Accelerated Innovation Deployment (AID) Demonstration
Project Narrative

I. **Project Abstract:** This application proposes a unique opportunity to effectively promote and advance the use of innovative technologies for Accelerated Bridge Construction (ABC), consistent with the objectives of the Technology and Innovation Deployment Program (TIDP). Iowa DOT is proposing an accelerated bridge replacement project that will evolve upon and advance the modular construction concept for ABC through the use of innovative technologies that are not routinely used by the state. Implementation of these innovative technologies, including the use of prefabricated bridge elements and systems (PBES) and high performance materials (HPM), will contribute toward advancements in project safety, construction schedule, construction impact, project quality, user satisfaction, and service life. Successful demonstration of the performance and benefits of these technologies will contribute toward increased adoption of these technologies by Iowa and other states.

II. **Project Description:** The proposed project consists of replacement of the bridge located on Iowa 92 over Little Silver Creek in Pottawattamie County, Iowa. The existing 150' x 28' continuous concrete beam bridge (FHWA #043820) was constructed in 1953 and is currently classified as structurally deficient, with a sufficiency rating of 36. The proposed bridge replacement is intended to increase the structural capacity of the bridge, improve roadway conditions, and enhance safety by providing a wider roadway.

The replacement structure is a three-span, 234' x 44' modular rolled steel beam bridge. Concept selection for this structure was based on consideration of several factors, including: (1) implementation of an accelerated construction schedule; (2) demonstration of innovative design, construction, and material technologies not frequently used in Iowa; and (3) evolution and improvement of the modular decked beam method of accelerated bridge construction. The new structure will include numerous technologies that meet the eligibility requirements for TIDP initiative funding, including the following:

A. Prefabricated Bridge Elements & Systems

1. Modular Decked Beam Superstructure - pre-constructed decked beam modules *($900,000)*: This project will demonstrate a considerable advancement in Iowa's experience with this technology by incorporating geometric complexities such as sag vertical curvature, beam camber, and skew. ***(based on lessons learned, this modified 2nd generation superstructure system will be used for the first time in Iowa)***
2. Precast Pile Caps: The contractor will be provided with fully designed/detailed options for the use of precast and cast-in-place (CIP) pile caps at the abutments and piers***. (multiple option approach is new to Iowa)***
3. Precast Approach Components: The contractor will be provided with a fully designed/detailed option for the use of precast approach components, including pavement panels and/or sleeper slabs. ***(multiple option approach is new to Iowa)***

B. High Performance Materials

1. Ultra-High Performance Concrete *($100,000)*: Longitudinal connection of the superstructure modules will be achieved through the use of UHPC. Use of this material will allow for improved constructability and greater long-term durability of

the deck joint system. ***(incorporate the latest improvement based on FHWA research thus the new joint details will be new to Iowa)***

2. Stainless Steel Deck Reinforcing *($250,000)*: Iowa DOT is designing the bridge deck for extended service life through the use of stainless steel reinforcing. Use of stainless steel reinforcing will also accommodate sandblasting preparation of the joint surfaces between deck modules, which should provide improved joint behavior compared to Iowa's previously used detail. ***(first use as exclusive deck steel in Iowa)***
3. HP-16 "Super Piles" *($120,000)*: To provide a cost-effective ABC pier solution that accommodates the poor soil conditions and considerable unbraced pier heights of the subject project site, Iowa DOT is proposing use of the new HP-16 pile sections for this project. ***(first use of this pile size/type for a state-owned bridge in Iowa)***

C. Design / Construction Innovations

1. Simple-Span-Made-Continuous Design *($30,000)*: Will be implemented at the piers to allow the bridge to behave as a continuous structure under live load, improving the performance and durability, and eliminating the need for deck joints. ***(new to Iowa)***
2. ABC Integral Abutments *($180,000)*: Fully designed/detailed plan alternates will be provided for the use of accelerated CIP pile caps, precast pile caps, or a capless framing option (beams supported directly on piling – ***new to Iowa***) for use at the bridge abutments. After the decked modules have been set, the module ends will be cast integrally with the pile foundation system as a part of the transverse deck closure at the abutments. This detail is anticipated to improve constructability and durability over Iowa's previous semi-integral abutment detail.
3. ABC Piers *($200,000)*: Accelerated construction of the piers will be accomplished through the use of precast concrete elements and/or accelerated CIP elements with concrete maturity monitoring. ***(multiple option approach is new to Iowa)***
4. ABC Approach Slab *($120,000)*: Accelerated construction of the approaches will be accomplished through the use of precast concrete and/or accelerated CIP elements with concrete maturity monitoring. ***(multiple option approach is new to Iowa)***

