

INTRODUCTION TO

# S-BRITE

Steel

Bridge

Research

Inspection

Training

Engineering



# Need for S-BRITE

- ⦿ Infrastructure continues to age
  - Avg. age of steel bridge in US is nearly 50 years
- ⦿ Workforce changing
  - Loss of legacy expertise not being replaced
  - New workforce not versed in older materials, structures, design, deterioration, etc. etc. etc
    - E.g., What are issues with T-1 steel?...What is T1 Steel?
- ⦿ Current available training (all levels) does not seem to meet the needs of owners
- ⦿ Much \$\$\$ spend on inspection, but no knowledge regarding inspection reliability and POD, etc.

# However, “Aging Infrastructure” is More than Just Steel Bridges

- ⦿ Led to concept of Center for Aging Infrastructure (CAI)
- ⦿ Natural to move into other structure types
  - Concrete, timber, etc
- ⦿ Also consider other aspects of aging infrastructure
  - Pavements
  - Safety
  - Drainage
  - Signals
  - Foundations
  - Etc.

*Grand Vision...*

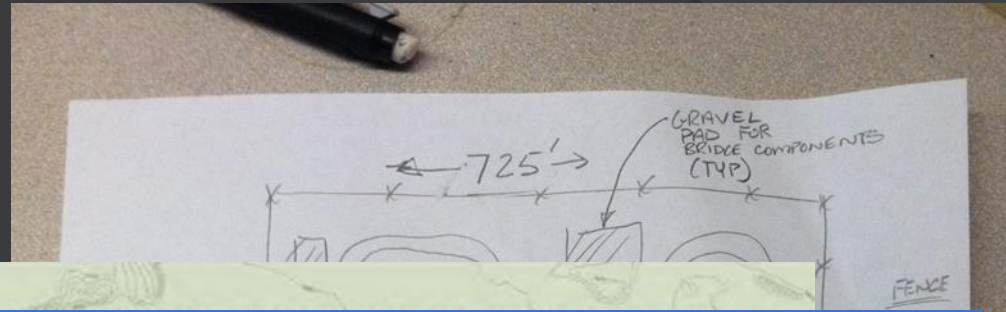


To Develop a Unique Center  
Focused on Extending the Safe Life  
of Existing Transportation Structures

# Status of S-BRITE

- ◎ INDOT has made major commitments for:
  - **Research** - Several projects underway
  - **Training** - Short Courses –Underway
  - **DEN** - Distributed Expertise Network - Underway
  - **S-BRITE/CAI** site development – Completed
    - Bridge Component Gallery
- ◎ Support from Pooled Fund Study TPF-5(281)
  - Participants:
    - KS, SD, IL, IA, MN, WI, FHWA
    - UT, Army Corps verbal commitments
  - Looking for More Partners!!!

# CAI/S-BRITE



# 1930's Truss 90 ft span



# Lafayette St. Bridge Fractured Girder (Minnesota)





# Dresbach Bridge Girders (Minnesota)



# I-35W Components



Components  
from 1903 RR  
Truss from  
Philadelphia



Components  
from 1903 RR  
Truss from  
Philadelphia



1956 Welded  
RR Bridge  
65 ft span



# Developing Rail Component

## Looking for:

- Bridges
- Signals
- Track
- Etc.



**DONATED BY BNSF**

# Various Other Components



# One-of-a-kind Training Environment





# Training Major Focus of S-BRITE

- Inspecting Steel Bridges for Fatigue
  - Oct 4&5 at Purdue
- Implementing Effective Retrofits on Steel Bridge Details
  - Spring 2017
- Designing Steel Bridges for Fatigue
- Welding in the Infrastructure
- HS Bolting



# Implementing Effective Retrofits on Steel Bridge Details

- Few engineers have direct experience with proper retrofit selection
  - Younger/new engineers even less
- New research has resulted in improved guidance in retrofit selection and implementation



# Hands-on Training



Not just death by PowerPoint

# Distributed Expertise Network (DEN)

- Distributed Expertise Network (DEN)
- Provide readily available expertise related to the existing inventory of structures
  - Provide access to experts around the country
  - When issue arises, treat as “moving research into practice” to provide assistance and issue tech. brief
- Provide “clearing house” of information on NDE, fatigue/fracture, corrosion, retrofit, welding, coatings, etc.

