ACCELERATED BRIDGE CONSTRUCTION

GEOSYNTHETIC REINFORCED SOIL (GRS) INTEGRATED BRIDGE SYSTEMS (IBS)

By: Paul Spitzley, County Highway Engineer

Overview

- Project background
- Selecting a GRS-IBS design
- Geotechnical research and design
- Final design and layout

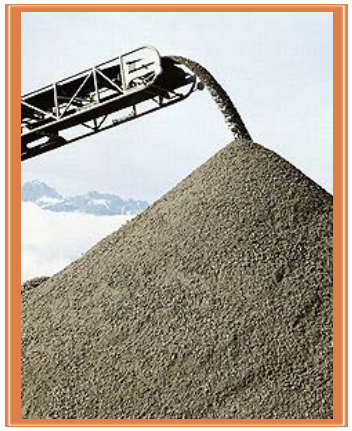
Background: Existing Bridge

- Over the Sebewa Creek
- Single 34’ span, Steel beams, corrugated steel deck, and vertical concrete abutments
- HMA Surface

Background: Existing Condition

- Rust
- Scaling
- Heavy section loss

Project Background: Users



- All Season Route
- Agricultural, sand, and gravel route
- Overweight/oversize permit applicants
- ADT 393 vehicles with 8% commercial

Background: Bridge Funding

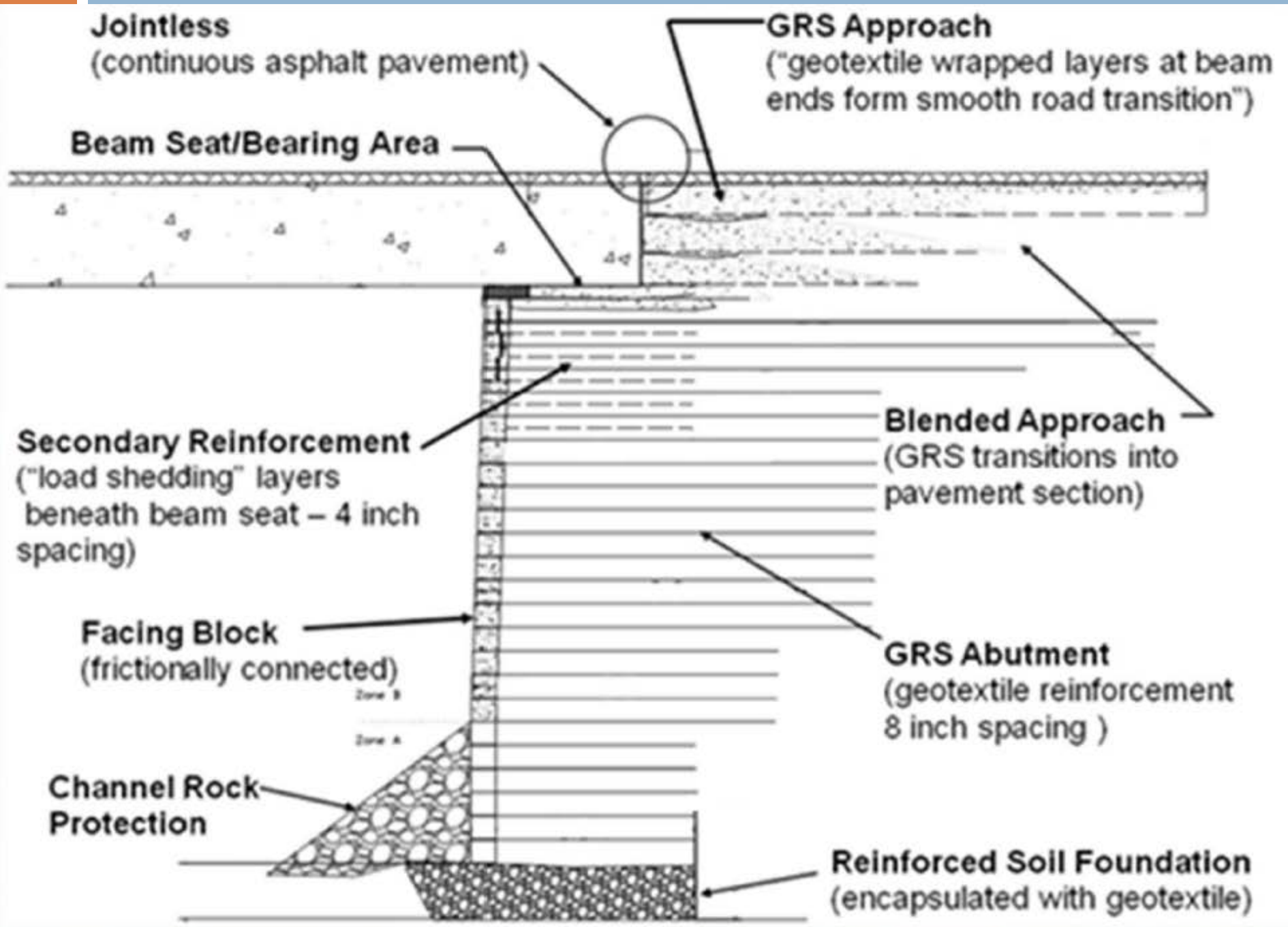
- Applied for local bridge funds in 2010
  - *Rehabilitation estimated at $338,500*
- Local Bridge Program approved the project in fall of 2010
- Further review of existing abutments found that replacement was necessary instead of rehabilitation
  - *Replacement estimate $668,000*
  - *$329,500 over original estimate*

