REQUEST FOR PROPOSAL (RFP) #14-01

INNOVATIVE STRUCTURAL AND MATERIAL DESIGN FOR CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

POSTED DATE: 12/5/14; CLOSING DATE: 12/19/14

PROJECT INFORMATION

Funds: $750,000
Estimated Contract Term: 35 months
Projected Start Date: February 1, 2015
Deadline for Submitting Proposals: December 19, 2014
Submit Proposals via Email to: Steven Gillen at sgillen@getipass.com

BACKGROUND

With the reconstruction of the central Tri-State corridor (I-294) planned for 2020-2022, a concrete pavement with an extended performance life, minimal maintenance, exceptional smoothness, and superb concrete durability is required. Continuously reinforced concrete pavement (CRCP) offers these options and has the advantage over jointed plain concrete pavement (JPCP) with prolonged smoothness, greater maintenance intervals, and the most favorable concrete surface for a future asphalt overlay. The main limitations of CRCP are the costs associated with the steel reinforcement and placement, structural designs that produce slab thickness similar to JPCP, premature concrete material related distress, and erodibility of the base layer. CRCP performance is linked to its transverse crack spacing and width, which are affected by the concrete material selection, climate, base friction, longitudinal joint types, and concrete-steel interaction and configuration. The main CRCP failure modes have been punchout from repeated loading, subbase erosion, concrete durability, and
 variabilities in best construction practices. Furthermore, terminal or transition joints such as the wide flange and lug systems are expensive to build and maintain and must be addressed in a roadway with a significant amount of bridge structures. Re-engineering, innovating, and building a more cost effective CRCP will require use of recycled and by-product materials, new construction processes to place steel and activate cracks at the desire intervals, higher erosion resistant support layers containing recycled materials from previous roadway, mild post-tensioning in the transverse direction, prediction of crack spacing and width with higher supplementary cementitious materials and internal curing, and alternative transition joints.

CRCP have been historically used on high volume roadways in the Chicago area with outstanding performance as well as other states such as Texas, Virginia, Oregon, California, and recently Indiana. The original CRCP designs on the Stevenson, Edens, and Dan Ryan Expressway resisted more traffic than they were designed for and provided a pavement structure for future overlays. Premature failures of CRCP have occurred because of concrete durability and subbase erosion. Recent designs in Belgium and for the North Texas Tollway have demonstrated that more economical CRCP can be built without sacrificing performance. Recent research has focused primarily on the structural design of the CRCP, subbase erodibility analysis and testing, and active crack control. Internal curing with lightweight aggregates has been used in a CRCP test section but no detail analysis and testing has been conducted for its use in CRCP. AASHTO’s current software Pavement-ME Design has an improved CRCP punchout model but does directly not consider widen lanes, subbase properties and erodibility, transverse post-tensioning, internal curing, higher percentages of SCM, CRCP transition joints, and optimal slab-base frictional properties. Automatic placement of steel called tube feeding has also been done in the past but not without its problems. Likewise concrete curing is critical for the formation of early and long-term properties and transverse cracks in the CRCP but modern products and monitoring of curing are inadequate.

**OBJECTIVE**

The research project objective is to provide the Tollway with a balanced CRCP system that has the same or lower cost and life-cycled assessment relative to JPCP. These objectives will be achieved by designing the concrete materials to achieve the desired early-age and long-term properties through innovative mix designs and curing management while maintaining physical and chemical durability of the concrete and steel. Furthermore, the CRCP slab thickness will be decreased by multiple means such as post-tensioning designed smaller crack widths, and a more erosion resistant support layer that utilizes recycled materials. Finally, improvement in CRCP construction efficiency will be proposed for steel placement and terminal joint design.

**RESEARCH TASKS AND REQUIRED DELIVERABLES**

The research shall be divided into six tasks, as described below:
Task 1: Materials for Optimal CRC Pavement Performance – This task will include investigations into a variety of factors that impact the performance of CRC pavements. These factors may include, but are not limited to, depth of chloride penetration, alternative mixture design options, and the impact of slab curling and warping.

