Basics before Beginning**

**Spacing, Size, and Margins**
- Line spacing on a final copy should be 1.25 spaces.
- Margins should be 1.25 inch on the inside margin, one inch on all other sides.
- After every sentence, there should be one space. This also includes after a period, colon, question mark, an exclamation point, or closing quotation marks.
- Double space between paragraphs.
- The type in tables or figure should be clearly legible and no smaller than 11-point.
- For body text, use 12-point serif font Times New Roman.
- Submit all materials on single-sided, 8 1/2 x 11-inch white paper.

**Justification**
All body text should be left-justified to prevent extra spacing caused by other justifications.

**Page Numbering**
Page numbers have already been preset on LTRC’s Word template but for additional use and understanding:

- Page numbers should be 3/8 inch from the bottom of the page located at the outside bottom corner of the page. Remember that document pages will be printed on the front and back side.

- The page number for an odd numbered page should be on the right-hand side of the page, meaning that the page will appear on the front

- The page number for an even numbered page should be on the left-hand side of the page, meaning that the page will appear on the back

This is very important because the 20 parts of the report listed on page 14 should fall on a right hand page (front page) and should be given odd numbers. If this does not happen naturally, a blank page must be inserted (see next section on how to insert a blank page), so the new section will begin on an odd numbered (front) page.

Each page throughout the report is to be numbered except for the following:

- Technical Report Standard Page
- Project Review Committee Page
• Title Page (p. 1)
• Introduction (p. 1)
• Blank sheets
• Heading pages for appendices

Use small, italic Roman numerals (ii, iii, iv, etc.) for all pages up to the Introduction. Use italic, Arabic numerals (2, 3, 4, etc.) for the body of the report beginning with the Objective as page 3 (since the Introduction is page 1 but not numbered).

Page numbers should be clearly separated from the text or any illustrations, figures, etc.

**Element Headings**
Start each major element (items 1 through 20 on page 14) on a separate right-hand page as noted in the previous section.

Headings for the *first-level head* (major element headings) should be centered and typed in bold and upper cased followed by a double space.

The *second-level head* should also be centered, typed in bold, and all major words should begin with a capital letter followed by a double space.

The *third-level head* (section headings) should be left-justified and typed in bold with all major words beginning with a capital letter followed by the text on the next line.

*Fourth level headings* (paragraph headings) should be indented, typed in bold with all major words beginning with a capital letter followed by a period with paragraph text on the same line.

If an extra level of heading is needed within a major element, the highest level heading within the element should be centered and typed in bold using upper and lower case letters.

The proper format for headings follows:

**FIRST-LEVEL HEAD**

*(upper case, boldface, centered at top of an odd numbered page—double spaced after)*

**Second-Level Head**

*(first letter capitals, boldface, centered on separate line—double spaced after)*

**Third-Level Head**

*(first letter capitals, boldface, flush left, on separate line—start text on next line)*

**Fourth-Level Head** *(first letter capitals, indented, boldface, followed by a period—paragraph text immediately following on the same line)*
Example on the following page using the four heading levels:
1 Major element heading
2 Major section heading
3 Section heading
4 Paragraph heading
1 METHODOLOGY

2 Data Collection

3 Topographic Data
The topographic data used as input to the numerical calculations was based upon USGS quad sheets...

4 Land Topographic Data. The land topographic data was primarily based upon using 7.5 ft. and 15 ft. USG Squad sheets....

4 Inland and Offshore Bathymetric Data. The inland and offshore bathymetric data was based on....

3 Barrier and River Data
Barriers and rivers which occur in the coastal zone have a controlling influence on flood levels.

2 Surge Simulation Model

The overland flooding model used in the study has been developed by the Federal Emergency Management Agency....

3 Grids and Input Files
The offshore and inland grids were based on the Lambert Plane Coordinates (southern grid). The offshore grids....
Equations
Number the equations in order, beginning to end. Fractions in displayed equations should be stacked, in accordance with preferred mathematical practice. When creating an equation in the text, the equation should be indented and the equation number should be placed flush right on the same line as the equation. This serves as a reference point for that equation when it is used again in the text. Number all displayed equations with Arabic numerals in parentheses.

Note: when you want to reference an equation that has been previously mentioned in the text, be sure to reference it with the parenthesis around it, e.g., “...see equation (44).”

Next, if you need to define the variables of the equation, make sure the word “where” is lower cased, followed by a comma, and then by a series of definitions or explanations. This can either be in list or paragraph format separated by commas or semicolons if needed.

**Example of possible formats:**

**List Format:**

\[ M_r = 2.12 + 3.44 \text{qc} + 63.15 \text{fs} \quad (7) \]

where, 
\( M_r \) = resilient modulus (ksi), \( \text{qc} \) = tip resistance (ksi), and \( \text{fs} \) = sleeve friction (ksi).

**Paragraph Format:**

\[ M_r = 2.12 + 3.44 \text{qc} + 63.15 \text{fs} \quad (7) \]

where, \( M_r \) equals resilient modulus (ksi), \( \text{qc} \) equals tip resistance (ksi), and \( \text{fs} \) equals sleeve friction (ksi).

**Putting Together the Report**
The following list contains all the required elements in proper sequence for an interim or final report acceptable to LTRC. For consistency, each part of the report must be titled accordingly in the listed order. Any deviations from this format must have the approval of the LTRC group manager and the publications and electronic media development program manager.

2. Project Review Committee
3. Title Page
4. Abstract
5. Acknowledgments (optional)
6. Implementation Statement
7. Table of Contents
8. List of Tables
9. List of Figures
10. Introduction
11. Objective
12. Scope
13. Methodology
14. Discussion of Results
15. Conclusions
16. Recommendations
17. List of Acronyms/Abbreviations/Symbols
18. References
19. Glossary (optional)
20. Appendix (optional)

**Authoring Templates**

Authors are required to format their reports with the LTRC Word template found at http://www.ltrc.lsu.edu/publications.html. This tool makes it possible to automatically label headings, paragraphs, figure and table captions, and other elements. LTRC’s Web site also includes the most up-to-date information regarding editorial procedures.


This form will be furnished by LTRC for insertion in all interim and final reports and is included in the LTRC report template as the first page. To download the template, go to http://www.ltrc.lsu.edu/publications.html. Contract researchers are required to complete the entire page as well as the abstract (part 16) and key words (part 17). The length of the abstract should not exceed that space provided on the form and will largely be the same as that information appearing in the Abstract portion of the report.

**2. Project Review Committee**

Reports submitted for publication are reviewed and recommended for publication by the Project Review Committee (PRC). The final publication decision is made by LTRC on the basis of the committee recommendation. To view the official proposal rating form, go to LTRC’s Publication Web page at http://www.ltrc.lsu.edu/publications.html. The PRC page is prepared by the project manager after the publication decision is made.

**Report Review Criteria**

- The text should be written in simple, concise, and effective language
- The content of the report should be new or original, deal with issues that are timely, and have lasting value
- Coverage of the subject should be complete, well organized, and supported by understandable and useful tables, figures, and references
- Data presented must be valid, and research methods described should be appropriate to the studies reported
Conclusions should be valid, appropriate, and properly supported

The report must be useful to practitioners, researchers, or both

Generic names of products and equipment should be used unless the author considers the trade names or manufacturers’ names essential to the purpose of the report

3. Title Page
Include the study title, authors, affiliation or department, type of report, project and report numbers, conducting research agencies, month and year of publication, and a standard disclaimer statement. Note that this page is counted as page i, but the number does not appear on the page.

The disclaimer statement appears on the lower portion of the title page, just before the date of publication.

Authors’ Names and Affiliations
The names and current affiliations of all authors should be listed on the title page. If the research was performed while the author had another affiliation and the author wishes that affiliation listed in addition to the current one, the author should note that both affiliations are to be used.

4. Abstract
The abstract should be as brief as possible and include:
• the principal objectives and scope of the investigation
• a brief description of the methodology employed
• a summary of the results or findings

A well-prepared abstract enables readers to identify the basic content of the report quickly and accurately, determine its relevance to their interests, and to decide whether they need to read the report in its entirety. When writing the abstract, remember it may be the only section read and should be self-contained. It should contain no bibliographic, figure, or table references.

The Abstract is the first page that will have a number on it, which is iii. It will be located on the bottom right hand of the page.

5. Acknowledgments
Significant contributions by personnel not directly responsible for the study may be acknowledged. The support and direction of the Project Review Committee may be acknowledged and the names of committee members listed. This portion of the report is optional.

When listing the names of those whom you wish to acknowledge, only professional and academic titles are acceptable (Dr. Smith). Social titles (Mr., Mrs., Ms.) are not appropriate.
Research Sponsorship
Authors of reports that report results of research sponsored directly or indirectly by federal programs should indicate this sponsorship in the Acknowledgments section.

6. Implementation Statement
The implementation statement describes the manner in which the results of the investigation may be implemented and what value they might have in application.

