# Innovative and Sustainable Bridge Solution using Recycled Plastic Composites

## Western Bridge Engineers Seminar

**By**

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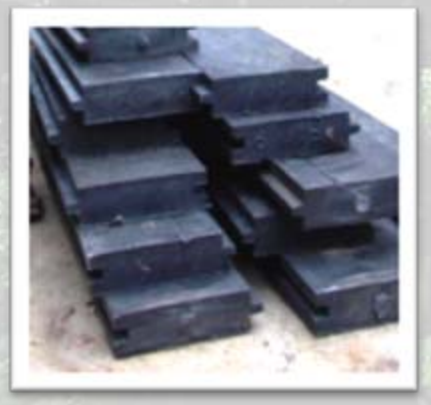
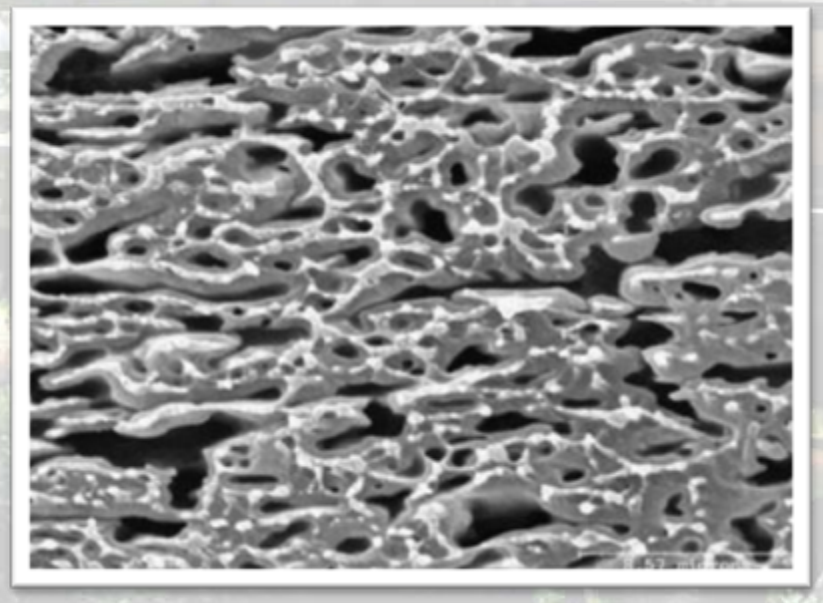
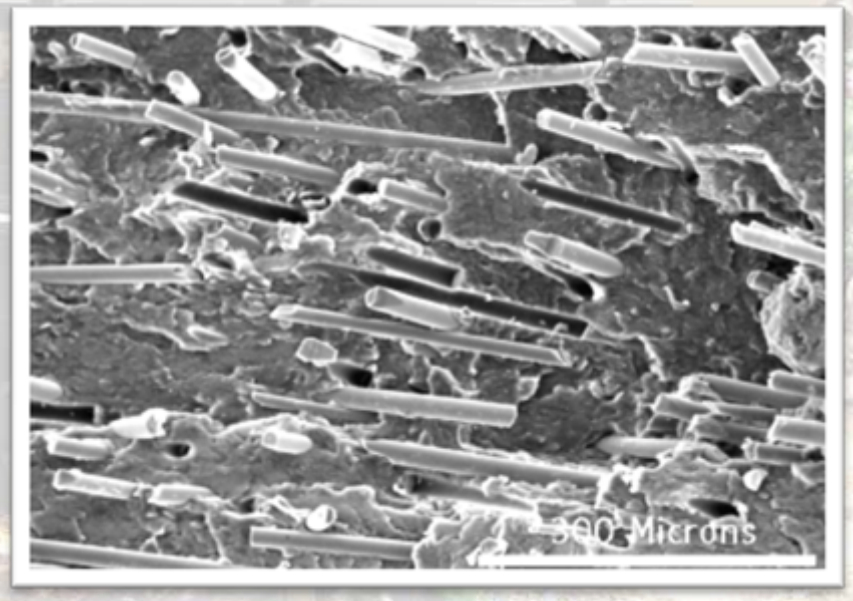
# From Wasteful to Useful



