

Solicitation Number: 1334

Status: Solicitation Posted

Title: Center for the Aging Infrastructure: Steel Bridge Research, Inspection, Training and Education Engineering Center - SBRITE

Sponsoring Agency: Indiana Department of Transportation

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Partners: IN

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Solicitation Expires:

Commitment Start Year: FY 2013

Commitment End Year: FY 2014

Duration: 24 months

100% SP&R Approval: Approved

Commitments Required: \$1,500,000, as detailed in tiered commitment tables.

Objectives and Impact

The objective is to develop the *Steel Bridge Research, Inspection, Training, and Education Engineering Center (S-BRITE Engineering Center)* focused on existing steel highway bridges. This National Center will be the first of its kind and will become the leading education, training, research, and engineering center related to all aspects affecting the existing aging steel bridge and structure inventory. Although the Center will be focused on highway bridges, it will also support stakeholders of steel railroad bridges as well as steel ancillary structures, such as lighting towers and sign supports. The Center will contribute to improved asset management decisions for DOTs, FHWA, and other partners relative to existing steel bridge inventory. This impact will be realized by ensuring existence of the following:

- High quality inspection data
- Advanced predictive models
- Improved management decisions
- Timely and effective execution

This will be accomplished by providing solutions to the following:

- inspection reliability issues
- inadequate technical expertise
- training and education opportunities for students and professionals
- short-term and long-term research needs

Once the center is successfully operational, other materials and systems, such as concrete, prestressed, and post-tensioned structures may be added.

Detailed Discussion

General

As infrastructure continues to age, the engineers who designed and had first-hand knowledge of the then new structures (*e.g., the Interstate era*), eventually exit the workforce. Further, engineering programs, research, and associated coursework move forward and evolve over time. Obviously, these advances in education are essential to progress with *new* designs and *new* materials. However, the vast majority of the infrastructure is comprised of structures built with older materials, design philosophies, and construction practices that are no longer discussed in the classroom. The average age of a steel bridge in Indiana is about 50 years, and similar statistics are found throughout the US. Further, most of the major “landmark” river crossings are steel structures that are approaching or exceeded their design lives. A quick review of the bridges crossing the Ohio, Hudson, or Mississippi Rivers provides stark reminders of the age of our infrastructure. Unfortunately, in many cases, this has left these critical structures effectively abandoned when it comes to ensuring their “healthcare” professionals are adequately trained. Clearly, a well rounded workforce must include engineers prepared to design the structures of the future working hand-in-hand with engineers prepared to maintain the structures of the past.

To successfully maintain the existing steel bridge inventory, expertise is needed in the areas of deterioration, fatigue, fracture, corrosion, repair/retrofit, coatings, materials, NDE, riveting, welding, fabrication, etc. There are multiple reasons for this loss of expertise, including budget cuts, natural attrition, and a diminishing pool of technical expertise related to aging infrastructure. Regardless of the cause, the effects are clearly seen in DOTs across the United States. Some of these needs must be addressed through new research, while others can be addressed through improved training. In some select cases, individual experts are needed for specific consultation in order to solve unique complex problems.

Utilizing some of Purdue’s existing strengths in education and research, the S-BRITE Center will engage faculty and engineers from around the country in order to explore partnership opportunities in training and research. Finally, a “Distributed Expertise Network” (DEN), which includes specific experts from inside and outside of Purdue will be created to assist partners with specific complex problems.

The S-BRITE Center will fill a growing need in the transportation industry as relates to existing and aging steel bridges.

Educational Aspects

A long-term goal of the S-BRITE Center is to create the next generation of bridge engineers and inspectors who are properly educated to be effective stewards of the existing aging steel bridge inventory. At the university level, the development of a new “minor” or certificate within Civil Engineering is proposed that will prepare engineering students for a career in the area of transportation structures. At the professional level, high-quality, specialized short courses for professionals will be developed and targeted at those individuals currently responsible for the existing infrastructure. The courses would go beyond the current NHI course level.

The Center would collaborate with external technical schools, in order to develop a new area of educational expertise, specifically, the *Steel Bridge Infrastructure Specialist*. Both one and two-year degree programs are envisioned and would involve the development of several new courses within existing degree programs.

A major goal is to develop training and performance testing criteria to establish rational criteria for defining a “team leader” and developing reliable inspection protocols. Further, performance testing methodologies and criteria will be developed and implemented to improve the reliability of inspections by those who are certified through the Center.

Bridge Component Gallery

Although training, education, and research are the overall focus of the Center, the cornerstone of the S-BRITE Engineering Center will be a multi-acre gallery which will include full-scale bridge structures, portions of complete structures, and individual components that will include a host of common and uncommon details used in steel bridges. Similar centers exist for the aircraft, ship, and offshore industries, though nothing has been developed for the steel bridge industry.

The gallery will provide a unique hands-on experience for education of individuals of all levels regarding steel fabrication, deterioration, inspection techniques, etc.

Since the bridge components will not actually be in service and will be in more accessible conditions, costly traffic control and extensive fall-protection will not be required during training. However, they will be situated so that real-world conditions exist to truly simulate in-situ inspection conditions. Having such a “living laboratory” will also be incredibly useful for research tools being developed for inspection, durability modeling, and performance testing of inspectors.