**Partner**



**S-BRITE**

# Distributed Expertise Network (DEN)

- ◎ “Experts” identified
  - Means to move their research into practice and provide input on specific issues/questions
- ◎ Pooled fund participants have access to DEN
- ◎ FAQ database up and running
  - For DEN Members ONLY
- ◎ **Topic areas:**
  - Fatigue, Fracture, Welding, Coatings, Bolting, Steel Bridge Design, Stability, Fire and Impact Damage, Field Testing, Repair/retrofit, etc.

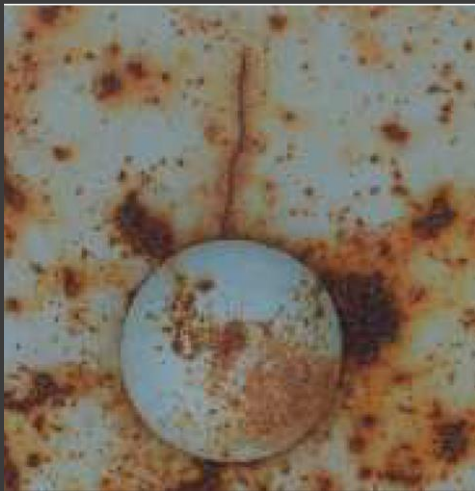
# Proposed DEN Members

Topic	Identified Expert(s)	Notes
Fatigue and Fracture	R.J. Connor / M.D. Bowman	Purdue Faculty
HS Bolting	P. Fish / G. Schrader	Fish and Associates, Inc.
Welding, Connections, Fabrication	K.H. Frank / D. McQuaid / R.J. Connor,	Emeritus UT Austin Professor & independent consultant / Independent Consultant / Purdue Faculty
Coatings Corrosion	R. Kogler	Independent Consultant
Repair and Retrofit of Steel Structures	R.J. Connor / M.D. Bowman / A.H. Varma	Purdue Faculty
Curved & Skewed Steel Bridges	Todd Helwig	Professor, UT Austin
Sign, Signal, and Luminaire Structures	R.J. Connor / M.D. Bowman	Purdue Faculty
Fire damage	A.H. Varma	Purdue Faculty
Impact Damage and Heat Straightening	A.H. Varma / R.J. Connor	Purdue Faculty
Field Instrumentation and Monitoring	R.J. Connor	Purdue Faculty
Non-destructive Testing	G.A. Washer / P Fish	Professor, Univ. of Missouri / Fish and Associates, Inc.

