NEW BRIDGE MATERIAL DESIGN OPTIONS

Presenter: Christine Mizioch
Title: Vice President, Accelerated Project Delivery
Agency/Affiliation: The Metric Group

Event: Florida Transportation Builders Association
Session Title: New Bridge Material Design Options
Date: March 20, 2012
WHAT IS TIG?

TIG is dedicated to sharing high-payoff, market-ready technologies among transportation agencies across the United States.

TIG promotes technological advancements in transportation, sponsors technology transfer efforts and encourages implementation of those advancements.

TIG reports to the Standing Committee on Highways (SCOH).

For more information visit http://tig.transportation.org.
The Lead States Team

AASHTO TECHNOLOGY IMPLEMENTATION GROUP

Kenneth Sweeney MaineDOT
Christine Mizioch (formerly MassDOT) The Metric Group

Dale Peabody MaineDOT
Mansour Mike Mohseni Colorado DOT

David Sherlock MaineDOT
Larry Parent Advanced Structures & Composites Center University of Maine

Dr. Tadeusz C. Alberski NYSDOT
Lou Triandifilou FHWA

Raja Jildeh Michigan DOT
Turner-Fairbank

Stacy McMillan MissouriDOT
Stephen Von Vogt Maine Composites Alliance
THE CHALLENGE:
• Crumbling Infrastructure
THE ANSWER:

• Rigidified FRP Arch Bridges ("Bridge in a Backpack")
• Hybrid Composite Beam
AASHTO TECHNOLOGY IMPLEMENTATION GROUP

BRIDGE IN A BACKPACK
WHAT IS BRIDGE IN A BACK PACK?

“Hybrid bridge system combining benefits of high-performance composites with cast-in-place concrete”
BENEFITS

SUSTAINABILITY

SIMPLIFIED CONSTRUCTION

MINIMIZED TRAFFIC OBSTRUCTION AND DETOURS

REDUCED CARBON FOOTPRINT
EARLY PROJECTS: 2008-2009

First Installation of Composite Arch System

34’ Span, 23 Arches (12” Diameter)

Neal Bridge
Maine DOT Demonstration Project
2008
EARLY PROJECTS: 2008-2009

First Commercial Installation by AIT

First Project Awarded on a Low-Cost Basis, Competing Against Traditional Materials

Design-Build Project

28’ Span, 12 Arches (12” Diameter)
Jenkins Bridge
Bradley, ME
28’ Span
Composite Panel Headwall
14 Arches (12” Diameter)

Royal River Bridge
Auburn, ME
38’ Span
Precast T-Wall Headwall
13 Arches (12” Diameter)
THIRD GENERATION BRIDGES

Perkins Bridge
Belfast, ME

48’ Span
Precast T-Wall Headwall
16 Arches (15” Diameter)

Tom Frost Memorial Bridge
Hermon, ME

45’ Span
Snowmobile/Pedestrian
3 Arches (12” Diameter)
EXPANDING IN NEW ENGLAND: 2011

Scott Reservoir Outlet
Fitchburg, MA

Part of MASS DOT Accelerated Bridge Program

38’ Span
Composite Panel Headwall
15 Arches (12” Diameter)
Pinkham Notch, NH
24’ Span
Composite Panel Headwall
6 Arches (12” Diameter)
EXPANDING IN NEW ENGLAND: 2011

Caribou, ME

Largest Span Bridge to Date
54’ Span
Precast Panel Headwall
22 Arches (15” Diameter)
Proposed AASHTO LRFD Guide Specifications for Design of Concrete-Filled FRP Tubes for Flexural and Axial Members

• Generic in nature – applies to all CFFT’s
• Presented to AASHTO’s T-6 (FRP) Committee in May 2011, currently under review
U.S. Interest

Proposals submitted for “Bridge-in-a-Backpack™” in 11 States

AIT has begun dialogue with over 20 states about potential future projects

International Interest

Working on proposals, and/or in discussion on future work in the following countries:

- United Arab Emirates
- Trinidad
- Russia
- Nigeria
- Panama
- Mexico
- Canada
NATIONAL RECOGNITION

2011 Focus Technology

AASHTO Technology Implementation Group

American Society of Civil Engineers

2011 Charles Pankow Award for Innovation

Engineering Excellence Award
Royal River Bridge, Auburn, ME
Kleinfelder|SEA Consultants and Maine DOT

2010 Award for Composites Excellence
Most Creative Application
BUILD BETTER®
WITH
HYBRID COMPOSITE BEAMS
(HCB®)
AASHTO TECHNOLOGY IMPLEMENTATION GROUP

WHAT IS THE HCB?
“Tied Arch in A Fiberglass Box”

Structural Member Using Different Building Materials

Cost-Effective Composite Beam

Stronger, Lighter, Corrosion Resistant

- Compression Arch
- Shear Connectors
- Tension Reinforcement
  - Galvanized P/S Strand
  - Fiberglass Cloth
- FRP Shell
BENEFITS OF THE HCB