7. Table of Contents
The table of contents lists, in the order in which they appear, the divisions and subdivisions of the report. It may be nothing more than the main headings, roughly equivalent to the chapter headings of a book. Major headings should be upper cased while all other headings, with the exception of figures and tables, should have all major words in the title capitalized. Headings should appear exactly how they are within the text:

- OBJECTIVE...........................................................................................................................................................................3
- SCOPE....................................................................................................................................................................................5
- METHODOLOGY.......................................................................................................................................................................7
- Data Collection.........................................................................................................................................................................7
- Topographic Data......................................................................................................................................................................7

8. List of Tables
This part of the report may be omitted when the number of tables is fewer than five.

Using Tables in the Report
Tables should supplement, not duplicate, the text. Use the following guidelines in preparing tables for publication:

1. Number tables consecutively in the order first cited in text, using Arabic numerals. Reference must be made to each table by number at the appropriate place in the text.

2. Tables must duplicate LTRC style as closely as possible.
   a. All tabular material should be single spaced.
   b. Table captions should be typed in bold and centered above the table with only the first letter capitalized.
   c. The table title is placed on the line below the table number.
   d. The word “table” is spelled out and capitalized when referring to it in text.

3. A period should not follow a table title. Within the table itself, all fonts and font sizes should be consistent with the report’s style.

4. Give each column in the table a head. [In some cases, the first (stub) column may have no head.] All heads should be aligned in flush left format.
5. Insert a full-width rule at the end of the table (and above the footnotes, if any).

6. Use lower case italic superscript letters for footnotes.

7. Check the accuracy of all totals included in tables before submitting report.

8. For use of measurements, see abbreviations section on pp. 25-26. The size of type in a table should be no smaller than 11-point. Actual measurement symbols and signs may be used for tables ( %, ″, etc.)

Example of correct table layout:

<table>
<thead>
<tr>
<th>Load Condition</th>
<th>Approach Angles, degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Unusual</td>
<td>10 – 20</td>
</tr>
<tr>
<td>Extreme</td>
<td>20 – 35</td>
</tr>
</tbody>
</table>

Note: After establishing the title for the table on one line, be sure to separate the heading and Table number into two lines by holding down the Shift key and Enter key simultaneously. This will break up the text on two lines, and when you update the link in the List of Tables, the entire title will appear on one line next to the table number.

9. **List of Figures**
This part of the report may also be omitted if the number of figures is fewer than five.

**Using Figures in the Report**
Use the following guidelines in preparing figures for publication:

1. Give each figure a caption. If a figure contains several parts (a, b, c, etc.), cite each part in the caption and label each corresponding part on the figure using the same size type as that in the rest of the figure.

2. Figure captions should be typed in bold and centered below the figure box with only the first letter capitalized. Use the figure number and a title below it with no additional explanation.

3. Number figures consecutively in the order first cited in text using Arabic numerals; text references of figures should be by those numbers (see figure 5). Never should a figure be referred to as “the figure opposite” or “the photograph on this page.” The exigencies of typing may rule out that placement and then the reference would be wrong.
4. LTRC requires that published figures be clear and legible. The type in published figures must not be less than 11-point. In addition, letters, symbols, and line weights must be uniform and the same size throughout the figure (i.e., if wording on the ordinate and abscissa is in 11-point type, symbols used to identify data points also should be in 11-point type). Figures must never be more than one page long.

5. The word “figure” is spelled out and capitalized when you refer to it within the text: “Figure 1 shows...” or “…see Figure 8.”

6. For oversized figures, use 3/4-inch margins on the left and 1/2-inch on other sides. The figure box as well as the caption must be included within that area.

7. If a table, figure, or illustration appears on the same page with straight copy, it should be centered horizontally within the established margins and should be set off by at least three blank lines from the copy above and below. If these items appear on a page by themselves, they should be centered horizontally and vertically within the page margins.

8. If you are using a figure or table, refer the reader to it before explaining it in the text. If the graphic is important to the explanation, place it next to the explanation. If not, place it in the Appendix. Illustrations, figures, or tables appearing in an appendix or separate section of a report should follow the same placement guidelines. Do not violate established margins used in the text.

9. Be sure to hold the Shift key down while enlarging illustrations and pictures in the body copy to prevent unnecessary stretching.

Example of correct figure layout:

![Figure 1](Image)

**Figure 1**
Stress-strain relationship for Duocel
Note: After establishing the title for the figure on one line, be sure to separate the heading and Figure number into two lines by holding down the Shift key and Enter key simultaneously. This will break up the text on two lines, and when you update the link in the List of Figures, the entire title will appear on one line next to the figure number.

10. Introduction
The introduction is not only desirable, but necessary. Its purpose is to supply sufficient background information to allow readers to understand and evaluate the results of the present study without referring to previous publications on the topic. Remember: this page should be considered page 1 even though no numbering should appear on it. The introduction should briefly and clearly state your purpose in conducting the study.

A good introduction:
- presents the nature and scope of the problem and what prompted the investigation
- reviews the pertinent literature and any earlier work that has a bearing on the present study
- presents any other pertinent information that must be understood before the questions under study can be approached

11. Objective
The objective of the report should be a clear, concise, and comprehensive description of the goals of the research study. The objective may be provided by the Project Review Committee (PRC) or the Request for Proposals (RFP). Additions or changes to the original objectives should be included.

12. Scope
The scope should not be confused with the objective. The objective defines the goal to be attained; the scope determines the boundaries of the ground to be covered. It governs the degree of comprehensiveness to be adopted and the consequent scale of the report. It also rules out irrelevant items. In other words, the scope answers the questions of what should be put in and what should be left out.

13. Methodology
The reader of the report may place a greater confidence in its conclusions if he knows how they were reached. Hence, a brief and definite statement of the nature of the study is essential. The methodology should include a description of materials, apparatus or equipment, treatment of data (whether computer, statistical, or mathematical), standard sampling and test methods, and so forth and can be presented in chronological order. Standardized test procedures should be referenced but not described. Variations from standard procedures should also be explained.

14. Discussion of Results
This element is as difficult as it is crucial. It is the core of the report since it is the basis from which conclusions are drawn. It is imperative that the evidence be organized and presented so the reader can follow the reasoning, step by step, to the writer’s conclusions. This element of the report should present a comprehensive analysis of the entire problem.
When writing it, keep in mind logical order, interdependence of parts, relative importance of parts, emphasis, and sequence. Processed data and data summaries in either graphic or tabular form are desirable. Raw data should only be included if absolutely essential and then should appear in the Appendix.

15. Conclusions
The findings of the investigation are presented in the order of their importance with the most important first. Conclusions must be drawn from unquestionable premises and be based on adequate data. They must agree in every respect with the details presented in the preceding pages. If the conclusions are made on the basis of limited materials, equipment, etc., then a statement to that effect must be made.

16. Recommendations
Sometimes this may be part of Conclusions. However, it is best to separate this element whenever feasible. It should include any future course of action that may be or should be taken to confirm the findings. This may involve either field evaluation of materials and/or equipment or cost analysis and savings in cost. In general, recommendations should be made concerning the integration of the findings by their inclusion into specifications, standards, procedures, methods, or techniques.

17. List of Acronyms, Abbreviations, & Symbols
In this section, list and define all abbreviations, acronyms, and symbols used in the report in alphabetical order.

The Use of Acronyms in the Report
*Do not use obscure abbreviations.* Abbreviations, acronyms, and symbols must be fully defined the first time they are used in the report; the definition should be given first, followed by the abbreviated term in parentheses.

Example:

> According to the Federal Highway Administration (FHWA)... The FHWA report said...

Once you define an acronym, it can be used throughout the rest of the report, including titles or headings.

The Use of Abbreviations in the Report
Abbreviations allow writers to avoid unnecessary repetition and are particularly useful in limited space, such as in lists, tables, charts, graphs, etc.

1. Common units of measure such as feet, inches, millimeters, pounds, etc., should be spelled out in the body of the text unless it is preceded by a number (e.g., 3 in.):

   Investigators measured valves in inches. The valve’s diameter is 3 in.

2. When abbreviating, keep in mind that most abbreviations are the same when singular and plural:
30 ft. and 1 ft.
13 cm and 1 cm

3. Avoid using the symbol form of abbreviations (with the exception of tables and figures):

   12 percent (not 12%)
   3 ft. (not 3’)
   56 in. (not 56”)

4. However, when speaking of temperature, it is proper to use the degree symbol followed by an “F” for Fahrenheit or a “C” for Centigrade:

   125°F    32°C

5. There should be one space before and after any abbreviation or symbol:

   The truck was 30 ft. wide and 5 ft. tall.
   The probability associated with the F-test is designated as Pr > F. The temperature was 76 °C.

6. Units used for the reporting of data shall be English units, followed by equivalent metric SI units in parenthesis if necessary.

   The spans are 320 ft. (100 m) long.

Here are some commonly units and their proper abbreviations (pay attention to the use of periods):

   English Units
   Length:
   Inch(es).................in.
   Foot/feet...............ft.
   Yard....................yd.
   Rod........................rd.
   Mile.....................mi.

