

The First Thermoplastic Bridges Located in U.S. Highways



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**PARSONS
BRINCKERHOFF**



Plastic Waste out of Landfills

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 re-manufacture



From Wasteful Material to Useful Solutions

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



Rail Tie



I - Beam



Board

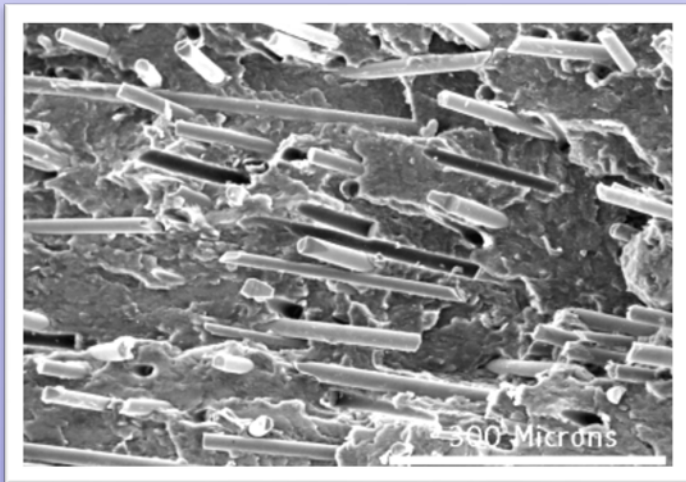


Piling

What is Axion Thermoplastic?