Selection of GRS-IBS

- FHWA - Every Day Counts Initiative

  Identify and deploy innovation aimed at shortening project delivery

- GRS-IBS is one of these innovations
  - GRS: Engineered fill closely spaced alternating layers of compacted granular fill material and geosynthetic reinforcement
  - IBS: a fast, cost-effective method of bridge support that blends the roadway into the superstructure


Jointless
(continuous asphalt pavement)
GRS Approach
("geotextile wrapped layers at beam ends form smooth road transition")
Beam Seat/Bearing Area
Secondary Reinforcement
("load shedding" layers beneath beam seat – 4 inch spacing)
Blended Approach
(GRS transitions into pavement section)
Facing Block
(frictionally connected)
GRS Abutment
(geotextile reinforcement 8 inch spacing)
Channel Rock Protection
Reinforced Soil Foundation
(encapsulated with geotextile)

Selection of GRS-IBS

- GRS-IBS Site Recommendations
  - Single span (140’ max.) & abut. height (30’ max.)
    - ✓ *40’ clear span*
    - ✓ *12’ abut. height prop.*
  - Low velocity stream
    - ✓ *Sebewa Creek vel. < 5.0 fps in 100 year storm*
  - Low water table
    - ✗ *Ground water present within abutment backfill*

Geotechnical Research

- SME performed the geotechnical evaluation
  - Support from MDOT
- Their Findings:
  - Ground water 1'-2' above bottom of abutment
  - Bearing Soils were only slightly above the minimum subsoil bearing resistance required to support the proposed GRS Abutments when tested for global stability