   Area:
   Square inch............sq. in. or in²
   Square foot............sq. ft. or ft²
   Square yard............sq. yd. or yd²
   Square rod...............sq. rd. or rd²
   Square mile............sq. mi. or mi²
Volume:
Cubic inch..........................in$^3$
Cubic foot..........................ft$^3$
Cubic yard..........................yd$^3$
Cubic Meter(s)..................m$^3$
Cubic Millimeter(s)........mm$^3$
Liters.............................L

SI fundamental units:
Meter...............................m
Kilometers........................km
Kilogram.........................kg
Second.............................s
Ampere.......................A
Kelvin...........................K
Mole.............................mol
Newtons.........................N
Grams............................g

Pressure:
Pound..............................lb.
Pound force......................lbf
Pound force per square inch.....psi
Kilopound per square..........ksi
Pound per square foot.........psf
Kilopounds per square foot.....ksf

Density:
Pound per cubic foot.........pcf

The Use of Symbols in Report
Carefully distinguish the following:
All capital and lower case letters
Capital O, lower case o, and 0 (zero)
Lower case l (el) and number 1 (one)
Letter X and multiplication sign x
Prime ’, apostrophe ‘, and superscript $^1$

English and Greek letters:
B and ß,
u and µ
18. References
Because the research report usually involves a great amount of reading and studying, this element is especially important. A full list of references cited should be given at the end of the report. It is necessary that each numbered reference in this section correspond to the designated number (in brackets and italicized) in the body of the report.

1. Be sure that references are complete. Include the names of corporate or personal authors or editors; title of article, chapter, book, or report; publisher or issuing agency; location of publisher and year of publication; volume and issue or report number; and page numbers.

2. References to unpublished papers presented at meetings should include name(s) of author(s); title of paper; and title, sponsor(s), location, and date(s) of meeting.

3. References to program manuals, tapes, or other documentation for models should refer to the specific edition being cited and should list the specific department within an agency that has responsibility for the model’s continuing use and development (e.g., “Interactive Transit Assignment Model. UTPS tape. Office of Planning Methods and Support, Federal Transit Administration”).

If a reference has no date, use “undated.”

In the list of references, use the number and a period then proceed to use the following style for the contents of the reference:

Author’s last name first, followed by initials. In case of multiple authors, put each last name first, followed by the initial. Multiple authors’ names should be separated by a semicolon.

- Title of article, book, or report
- Volume and issue or report number
- Publisher or issuing agency
- City and date of publication (this is the proper place to put the year, not with the title)
- Page numbers
- NTIS data (optional)

Detailed reference style instructions are available on request from the editorial staff. The following examples illustrate the basic LTRC style for references:

TRB Publications

Book
Article in Journal or Other Periodical

Government Report

Other Irregular Publications (Reports, Theses, Dissertations, etc.)

Web Page

Using References in Report
References should be numbered in the reference list in the order in which they appear in the text. Denote a reference at the appropriate place in the text by an italic Arabic numeral in italicized brackets, placed at the end of the sentence before the period, e.g., [2]. For more than one reference, use separate brackets with a comma in between.

Example:
Transportation control measures are used to reduce mobile source emissions [1], [2], [3].

Do not cite as a reference unpublished material, personal communications, telephone conversations, or similar material that would not be available to readers in printed form in a library or from the originating agency. Instead, cite the unpublished work in the text and enclose the author’s name along with the term “unpublished data” in parentheses. Double-space between references on the list. Do not repeat a reference in the list, and do not use ibid., idem., op. cit., or loc. cit.

If a reference is cited more than one time in the text, repeat the number first assigned to the reference.

Footnotes
Do not use footnotes in the text. Incorporate such notes within the text, or delete the notes entirely. Footnotes are only acceptable when contained in tables or figures.

Clearances and Copyrighted Material
Authors must assume full responsibility for securing any necessary clearances and written permissions for publication from any contracting or supervisory agencies involved in the research or from holders of copyrights on material used in the report. All contributions to the work must be properly acknowledged.
When a report that contains previously copyrighted material, authors must obtain written permission from the copyright holder(s) to publish the material.

20. Appendix (optional)
All data which cannot be worked into the body of the report without interrupting the thought, or are too technical, are put in the appendix. Any reproduced materials must be of excellent quality and immediately relevant to the content of the report. Writers may not include copyrighted material (book or magazine excerpts) without the express written permission of the author.

Include pertinent material in the report itself or, where necessary, include a note stating that background material, such as derivation of formulas, specifications, or survey forms, is available in the Appendix. Every attempt should be made to limit information to one appendix.

Appendices
Having more than one appendix is acceptable only in cases where vast amounts of data or corollary information are to be included. Photocopies of books, articles appearing in other publications, faxes, or copyrighted material are not acceptable. All information presented must be clean and legible originals.

LTRC Publications and Electronic Media Office
Authors are welcome to contact the LTRC Publications and Electronic Media Office (225.767.9150) at any time regarding publication specifications, reference lists, and related matters. Note: Reports that do not conform to the specifications in this guide are subject to delay in publication pending return of the report to the author(s) for revision or completion.

Executive Summaries
Executive summaries are at the discretion of the project manager depending on the size of the final report. Because executive summaries will be the primary printed piece, they will reflect the most important elements of the final report and should include most parts of the report (e.g., Objective, Introduction, Methodology, etc.). However, executive summaries should omit the Appendix because it will appear on a CD with the final report.

Formatting rules for executive summaries will follow those of final reports. Tables and figures should be included only if they are essential to the content of the executive summary. Since the executive summary is a condensed version of the final report, the page limit should not exceed 75 pages.

Additional information on executive summaries:
- The principal investigator must use final report template available online at http://www.ltrc.lsu.edu/publications.html to create the executive summary.
- The principal investigator is responsible for generating the executive summary and carrying out the necessary edits until completion.
- A final report will still be published with an executive summary, but it will be limited in distribution (e.g., LTRC staff, state library copies, DOTD chief engineer, etc).
• A CD included with an executive summary will include the complete final report.

Common Errors
In any writing, there are certain areas that seem to plague the average writer. These errors, while common, are nonetheless incorrect and are frequently based on erroneous information or a reluctance to double check the rules. What follows are the most frequently committed grammatical errors or problems encountered by the editorial staff of LTRC. It is by no means a comprehensive list but is provided to help you avoid simple mistakes that hinder the publication process and to make your writing the best it can be.

Agreement
Agreement is a standard rule in any form of writing. By having sentence agreement, it means that subjects (nouns or pronouns) should agree in number with the sentence verbs.

The report is finished. (Not the plural are finished)
He was the engineer who designed the bridge. (Not the plural he were)

Capitalization
Capitalize directions when referring to a specific region:

South Louisiana the Midwest
the North

Do not capitalize if referring to a direction or a general area:

eastern Mississippi
south of the border
toward the north

Capitalize main words in headings and subheadings as well as titles of books, articles, and other documents. However, articles (a, an, the), coordinate conjunctions (and, but, or, nor, for, so, yet) or short prepositions (to, of) do not get capitalized unless they appear as the first word.

When referring to parts of your report, capitalize the first letter (e.g., see Appendix).

Civil, military, religious, and professional titles are capitalized when immediately preceding a personal name and are used as part of the name (sometimes replacing the title holder’s first name). Titles are normally lower cased when following a name or used in place of a name.

Governor Jindal
Kip Holden, the mayor of Baton Rouge,... Amy Stevens, who is a psychologist,...
Colons
Colons, unlike periods, commas, and semicolons, do not indicate a stop. Instead, colons indicate that a list or related thoughts will follow.

Example 1:
The following conclusions can be drawn from research results obtained in this project:
• Clusters of two or more FRP piles are capable of providing adequate sideways protection for the low and medium energy performance levels.
• Pier mounted elastic spring fenders are not practical for high energy head-on impact.
• Inelastic energy absorbing fenders are well suited for use as pier-mounted crash cushions.

Example 2:
The focus of the effort is to identify or propose fender systems that are: (1) modular, (2) easily installed or replaced, and (3) suitable for retrofitting existing bridges or for use in new construction.

Commas
Some writers seem to think sprinkling commas every few words is a good rule, but it makes for difficult reading. A few rules on how to use commas:

1. Use a comma to join two independent clauses with these conjunctions: and, but, or, for, nor, so, yet.

   The experiments were recently concluded, but their results have not yet been published.

2. Use a comma when joining a dependent clause and independent clause.

   After such a collision, one expects that both the fender and the barge will suffer extensive damage.

3. A comma is needed to set off a phrase that cannot stand alone as a sentence. Use the comma only if there is a phrase such as “But, to be fair, she did get it done on time.”

4. Do not use a comma between a month and year in a date: not November, 1990 but November 1990. The comma stops two sets of numerals from running into one another, as in November 20, 1990.

5. The comma is preferred before the last item in a list: “the first, second, and third chapters.” Leaving it out (“the first, second and third chapters”) is a habit picked up from journalism. Omitting the final comma runs the risk of suggesting the last two items (in the example above, the second and third chapters) are a special pair.

6. Commas set off transitional words and expressions when introducing sentences or when linking together two independent clauses. Some transitions include: accordingly, consequently, for
example, for instance, further, furthermore, however, indeed, nevertheless, nonetheless, on the contrary, on the other hand, then, and thus.

They, however, cannot provide protection for head-on collisions.