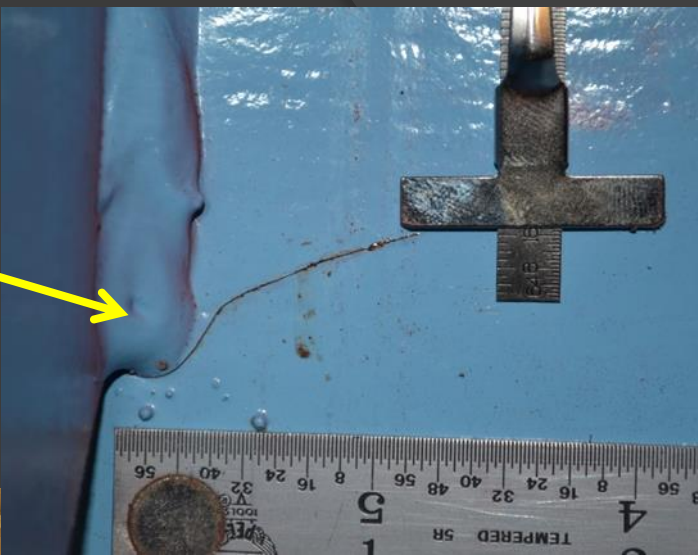
# Steel Property Material Archive

The screenshot shows a web browser window with the URL <http://datacenterhub.org/resources/67/>. The browser's address bar and tabs are visible at the top. Below the browser window, the website's navigation menu includes "DATAHUB", "DATA", "COMMUNITY", and "ABOUT". A "LOGIN" link is also present. The main content area features a breadcrumb trail: "Home > Resources > Databases > Steel Bridge Database > About". The page title is "Steel Bridge Database", attributed to Robert J. Connor at Purdue University. A "Dataview" search box is located on the right. A Creative Commons BY-NC license is displayed. On the right side, there are links for "0 review(s) (Review this)", "0 Citation(s)", and "0 questions (Ask a question)". The main content area has tabs for "About", "Reviews", "Citations", "Questions", and "Supporting Docs". Under the "About" tab, the "Category" is "Databases" and the "Published on" date is "17 Dec 2014". The "Abstract" section includes a photograph of a steel truss bridge and text stating: "This database includes information collected from 47 steel bridges built between 1921 to 1981 in U.S. Data that are included are Charpy V-Notch test (CVN) results, chemistry, and tensile properties of the samples taken from each bridge. The following are the column headers for this database: 1. Title (bridge name) 2. Project Personnel 3. Year (when data were collected) 4. Field 5. Main Subject 6. Report(s) (associated reports, or any other documentation) 7. Project page". The Windows taskbar at the bottom shows various application icons and the system clock indicating 3:08 PM.

# Probability of Detection (POD) of Cracking in Steel Bridge Details







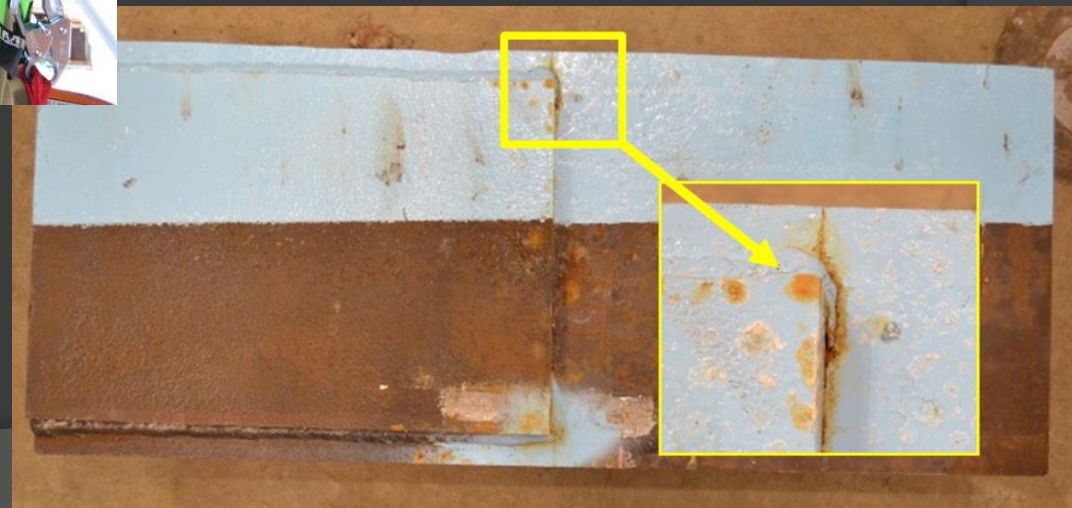
# Cracked Details



# POD Testing



Utilizing S-BRITE in  
NCHRP 12-104



# How do states get involved?

- ◎ Look for TPF-5(281) on Pooled Fund website
  - Ask existing partners for feedback
- ◎ Can participate in “traditional” fashion
  - Receive training
  - Participate in research
  - Receive DEN support
- ◎ Can also request and support specific task

# Examples of Specific Tasks

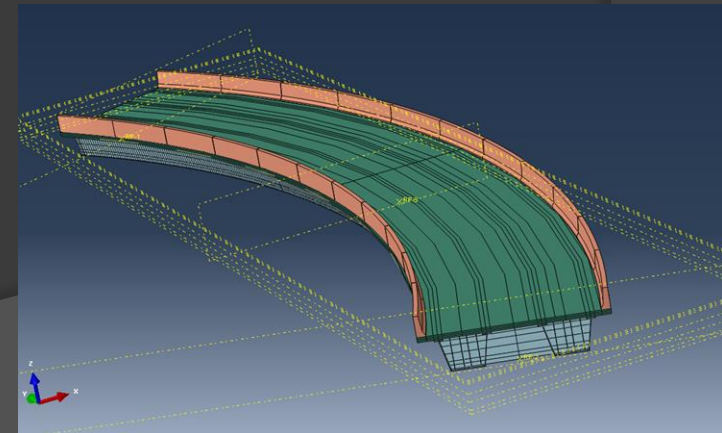
- ◎ Minnesota DOT
  - Participating as traditional partner
  - Also requested specific support related to Winona Bridge
    - Testing of selected built-up tension members
    - Supporting separate unique scope