A table titled *"Table 1: Project Innovations, TIDP Goals and AID Eligibility"* has been included as an attachment to this application, summarizing the alignment of the proposed innovations with the initiative goals and funding eligibility.

III. **Innovation Performance:** Iowa DOT has set the following performance goals for the project, in alignment with the goals of the TIDP initiative:

A. Faster Construction

1. The proposed combination of accelerated construction techniques will reduce the duration that highway users are impacted by more than 50%. It is estimated that the construction time would be six months under non-accelerated construction, however, for this project the construction time allotted will be based on a maximum 21 day road closure. Due to an accelerated construction period mandated by the contract documents, the traveling public will be impacted a maximum of 21 days. Contractor compliance with this accelerated construction period will be assured through a liquidated damages clause in the contract documents.
2. The substructure precast components will be assembled on site in a highly accelerated fashion. The prefabricated superstructure units will be moved into position. This innovative construction concept will reduce the traffic detour duration by more than

90%. The shorter duration of closure relates to a significant reduction of total out-of-distance trip time as compared to the duration for more traditional construction methods.

B. Reduced Congestion:

1. The first stage of construction will occur with the roadway remaining open to traffic. Precast components will be constructed off-site. Given the fact that this stage will be constructed while the bridge remains fully open to traffic, the trip time goal for this stage is far less than a 10% increase in trip time during construction as compared to the average pre-construction time.
2. The second stage of construction occurs after bridge closure and off-site traffic detour. During the 21 day road closure period, motorists will be directed to 18.5-mile detour, eliminating traffic queuing and congestion at the construction site.
3. Results from the user satisfaction survey (discussed in **E**) will be a true measure of the effectiveness of this construction methodology to reduce construction congestion.

C. Improved Quality and Service Life

1. The use of prefabricated/precast components will improve quality and long term performance of the bridge since virtually the entire bridge will be produced off site. Strict compliance with specifications without the negative effects of severe environmental conditions is ensured.
2. Improved service life (100+ years) will be achieved through the use of HPM (i.e. stainless steel, and UHPC) and prefabricated elements with the goal of significant reduction in future maintenance
3. Although no longer an innovation in Iowa, improved consolidation resulting from the proposed fully contained flooded backfill treatment will mitigate the problem with settlement that results in bumps at the bridge. Better ride will increase driver satisfaction.
4. It is not expected that this project will require specialized construction equipment. In fact, one of the most significant advantages of the proposed bridge system is that it can be constructed by smaller, local contractors using commonly-available construction equipment. This elimination of specialized equipment brings the concept of ABC to within the reach of virtually all bridge owners and contractors around the country.

D. Improved Safety

1. Improved Safety will be a product of the goals discussed above (**A-C**).
2. The project includes the performance goal of achieving a work zone crash rate equal to or less than the existing conditions.
3. Work zone safety during construction will be improved through the use of prefabricated bridge components. The ABC methods reduce the duration of the traffic off-site detour. Closing the bridge to traffic minimizes traffic exposure to the construction hazards.
4. The project includes the performance goal of an incident rate for worker injuries to be less than 4.0 based on the OSHA 300 rate. The proposed project construction methods will create an environment for a safer work zone by utilizing features such as off alignment construction, prefabricated components and detouring traffic. According to the AGC of Iowa, the current OSHA 300 rate for highway construction contractors in Iowa is 4.8. Given the current OSHA 300 rate and the inclusion of

features that will reduce the risk for exposure to construction hazards and enhance safety, our goal to achieve an incident rate of less than 4.0 is feasible.