The fender retracts under impact, thus it absorbs energy by action of gravity and friction.

7. Commas, similar to periods, go inside closing quotation marks. However, commas go outside parentheses or brackets.

“…Test System for Site Characterization,”
...the Louisiana Transportation Research Center (LTRC), and....

That versus Which
While that and which can sometimes be used interchangeably, there are better uses for each word.

That should be used restrictively (essential to the sentence’s meaning) to identify a particular item being talked about:

Bridge fender systems that provide acceptable collision performance should be identified.

Which is used non-restrictively (can be omitted and not lose essential meaning of the sentence) to add something about an item already identified:

Properly designed fender systems help protect bridges against catastrophic failures, which can cost millions of dollars.

Which should be used restrictively only when it is preceded by a preposition. Otherwise it is almost always preceded by a comma, a parenthesis, or a dash.

The third case in which the voids were filled with concrete were tested.

Dashes
Dashes can act as a way to set off ideas within a sentence. In this case, writers should use the em dash (—). To create an em dash, hold down the Alt+Ctrl+Num- keys together.

Hyphens, however, should be used in measurements (12-in. opening), when words modify each other (air-void), and when two or more words act together to create a new meaning (one-half, double-checked, etc.)

Data
From Latin, data is a plural noun: “The data are,” not “the data is.” The (now nearly obsolete) singular is datum.
**Italics**
The advent of word processing has enabled the individual to create a document using typesetter’s marks, previously impossible with a typewriter. Therefore, italicize any word that would conventionally be underlined; make sure to differentiate between quotes (“””) and inch marks (“”). Italics are also used for titles published works including: books, magazines, newspapers, and other works individually produced or published.

**Effect versus Affect**
Affect means “to influence” or “to have an effect on.”

Many variables can affect a vehicle’s position on narrow roadways.

Effect is usually a noun, and it means “an outcome or result.”

A parametric study is conducted to investigate the effect of using simple spring buffers.

**E.g. versus i.e.**
The abbreviation e.g. is for the Latin exempli gratia, “for example.” Whereas, the abbreviation, i.e., id est in Latin, means “that is.” They’re not interchangeable. Both abbreviations should be followed by a comma when used in text.

**It's versus Its**
There is no shortcut; all you can do is memorize the rule. It’s with an apostrophe means it is; its without an apostrophe means belonging to it. An analogue might provide a mnemonic: think of “he’s” (“he is” gets an apostrophe) and “his” (“belonging to him” doesn’t).

**Lists**
Lists are essential to technical writing. They assist the reader in making the content easier to remember and read. When creating lists, there are two types to consider: displayed lists and paragraph lists.

**Displayed Lists**
- Use a displayed list for a long series of items and any series you want to emphasize.
- Use numbers or lower case letters (followed by a period and not enclosed by parenthesis) or bullets to identify each item in a list.
- The first letter of each item should be capitalized unless the listed items complete a thought begun in the introductory sentence:

Examples:

Specifically, the objectives consisted of the following:
- Review and document....
- Investigate the impact of.....
- Examine the potential...
- Develop a recommended...
Bridge protection systems generally are approached by:

1. reducing the annual frequency of...
2. estimating the probability of...
3. reducing disruption costs of...

When introducing a list, use anticipatory words or phrases, such as the following, as follows, thus, and these, followed by a colon.

When items in the list are complete sentences, end each item in a period.

**Paragraph Lists**

1. If the list is not meant to be emphasized, and there are less than six items, list items within the paragraph.

   *Example:*

   Three different data collection methods consist of the following: (1) videotaping traffic and then analyzing with an image-sensing processor in the lab, (2) spreading sand on the pavement to measure the wheel path from the road edge, and (3) installing tubes of different lengths transversally on the roadway to measure the lateral position of vehicles.

2. Use lower case letters or numbers for each item in the list enclosed by parenthesis, e.g., (1) or (a).

3. Capitalize items only when each item is a complete sentence or if an item begins with a proper noun.

4. If the list proceeds with a preposition or a verb, there is no need for a colon to introduce the list.

   *Example:*

   The main study of the test was to (a) determine moisture unit weight, (b) discover limits, and (c) classify soils.

**Parallelism**

The most important thing to remember when creating both types of lists is that all items in the list parallel each other in structure. By beginning items with the same type of word (noun, verb, adjective, etc.), writers will ensure that their lists are parallel.

**Numbers**

The old rule about spelling out numbers less than 10 holds true for the most part, but there are some exceptions.
1. Never begin a sentence with a numeral: either spell out the number, or rewrite the sentence to move the number from the beginning.

2. Very large round numbers should be spelled out: not 1,000,000,000, but one billion. If ever you need real precision in expressing very large numbers, scientific notation might make sense.

3. Be consistent in a series of numbers. Either spell out numerals or use numerals for every member of the list:

   Avoid: “...pages two, six, 10, and 23.”
   Use: “...pages 2, 6, 10, and 23.”

4. Dates should always get numerals (e.g., October 3, 1990).

5. There is no reason to use both numerals and words for the same number. Do not use redundancies like two (2) or 12 (twelve).

6. The only time you should mix spelling and numerals is in very large numbers:

   Avoid: 8,600,000
   Use: 8.6 million

7. Use numerals for anything difficult to spell out: not four and sixteen seventeenth, thirteen thousand three hundred twenty six, or three point one four one five nine. You can, however, spell out simple fractions like one half or two thirds.

8. When numerals are followed by percentages, measurements, or are decimals, use the numeric figure:

   5 in.  .566 mm  7 percent

Proofread
You should always read over your work carefully before handing it to someone else, looking for typos, misspelled words, problems with agreement, missing words, and so on. Remember, though, proofreading is only one part of the revision process.

Semicolons
Semicolons are primarily used to link sentences and separate thoughts.

- Use a semicolon when combining two sentences that are similar in content.
- A semicolon should be used to separate items in a series when one or more commas have already been used in that series.
**Spell Check**

The spelling checkers built into most word processors leave a lot to be desired, but they’re not all bad. Spelling checkers are usually right when they tell you a word is misspelled (only names and rare words are likely to be stopped incorrectly). The problem, though, isn’t false positives, but false negatives—when the spelling checker tells you something is right when it isn’t. If you type *to* instead of *too*, the spelling checker will let it slip right through, since both are legitimate words. Typos are one thing, but if you have any question about the meaning or usage of a word, use a real dictionary, not a spelling checker. Just remember that a computerized spelling checker doesn’t absolve you from the need to proofread everything carefully.

**Quotation Marks and Punctuation**

Commas and periods go inside quotation marks, while semicolons and colons go outside, regardless of the punctuation in the original quotation. Question marks and exclamation points depend on whether the question or exclamation is part of the quotation or part of the sentence containing the quotation.

Some examples:

**Periods always go inside:**

- See the chapter entitled “The Conclusion, in which Nothing is Concluded.”

**Commas always go inside:**

- The spokesman called it “shocking,” and called immediately for a committee.

The question mark is part of the outer sentence, not the quoted part, so it goes outside:

- Have you read “Fundamental Principles of Engineering”?

The question mark is part of the quoted material, so it goes inside:

- He asked, “How are you?”

All quoted material goes in “double quotation marks”; if you need a quotation inside a quotation, use ‘single quotation marks’ (also called “inverted commas”) inside:

- “This for quotations, ‘this’ for quotations inside quotations.”

Quotations inside quotations are the only place for single quotation marks—don’t use them to highlight individual words.
22.2 Final Report Checklist

Before submitting any report for editing, please make sure the following checklist is complete:

☐ All parts of the Technical Standard page are filled in (including the correct number of pages of the report).

☐ Page numbers are italicized in Times New Roman font and are properly assigned (pp. 9-10).

☐ Line spacing of the report is 1.25 in.; all body text is left-justified (p. 9)

☐ References are at the end of sentences, in separate brackets, and italicized (p. 29).

☐ Equations are indented and equation numbers are flush right surrounded by a parenthesis; equations are correctly referenced in text (p. 13).

☐ Headings are set up correctly (pp. 10-12).

☐ Tables and figures (including captions and headings) are centered with text (pp. 18-22), table and figure numbers and headings are on separate lines, and references to tables and figures in text are capitalized.

☐ Table of Contents/List of Tables/List of Figures correspond with the correct page numbers.
22.3 **Synthesis Reports**

Following is a discussion of the principal elements of a typical published synthesis report, ordered as they should be in the published report. These instructions are part of the contract. Reports not in conformance may be returned to the author for revisions.

**Cover**
Provide high-quality art for synthesis covers, including description and picture credit.

**Title Page**
LTRC staff will create the title page for all drafts. The consultant should provide author information for this page.

**Foreword and Preface**
LTRC staff writes these.

**Table of Contents**
The table of contents should show first, second, and third headings and appendix titles and page numbers. Contents pages should be included with all drafts reports.

**Summary**
The summary is the part of the report most likely to be read by the executive audience with more interest than time to spare. We therefore expect synthesis study authors to write excellent summaries from which the lay reader can get a solid, workable picture of the report’s findings.