# Examples of Specific Tasks

## ○ Wisconsin DOT

- Supporting specific task focused on system analysis of twin-tub girder bridges
- Objective is to demonstrate which structures can be removed from FC list for long-term hands-on inspection.
- Already have obtained FHWA for one bridge
  - i.e., no longer classified as FC



# Proposed Specific Task Focused on Risk-based Inspection

- ◎ FHWA moving towards RBI
  - MAP 21 requirement
- ◎ Proposed study on implementation of RBI processes within State DOT programs
- ◎ Based on work by Washer as reported in NCHRP 782
  - Procedure to set inspection interval between 12 and 96 months
- ◎ Desire to be able to “hit the ground running”

# Proposed Task Focused on RBI

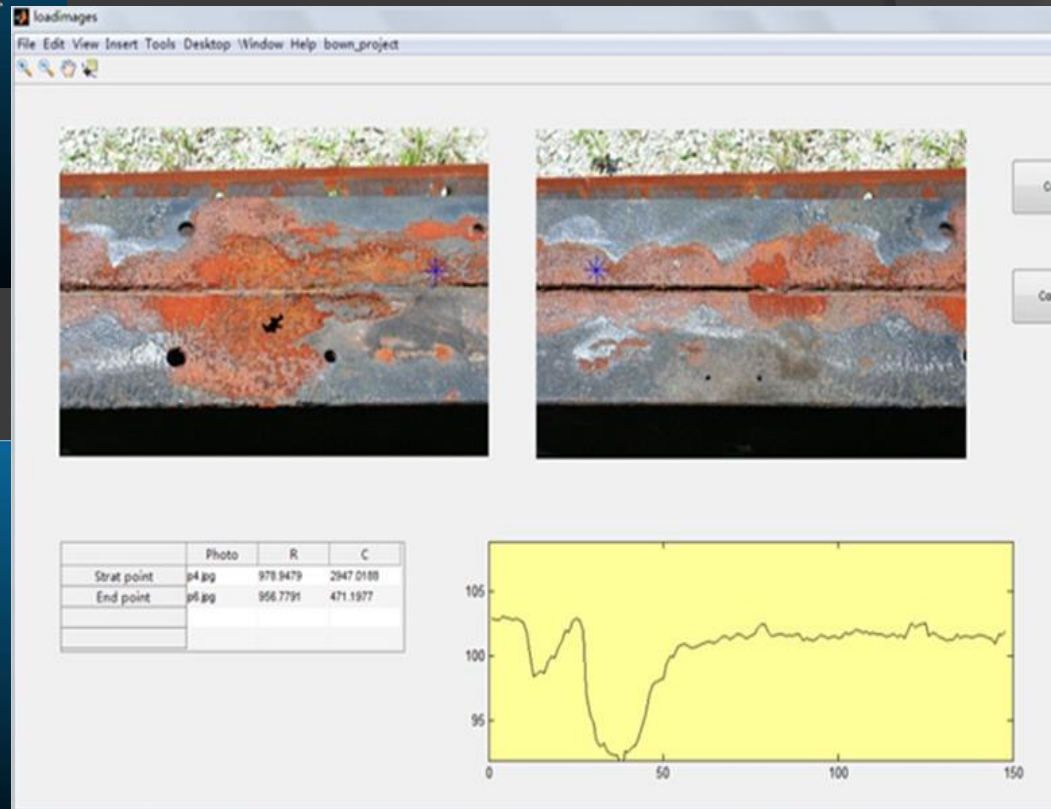
- ① Develop a handbook for implementation of RBI to ensure consistent application
- ① Develop methodologies for supporting preservation activities within an RBI framework
- ① Study the implementation of technologies to support RBI:
  - Unmanned Aerial Vehicles (UAVs) within a RBI program
  - Using S-BRITE to study reliability of inspection