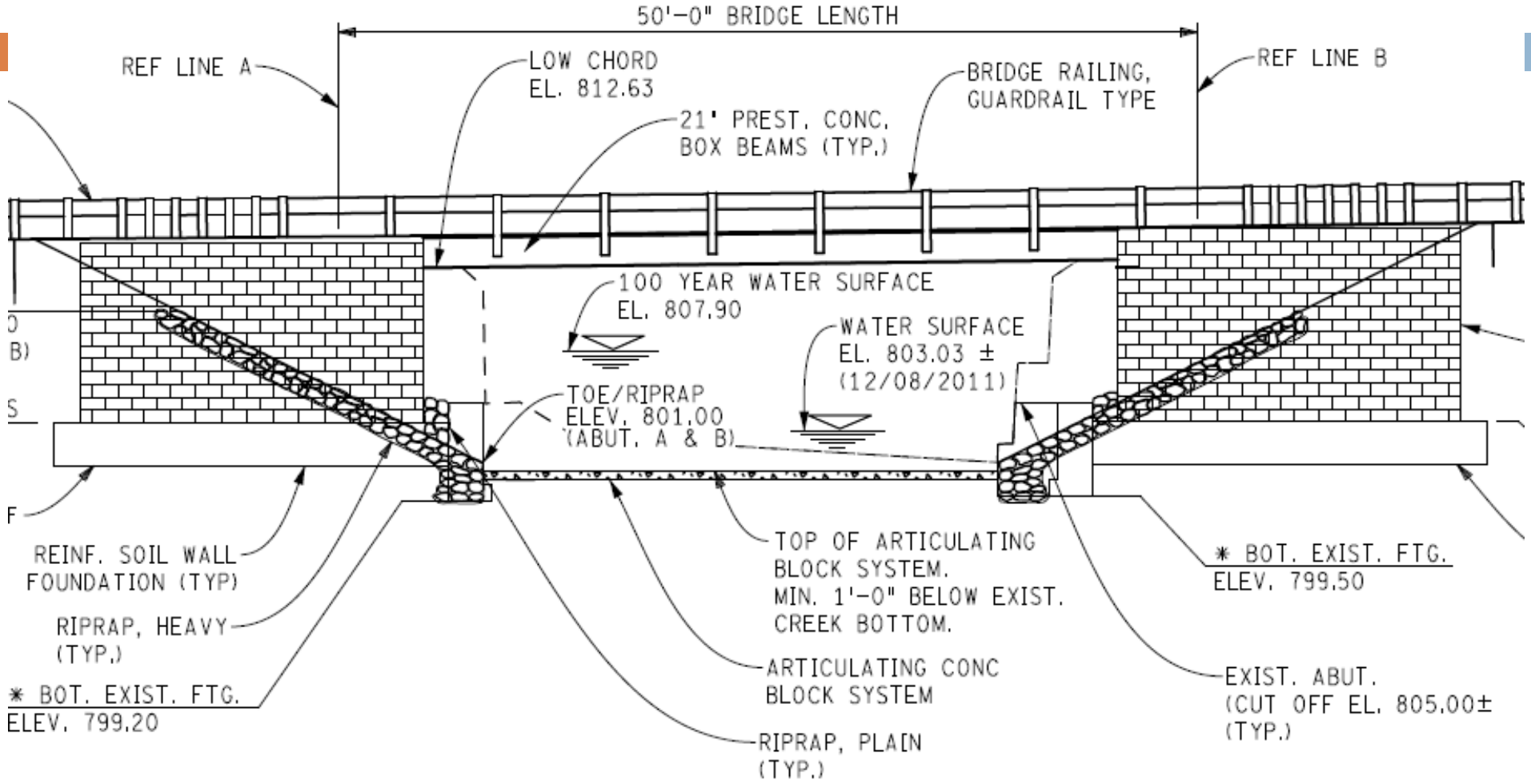
Geotechnical Design

- SME's Recommendation:
  - Leave existing abutments in place, construct berms on each end as necessary, and submersible pump dewatering
  - Two of the GRS abutment reinforcement layers be extended an additional 10' in length beyond the other layers (25' from abut.)
    - *Factor of Safety > 1.54 for global stability*

Final Design

- Designed by Williams and Works
- 50’ prestressed conc. box beams (side-by-side)
  - *39’ to 41’ clear span with 5’ beam seats*
- HMA deck
- Precast curb and guardrail anchorage onto fascia beams
- Articulated concrete block system in stream bed
- Progress Schedule
  - *July 7th to August 15th OR 6 weeks*