5. The increased durability of the driving surface created by the prefabricated bridge superstructure should reduce the potential for vehicles to lose control while driving over a degraded portion of the deck. Also, it is expected that constructing the bridge to the current standard bridge width will decrease potential for future fatalities and injuries due to the greater horizontal distance to the barrier rail.

E. User Satisfaction

1. The project includes the performance goal of 4+ on the Likert scale for the following questions: (1) How satisfied the user is with the new facility, compared with its previous condition, and (2) How satisfied the user is with the approach used to construct the new facility in terms of minimizing disruption.
2. The Iowa DOT has added many innovative features that will increase project safety, reduce traffic congestion, and increase quality with the goal of increasing the overall user satisfaction. A user survey will be implemented after construction to determine the level of user satisfaction related to the new facility and the construction approach.
3. Timely project information such as construction progress, road closure, detour routes, schedules and other announcements will be posted on a project web site and made available to the local media.
4. Press releases will also be utilized for key project events. This approach proved to be successful on a similar project in Iowa, raising the level of public confidence in our sensitivity to their needs.

IV. Applicant Information and Coordination with Other Entities:

- Project point of contact: Ahmad Abu-Hawash, Chief Structural Engineer
  Phone:515-239-1393 E-mail: ahmad.abu-hawash@dot.iowa.gov
- Coordination with other entities: In preparation for this innovative project, Iowa DOT is hosting a workshop (May 1-2, 2014) that is focused on the innovative features being used on this project such as ABC connection details using UHPC. The workshop is co-sponsored by the FHWA (Turner-Fairbank Research Center and a T2 Grant). Through the T2 grant, engineers from several state DOTs will be invited to share their experience using the proposed innovations (see attachment). This collaborative effort will involve FHWA, Iowa State University (a member of the ABC-UTC), and several state DOTs (Indiana, South Dakota, and New York).

V. Funding Request:

Iowa DOT requests the maximum funding amount of $1,000,000 (see *"Table 2: Estimated Innovation Costs"*, attached, for cost justification). The current development estimate for the bridge replacement project is $3,200,000. Nearly 100% of the structural cost of the new bridge will be influenced by the use of eligible technologies.

VI. Eligibility and Selection Criteria:

Iowa DOT as the project owner and submitter has determined this project to be eligible for this grant based on the stated eligibility requirements:

- Eligible for assistance under title 23, U.S.C.
- Ready to initiate within 6 months of applying for AID Demonstration funding
  - ✓ Project is in the design phase with anticipated FHWA authorization by September 2014 and is scheduled for December 2014 letting.

- Involves multiple aspects of highway transportation
  - ✓ Structures, materials, pavements, construction
- Includes innovation that aligns with TIDP goals
  - ✓ Refer to "Project Description" for proposed innovations
  - ✓ Use and evaluation of the proposed innovations on this project will result in acceleration of the adoption of innovative technologies by Iowa and other states
  - ✓ Use of the proposed innovations on this project will significantly contribute to improved safety, faster construction, reduced congestion from construction, and improved quality and user satisfaction.
  - ✓ Use of the proposed innovative materials (UHPC, stainless steel) and construction procedures (prefabrication) will result in more efficient construction, thus improving highway efficiency, safety, reliability, service life, and sustainability
- Includes innovation that is proven in real-world application with documented benefits
  - ✓ Proposed innovations have been proven
- Includes innovation that is not routinely used by applicant
  - ✓ This project includes numerous new-to-Iowa innovations
  - ✓ This project includes numerous innovations that have been significantly improved/evolved from innovations demonstrated once previously in Iowa. This project includes application of these innovations to a structure with considerably more geometric complexity.
- All innovations included in this application, if successful, will be available to our designers to use on future designs as applicable. Iowa has a proven track record for implementing and adopting new technologies (i.e. repeated use of UHPC and precast elements) with a strong commitment from agency executives. Therefore many of the proposed innovations can result in significant improvement in our conventional practice.