- No more than four pages (1,700 to 2,100 words)
- No headings
- No text boxes
- Non-technical prose

All sections should end with transition sentences that carry the thought from the previous paragraph into the following paragraph. The Summary stands alone, without the body of the report.

**Major findings of the synthesis**
Include one or two paragraphs describing the objectives and major findings of the synthesis. The opening paragraphs should be concise and to the point, written with direct and straightforward sentences. The first sentence is an opportunity to capture the readers’ immediate attention.* Readers should understand right away what this synthesis is about and what they will learn from the report. A good summary does not simply restate the scope of work for the synthesis study— it will paraphrase, summarize, and incorporate information from the work itself.

**Brief details of study methodology (one or two sentences)**
- How was the information gathered (e.g., literature review, survey, interviews, case examples).
- If a survey was used, to whom was the survey sent?
- What was the survey response rate (include number of surveys sent, number of survey responses, and response rate as a percentage).
Major conclusions (in brief)
Should be concise and to the point, drawing from, but not repeating, the analytic “Conclusions” section (see below).

Recommendations for future research (not required)
- What gaps in knowledge were identified in this synthesis?
- What research could be done to fill those knowledge gaps?

* Here are some examples of opening sentences that are likely to encourage the reader to delve further into the summary and give your work a wider readership.

For a report on speed-reduction techniques in rural areas:
North America’s rural landscape is dotted with isolated settlements, villages, and small towns that are typically located on rural roads where the general speed limit is 55 to 60 mph (90 to 100 km/h). Motorists are expected to slow down as they pass through these settlement areas, reducing their operating speed to 30 or 40 mph (50 or 65 km/h) in sections of road known as transition zones.

For a report on keeping birds away from airports:
Birds and airplanes are a dangerous combination.

For a report on freight transportation surveys:
The efficient movement of freight is important for local, state, and even national economic viability.

For a report on traffic signal retiming practices:
Traffic signals that are not timed to coordinate efficiently with vehicular traffic can cause travel delays, increased accident rates, increased pollution from vehicle emissions, and increased fuel consumption, among other concerns.

Introduction or Background Chapter
The first chapter should provide brief, relevant background; define terms; clearly identify the issues to be addressed; and, if applicable, what “high profile” issues are not addressed and why. It should note any problems common among agencies concerning these issues and include a paragraph that succinctly describes how the synthesis is organized (methodology and chapter outline). The first chapter should also include a description of the survey process.

Intermediate Chapters
These chapters discuss the information outlined in chapter one (literature search, survey results, cases studies, etc.). Begin each chapter on a new page.

Conclusions and Further Research
The final chapter of a synthesis report should normally be titled “Conclusions.” The conclusions chapter is intended to portray the current state of practice through a technical assessment of the facts and information presented in the preceding chapters. Conclusions must be well supported and documented in the report. It is acceptable for a synthesis to highlight practices that are viewed as successful by many of the entities surveyed in developing the synthesis or that are characterized as such in the literature reviewed by the report author; however, such practices should not be presented as “best” practices or
“recommended” practices. The only recommendations that are permitted in a synthesis are recommendations for needed research.

7. A brief reiteration of the background and objective of the synthesis – no more than two or three sentences to place the information in context.

8. A summary of the findings from the previous chapters – should be grounded in the project survey responses, literature review, and interviews, and should not recommend particular practices except as recommended by others (and cited as such).

9. Statements of barriers to widespread implementation of promising methods or practices should be presented as observations or conclusions, not as recommendations.

10. Recommendations for further research – should be limited to statements of the important knowledge gaps identified in the synthesis study and research that could fill those gaps. No new information should be presented in the conclusion.

References
Consultants are responsible for the accuracy and completeness of all reference citations. References should be numbered in the reference list in the order in which they appear in the text. Denote a reference at the appropriate place in the text by an italic Arabic numeral in italicized brackets, placed at the end of the sentence before the period, e.g., [2]. If a reference is cited more than one time in the text, repeat the number first assigned to the reference. For more than one reference, use separate brackets with a comma in between.

Example:
Transportation control measures are used to reduce mobile source emissions [1], [2], [3].

Do not use footnotes in the text: cite all such information within the text or references.

Glossary
If there are a number of terms used in the report whose definition might be misinterpreted or be unfamiliar to the reader, these terms should be provided, with definition, in a Glossary. Defined words should be bolded and a double space should separate each definition.

Appendixes
Appendixes are used to present material that supplements the information given in the text, but that cannot be conveniently inserted into the text. Appendixes should not be used to present information that is crucial to understanding the subject matter; this information should appear in the body of the synthesis. There is no limit on the number of appendixes that can be included in a synthesis; however, each must be lettered, titled, and be specifically mentioned in the main body of the text. Provide a list of appendix titles with the draft report. Appendixes follow the References (or Bibliography or Glossary). Appendixes of substantial length may be considered as a web-only portion(s) of the document.
Report Style Guide

Headings
The use of headings and subheadings in each chapter is encouraged. However, the use of more than four levels of headings should be avoided. The following style for headings should be used:

Headings for the first-level head (major element headings) should be centered and typed in bold and upper cased followed by a double space.

The second-level head should also be centered, typed in bold, and all major words should begin with a capital letter followed by a double space.

The third-level head (section headings) should be left-justified and typed in bold with all major words beginning with a capital letter followed by the text on the next line.

Fourth level headings (paragraph headings) should be indented, typed in bold with all major words beginning with a capital letter followed by a period with paragraph text on the same line.

The proper format for headings follows:

FIRST-LEVEL HEAD
(Upper case, boldface, centered at top of an odd numbered page—double spaced after)

Second-Level Head
(First letter capitals, boldface, centered on separate line—double spaced after)

Third-Level Head
(First letter capitals, boldface, flush left, on separate line—start text on next line)

Fourth-Level Head. (First letter capitals, indented, boldface, followed by a period—paragraph text immediately following on the same line)

A heading must be followed by two or more subheadings at the next level, not by a single subheading. References should not be cited in headings. Acronyms previously spelled out may be used in level three and four heads, but not levels one and two.

Quotations
Quotations of five or more lines or two complete sentences (block quotes) should be indented and set off from the text without quotation marks. Quoted material within a block quotation should be enclosed in single quotation marks. Run short quotations into the text, using double quotation marks. Cite appropriate references for all quotations directly following quoted material with page number(s).

Changes should not be made to quoted material; however, interpolations (in brackets) may be added, and obvious misspellings should be corrected.
Footnotes
Do not use footnotes to the text. Cite all such information within the text or references.

List of References
Double-space between references on the list. Do not repeat a reference in the list, and do not use ibid., idem., op. cit., or loc. cit. Each reference should contain the standard bibliographic data required in a scholarly reference list with each section separated by a comma:

- Last name and initials of up to the first six authors (or editors). All authors/editors are cited surname first, followed by initial(s). In case of multiple authors, put each last name first, followed by the initial.
- Title of work
- Journal title, if applicable. For journal article, cite volume and issue number
- Publisher, location of publisher (city/state, city/country), and edition if not a journal article
- Date of publication (or for website, date site accessed and date of publication)
- For symposium or conference, cite meeting dates and location
- Inclusive pagination, if applicable. Total number of pages if entire work cited
- If the author is also the publisher only show as publisher
- If not dated, specify as such where date would normally be cited (n.d.)
- Do not use ibid, idem, op. cit., or loc. cit.
- References to classified documents, personal correspondence (or telephone conversations), or other sources of information that are inaccessible to the reader should be avoided, if possible.
- Unpublished work can be cited in the References. Provide as much information as possible [author(s), title, web address, other source material, date] and label as unpublished.
- Electronic Sources
  1. The following information is included:
     a) Corporate or personal authors,
     b) Title of the document or publication,
     c) Publisher (if available),
     d) Place of publication (if available),
     e) Publication date (if available),
     f) Complete URL, and
     g) Date accessed (if provided by the author).
  2. The italicization of titles follows the rules for printed publications and documents.
  3. The uniform resource locator (URL) identifies the location of the source on the Internet. Case should be preserved because it may be significant. Include “http://” if given.
  4. In manuscript, do not break URLs. In pages, URLs may be broken across lines after a period, question mark, slash, or hyphen; do not add hyphens.
  5. Do not edit, delete, or update references to electronic sources.

Examples of references follow:

Book:


**Book Chapter:**

**Journal Article:**


**Newspaper Article:**

**Symposium:**

**Report:**


**Dissertation:**

**Proceedings:**

Law, Statute, Regulation:

Manual, Guide:


Preprint:

Website:

Personal Communication:
Erica Smith, e-mail message to author, December 15, 2015.


Tables
Tables provide a useful means of presenting large amounts of detailed information in limited space. Tables should supplement, not duplicate, information given in the text or illustrations. Tables should be understandable without continual reference to the text. Simple lists should not be presented as tables. Number tables consecutively in the text using Arabic numerals (e.g., Table 1). The Arabic numeral and the title of table should be centered in bold above the table on two separate lines, with only the first word capitalized and any other proper nouns capitalized in the heading. A period should not follow a table title. Within the table itself, all fonts and font sizes should be consistent with the report’s style. Continue to number Appendix tables by using Arabic numbers. Each table should have a number and a title, column headings, a stub column (containing row headings), field column(s) (containing table data), and explanatory footnotes, if necessary.