Recycled Structural Composites

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

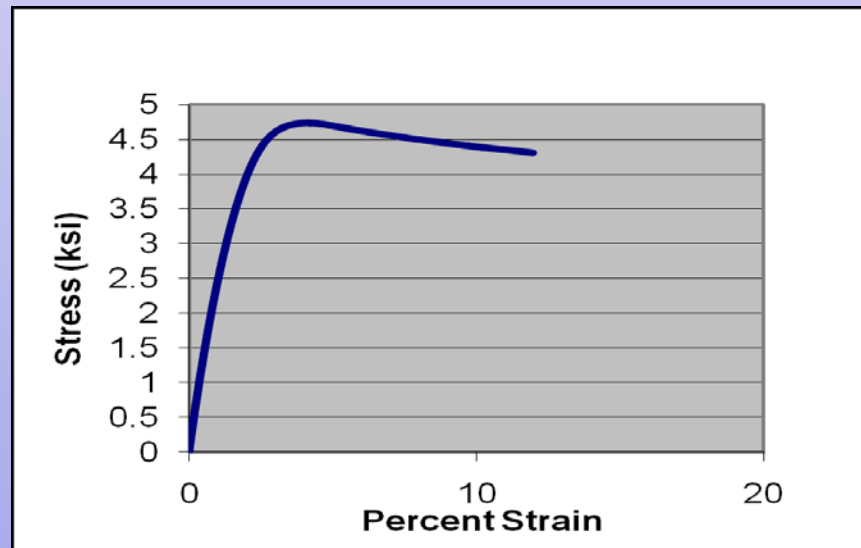


Product Advantages

- **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

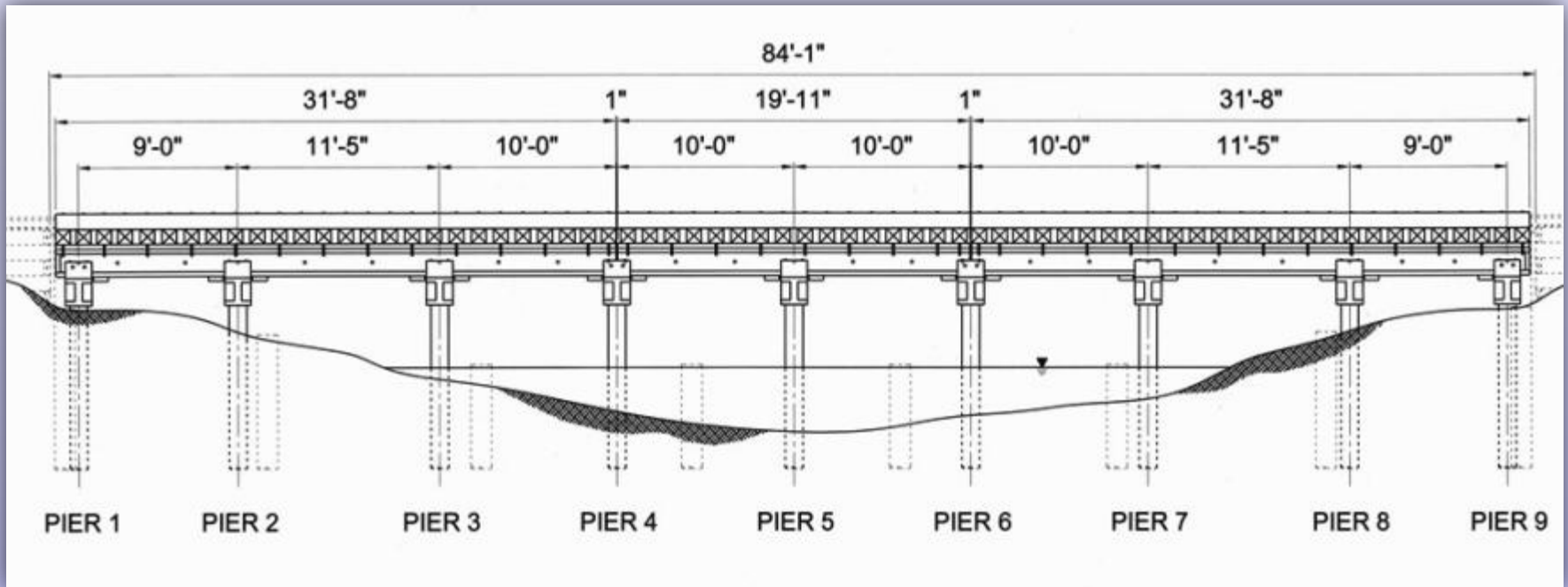


Fort Eustis, VA

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**

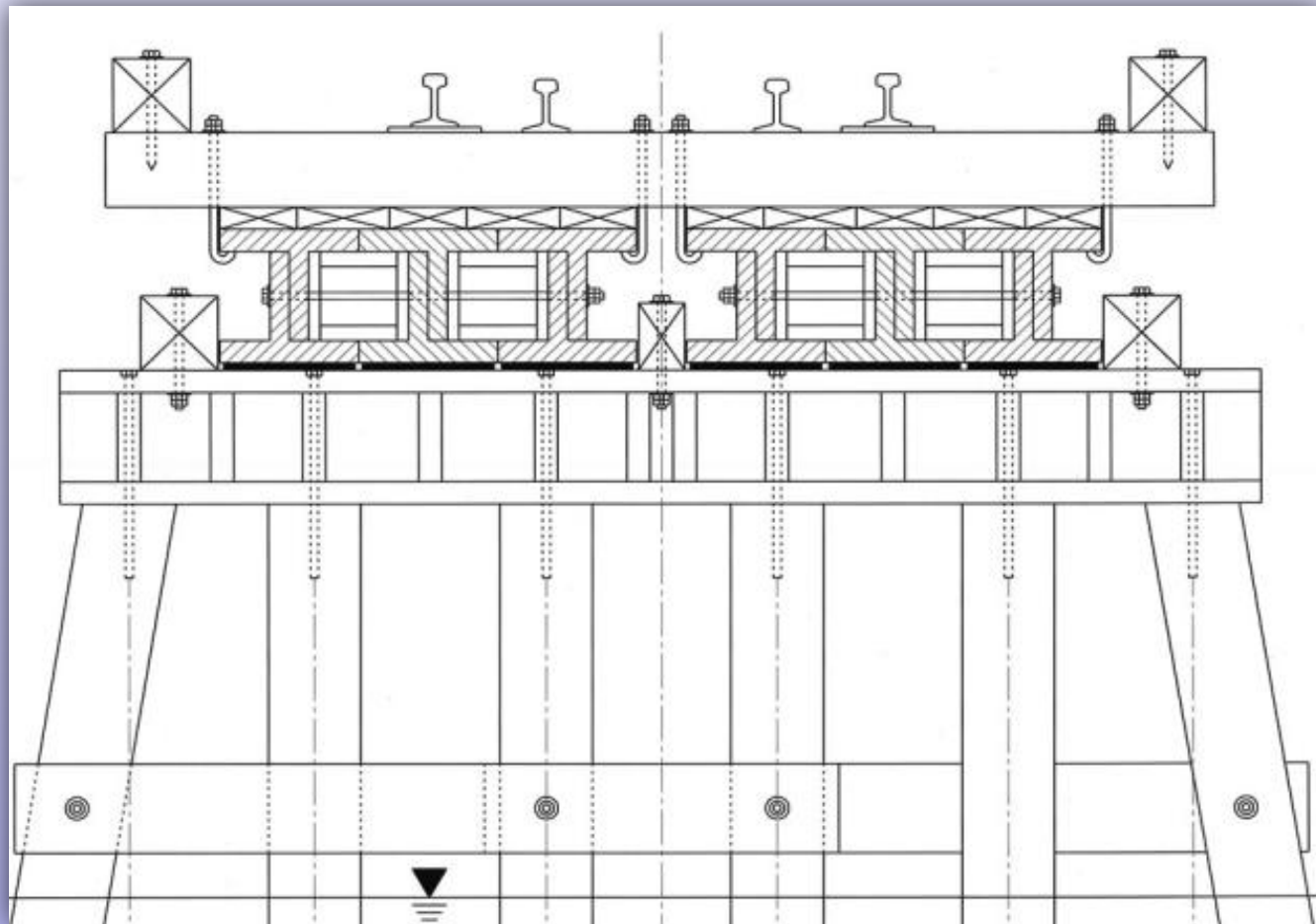
Fort Eustis, VA Bridge No. 7



ELEVATION

Fort Eustis, VA

Typical Section



Fort Eustis Construction