Distributed Expertise Network (DEN)

To help fill the technical voids found at most DOTs, a unique team of experts will be assembled through the S-BRITE Center to create a Distributed Expertise Network (the DEN). Some of these individuals will be housed locally at the Center while others will be located at their respective institution. The DEN will serve the role that no longer exists in many individual state DOTs today, specifically the existence of a group of highly specialized technical experts that are “on-call” to assist as issues arise through a “moving research into practice” arrangement. These experts will effectively be “on call” to the Center and the participants, and will be able to travel to the participant’s location if required and per the funding level provided. There would be no need for special subcontracts between the individual state and the expert since the contracts will already be in place as participants of the Center.

Levels of Commitment

Since states have different needs and resources, three different levels or “tiers” of contributions have been developed with each tier receiving defined benefits. Participants will be stakeholders in the direction of the Center, research program directions, and coursework development. Details are contained in the Table below and are “per” year benefits.

Tier 1A and Tier 1B

(Tier 1A and 1B offer slightly different benefits. Tier 1A will be more attractive to states wishing to have more access to the training to be provided by S-BRITE and includes benefits of bringing two individuals to the S-BRITE Center for hands-on training and short course participation at the Bridge Component Gallery. Tier 1B offers slightly less training than Tier 1A, but follows more closely the traditional pooled fund model of supporting research projects thereby requiring less travel associated with attending the bridge component gallery.)

Tier 1A

- \$ 30,000 per year for 2 years for a total commitment of \$ 60,000
- This level provides support for the administration and policy development for center operations and strategic plan as well as for course development, traditional research and the gallery development and maintenance.
- Specific deliverables will include 1 training course at the stakeholder’s facility for up to 30 people as well as 1 training course for up to 2 people including travel to Purdue University for specialized training at the bridge gallery or attending short courses. The two can attend the same training or each can attend training for up to two different topics (e.g., 1 individuals may attend one course and 1 may attend a different course). It also includes 8 hours of specific assistance through the DEN.

Tier 1B

- \$ 30,000 per year for 2 years for a total commitment of \$ 60,000
- This level provides support for the administration and policy development for center operations and strategic plan as well as for course development, traditional research and the gallery development and maintenance. Tier 1B provides the participant more involvement in traditional research.
- Specific deliverables will include 1 training course at the stakeholder’s facility for up to 30 people. It also includes 12 hours of specific assistance through the DEN.

Tier 2

- \$ 50,000 per year for 2 years for a total commitment of \$ 100,000
- This level provides support for the administration and policy development for center operations and strategic plan as well as for course development, traditional research and the gallery development and maintenance.
- Specific deliverables will include 1 training course at the stakeholder’s facility for up to 50 people as well as 1 training course for up to 5 people including travel to Purdue University for specialized training at the bridge gallery or attending short courses. The five can attend the same training or each can attend training for up to two different topics (e.g., 2 individuals may attend one course and 3 may attend a different course). It also includes 20 hours of specific assistance through the DEN.

Tier 3:

- \$ 100,000 per year for 2 years for a total commitment of \$ 200,000
- This level provides support for the administration and policy development for center operations and strategic plan as well as for course development, research and the gallery development and maintenance.
- Specific deliverables will include 2 training courses at the stakeholder’s facility for up to 50 people as well as 2 training course for up to 10 people including travel to Purdue University for specialized training at the bridge gallery or attending short courses. The ten can attend the same training or each can attend separate training for up to three different topics. It also includes 40 hours of specific assistance through the solutions center.

Tier 4:

- \$ 150,000 per year for 2 years for a total commitment of \$ 300,000
- This level provides support for the administration and policy development for center operations and strategic plan as well as for course development, research and the gallery development and maintenance.
- Specific deliverables will include 3 training courses at the stakeholder’s facility for up to 50 people as well as 3 training course for up to 15 people including travel to Purdue University for specialized training at the bridge

gallery or attending short courses. The 15 can attend the same training or each can attend separate training for up to four different topics. It also includes 60 hours of specific assistance through the solutions center.

Categories	Approximate Distribution of Commitment				
	Tier 1A	Tier 1B	Tier 2	Tier 3	Tier 4
Administration / Policy Development &	\$2,500	\$3,000	\$4,000	\$8,000	\$12,000
New Course Development (Professional Training, New Inspector Certification Program, and Graduate, Undergrad, and	\$3,000	\$3,000	\$7,500	\$15,000	\$22,500
Traditional Research	\$7,500	\$10,500	\$5,500	\$11,000	\$16,500
Professional Training	\$9,000	\$7,000	\$12,500	\$25,000	\$37,500
Database and access to Distributed	\$3,000	\$4,000	\$5,500	\$11,000	\$16,500
Development and Maintenance of Bridge Component Gallery at Purdue University	\$5,000	\$2,500	\$15,000	\$30,000	\$45,000
Yearly Commitment	\$30,000	\$30,000	\$50,000	\$100,000	\$150,000