- Column heads cannot be repeated or changed within a table. If this is the case, the table is actually two (or more) tables and should be redrawn as such.
- A table taken verbatim from another source must be referenced (add reference number after title or denote source as footnote).
- Notes may be added when the information pertains to the entire table.
- Include a separate list of table titles with the draft report.
- Tables will be placed as close to their initial callout as possible.
• When a dash (—) is used as data entry, please indicate its meaning in a footnote (e.g., missing data, data not available).
• Use superscript numbers for footnoting material in any part of the table. Footnotes should be numbered consecutively from left to right, top to bottom.

Figures
All figures should convey information clearly and completely. Use the following guidelines in preparing figures for publication:

• Give each figure a caption. If a figure contains several parts (a, b, c, etc.), cite each part in the caption and label each corresponding part on the figure using the same size type as that in the rest of the figure. The Arabic numeral and the figure caption should be centered in bold below the table on two separate lines, with only the first word capitalized and any other proper nouns capitalized in the heading—and no period.
• Number figures consecutively in the order first cited in text using Arabic numerals; text references of figures should be by those numbers (see Figure 5). Never should a figure be referred to as “the figure opposite” or “the photograph on this page.” The exigencies of typing may rule out that placement and then the reference would be wrong.
• Make published figures clear and legible. The type in published figures must not be less than 11-point. In addition, letters, symbols, and line weights must be uniform and the same size through out the figure (i.e., if wording on the ordinate and abscissa is in 11-point type, symbols used to identify data points also should be in 11-point type). Figures must never be more than one page long.
• The word “figure” is spelled out and capitalized when you refer to it within the text: “Figure 1 shows...” or “...see Figure 8.”
• If a table, figure, or illustration appears on the same page with straight copy, it should be centered horizontally within the established margins and should be set off by at least three blank lines from the copy above and below. If these items appear on a page by themselves, they should be centered horizontally and vertically within the page margins.
• If you are using a figure or table, refer the reader to it before explaining it in the text. If the graphic is important to the explanation, place it next to the explanation. If not, place it in the Appendix. Illustrations, figures, or tables appearing in an appendix or separate section of a report should follow the same placement guidelines. Do not violate established margins used in the text.
• Continue to number figures in the Appendix using the consecutive Arabic numeral.

When submitting digital art, adherence to the following guidelines can help to reduce problems in the conversion of digital images to an acceptable format for black and white printing.

• (Half-tones) Submit at 300 dpi at a minimum size of 3 in. x 3 in.
• (Line art) Submit at 1200 dpi at a minimum of 3 in. x 3 in. for illustrations.
• If a figure is taken from another source, reference that source as part of the figure caption [e.g.,

Figure 1
Warren truss bridge (Carr and Black 1999)

Or

Figure 30
Neoprene boot (Courtesy: Indiana DOT)
• If possible, submit figures at the actual size they are to be reproduced. A full two-column figure is 41.5 picas (6.75 in. and 17.1 mm) and a full one-column figure is 20 picas (3.25 in. and 8.25 mm).
• Type size for external lettering should be in the range of 8–10 points (2.1–2.7 mm) and 6–8 points (1.6–2.1 mm) for all internal lettering.
• Labels on line drawings should be clear and legible. Interior graph lines in non-original line art tend not to reproduce well and need not be inserted. Similarly, shaded backgrounds should be removed because of inconsistent reproduction quality. Provide the best available copy for any illustrations in the synthesis. Duplicates will not reproduce as well as glossy prints or computer-generated line art and are generally not acceptable. High-resolution digital artwork is also acceptable. Include a complete set of prints (copies) with any digital figures submitted. Graphs, pie charts, or other artwork with shading must be suitable for black and white printing. Duplicate prints with shading will not reproduce well.
• Illustrations with several gradations of shading will also generally not reproduce well. If possible, use hatching or other distinctive markings (e.g., vertical or horizontal lines or grids) to differentiate between bars. Identify each figure by writing the synthesis topic number and figure number below the figure, centered and bold. Include a separate list of all figure captions with the draft report.

Copyright Permission
To reproduce any copyrighted materials (tables, figures, charts, etc.) written authorization must be obtained from the owner of the original copyright. It is the responsibility of the author to secure this permission. Permission is not needed for brief quotations (50 words or less) when the quotation is properly referenced. Permission must be obtained for longer quotations. Material published by the U.S. government is not usually copyrighted and, if not, does not require permission, unless it credits a previously copyrighted source. A typical acknowledgment should read: “Reprinted with permission from Smith et al. Copyright 1983 American Institute of Physics.” For a figure, the acknowledgment should read: Photo (or graphic) courtesy of . . . (e.g., Arizona Department of Transportation). For a table, reprinted without change, the acknowledgment should read: Source: . . . (e.g., Source: Houston METRO).

Use of Numbers
• Always spell out numbers at the beginning of a sentence.
• Within a sentence use only Arabic numerals with units of measure (e.g., 5 ft., 18 percent). Otherwise, spell out all numbers one through nine (e.g., five bridges, two departments) and use Arabic numerals for numbers 10 and greater.
• When using the International System of Units (SI), provide customary U.S. equivalents. The project staff uses ASTM E 380-91 for metric conversions.
• Use Arabic numerals for all numbers with decimals (e.g., 5.7). For numbers of less than one, use a zero to the left of the decimal point (e.g., 0.06).
• Spell out the word number in the text; “No.” can be used in tabular material.
• Commas are used with numerals of four or more digits except for metric, years (date), page numbers, military time, and model numbers.
• Hyphenate compound numbers.

Equations
Equations should be written so that all elements are easily definable and the spatial relations between symbols are obvious. All variables should be in italic type, with numbers, subscripts, and superscripts
(unless variables) in Roman type. Display equations should be numbered sequentially throughout the text using an Arabic number in parentheses, set flush right on the same line as the equation; for example:

\[ X^2 + Y^2 = Z^2 \]  \hspace{1cm} (1)

When referring to an equation in the text, use the equation spelled out followed by the number in parenthesis [e.g., This relationship can be illustrated by the use of equation (2)]. All letters or symbols that might be confused with any other (e.g., circles, “ohs,” zeros, ones, and “els”) should be marked at first use. Label all Greek letters at first mention.

Next, if you need to define the variables of the equation, make sure the word “where” is lower cased, followed by a comma, and then by a series of definitions or explanations. This can either be in list or paragraph format separated by commas or semicolons if needed.

Lists
Lists may be presented in three ways: (1) as a numbered series within a sentence; (2) as bulleted items, each on a separate line or lines; or (3) as numbered items, each on a separate line or lines. All items in a single list should follow the same grammatical style, either a word, phrase, sentence, or paragraph.

Abbreviations/Acronyms
Abbreviations and acronyms do not need to be introduced unless they are repeated at least three times in the text or tables (except for units of measurement). Abbreviations used in the Summary and Conclusions must be used at least three times as well. An abbreviation or acronym must be spelled out at first use [e.g., Intelligent Vehicle Highway System (IVHS)] unless it appears in a heading.

- A term should be represented by only one form of abbreviation/acronym, and no two terms should have the same abbreviation/acronym.
- Spell out all abbreviations in titles and headings, except table titles and figure captions.
- United States is spelled out when used as a noun and abbreviated (U.S.) when used as an adjective (e.g., U.S. Department of Transportation).
- Common units of measure such as feet, inches, millimeters, pounds, etc., should be spelled out in the body of the text unless it is preceded by a number (e.g., 3 in.)
- When abbreviating, keep in mind that most abbreviations are the same when singular and plural: 30 ft. and 1 ft.; 13 cm and 1 cm
- Avoid using the symbol form of abbreviations (with the exception of tables and figures): 3 ft. (not 3'); 56 in. (not 56")
- When speaking of temperature, it is proper to use the degree symbol followed by an “F” for Fahrenheit or a “C” for Centigrade: 125°F, 32°C
- There should be one space before and after any abbreviation or symbol: The truck was 30 ft. wide and 5 ft. tall.
- Units used for the reporting of data shall be English units, followed by equivalent metric SI units in parenthesis if necessary.