# What is Thermoplastic?

- **Recycled Plastic**
- **Immiscible Polymer Blend**
  - **High Density Polyethylene with Polystyrene or Polypropylene coated glass fibers (up to 8%)**





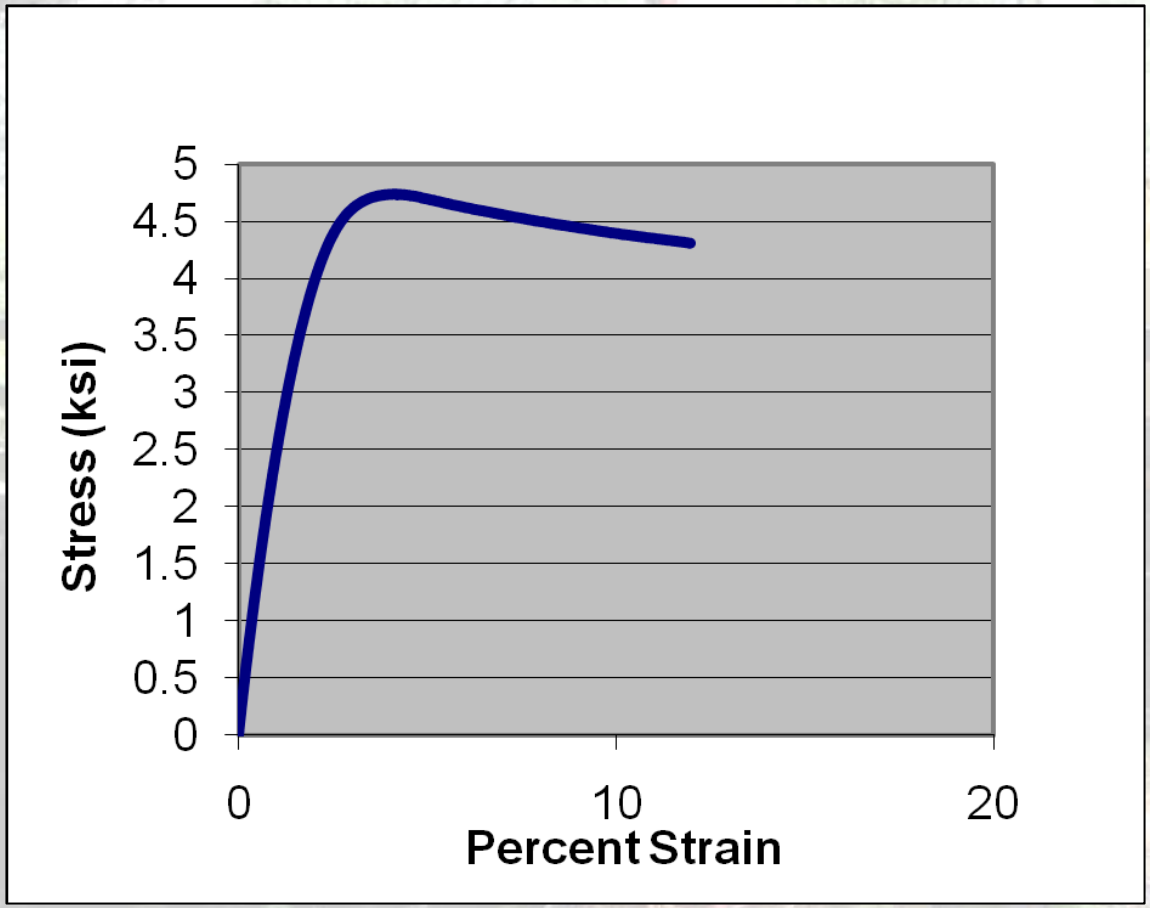
# Product Advantages

- 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

# Thermoplastic Properties

- **Weight:  55pcf (Wood: 60pcf; Concrete: 150pcf; Steel: 490pcf)**
- **Specific Gravity:  0.85 – 0.90**
- **Elastic Modulus:  250,000 psi**
- **Allowable Flexural Stress:  600 psi (Ult. = 3,000 psi)**
- **Allowable Compressive Stress:  600 psi (Ult. = 2,500 to 4,300 psi)**
- **Allowable Shear Stress:  350 psi (Ult. = 1,500 psi)**
- **Coefficient of Thermal Expansion:  0.0000282 in/in/deg F**