As a part of this project, Iowa DOT will provide:

- Monitoring and evaluation activities regarding the effectiveness of the innovations.
- Subsequent technology transfer and information dissemination activities.
- Final report within 6 months of project completion which documents the process, benefits, and lessons learned including development/refinement of guidance, specifications or other tools/methods to support rapid adoption of the innovation(s) as standard practice.
- Papers and presentations at various conferences.
- A showcase/workshop if desired.
- A project website (similar to http://www.iowadot.gov/us6kegcreek/) with a live webcam.
- Accept FHWA oversight of the project.
- Conduct a customer satisfaction survey for the project.
- Work with FHWA on the development and implementation of a plan to collect information and report on the project's performance with respect to the relevant outcomes that are expected to be achieved through the innovation in the project.
- Report on the specified performance indicators for this project as detailed in Section III of this application.

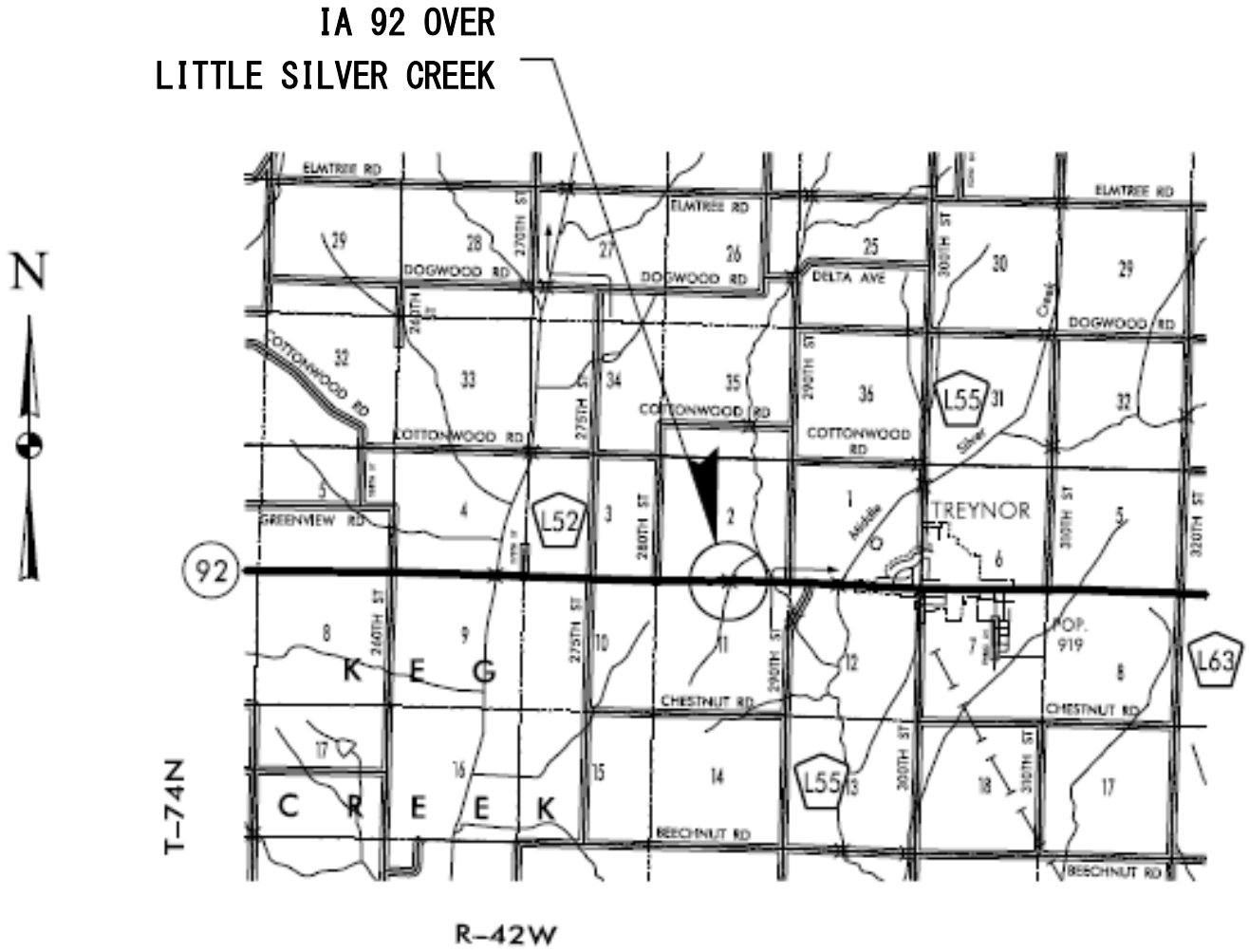
Additional Attachments: ☐ No ☒ Yes (PDF files identified by Applicant and Project Title)