Task 2: Early-age Cracking Evaluation – Investigate the impact of various CRC pavement inputs such as drying shrinkage, zero stress, temperature, creep, and friction on the spacing and width of early-age cracking.

Task 3: CRC Pavement Support Layers – This task will investigate the benefits associated with various support layers under CRC pavement, including cement-treated base (CTB), warm-mix asphalt (WMA), and materials with various amounts of recycled material.

Task 4: Alternative Construction Techniques – This task will investigate the effectiveness of CRC pavement construction techniques including two-lift paving, active crack control, and various curing treatments.

Task 5: Development and Evaluation of Transverse Post-Tension – This task will include the creation of small-scale slabs that will be used to evaluate a turn-buckle post-tensioning technique.

Task 6: Analyze CRC Pavement Performance – This task will involve the instrumentation of test sections built by the Tollway and review and evaluation of pavement performance data collected by the Tollway.

Deliverables that will be required throughout this project will include:

- Quarterly progress reports, in electronic format, containing a summary of effort performed during the quarter and expected progress for the following quarter.
- Final report, in electronic format, summarizing the results and recommendations developed as a result of this research effort.
- A one-page technical briefing document summarizing the results of the research effort.
INSTRUCTIONS FOR SUBMITTING A PROPOSAL

The proposal shall be prepared in accordance with the guidelines presented in Appendix A. The contact name/email and due date are presented on the first page. All potential Principal Investigators (PIs) should read and understand the responsibilities of Illinois Tollway Principal Investigators, which are presented in Appendix B.

Technical questions regarding the research project or questions regarding the RFP procedures should be submitted to Steven Gillen, via email at sgillen@getipass.com. Technical questions received by the Tollway and answers will be posted on the Tollway website as they are received.

SPECIAL CONDITIONS FOR REVIEWING PROPOSALS AND AWARDING ILLINOIS TOLLWAY FUNDS

Please note that the following two conditions will be applied in reviewing all proposals received and in awarding Tollway funds:

1) In reviewing and evaluating the proposals received from this solicitation, preference will be given to Illinois public universities over others.

2) The award of this project is contingent upon the availability of funds at the time of award.
APPENDIX A: GUIDELINES FOR PREPARING PROPOSALS FOR THE ILLINOIS TOLLWAY

Please use the following format for submitting Tollway proposals for consideration. Please limit your total proposal to 15 pages in length (not including the Cover/Summary Page or optional Appendices), ensure file size is less than 5 MB, and use a font size no smaller than 10. We suggest Arial font with 1.5 spacing between lines.

1. **Cover/Summary Page**
   
   Use the cover page included in Appendix C.

2. **Research Plan**
   
   The research plan should describe in a specific and straightforward manner the proposed approach for solving the problem described in the problem statement. The research plan should be subdivided into the following sections:

   (a) **Introduction, including Research Idea Statement**

   Provide an introduction to the proposal and a concise overview of the research approach. Outline the objectives of the research project and explain the questions that will be answered by the research.

   (b) **Research Approach/Work Plan**

   Include the details of how the investigator will carry out the project and accomplish the project objectives. Itemize the tasks to be completed, explaining each in sufficient detail so the reviewers understand what will be done for each task and what will be produced or completed with each task.

   (c) **Anticipated Research Results**

   Specifically state the anticipated research results and deliverables.

   (d) **Applicability of Results to IDOT Practice**

   Describe how the anticipated research results can be used to improve Tollway practices.

3. **Qualifications and Accomplishments of the Research Team**

   Identify who will perform the research and provide a brief explanation of each researcher’s qualifications to perform the research. Please provide examples of similar research that the proposed individuals have performed.
4. **Other Commitments of the Research Team**

Briefly outline the other commitments of the proposed principal and co-principal investigators to demonstrate that both will be able to fulfill the commitments of the proposal.

5. **Equipment and Facilities**

Describe the facilities and equipment available to undertake the research proposal.

