GRS-IBS In Midland

6 years of Lessons Learned

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WHAT IS GRS-IBS?
QUICK REFRESHER

**GRS-IBS SECTION**

- **Jointless** (Continuous Pavement)
- **Integrated Approach** (Geotextile Wrapped Layers at Beams to Form Smooth Transition)
- **Beam Set** (Supported Directly on Bearing Bed)
- **Facing Elements** (Frictionally Connected - Top Three Courses Pinned and Grouted)
- **Scour Protection (Rip Rap)** (If Crossing a Water Way)
- **Bearing Bed Reinforcement** (Load Shedding Layers Spaced at ≤ 6 in.)
- **GRS Abutment** (Reinforcement Spacing ≤ 12 in.)
- **Reinforced Soil Foundation** (Encapsulated with Geotextile)
SO....WHERE ARE WE AT?

- How many in audience have worked on a GRS-IBS bridge in Michigan?

- How many have even considered this technology as an option?
By end of 2019 – 26 built?

3 more in 2020?

Last report I could find from 2018 estimated over 200 bridges nationally!

It is estimated that over ¾ of bridges needing replacement could consider GRS-IBS!
IT IS ALL ABOUT MORE FOR LESS

- $$$ - Estimated $350K saved per bridge – adds up to $9,000,000 for 26 bridges in 5 years!!!

- Time – “Every Day Counts!” average time saved is 3 weeks per bridge – adds up to 78 weeks of construction time!!

- Flexibility – Easily modified to fit individual sites, natural bottom, avoid utility conflicts, single spans from 20 to 140 ft. (starting to see multi-span…)

- Constructability – 9 of the bridges have been built by the 3 different county forces, with 2 more planned for 2020. Additional average savings of $200,000 each...that is another $1,800,000 saved!
SO... WHAT IS HOLDING US BACK?

- Fear of new technology?
- Concern about Scour?
- Types of Facing Materials?
- Lack of Contractors?
- Longevity?
CONSIDERATIONS - Technology

- Part of FHWA’s Everyday Counts Initiative since 2010 – first one built in 2005
- New FHWA Spreadsheet that follows LRFD methodology
- Not new any more...
CONSIDERATIONS - Scour

- Locating the RSF
  - Typically place top at estimated scour
  - New FHWA TechBrief (12/18) – Changes this
- Counter Measures – riprap, sheet piling, depth of RSF, ???
- Monitoring
CONSIDERATIONS – Flood Events
CONSIDERATIONS – Facing Options

- MDOT has updated Special Provision that limits the use of precast block units to:
  - Modular Block Unit -
    - Redi-Rock
    - Recon Retaining Wall Systems
  - Segmental Block Unit -
    - Allan Block
    - Keystone Retaining Wall System
- Very different types of block...
CONSIDERATIONS - Facing Options

- Large block vs. smaller block
- Equipment vs. Labor
- How does it impact beam lengths?
CONSIDERATIONS - Facing Options

Beams have to “span” the block and setback

Bearing width is a function of services loading.

Width of facing directly impacts beam lengths

Lots of impacts if during construction
CONSIDERATIONS - Facing Options

SRW
Image source: Utah DOT

Sheet Pile
Image source: Scott County, IA

Large Wet Cast Block
Image source: Town of North Haven, ME

CMU
Image source: PA DOT

Pre-cast panel
Image source: Colorado DOT

From: Chris Johnecheck, PE, 2015 Bridge Conference Presentation
CONSIDERATIONS - Facing Options
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CONSIDERATIONS - Contractors

- At least 6 different “Bridge” contractors
- Local Bid and MDOT/LAP Bid
- At least 3 different Road Commissions have self built
CONSIDERATIONS - Longevity

- Geosynthetics have 100-year design life
- Facing is cosmetic
- No bridge bump, reduced impact
- Oldest structure built in 2005
- Technique dates to the Great Wall of China...
CONSIDERATIONS – Superstructure
**ELEMENTS - GRS “Mass”**

- **Facing**
  - NOT Structural
  - Tied to reinf. by friction

- **Backfill Material**
  - Granular or Native = 95% Max.
  - Aggregate = Uniform Effort

- **Spacing between Geotextile Reinforcement**
  - Typically 12” or less
  - Follows 1:1 cut slope
ELEMENTS - Beam Bearing

- Integrated Approach Reinforcement
- Beam Seat (wrapped tails)
- Bearing Bed Reinforcement
  - $\frac{1}{2}$ Reinforcement spacing
ELEMENTS - Beam Bearing

- Clear Space (different than seen in manuals)
- Solid Block Facing Unit (Beam in contact)
- Polystyrene Board (to crush)
- #4 Epoxy Rebar & Concrete fill top 3-4 rows
ELEMENTS - RSF

Natural River Bottom

Heavy Riprap (don’t skimp)

B_{total} = 0.3H

Depth = 0.25B_{total}

Width = B_{total} + 0.25 B_{total}

6AA vs. 21AA
ELEMENTS - RSF

Permanent Sheet Piling

Increased scour protection if needed
CONSIDERATIONS - Soils

- Existing “Bearing Soils”
  - Stiff Clays/Silts
  - Compact Granular
  - Loose Granular

- Backfill Materials
  - Granular Free Draining
  - Aggregate
  - Native
LESSONS LEARNED
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Sidewall and Backwall for “spread” beams
LESSONS LEARNED

Face thickness & Bearing area
Over-excavate
Geotextile strength
WHAT IS THE FUTURE?

Figure 3. Construction of U.S. 301 Trail Bridge with multi-span GRS-IBS in Zephyrhills, Florida.

ACM Freeway Loop - Willow Run

Figure 4. Completed two-span GRS-IBS bridge in Knox County Beach, Maine.