Technical Topics on GRS-IBS Bridges

5 years of Lessons Learned

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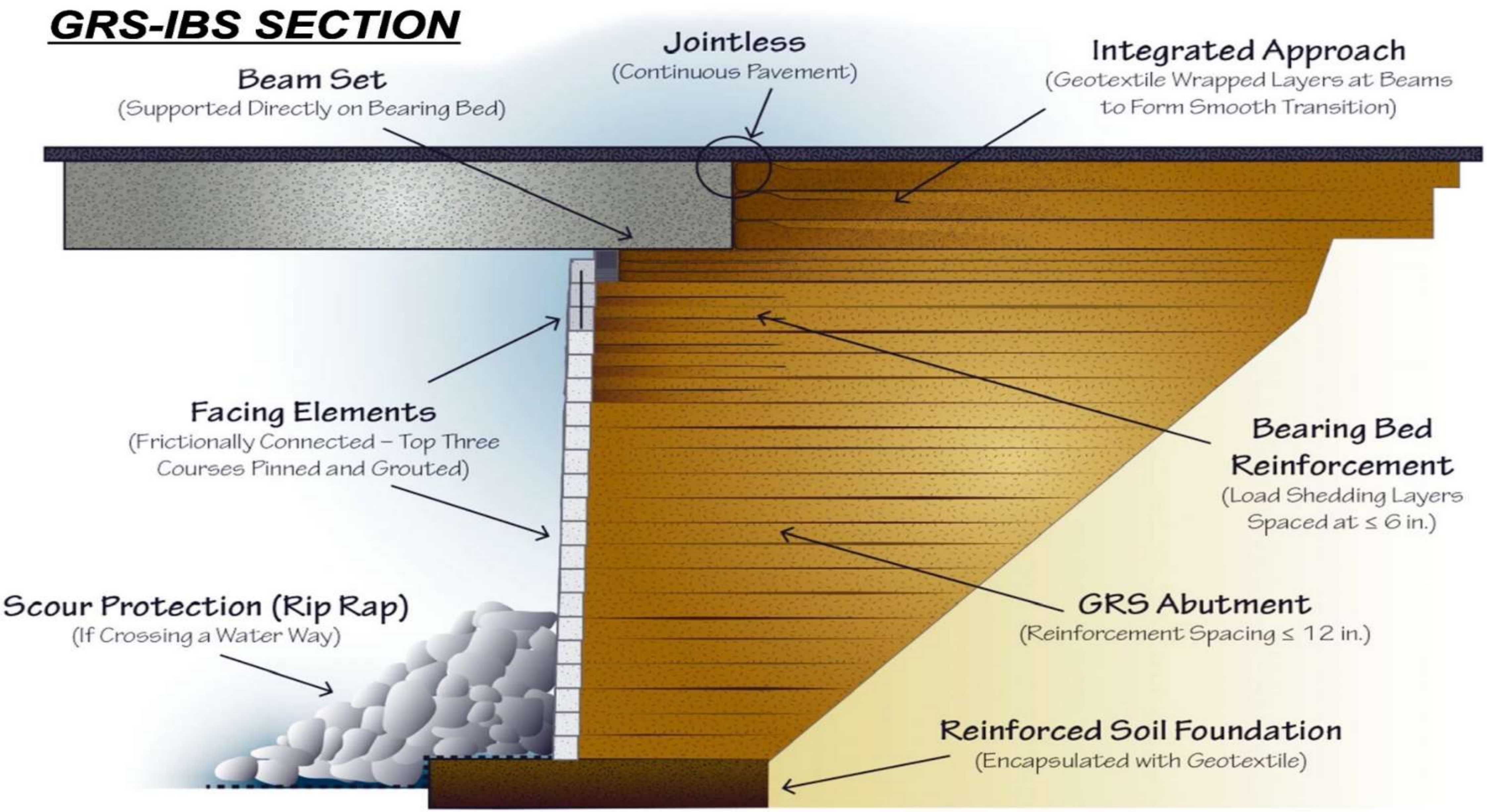
WHAT IS GRS-IBS?

