

REQUEST FOR PROPOSALS

Update LADOTD Policy on Pile Driving Vibration Management

PROBLEM STATEMENT

The Louisiana Department of Transportation and Development (LA DOTD) spends millions of dollars annually on the construction of driven pile foundations. By nature, pile driving emits vibrations that may be felt some distance away from the driving activities. This kind of vibration may damage adjacent buildings and structures and may be annoying to the people nearby.

LA DOTD has a special provision for vibration monitoring that is used on projects that may be sensitive to vibration from pile driving activities. By special provision and cost to the department, a contractor must “conduct seismic monitoring of vibrations during pile driving and other heavy equipment operations in areas that are not normally subjected to such operations. The contractor will be required to adjust the pile driving operation to bring the vibration levels into the acceptable limits” as identified in the special provision. The special provision also requires that “probes shall be located at distances of 300 feet and 500 feet from the pile driving location to obtain data.”

Because people have become increasingly intolerant of pile driving vibration, the public has requested that the department extend the vibration monitoring range beyond 500 feet. This has led to the question of what is a reasonable monitoring range for pile driving vibration and what is the cut-off limit for probe setting. An unreasonable coverage of vibration monitoring will waste the taxpayers’ dollars. The key issue here is the acceleration distribution caused by a pile-driving event and its correlation with surrounding structure damage. Such impact varies with geotechnical conditions, the types of structures, the types of piles, and driving equipment, etc. All of these should be explored and investigated as a part of the risk management of pile driving. Therefore, there is a need to evaluate the current department policy on the issue, based on new developments in technology and accumulated historical data in the state. The results of this study will help the department update its pile driving monitoring policy and conduct a more cost-effective pile driving monitoring program and risk management.

OBJECTIVES

The objective of this study is to evaluate the current LA DOTD policy on pile driving vibration monitoring based on new developments in technology and accumulated historical data in the state and to make recommendations to the department for risk management of pile driving. The research is anticipated to encompass at a minimum the following tasks:

Task 1. Examine and review the state of the art and practice on pile driving vibration monitoring and risk management. This will include a literature search of previous and on-going nationwide research projects and case studies on the subject.

Task 2. Survey various state highway agencies and other national agencies to examine and review the state of practice and policies on pile driving vibration monitoring and risk management. Look into how other states handle the documentation policy of before and after construction and how other states use AASHTO’s policy on the issue. Also contact the legal section of the department for law suit cases.

Task 3. Collect the available field monitoring data on pile driving with associated construction records, geotechnical information, surrounding property damages, etc., from the LA DOTD and other possible sources.

Task 4. An interim report is due six months after the commencement of the project to the Project Review Committee (PRC) for review and approval. This report shall summarize the findings of Tasks 1-3 and develop a plan for additional research to address deficiencies or improvement to existing LA DOTD practice with consideration of risk management. Best practices for risk management, a factorial analysis plan, and future field monitoring activities if needed should be considered.

Task 5. Evaluate and/or analyze the data collected to develop simple models that will be used to determine the vibration monitoring range based on information such as soil type and condition, pile type, pile driving equipment, structure type and importance, etc. The structure type and importance include, but are not limited to historical building, residential building, chemical plants, commercial facilities, hospitals, etc.

Task 6. Validate existing or develop new correlations between the ground vibration caused by a pile-driving event and structure damage, considering different geotechnical conditions and structure types.

Task 7. List and evaluate mitigation strategies to control the vibration and structure damage caused by pile driving, considering the importance of nearby building structures and geotechnical conditions.

Task 8. Update the LA DOTD pre-inspection guideline for sites and the buildings on them.

Task 9. Develop a GIS database that meets the requirements of LTRC/LA DOTD to compile all field data collected. LTRC will provide technical assistance for this task.

Task 10. Make recommendations to implement the results and findings developed from this study. Work with LA DOTD engineers to assess the potential benefits from the implementation of recommendations made by this study.

Task 11. Prepare a final report documenting the entire research effort. The final report shall provide a rational plan for pile driving vibration monitoring and risk management that will consider the variation of field and construction conditions. A central focus of this report shall be on the implementation and shall make available a summary of economic benefit associated with the approach suggested. The project investigators shall be ready to present their findings to LA DOTD engineers and administration.

SPECIAL NOTES

- A. Task descriptions are intended to provide a framework for conducting the research. LTRC is seeking the insight of proposers on how best to achieve the research objectives. Proposers are expected to describe research plans that can realistically be accomplished within the constraints of available funds and contract time. Proposals must present the candidate's current thinking in sufficient detail to demonstrate their understanding of the problem and the soundness of their approach.
- B. Hours and cost for each task of the research are required for appraisal with a maximum of 20% of research funding for Tasks 1-4.

- C. An opportunity to demonstrate the candidate's qualification and research approaches in front of the Project Review Committee is available upon request.
- D. LTRC projects are intended to produce results that will be applied in practice. It is expected that the implementation of the results of this research into practice will evolve as a concerted effort during this project. The final report must contain an implementation plan to include as a minimum, the following:
 - a. The "product" expected from the research;
 - b. A realistic assessment of impediments to successful implementation;
 - c. The activities necessary for successful implementation;
 - d. The criteria for judging the progress and consequences of implementation.
- E. To assist in the implementation process, the investigators of this research shall present the final results to LA DOTD officials in an oral presentation to be held in Baton Rouge, LA, at DOTD Headquarters after acceptance of the final report.
- F. The successful investigators will be required to complete an LTRC course on Microsoft Word for LTRC report formatting.
- G. The proposal should include travel to meet with the Project Review Committee for a "kick off" meeting, presentation of interim report, and presentation of the final report at a minimum.

ESTIMATED COST OF RESEARCH

\$200,000

ESTIMATED COMPLETION TIME

A final report is due 18 months after the initiation of this study, including a draft report due three months before the study completion date for review, modification, and approval.

LTRC PRIMARY CONTACT

Zhongjie "Doc" Zhang, Ph.D., P.E.
Pavement & Geotechnical Research Administrator
Phone: (225) 767-9162
e-mail: zzhang@dotd.la.gov

AUTHORIZATION TO BEGIN WORK

January, 2009 (Estimated)

PROPOSAL FORMAT

All proposals are required to be formatted according to LTRC Manual of Research Procedures available on the web site: www.ltrc.lsu.edu. Chapter 2 of that manual provides guidance on proposal development. (<http://www.ltrc.lsu.edu/publications.html>).

PROPOSAL SELECTION

The Project Review Committee selected for this project will review, evaluate, and rank all proposals received using the criteria established on the LTRC proposal review form, which is available on the website: (<http://www.ltrc.lsu.edu/publications.html>).

DEADLINE FOR RECEIPT OF PROPOSALS

Ten copies of the proposal must be received by LTRC by the close of business December 1, 2008. Proposals should be submitted to:

Harold R. Paul, P.E.
Director
Louisiana Transportation Research Center
4101 Gourrier Ave.
Baton Rouge, LA 70808