Driving RSPC Piles

Splicing



Pile Cap Installation

Fort Eustis Construction



Transportation



Storage



Installation

Fort Eustis, VA

Competed Bridge No. 3



Fort Eustis, VA

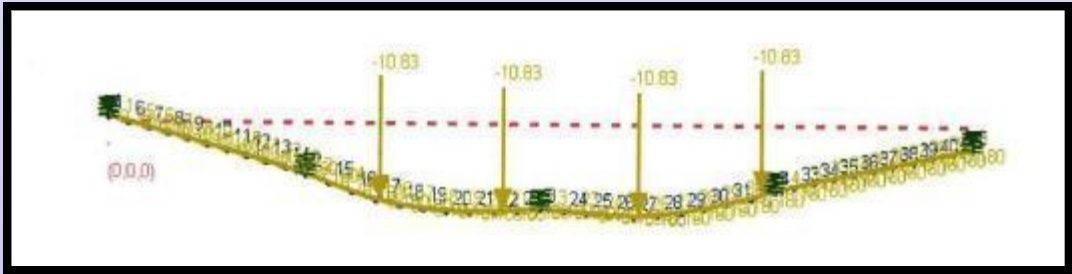
Live Loads for Testing



Fort Eustis, VA Live Load Testing



Fort Eustis, VA Deflections



Estimated Deflection = 0.25"

Measured Deflection = 0.21"

Bridge No. 3

Estimated Deflection = 0.32"

Measured Deflection = 0.29"