QUICK REFRESHER



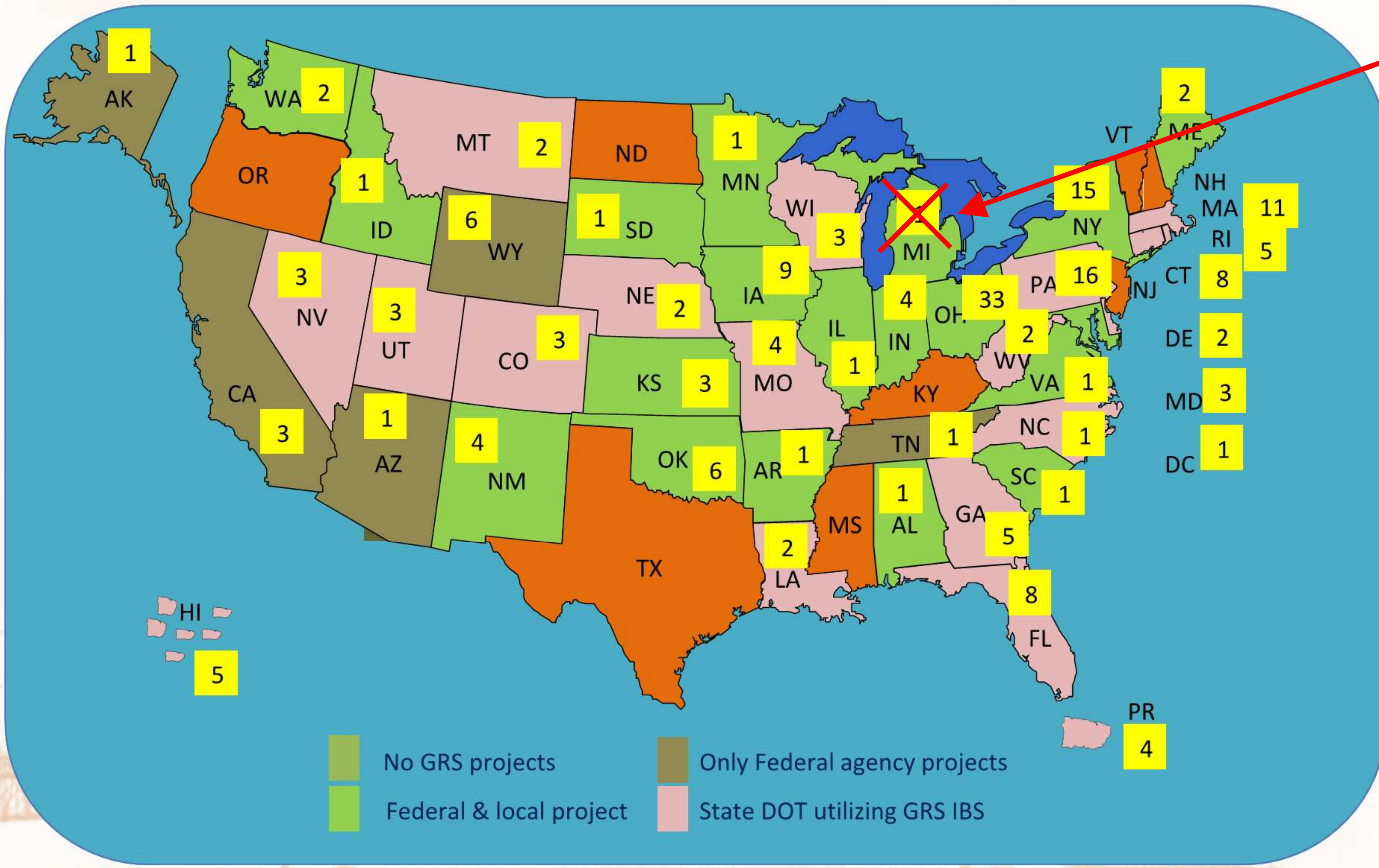
SO....WHERE ARE WE AT?

- How many in audience have worked on a GRS-IBS bridge in Michigan or out of state?

- How many have even considered this technology as an option?

GRS IBS – Implementation Progress

190 Bridges nationally in 43 states including PR and DC - September 2014



By end of 2019 – at least 22 built

3 more in 2020

Last report I could find from 2017 estimated over 200 bridges nationally!

It is estimated that over ¾ of bridges needing replacement could consider GRS-IBS!