Accelerated Innovation Deployment (AID) Demonstration

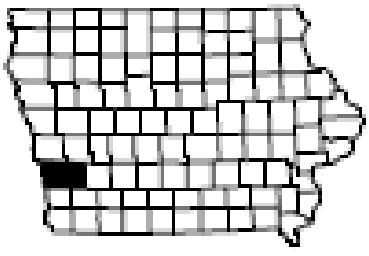
Attachment

Applicant: **Iowa Department of Transportation**

Project Title: **Iowa 92 over Little Silver Creek, 234' x 44' Modular Rolled Steel Beam Bridge**



LOCATION MAP



POTTAWATTAMIE COUNTY, IA

LOCATION

IA 92 OVER LITTLE SILVER CREEK
T-74N, R-42W
SECTION 2 & 11
KEG CREEK TOWNSHIP
POTTAWATTAMIE COUNTY
FHWA NO. 43821 (PROPOSED)
LATITUDE 41.232779°
LONGITUDE -95.634139°

Accelerated Innovation Deployment (AID) Demonstration

Attachment

Applicant: **Iowa Department of Transportation**

Project Title: **Iowa 92 over Little Silver Creek, 234' x 44' Modular Rolled Steel Beam Bridge**

Project Innovations	TIDP Goals					AID Eligibility		
	IMPROVES SAFETY	*FASTER CONSTRUCTION*	*REDUCED CONGESTION*	*IMPROVED QUALITY / USER SATISFACTION*	*INCREASED SERVICE LIFE*	*NEW APPLICATION OF TECH. / DETAILS*	*IMPROVED APPLICATION OF TECH. / DETAILS*	*TECHNOLOGY NOT ROUTINELY USED BY IOWA*
PREFABRICATED BRIDGE ELEMENTS & SYSTEMS								
DECKED BEAM MODULAR UNITS	X	X	X	X			X	X
PRECAST PILE CAPS	X	X	X	X				X
PRECAST APPROACH COMPONENTS	X	X	X	X				X
HIGH PERFORMANCE MATERIALS								
ULTRA HIGH PERFORMANCE CONC.		X	X	X	X		X	X
STAINLESS STEEL REINFORCING		X	X	X	X	X		X
HP-16 "SUPER PILES"	X	X	X	X		X		X
DESIGN/CONSTRUCTION								
SIMPLE-MADE-CONTINUOUS	X			X	X	X		X
ABC ABUTMENT DETAILS						X		X
ABC PIER DETAILS	X	X	X	X			X	X
ABC APPROACH DETAILS	X	X	X	X			X	X

TABLE 1: Project Innovations, TIDP Goals and AID Eligibility

Project Innovations	Estimated Innovation Cost
PREFABRICATED BRIDGE ELEMENTS & SYSTEMS	
DECKED BEAM MODULAR UNITS	$900,000
PRECAST PILE CAPS	(Included Below)
PRECAST APPROACH COMPONENTS	(Included Below)
HIGH PERFORMANCE MATERIALS	
ULTRA HIGH PERFORMANCE CONC.	$100,000
STAINLESS STEEL REINFORCING	$250,000
HP-16 "SUPER PILES"	$120,000
DESIGN/CONSTRUCTION	
SIMPLE-MADE-CONTINUOUS	$30,000
ABC ABUTMENT DETAILS	$180,000
ABC PIER DETAILS	$200,000
ABC APPROACH DETAILS	$120,000
TOTAL:	$1,900,000

TABLE 2: Estimated Innovation Costs