Bridge No. 7

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



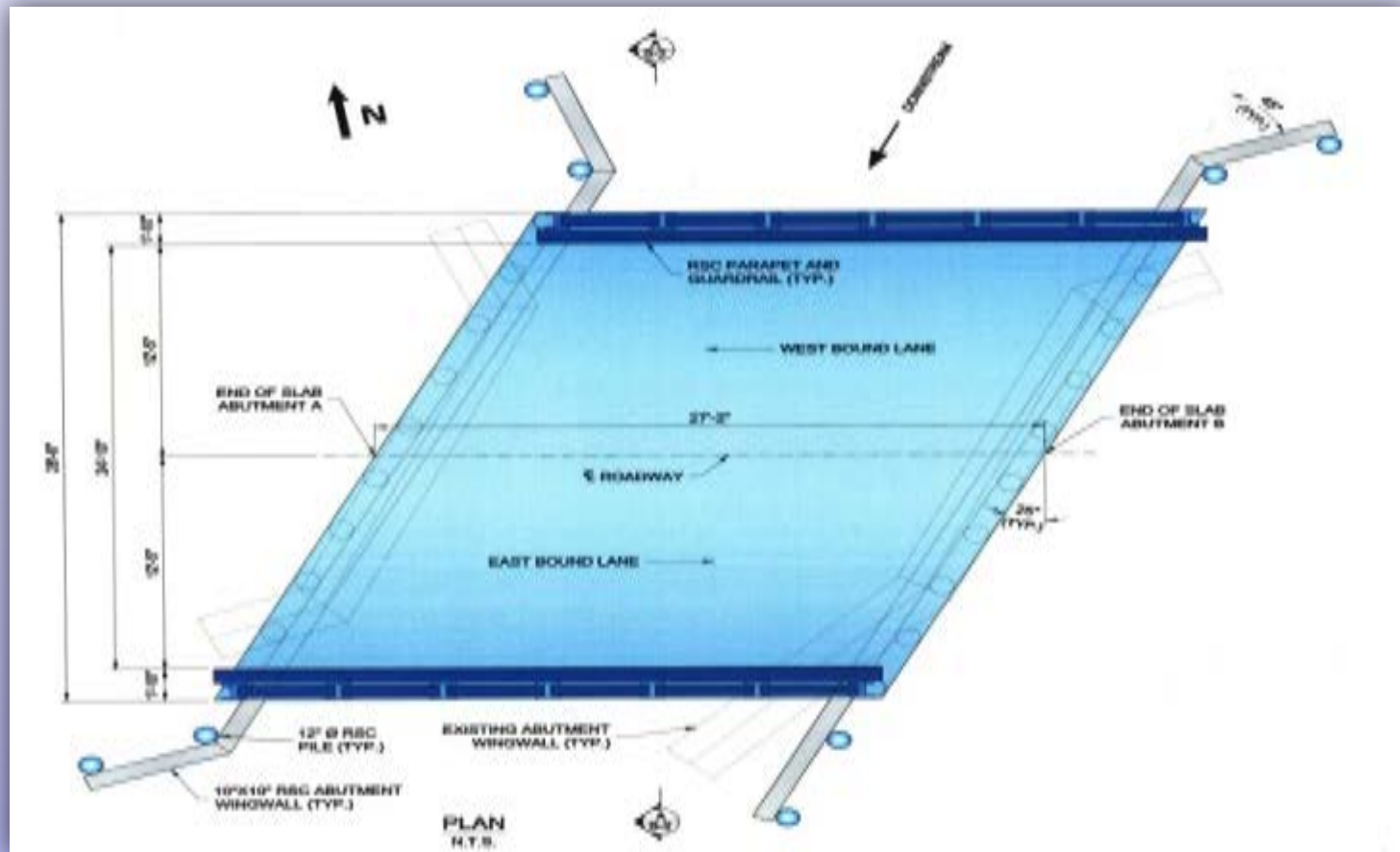
Onion Ditch Bridge

West Liberty, OH



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



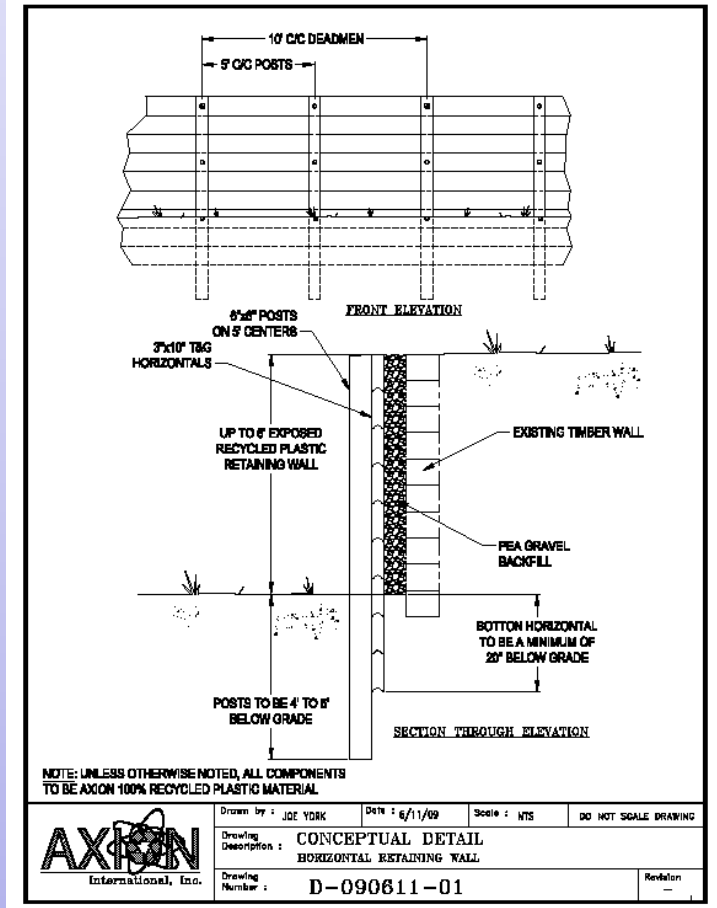
Energy & Mining

- ❖ Ideal for >100,000# active equipment with tracks in wet conditions