# Typical Stress/Strain Curve



# 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

# Wharton State Forest, NJ

* 2002
* Length - 56 feet
* Live Load - HS 20

# Fort Bragg, NC

Load Bearing Capability

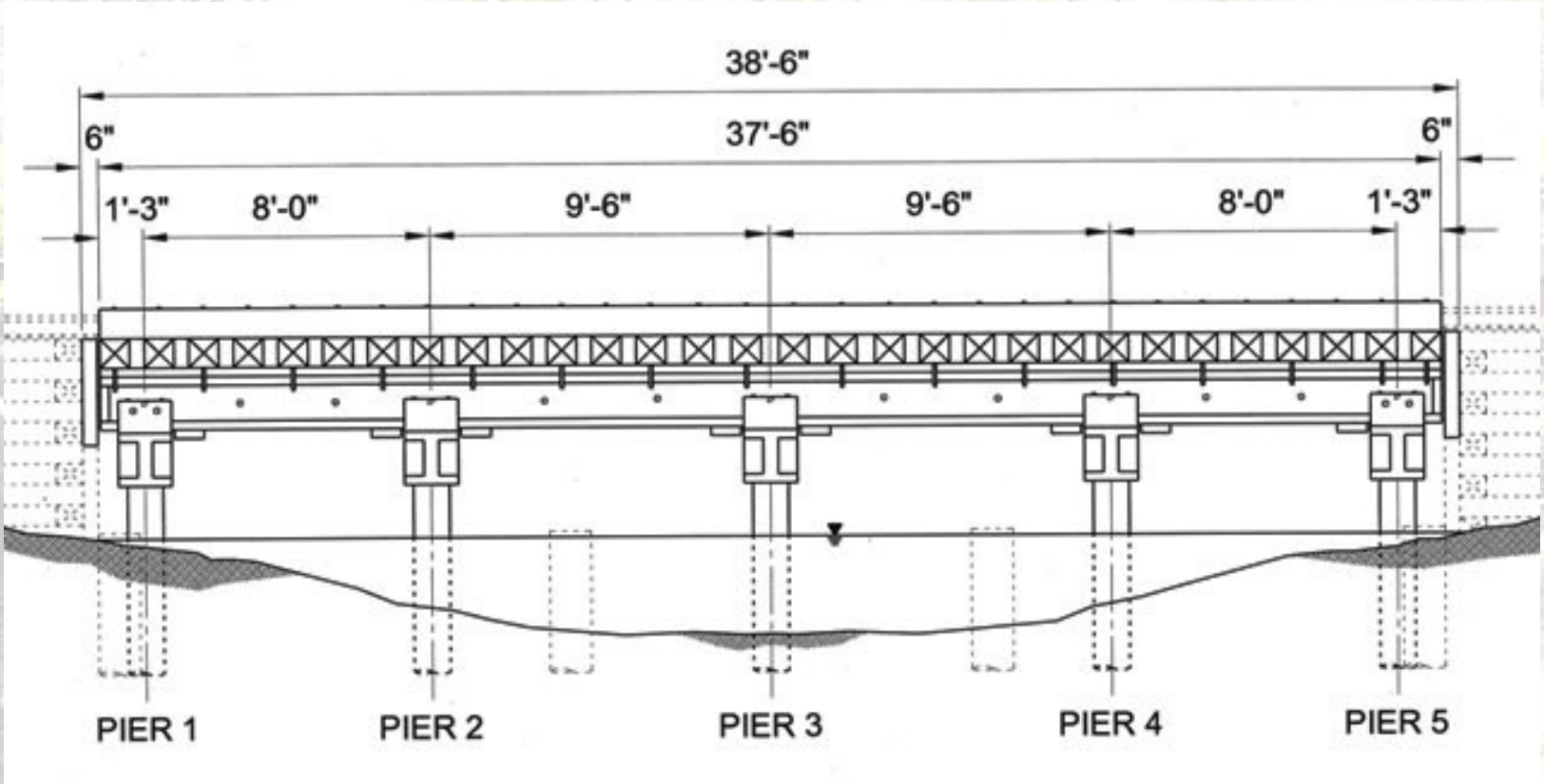
M1 Abrams Tank on the Bridge

# Fort Eustis, VA

## Bridges 3 and 7

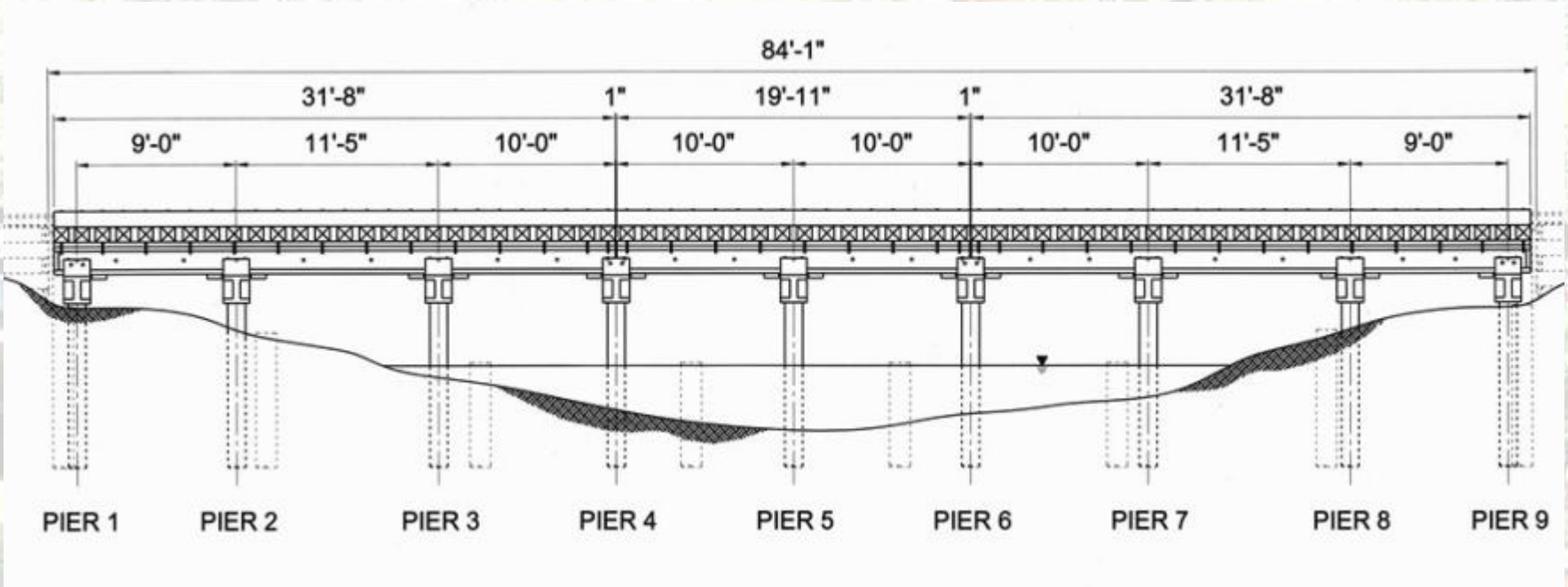
- Live Load: Cooper E60 and 260 Kip alternate loading with 20% impact
- Deflection: L/600
- Length of Piles: about 45 feet
- Capacity of piles: 17 – 20 tons in end bearing per Pile
- Abutments: Existing timber abutments retained
- RSPC Elements: Railroad Ties, Curbs, Girders, Shear Blocks, Pier Caps, Piles and Transverse Connectors