6. **Time Requirements**

Describe the time that will be required to complete the research proposal, including final report preparation, Tollway editing, review of the report by the Technical Review Panel (TRP), and final review/publishing of the report. Include a timeline for each task. Please plan on submitting the draft final report to the Tollway for initial editing at least three months before the end date for the project.

7. **Itemized Budget**

Provide an itemized budget for the entire project, including the cost of personnel, consultants, subcontracts, equipment, materials, travel, overhead/indirect costs and cost share (match). Please itemize equipment and travel requests, especially any requested out-of-state travel or planned attendance at conferences. If you anticipate having a sub-award for extra support from outside your agency, please be aware that the sub-award cannot exceed 50% of the total project budget without prior approval.

8. **Cooperative Features (if appropriate)**

If assistance or cooperation is required from other agencies, public or private, to complete this proposed research, describe the plans for securing this assistance.

9. **Appendices (if appropriate)**

You may include such things as statements regarding previous work on the problem or related problems, abstracts of related projects, a bibliography or list of references, or materials describing the submitting organization.
APPENDIX B:
RESPONSIBILITIES OF ILLINOIS TOLLWAY PRINCIPAL INVESTIGATORS

1. Prepare and submit a project proposal/work plan and multi-year line-item budget, consistent with the Illinois Tollway RFP for the newly-approved research project.

2. Meet with the Technical Review Panel (TRP) and revise the project proposal/work plan and multi-year budget, as agreed with the TRP.

3. Assist the TRP chair in preparing an Implementation Planning Worksheet and work throughout the project to identify the expected benefits of the research, e.g., construction savings, operation and maintenance savings, increased lifecycle, safety, etc.

4. Carry out the project as agreed with the TRP, or notify the TRP if any problem develops regarding the project.

5. Provide online quarterly progress reports to the TRP chair for review and approval.

6. Attend quarterly meetings of the TRP to provide project updates and answer TRP members’ questions about the project.

7. Provide the TRP a synopsis of the project’s implementation potential as well as implementation strategies. In conjunction with the TRP, develop Implementation activities/tools such as draft specifications, policy guidelines, software, and training on new test/practice/equipment/software and develop an implementation cost estimate, if applicable.

8. Near the completion of the research project, draft a final research report in accordance with the Tollway report format. (The timeline for the work plan must allow adequate time to prepare the report, typically three months.)

9. At least three months before the end date for the project, submit the draft final report to the Tollway for preliminary editing (prior to submission to the TRP).

10. After the Tollway returns the edited draft final report, submit the report to the TRP chair for review and work with the TRP chair to finalize the content of the report.

11. Re-submit the final report to the Tollway for publication. The Tollway will post the final report to the Tollway website and will arrange to publish the final report.

12. The publication or release of all work products, any information that is deemed confidential by the Tollway, or information which includes patentable results may not be published/released without the Tollway’s approval.
13. Include the Illinois Tollway acknowledgement statement and disclaimer statement (available on the Tollway website) in all publications and presentations regarding research sponsored partially or fully by the Tollway.
APPENDIX C:  
PROPOSAL COVER SHEET FOR  
SOLICITATION #14-01  

INNOVATIVE STRUCTURAL AND MATERIAL DESIGN FOR  
CONTINUOUSLY REINFORCED CONCRETE PAVEMENT  

DUE DECEMBER 19, 2014  
TO sgillen@getipass.com  

<table>
<thead>
<tr>
<th>Submitted by: (Include Name and Address of Organization)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Investigator(s):</td>
<td></td>
</tr>
<tr>
<td>Corresponding Investigator Name:</td>
<td></td>
</tr>
<tr>
<td>Corresponding Investigator Phone:</td>
<td></td>
</tr>
<tr>
<td>Corresponding Investigator Fax:</td>
<td></td>
</tr>
<tr>
<td>Corresponding Investigator Email:</td>
<td></td>
</tr>
<tr>
<td>Submission Date:</td>
<td></td>
</tr>
</tbody>
</table>