SUSTAINABILITY
(100+ Year Service Life, No cracking/spalling/rusting, Never Needs Painting)

CONGESTION RELIEF
(Perfect for Modular Bridge Installation “ABC”, Reduced traffic congestion during construction)

LIGHTWEIGHT
(Shipping and Erection weight is 10% of Concrete Beam, 33% of Steel Beam)

REDUCED CARBON FOOTPRINT
(Uses 80% Less Cement, Reduces Number of Delivery Trucks, Allows for Smaller Cranes)
### Projects Completed/Contracted

<table>
<thead>
<tr>
<th>Date</th>
<th>Length</th>
<th>Project Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/2007</td>
<td>30'</td>
<td>Railroad Bridge at TTCI</td>
<td>Colorado</td>
</tr>
<tr>
<td>08/2008</td>
<td>57'</td>
<td>High Road Bridge</td>
<td>Illinois</td>
</tr>
<tr>
<td>10/2009</td>
<td>31'</td>
<td>Route 23 Bridge</td>
<td>New Jersey</td>
</tr>
<tr>
<td>03/2011</td>
<td>42'</td>
<td>Railroad Span for BNSF</td>
<td>Colorado</td>
</tr>
<tr>
<td>06/2011</td>
<td>540'</td>
<td>Knickerbocker Bridge</td>
<td>Maine</td>
</tr>
<tr>
<td>07/2011</td>
<td>100'</td>
<td>Research Pier in Machias</td>
<td>Maine</td>
</tr>
<tr>
<td>06/2011</td>
<td>180'</td>
<td>Safe &amp; Sound Bridge B0439</td>
<td>Missouri</td>
</tr>
<tr>
<td>03/2012</td>
<td>106'</td>
<td>Safe &amp; Sound Bridge B0410</td>
<td>Missouri</td>
</tr>
<tr>
<td>07/2012</td>
<td>100'</td>
<td>Safe &amp; Sound Bridge B0478</td>
<td>Missouri</td>
</tr>
</tbody>
</table>
WORLD’S 1st COMPOSITE RAIL BRIDGE

First Installation of an HCB

Completed through HSR and NCHRP IDEA Program of Transportation Research Board

30’ Span for Class 1 Railroads

Subjected to 237 Million Gross Tons of Heavy Axle Freight Traffic

FAST Loop at TTCI
Pueblo, CO
Nov 2007
1st HCB HIGHWAY BRIDGE

First Commercial Installation of an HCB Bridge through FHWA-IBRD Grant

Entire Bridge shipped on One Truck

57’ Span

6 beams Installed in 1 day

High Road Bridge
Lockport, IL
Aug 2008
STAGED CONSTRUCTION USING HCB

Easy installation in congested urban environment

6’ wide planks at 2,000 lbs. per pick

31’ Span

6 beams for each half installed in 3 hours

Route 23
Cedar Grove, NJ
Oct 2009
HELPING WITH SAFE & SOUND

Three HCB bridges included as part of Missouri DOT Safe & Sound Project – 800 bridge program

B0410 – 106’ Single-Span Bridge
B0478 – 100’ Two-Span Bridge
B0439 – 180’ Three-Span Bridge

Bridge B0439
Jackson Mill, MO
Nov 2011
World’s Longest Composite Bridge

Funded by Maine Composite Initiative
8-Span Bridge with 60’ and 70’ Spans for total length of 540’ (shorter end Spans)
Competitive on Cost Basis

Knickerbocker Bridge
Boothbay, ME
June 2011
ANTICIPATED PROJECTS: 2012

I-15 Overpass in Utah
Manderfield, UT
($1M FHWA – HFL Grant)

Tide Mill Bridge
Westmorland County, VA

Dry Branch Bridge
Charleston, WV
106' single span
IBRD Grant

Potomac Hollow Bridge
Allegheny County, MD
26'-6" single span on 31 degree skew
IBRD Grant

B0410 – Lockwood, MO – July 2012
106 ft. span w/60 in. HCB Double Box
AASHTO TECHNOLOGY IMPLEMENTATION GROUP

NATIONAL RECOGNITION

2011 Focus Technology

2010 Nova Award

National Grand Award
High Road Bridge, Lockport, IL
Teng & Associates – Consultants

2010 Award for Composites Excellence
Infinite Possibility
TIG Team Activities

- Established web-based information and tech resources.
- Created information/promotional materials
- Highways for L.I.F.E. webinar conducted (100 participants)
- AASHTO design spec for concrete-filled tube arch approved by bridge subcommittee.
TIG Team Activities (cont’d)

- Presentations completed at FL Transportation Builders Assn., FDOT Structural Engineers Mtg, WASHTO, MAASTO (additional presentations planned)
- Fire resistance, maintenance and inspection guidelines in development by UMaine AEWC Center.
- Individual State assistance underway (MT, others)
- Case studies in development
NEW BRIDGE MATERIAL
DESIGN OPTIONS

QUESTIONS?
For more information, visit

http://tig.transportation.org

and click on

New Bridge Material Design Options