# Fort Eustis, VA
## Bridge No. 3



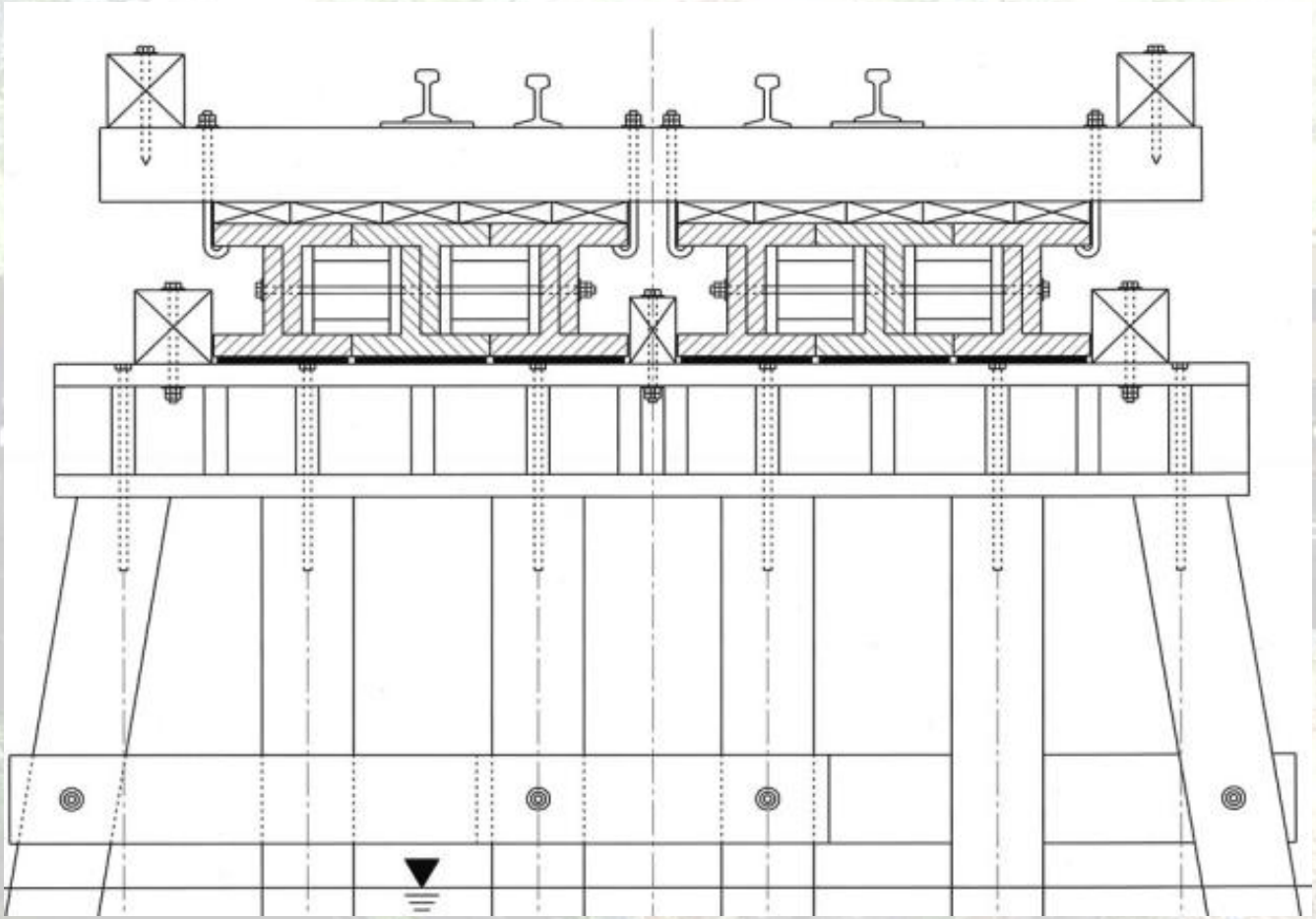

ELEVATION

# Fort Eustis, VA
## Bridge No. 7




ELEVATION

# Fort Eustis, VA
## Typical Section



# Fort Eustis Construction

Driving

Pile Cap Installation

Splicing

# Fort Eustis Construction

Transportation

Storage

Installation

# Fort Eustis, VA
## Completed Bridge No. 3

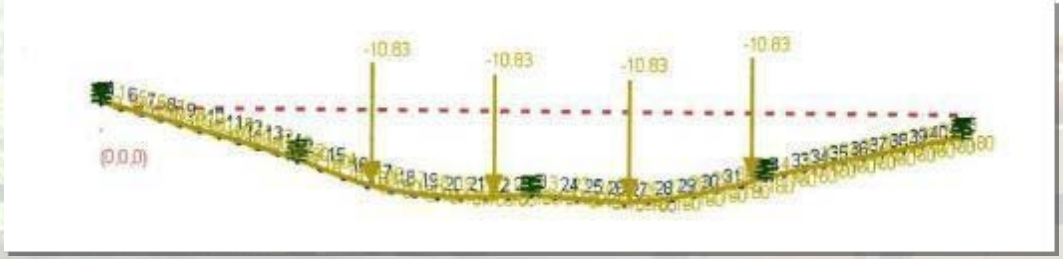