Profile



ELEVATION

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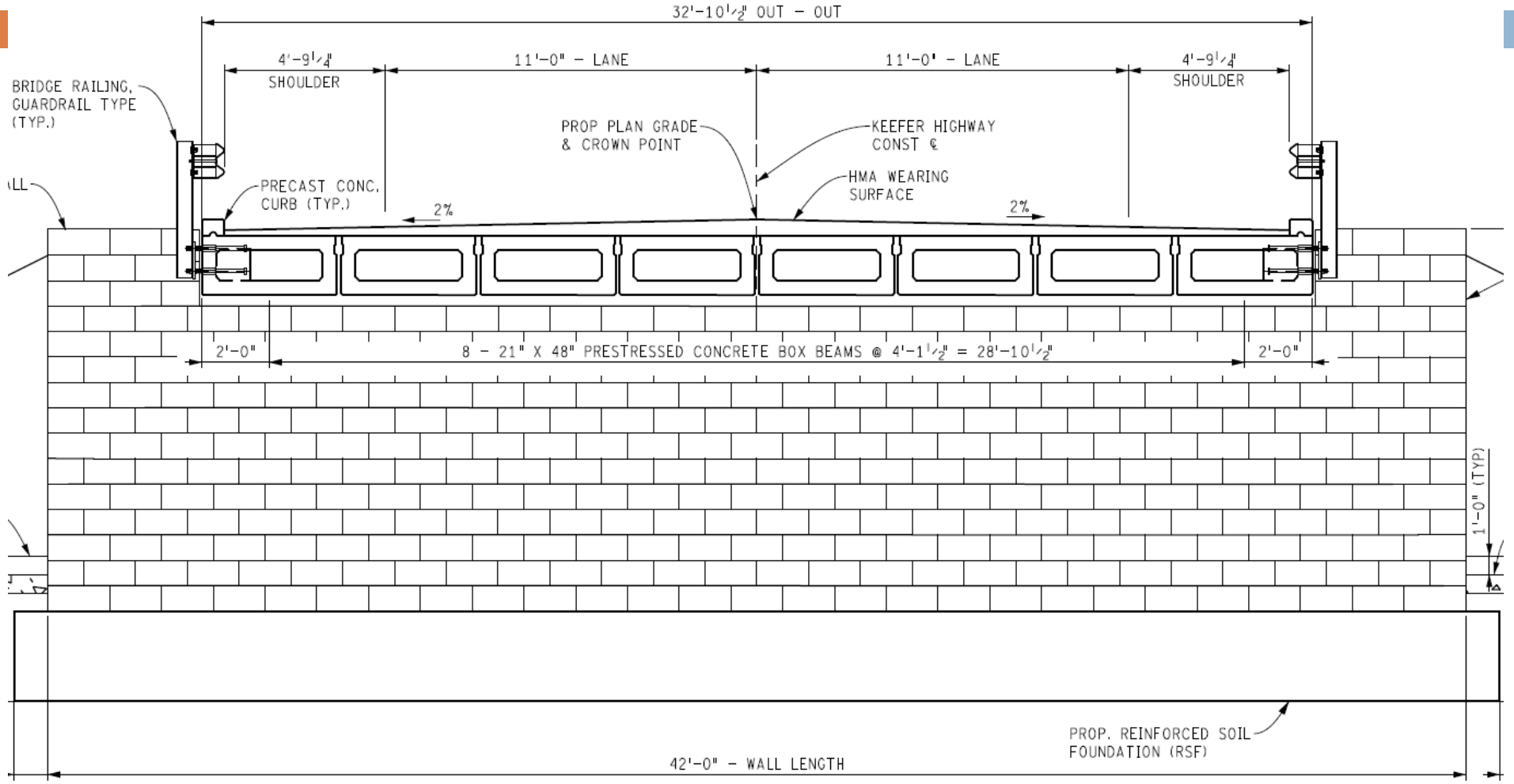
Cross Section



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Questions / Comments