- ❖ Developing line of Laminated Mats for <100,000# equipment

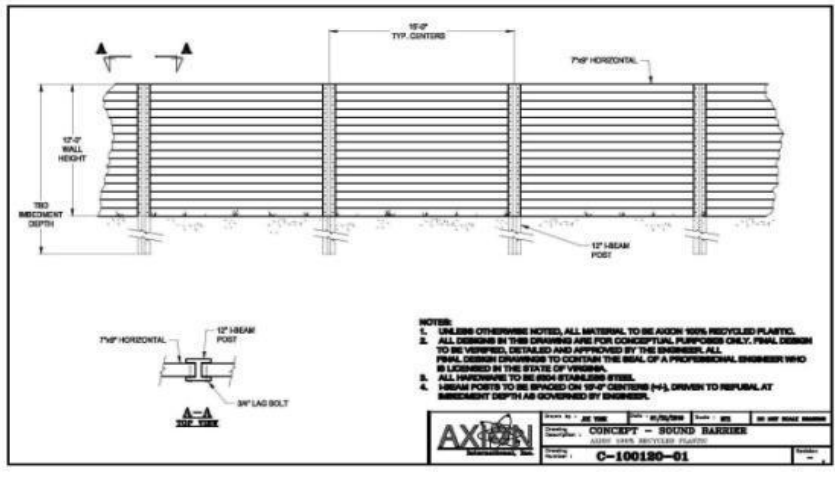
- ❖ Strong & Durable → > 5x Life Cycle
- ❖ Lighter Weights = Lower Logistics Costs
- ❖ Sustainable Product, Recycle AGAIN!
- ❖ Sales & Rental Options



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?