# Fort Eustis, VA

## Completed Bridge No. 7

# Fort Eustis, VA
## Live Loads for Testing



# Fort Eustis, VA
## Deflections




| Estimated Deflection = 0.25” |
| --- |
| Measured Deflection = 0.21” |

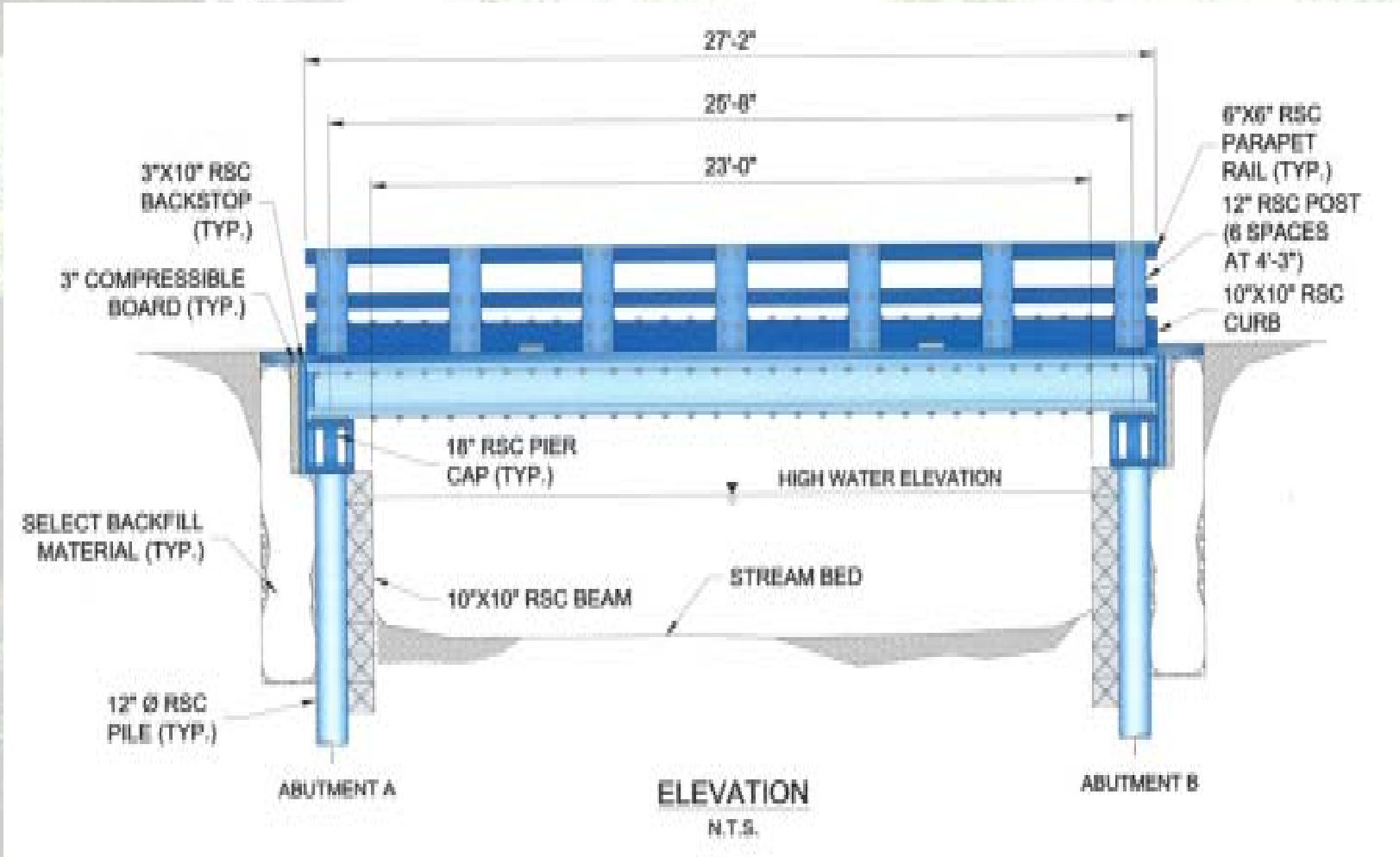
Bridge No. 3

| Estimated Deflection = 0.32” |
| --- |
| Measured Deflection = 0.29” |


Bridge No. 7

# Other Applications

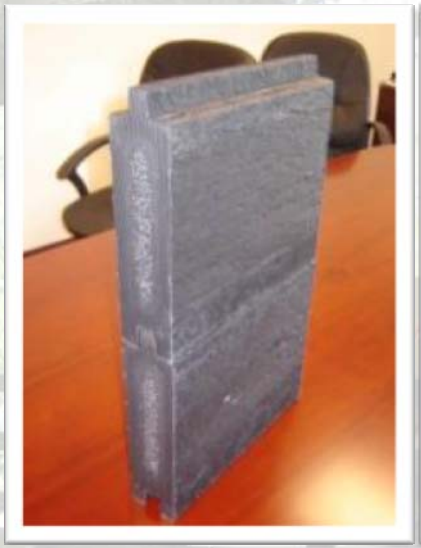
