

REQUEST FOR PROPOSALS

LTRC No. 20-1ST, SIO No. DOLT1000342

DEVELOPING LIVE LOAD DISTRIBUTION FORMULAS FOR CAST-IN-PLACE CULVERTS IN LOUISIANA

The National Bridge Inventory (NBI) shows that almost one quarter of the nation's 611,845 bridges are classified as culverts. NBI also lists over 2,500 culverts in Louisiana. A significant portion of these culverts are concrete box culverts; of which many older ones are cast-in-place (CIP) reinforced concrete box culverts. Departments of Transportation (DOTs) around the nation are currently required to load rate culverts in their inventory using AASHTO-LRFR. Because of excessive conservatism inherent in the live load distribution formulas, many of these culverts produce low rating factors and, hence, need to be posted even though the performance of these culverts is typically acceptable, and they rarely show signs of distress. Furthermore, Louisiana standard details for CIP box culverts introduce an additional challenge due to the lack of negative moment reinforcement at exterior corners.

In 2016, LTRC funded Project 16-3ST to assess the load rating of a representative group of CIP box culverts from the Louisiana DOTD inventory. Eight culverts with low fill heights and different pavement types were selected for the study. Following AASHTO live load distribution formulas, it was clear that the culverts' rating factors were less than 1.0. However, calibrated three-dimensional (3D) finite element models revealed that the rating factors were all acceptable; i.e., over 1.0. This showed that the live load distribution formulas are a major cause of this outcome (http://www.ltrc.lsu.edu/pdf/2018/FR_593.pdf). Ongoing NCHRP Project 15-54 is tasked with developing new live load distribution formulas to alleviate some of the issues faced by DOTs all over the country. Finding from this NCHRP project may help, however, it will not address the special configurations of Louisiana due to old standard details.

Note: Data obtained from the previous study will be made available to all interested proposers.

OBJECTIVE

The objective of this project is to develop live load distribution formulas suitable for Louisiana CIP box culverts with their special reinforcement detailing

RESEARCH APPROACH

The Louisiana Transportation Research Center (LTRC) is seeking the insight of proposers on how best to achieve the research objectives. Proposers shall describe research plans that can be realistically accomplished within the constraints of available funds and contract time as allowed in this RFP.

Proposals must present the candidate's current thinking in sufficient detail to demonstrate their understanding of the problem and the soundness of their approach. Task descriptions are intended to provide a framework for conducting the research. The proposal shall address at a minimum, the following tasks:

Task 1 – Literature Review

Conduct a literature review of research on live load distribution in concrete box culverts. A search of

the TRIS database is a minimum.

Task 1 – Review Current Analysis

Review and calibrate current 3D analysis, and/or develop and calibrate new 3D finite element models for representative culverts.

Task 3 – Parametric Study Plan

Prepare a plan for the parametric study. The plan will be presented to the PRC before any work is to proceed. The parametric study will encompass a wide range of parameters that cover the design space for which CIP-RC box culverts are often used.

Task 4 – Interim Report

Submit an interim report documenting work completed in Tasks 1 – 3. Prepare a presentation to the PRC documenting the research effort completed in Tasks 1 and 2 as well as outline the plan for the parametric study developed during Task 3.

Note: The PI may not proceed with the parametric study before PRC’s approval of the proposed plan and the written notification from the Project Manager.

Task 5 – Conduct Parametric Study

Conduct the parametric study outlined in Task 4 and approved in Task 4.

Task 6 – Data Analysis

Develop live load distribution formulas that account for the major parameters known to influence the behavior of culverts

Task 7 – Provide a Final Report, Technical Summary, and PRC Presentation

The researcher shall provide a final report that documents the entire research effort for internal future reference and the benefit of others. A Final Draft Report, Technical Summary document (two pages), and summary presentation to the Project Review Committee (PRC) are due three (3) months prior to the project completion date for review and approval.

Task 8 – Workshop

A workshop, demonstrating the application of the developed load rating formula(s), will be held at the end of the study after acceptance of the deliverables in Task 7.

DELIVERABLES

The proposal shall include project deliverables for appropriate tasks. Deliverables shall be due as defined in the proposal. The proposal shall include at a minimum the following deliverables:

- Task 4: Interim report and presentation to PRC including presentation of the parametric study plan.
- Task 6: Final Report, Technical Summary, and summary presentation.
- Task 7: Conduct a workshop.

SPECIAL NOTES

A. LTRC research projects will be conducted in accordance with the LTRC Manual of Research Procedures, 2016 edition.

(http://www.ltrc.lsu.edu/pdf/2016/LTRC_RESEARCH_MANUAL_FINAL.pdf)

- B.** Any work that is anticipated to be required from LTRC or DOTD shall be specifically detailed in the proposal.
- C.** Any surveys or questionnaires developed by the research team shall be reviewed and approved by the PRC prior to distribution.
- 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; and
 - 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, Louisiana at LA DOTD Headquarters after acceptance of the final report.
- F.** 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. Funds budgeted for travel shall be limited to what is necessary for the conduct of the research. Funds shall not be budgeted for conference travel. Funding for technology transfer of research results are available upon request subject to LTRC approval and available funds.
- G.** LTRC’s mission includes the support of higher education in Louisiana. Consultant and out-of-state institutions submitting proposals are encouraged to cooperate and collaborate with Louisiana universities for the purpose of sharing of knowledge and increasing transportation expertise in the academic community.
- H.** Graduate assistance stipends are allowed. Tuition reimbursement or tuition remission rates applied to stipends are not allowed.
- I.** To equitably answer any questions regarding this Request for Proposals, the Louisiana Department of Transportation and Development (LA DOTD) website will be updated with questions and answers and related documents regarding the project.
<http://webmail.dotd.louisiana.gov/agrestat.nsf/WebAdvertisements?OpenPage>
LA DOTD makes these documents available for informational purposes only to aid in the efficient dissemination of information to interested parties. LA DOTD does not warrant the documents against deficiencies of any kind. The data contained within this web site will be periodically updated. Interested parties are responsible to be aware of any updates. Questions regarding this RFP should be submitted in writing to the LTRC contact person. Questions must be received by close of business seven calendar days prior to deadline date.
- J.** Consultants and business entities 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>
- K.** If Sub-Consultants/Entities are used, the Prime Consultant/Entity must perform a minimum of 51% of the work for the overall project.
- L.** LTRC reserves the right to withhold invoice payments for delinquent deliverables as defined in the proposal.

ESTIMATED COST OF RESEARCH

\$100,000

ESTIMATED COMPLETION TIME

18 months *(include three months for review and approval of final report - i.e. final report due 15 months).*

LTRC PRIMARY CONTACT

Walid Alaywan, Ph.D., P.E.
Sr. Structures Research Engineer
Phone: (225) 767-9106
Email: walid.alaywan@la.gov

AUTHORIZATION TO BEGIN WORK:

February 2020 (Estimated)

PROPOSAL FORMAT

All proposals are required to be formatted according to LTRC Manual of Research Procedures. Chapter 2 provides guidance on proposal development. A copy of the Manual may be downloaded from our website (<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 proposal review form.

SUBMISSION OF PROPOSAL

Submit proposals in one of the following manners: (1) Electronically in PDF format, or (2) 10 hard copies. Proposals must be received by LTRC by 12:00 PM (Noon), Thursday, January 2, 2020.

Samuel Cooper, Jr., Ph.D., P.E.
Director
Louisiana Transportation Research Center
4101 Gourrier Ave.
Baton Rouge, LA 70808
Tel: (225) 767 9101, e-mail: Samuel.Cooper@LA.GOV