# Proposed Task Focused on RBI

- ⦿ Anticipated costs:
  - Looking for two year commitments at \$50k/year
  - Requesting at least six states participate
- ⦿ Since this will be part of existing TPF-5(281), there is not need for time consuming “start-up”
- ⦿ For more information, see Dr. Glenn Washer
  - He is here



# Proposed Task Focused on the Development of Tools for Corrosion and Damage Measurement using 3D Imaging



# Summary

- ⦿ Much progress in 2016
- ⦿ Training to continue and expand
- ⦿ Research to continue and expand
  - Begin to bring in other materials etc.
  - Internal curing concrete already on site
- ⦿ Develop industrial partner program in 2017
- ⦿ More State Partners welcome
  - Ask partner states about their experiences

# Acknowledgements

- Indiana DOT
- Iowa DOT
- Kansas DOT
- South Dakota DOT
- Minnesota DOT
- Illinois DOT
- Wisconsin DOT
- FHWA
  
- Steel Dynamics
- Hirschfeld Industries
- AZZ Galvanizing
- BNSF, CSX, CP, & Indiana RR
- Transportation Technology Center, Inc.



**S-BRITE Center**

Steel Bridge Research

Inspection & Training

Educational Aspects

Bridge Component  
Gallery

Historic Bridge Steel  
Archive

**S-BRITE Spotlights**

**S-BRITE Receives Steel Truss Bridge**

Here is a quick look at the anticipated delivery of a 1937 truss bridge originating from Michigan. The trusses will be setup later this spring for use at Purdue University's Steel Bridge Research, Inspection, Training, and Engineering Center (S-BRITE) located outside of campus. The S-BRITE Center is under the direction of Associate Professor of Civil Engineering Robert Connor.



**Contact Info**

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**Vision Statement**

S-BRITE will be the nationally leading

<https://engineering.purdue.edu/CAI/SBRITE>

# Google “S-BRITE”

The screenshot shows a Google search for "s-brite" in a Chrome browser. The search results page displays several entries:

- S-BRITE - Bridge Component Gallery - The Center for the Aging ...**  
engineering.purdue.edu › Engineering › CAI › SBRITE › Facilities ▾ Purdue University ▾  
Figure 1 shows the first phase of construction for the S-BRITE Center Bridge Component Gallery (BCG). The POD Research frame can be seen in the foreground ...  
You've visited this page 4 times. Last visit: 9/20/16
- S-BRITE - Training - The Center for the Aging Infrastructure - Purdue ...**  
engineering.purdue.edu › Engineering › CAI › SBRITE ▾ Purdue University ▾  
S-BRITE TRAINING COURSES. Click here for Bridge Inspection Certification for INDOT Fracture-Critical and Complex Bridge Inspection ...  
You've visited this page 2 times. Last visit: 9/20/16
- Steel Bridge Research, Inspection, Training, and Engineering Center ...**  
https://engineering.purdue.edu/CAI/SBRITE ▾ Purdue University ▾  
AISC (American Institute of Steel Construction), NSBA (National Steel Bridge Alliance), and the Purdue S-BRITE Center have partnered to offer a Steel Bridge ...
- Scotch-Brite™ Brand**  
www.scotch-brite.com/ ▾  
Cleaning Tools for Every Mess. From keeping tidy to the deepest clean, we have every tool you need to leave your home spotless.

Below the search results is an "Images for s-brite" section with a "Report images" link. The image thumbnails include various Scotch-Brite products like pads, brushes, and spray bottles.

On the right side of the page, there is a local business listing for "Steel Bridge Research Inspection Training and Engineering Center". The listing includes a photo of a building, a map, and contact information:

- Steel Bridge Research Inspection Training and Engineering Center** ★
- Website | Directions
- Research Center
- Address:** S Sharon Chapel Rd, West Lafayette, IN 47907
- Phone:** (765) 494-7081
- Hours:** Open today · 9AM–5PM ▾
- Suggest an edit · Own this business?
- Reviews | Write a review | Add a photo
- Be the first to review
- Send to your phone | Send

The Windows taskbar at the bottom shows the time as 2:55 PM on 10/3/2016.

# S-BRITE

TPF-5(281)

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