# County Highway Bridge

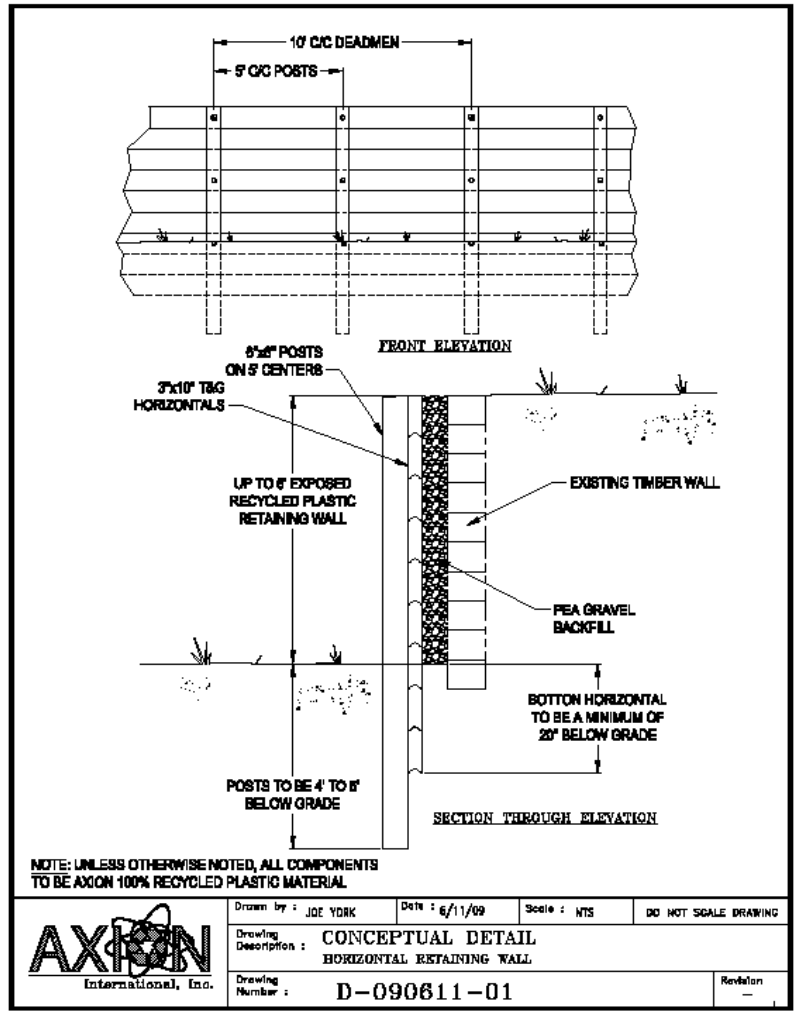


# Other Applications

- Marinas
- Fenders
- Jetties and Piers
- Platforms and Boardwalks
- Temporary Reusable Bridges
- Sound Walls & Retaining Walls
- Railroad Ties & Switch Sets

# Retaining Walls





# Railroad Ties and Switch Set

# Conclusion

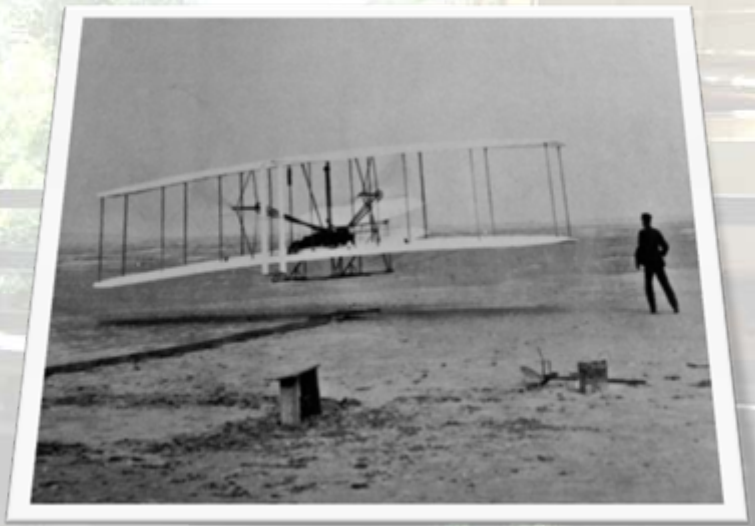
- Green, Sustainable and Durable
- Environmentally Beneficial
- Vast Areas of Application
- Accelerated Construction
- Minimal Maintenance
- Cost Competitive

# Acknowledgements


- Producer: Axion International, Inc.
- Inventor: Rutgers University
- Designer: Parsons Brinckerhoff
- Marketer: Innovative Green Solutions


GP 16
120 Tons

# Questions?



World's 1st Airplane
12 seconds
120 ft distance

World's 1st Plastic Railroad Bridges
12 ft max. span
120 ft total length