Word Template Available
To utilize a template of a blank report, please visit [http://www.ltrc.lsu.edu/publications.html](http://www.ltrc.lsu.edu/publications.html) and click on “Find LTRC Publication Forms and Report Templates.” You will find a Word document set up with links and guideline reminders.
Louisiana Transportation Research Center

NOTIFICATION OF SUBMISSION OF JOURNAL PAPER/S, CONFERENCE PAPER/S (FOR EITHER PRESENTATION AND/OR PUBLICATION), CONFERENCE ABSTRACT/S, AND SIMILAR ARTICLES BASED ON LTRC FUNDED PROJECTS

TITLE OF PUBLICATION:__________________________________________________________

ASSOCIATED LTRC PROJECT NO:__________________________________________________

PRINCIPAL AND CO-AUTHORS:____________________________________________________

JOURNAL/CONFERENCE/LOCATION SUBMITTED TO:____________________________________

AUTHORS PRESENTING PAPER (FOR CONFERENCE PRESENTATIONS ONLY):____________________

TYPE OF PUBLICATION

☐ Journal Paper  ☐ Paper for Conference Presentation Only (Not included in conference proceedings)
☐ Paper for Publication in Conference Proceedings (No presentation is involved)
☐ Paper for Conference Presentation and Publication in Proceedings
☐ Abstract of Paper for Conference Presentation (Submission of full paper is not required)

TO BE COMPLETED BY SUBMITTER

Will paper be presented even if publication in conference proceedings is declined? ☐ Yes ☐ No

Will travel funds be requested from LTRC? ☐ Yes ☐ No

(If yes, LTRC Out-of-State Travel Approval Request Form will need to be submitted at least 3 weeks prior to travel)

TO BE COMPLETED BY LTRC PROJECT MANAGER

LTRC APPROVALS NECESSARY FOR ON-GOING PROJECTS

Does project progress and results warrant:

Paper Presentation? ☐ Yes ☐ No

Publication? ☐ Yes ☐ No

LTRC Project Manager__________________________________________________________ Date

LTRC Research Area Administrator________________________________________________ Date

LTRC Associate Director, Research______________________________________________ Date

☐ APPROVED ☐ DENIED

LTRC Director______________________________________________________________ Date

Form 1020 Rev. 08.05
Bayou Corne Sinkhole: Control Measurements of State Highway 70 in Assumption Parish, Louisiana

INTRODUCTION
The sinkhole located in Assumption Parish, Louisiana, threatens the stability of Highway 70, a state maintained route. In order to mitigate the potential damaging effects of the sinkhole on this infrastructure, the Louisiana Department of Transportation and Development (DOTD) has requested accurate and precise measurements of control points along the affected portion of the highway. The Center for Geoinformatics (C4G) at Louisiana State University (LSU) was contracted to measure and collect horizontal and vertical positions at various locations along the highway using Global Positioning Systems (GPS) enhanced by a real-time network (RTN) of continuously operating reference stations (CORS) maintained by C4G.

OBJECTIVE
The fundamental objective for this project was to measure and assess the surface stability of the portion of Highway 70 that is potentially vulnerable to the sinkhole. Using GPS enhanced by RTN maintained by C4G, both horizontal and vertical positions were measured and collected at 20 point locations along the north shoulder of the highway and 8 locations on the bridges over Bayou Corne (west of the sinkhole) and Grand Bayou (east of the sinkhole).

SCOPE
Initially, the project identified 21 road surface control points for GPS measurements along Highway 70. All GPS measurements included the horizontal and vertical positions of the control points along the highway corridor bounded by Bayou Corne in the west and Bayou Choupique in the east. The field observations initially included two separate control measurements per session. This workflow produced two unique GPS datasets that were combined to provide a single weighted solution for each control point.

Following a request by DOTD to modify the data collection tasks, acquisition of weighted positions were abandoned in November 2012 in order to support an additional day of measurements at eight control point locations on the bridges over Bayou Corne and Grand Bayou. Furthermore, a control point was dropped from the workflow due to poor positional accuracy resulting from nearby tree canopy.

METHODOLOGY
The methods employed for this study were organized into three complementary tasks: field measurements, data processing, and data distribution. These tasks, including data backup strategies, are described in the following text.

Field Measurements
Field measurement tasks were organized into three distinct observation periods. The methods employed for measuring data points are discussed in the final report.

Observation Periods
During the 10-month period between September 2012 and June 2013, the highway control points were observed a total of 23 times. Thirteen bridge control point observations were collected between November 2012 and June 2013.

Measurement Techniques
In order to avoid measurements potentially influenced by the sinkhole, all field observations were collected using GPS equipment (e.g., data collectors, antennas, and cellular modems) maintained by C4G and augmented by the C4Gnet RTN. Measurements at
each control point were comprised of occupations lasting 300 one-second epochs (i.e., 5 minutes).

As per best practice techniques for minimizing the effects of atmospheric instability and mitigating unfavorable satellite geometries, measurements were initially collected at separate times during each day in the field (i.e., session). Positional solutions were computed using a weighted average technique that emphasized accuracy by minimizing positional dilution of precision (PDOP) and root-mean square error (RMSE) values quantified by the equipment. This technique produced a single weighted solution for each position.

In November 2012, weighted positional measurements were abandoned in order to support a request by DOTD to add the measurements at control points on the Bayou Corne and Grand Bayou bridges. Accordingly, 28 points were regularly measured: 20 locations along Hwy 70, 4 positions on the Bayou Corne bridge, and 4 positions on the Grand Bayou bridge.

CONCLUSIONS

No discernible movement of Highway 70 or the bridges over Bayou Corne, Grand Bayou, and Bayou Chequiquie have been detected relative to the sinkhole during the report’s measurement period. Sporadic measurements collected in the field demonstrate random and systematic errors that confound detailed analysis for determining significant trends. A more effective strategy would employ long-term occupations that can better account for both random and systematic errors.

Despite the biases, the average range of horizontal error observed for the highway control points was 0.19 ft. (5.8 cm), which included a minimum error of 0.007 ft. (0.2 cm) and a maximum of 0.46 ft. (14.5 cm). The average range of vertical error observed along the highway was 0.3 ft. (9.4 cm), with a minimum value of 0.001 ft. (0.3 cm) and a maximum of 0.45 ft. (13.7 cm). For the bridge control point observations, the average range of horizontal error was 0.08 ft. (3 cm), with a minimum of 0.006 ft. (0.2 cm) and a maximum of 0.05 ft. (1.2 cm). The average range of vertical error observed for the bridges was 0.26 ft. (8 cm), with a minimum of 0.05 ft. (0.2 cm) and a maximum of 0.4 ft. (12 cm).

Sporadic vs. Long-Term Occupation

As depicted in the results, static, ad hoc occupations of control points are susceptible to random and systematic errors. Random errors refer to measurement variability caused by unknown and unpredictable changes in environmental conditions that can vary in magnitude and direction (Grewal, 2002). Examples include, but are not limited to: random orbital information of GPS satellites (e.g., relativistic effects of gravity), atmospheric instability in the lower (e.g., stratosphere) and upper (e.g., thermosphere) atmosphere, and signal interference due to multipath reflections. Systematic errors are typically caused by predictable changes in the environmental conditions and/or processes. Examples include, but are not limited to: user and instrument error (e.g., clock synchronization, software malfunctions), unfavorable satellite geometry, signal interference due to tree canopy cover, and finally the hydrographic heave and shrink on the local soils (related to the swamp and near-by bayous).

Long-term occupations are less susceptible to both random and systematic error by reducing their influence on the measurement solutions. For instance, random error can be reduced by occupying a location for a long period of time. Doing so provides a more reliable measurement of surface conditions by averaging, or smoothing, trends over a longer period of time. The predictable, systematic errors can be constrained by following best practices when performing static occupations and using models to remove the unwanted sources of interference. For instance, known sources of time domain interference can be excluded (e.g., r e, masked) from the positional solutions, user error can be mitigated, and EMI can be isolated. Errors expected for a fixed CORS station can be reduced to estimated precision between 0.08 ft. (0.1 cm) horizontal and 0.66 ft. (2 cm) vertical (area mean) (Armstrong, 2003).

It is important to note that systematic error that cannot be constrained may be indicative of movement associated with regional subsidence, or even the sinkhole itself.

RECOMMENDATIONS

CgR recommends deploying continuously operating GPS reference stations (CORS) as a cost effective monitoring strategy for improving the accuracy, precision, and consistency of the surface stability. The variability associated with short-term, static GPS observations makes identifying specific trends difficult due to the myriad of random and systematic errors associated with the techniques used. While these biases cannot be eliminated, utilization of a network of CORS will permit second-by-second monitoring of the surface that, when correlated with the CgR net RTN, can minimize biases that plague the static occupations of the current project. Additionally, utilization of CORS will better detect trends and movement of the road surface, which decision makers and emergency managers require for establishing situational awareness and ensuring public safety. Therefore, nominal observation precision can be constrained to within 0.08 ft. (0.1 cm) horizontal and 0.66 ft. (2 cm) vertical under ideal conditions.

