The First Thermoplastic Bridges Located in U.S. Highways

Vijay Chandra, PE, Director of Structures, Parsons Brinckerhoff
John S. Kim, PhD, PE, Senior Professional Associate, Parsons Brinckerhoff

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Plastic waste is a global problem

- Over 100 million tons are placed in landfills every year worldwide
- Most plastics take several decades to degrade
- Less than 30% of the plastic waste in the U.S. is recycled and remanufacture
From Wasteful Material to Useful Solutions

Excellent Structural Performance
Lower Total Life-Cycle Costs
Tangible Sustainability Factors

Rail Tie | I - Beam
---|---
Board | Piling
Recycled Structural Composites

- High Density Polyethylene with Polystyrene or Polypropylene coated glass fibers
- Unique combination of durability and strength
- 100% recycled plastic composites

What is Axion Thermoplastic?
Product Advantages

- Green Product (Recycled Plastic)
- No Corrosion, Rotting or Insect Infestation
- Reduced Landfill Dumping
- Good Toughness Characteristics
- No Chemical Additives
- Green House Gas Savings
- Reduced Maintenance
- Sustainable & Durable
- Cost Competitive: Initial and Life Cycle
Properties

- Weight: 55pcf (Timber: 60pcf; Concrete: 150pcf)
- Specific Gravity: 0.85 – 0.90
- Elastic Modulus: 250,000 psi
- Allow. Flex. Stress: 600 psi (Ult. = 3 ksi)
- Allow. Comp. Stress: 600 psi (Ult. = 2.5 – 4.3 Ksi)
- Allowable Shear Stress: 350 psi (Ult. = 1.5 Ksi)
- Coef. of Thermal Exp.: 0.0000282 in/in/deg F
Design Considerations

- Ultraviolet Degradation - 0.003 in/yr (full sunlight)
- Creep - Low (high Safety factor to Ultimate)
- Thermal Resistance - Heat Deflection +/- 250 deg F
- Skid Resistance - Coefficient Of Friction = 0.5 with tire
- Acid Resistance - To most acids & salts
- Moisture Absorption - Virtually impervious
- Abrasion - High resistance to sand & salts
- Color - Graphite
Bridge Applications
Fort Leonard Wood, MO

W = 26 ft; L = 24 ft
Max Load = 25,000 lbs.

1998
Wharton State Forest, NJ

* Length - 56 feet
* Live Load - HS 20

2002
Fort Bragg, NC

Load Bearing Capability

M1 Abrams Tank on the Bridge

2009
Fort Bragg Construction

Driving RSPC piles

Pile Cap Installation
Military Rail Bridge
Ft. Eustis, Virginia
Fort Eustis, VA

Bridges 3 and 7

- **Live Load**: Cooper E60 and 260 Kip alternate loading with 20% impact
- **Deflection**: L/600
- **Length of Piles**: about 45 feet
- **Capacity of piles**: 17 – 20 tons in end bearing per Pile
- **Abutments**: Existing timber abutments retained
- **RSPC Elements**: Railroad Ties, Curbs, Girders, Shear Blocks, Pier Caps, Piles and Transverse Connectors
Fort Eustis, VA
Bridge No. 7

ELEVATION
Fort Eustis, VA
Typical Section
Fort Eustis Construction

Transportation

Storage

Installation
Fort Eustis, VA
Competed Bridge No. 3
Fort Eustis, VA
Live Loads for Testing

- Flat Bed
- GE 80 Tons
- GP 16 120 Tons
Fort Eustis, VA
Live Load Testing

GP 16
120 Tons
Fort Eustis, VA
Deflections

Bridge No. 3

Estimated Deflection = 0.32”
Measured Deflection = 0.29”

Bridge No. 7

Estimated Deflection = 0.25”
Measured Deflection = 0.21”
Scotland Highway Bridges

2011
Scotland Highway Bridges
Scotland Highway Bridges
Scotland Highway Bridges
Birch Hill Road Bridge
York, Maine

After (13 ft Opening)

Before (3 ft Opening)
Birch Hill Road Bridge
York, Maine
Birch Hill Road Bridge
York, Maine
Birch Hill Road Bridge
York, Maine
Birch Hill Road Bridge
York, Maine
Onion Ditch Bridge
West Liberty, OH
Onion Ditch Bridge
West Liberty, OH

General Information
- Year Built: 2012
- Total Length: 25’ 2”
- Max Span: 24’ 0”
- Live Load: HL93
- Installation Time: 6 weeks

Project Team
- Client: Logan County Ohio
- Engineer: Parsons Brinckerhoff
- Fabricator: Axion International
- Installer: Logan County Ohio
Other Applications

Floating Docks

Industrial Supports

Pier Fenders & Pilings

Pipe Supports
Railroad Ties and Switch Set

- ECOTRAX® Railroad Ties Over 12 years of successful in-line testing
- Complete series of AREMA and ASTM testing
- Expanding customer base in U.S. & Internationally
- Direct sales to Class 1 Railroads, Transit, Regional Short Line, Private Sidings
- Core Applications – Street Crossings, Switch Ties, Wet Track Areas, Transit Platforms
STRUXURE® Heavy Construction Mats

- Ideal for >100,000# active equipment with tracks in wet conditions
- Developing line of Laminated Mats for <100,000# equipment
- Strong & Durable $\rightarrow$ > 5x Life Cycle
- Lighter Weights = Lower Logistics Costs
- Sustainable Product, Recycle AGAIN!
- Sales & Rental Options

Energy & Mining
Retaining Walls
Sound Walls
More Applications

- Marinas
- Fenders
- Jetties and Piers
- Platforms and Boardwalks
- Temporary Reusable Bridges
- Culverts
Acknowledgement

- Manufacturer: Axion International
- Designer: Parsons Brinckerhoff
- Inventor: Rutgers University
Conclusions

- Green, Sustainable and Durable
- Environmentally Beneficial
- Vast Areas of Application
- Accelerated Construction
- Minimal Maintenance
- Cost Competitive
Questions?