Improve Monitoring of Highway Stability Using CORS Technology

Installing multiple CORS along the highway will provide consistent, accurate, and reliable telemetry of surface conditions. Additionally, the CORS network can be correlated with the CgR net RTN, a network of 70 CORS sites distributed across the State. In doing so, positional accuracy and precision will be improved by mitigating various sources of random error (e.g., atmospheric and satellite geometry). This logic is planned as part of LTRC research project 23-95T.
LTRC Distribution Checklist

Study Title: ___________________________ Report No. ______

Type of Report: 
- [ ] Final Report
- [ ] Interim Report
- [ ] Technical Summary
- [ ] Technical Assistance Report
- [ ] Implementation Report
- [ ] Project Capsule
- [ ] Other: ___________________________

Group Administrator: ___________________________

ELECTRONIC DISTRIBUTION

LA DOTD
- LTRC Project Manager
- Project Review Committee
- Secretary & Deputy Secretary
- Chief Engineer
- Assistant/Deputy Assistant Secretaries
- Policy Committee
- Administrators
- DOTD Chiefs
- DOTD Directors
- Assistant District Administrators
- District Area Engineers
- District Traffic Operations Engineers
- District Laboratory Engineers
- District Project Engineers
- DOTD Engineers
- LTRC Engineers

LA Universities
- Deans, College of Engineering
- Principal Investigator(s)

States
- AASHTO Research Advisory Committee (RAC)

National Libraries
- Federal Highway Administration Research Library (fhwa.library@dot.gov)
- TRIS & TRB Library—Russell Houston (rhouston@nas.edu) & Nancy Choudhry (nchoudhry@nas.edu)
- National Transportation Library (NTL) (NTLDigitalSubmissions@dot.gov)
- National Technical Information Service (NTIS) (input@ntis.gov)
- DOT Library—Linda Cullen (library@ost.dot.gov)
- ITS (Electronic Documents Library)—Susan Sve (itsweb.master@fhwa.dot.gov)
- University of California—TRI-NET Repository, Institute of Transportation Studies Library (revans@library.berkeley.edu)
- Northwestern University Transportation Library—Roberto Sarmiento (r-sarmiento@northwestern.edu)
- Volpe National Transportation Systems Center—TRI-NET Repository (susan.dresley@dot.com)
- Federal Highway Administration—Office of Corporate Research, Technology, and Innovation MGMT (john.moulden@dot.gov)
- Transportation Research Board Library (TRID) (Submit an electronic copy — http://trid.trb.org/submit.aspx)

Industry
- LAPA—Louisiana Asphalt Pavement Association
- CAAL—Concrete Aggregate Association of LA

140
HARD COPY DISTRIBUTION

- Federal Highway Administration (1)
  5304 Flanders Drive | Suite A Baton Rouge | LA 70808
- Resource Centers (4)
  EASTERN, 30 South Howard Street | Suite 4000 | Baltimore, MD 21201
  SOUTHERN, 61 Forsyth Street SW | Suite 17T26 | Atlanta, GA 30303-3104
  MIDWESTERN, 15900 Governors Highway | Suite 303 | Olympia Fields, IL 60461-1021
  WESTERN, 201 Mission Street | Suite 2100 | San Francisco, CA 94305
- FHWA Research Librarian (1)
  FHWA Research Library | 6300 Georgetown Pike | McLean, VA 22101-2296
- Volpe National Transportation Systems Center (1)
  TRISNET Repository DTS-930 | Kendall Square | Technical Reference Center | Cambridge, MA 02142
- Roberto Sarmiento (1)
  Transportation Library, Northwestern University | 1535 Sheridan Road | Evanston, IL 60208
- University of California (1)
  TRI - NET Repository, Institute of Transportation Studies Library | 412 McLaughlin Hall | Berkeley, CA 94720

Additional Hard Copies

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Recommended for Approval

<table>
<thead>
<tr>
<th>Editor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LTTRC Implementation Engineer</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LTTRC Manager</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LTTRC Administrator</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Associate Director, Research</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Director</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

TOTAL HARD COPIES 141
# Public Document Submittal Form

Please include this completed form with all deposits of publications (tangible and digital).

<table>
<thead>
<tr>
<th>Agency Name</th>
<th>Mythical Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Name</td>
<td>Ms. Jane X</td>
</tr>
<tr>
<td>Position</td>
<td>Director of Something Important</td>
</tr>
<tr>
<td>Contact Email</td>
<td><a href="mailto:js@email.gov">js@email.gov</a></td>
</tr>
<tr>
<td>Phone</td>
<td>225-123-4567</td>
</tr>
<tr>
<td>Today’s Date</td>
<td>7/15/2015</td>
</tr>
</tbody>
</table>

## Document Information

Please use only one entry per title (e.g., multiple copies of “Meeting Minutes” may be entered in #1). To see examples of how different types of publications may be entered, please view the sample form on the agency webpage at [http://www.state.lib.la.us/state-employees/depository-library-program/state-agencies](http://www.state.lib.la.us/state-employees/depository-library-program/state-agencies).

<table>
<thead>
<tr>
<th>#1</th>
<th>Title and Subtitle: Journal of Louisiana Something</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format(s) Distributed to Public: Print/Hard Copy, Digital</td>
<td></td>
</tr>
<tr>
<td>Number of Issues / Editions Sent: 2</td>
<td></td>
</tr>
<tr>
<td>Date(s) of Publication: v.24, n.6-7 (2014)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#2</th>
<th>Title and Subtitle: Annual Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format(s) Distributed to Public: Print/Hard Copy, Digital</td>
<td></td>
</tr>
<tr>
<td>Number of Issues / Editions Sent: 1</td>
<td></td>
</tr>
<tr>
<td>Date(s) of Publication: Oct. 1, 2014</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#3</th>
<th>Title and Subtitle: Minutes of Board Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format(s) Distributed to Public: Print/Hard Copy, Digital</td>
<td></td>
</tr>
<tr>
<td>Number of Issues / Editions Sent: 3</td>
<td></td>
</tr>
<tr>
<td>Date(s) of Publication: Aug., Oct., Dec. (2014)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#4</th>
<th>Title and Subtitle: Guide to Something</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format(s) Distributed to Public: Print/Hard Copy, Digital</td>
<td></td>
</tr>
<tr>
<td>Number of Issues / Editions Sent: 1</td>
<td></td>
</tr>
<tr>
<td>Date(s) of Publication: 2015</td>
<td></td>
</tr>
</tbody>
</table>
27 APPENDIX U - RESEARCH ASSESSMENT AND IMPLEMENTATION REPORT (1902)

Research Assessment and Implementation Report

Project Number:  
Project Title:  
Principal Investigators:  
PRC Chairman:  
PRC Members:  
LTRC Project Manager:  
LTRC Technology Transfer Engineer:  

Objectives  
[What are the objectives/deliverables/products of this research?]  

Implementation Recommendations  
[Provide the implementation recommendations as developed by the Project Review Committee]  

Potential Impact  
[Describe potential impact of the recommendations in terms of cost, efficiency, safety, convenience, aesthetics, etc. Describe required changes to existing specifications, standards, procedures, etc.]  

Target Audience  
[Who will benefit from this research? List whom you want to reach, their primary interest, and your objective in reaching them.]  

Strategies and Tactics  
[Describe practical areas of application. List the activities required for implementation, including resource needs. Consider needs for training, multimedia, and marketing.]  

Timeline  
[Create a schedule for each discrete strategy or tactic.]  

Implementation Responsibility  
[Define roles and responsibilities of all personnel involved in the implementation effort. Identify who will be the decision makers to implement results of the research.]  

Evaluation  
[Identify methods for evaluating the implementation effort. How will benefits be quantified or assessed?]
# Appendix V - Technology Transfer Travel Approval Request Form (1922)

<table>
<thead>
<tr>
<th>Louisiana Transportation Research Center</th>
<th>LTRC USE ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECHNOLOGY TRANSFER TRAVEL APPROVAL REQUEST</td>
<td>DATE OF RECEIPT:</td>
</tr>
<tr>
<td>To be used for all travel funds requested for presentation of results not related to conduct of research titles for on-going and completed projects. Reimbursement direct to traveler not to be invoiced through project funds.</td>
<td>STATE PROJECT NO.:</td>
</tr>
<tr>
<td>PART I TRAVEL REQUESTED</td>
<td></td>
</tr>
<tr>
<td>1. PERSON(S) REQUESTING TRAVEL:</td>
<td>2. UNIVERSITY/AGENCY:</td>
</tr>
<tr>
<td>3. ADDRESS:</td>
<td>4. DESTINATION ITINERARY:</td>
</tr>
<tr>
<td>5. DATE OF DEPARTURE:</td>
<td>6. DATE OF RETURN:</td>
</tr>
<tr>
<td>7. PURPOSE OF TRAVEL (E.G. CONFERENCE PRESENTATION, TECHNOLOGY TRANSFER EVENT, IMPLEMENTATION MEETING, ETC.)</td>
<td></td>
</tr>
<tr>
<td>8. EXPLAIN HOW IT IS RELATED TO THE REFERENCED PROJECT</td>
<td></td>
</tr>
<tr>
<td>9. LTRC PROJECT NO. RELATED TO TRAVEL</td>
<td>10. PROJECT TITLE:</td>
</tr>
<tr>
<td>11. TOTAL COST OF TRAVEL: $</td>
<td>12. INDICATE IF TRAVEL WILL BE SHARED/REIMBURSED BY OTHER PARTY: YES [ ] NO [ ]</td>
</tr>
<tr>
<td></td>
<td>13. IF SHARED/REIMBURSED, INDICATE LTRC REQUESTED AMOUNT: $</td>
</tr>
</tbody>
</table>

| PART II APPROVAL | |
| RECOMMENDED BY GROUP MANAGER: | DATE: |
| RECOMMENDED FOR APPROVAL BY ASSOCIATE DIRECTOR, RESEARCH: | DATE: |
| APPROVED BY DIRECTOR, LTRC: | DATE: |
| LTRC APPROVAL LIMITATIONS, RESTRICTIONS OR REASON FOR REJECTION: | |