From: Chris Johnecheck, PE, 2015 Bridge Conference Presentation

IT IS ALL ABOUT MORE FOR LESS

- **$$$** - Estimated $350K saved per bridge – adds up to **$6,300,000 for 18 bridges in Midland County over 4 years!!!**

- **Time** – "Every day counts!" average time saved is 3 weeks per bridge – adds up to **54 weeks of construction time!!**

- **Flexibility –** Easily modified to fit individual sites, natural bottom, avoid utility conflicts, single spans from 20 to 140 ft.

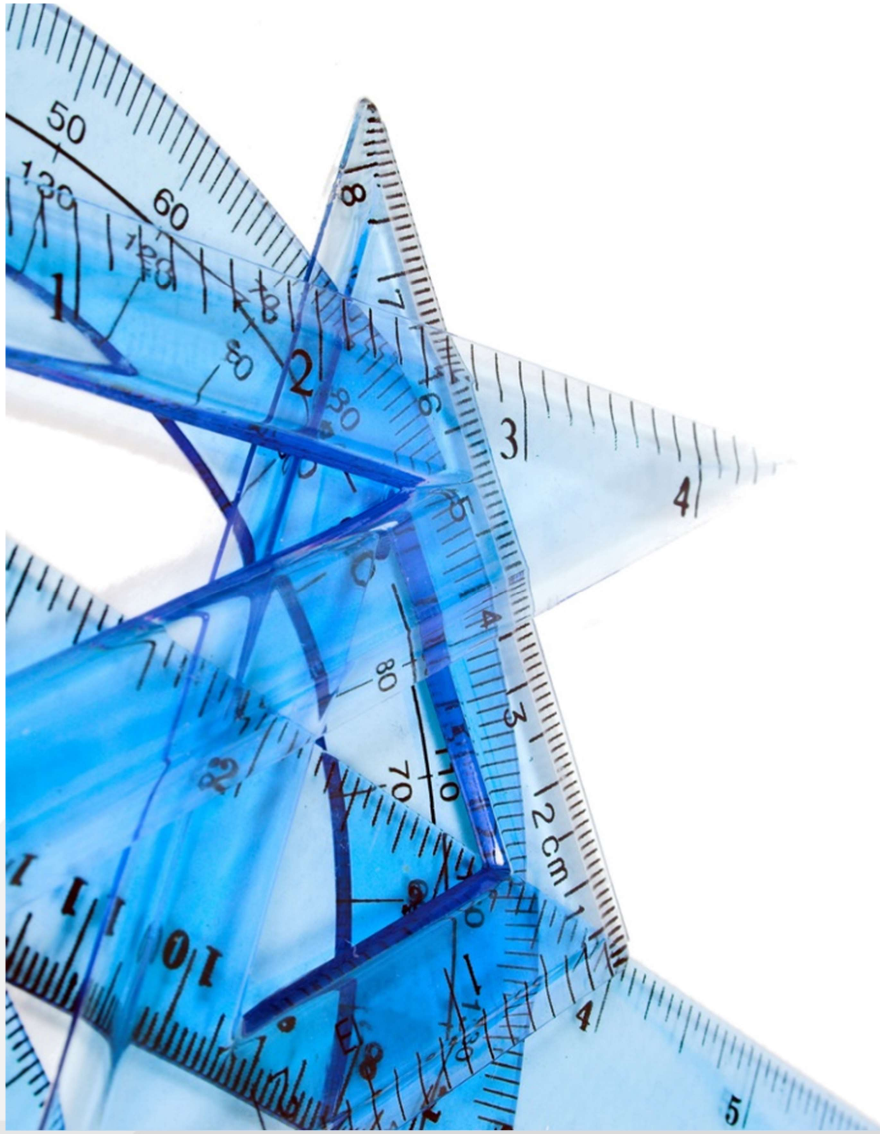
- **Constructability** – 8 of the 22 bridges will be built by the County's own forces

SO… WHAT IS HOLDING US BACK?

- **Fear of new technology?**
- **Lack of Knowledge?**
- **Concern about Scour?**
- **Soil Conditions?**
- **Longevity?**

KEY DESIGN CONSIDERATIONS

- **Part of FHWA's Everyday Counts Initiative since 2010 – first one built in 2005**
- **New FHWA Spreadsheet that follows LRFD methodology**
- **Key Failure Modes:**
  - **Sliding at top or bottom of RSF**
  - **Soil Bearing Capacity**
  - **Reinforcement Strength**
  - **Global Stability**
  - ***Overturning is NOT***

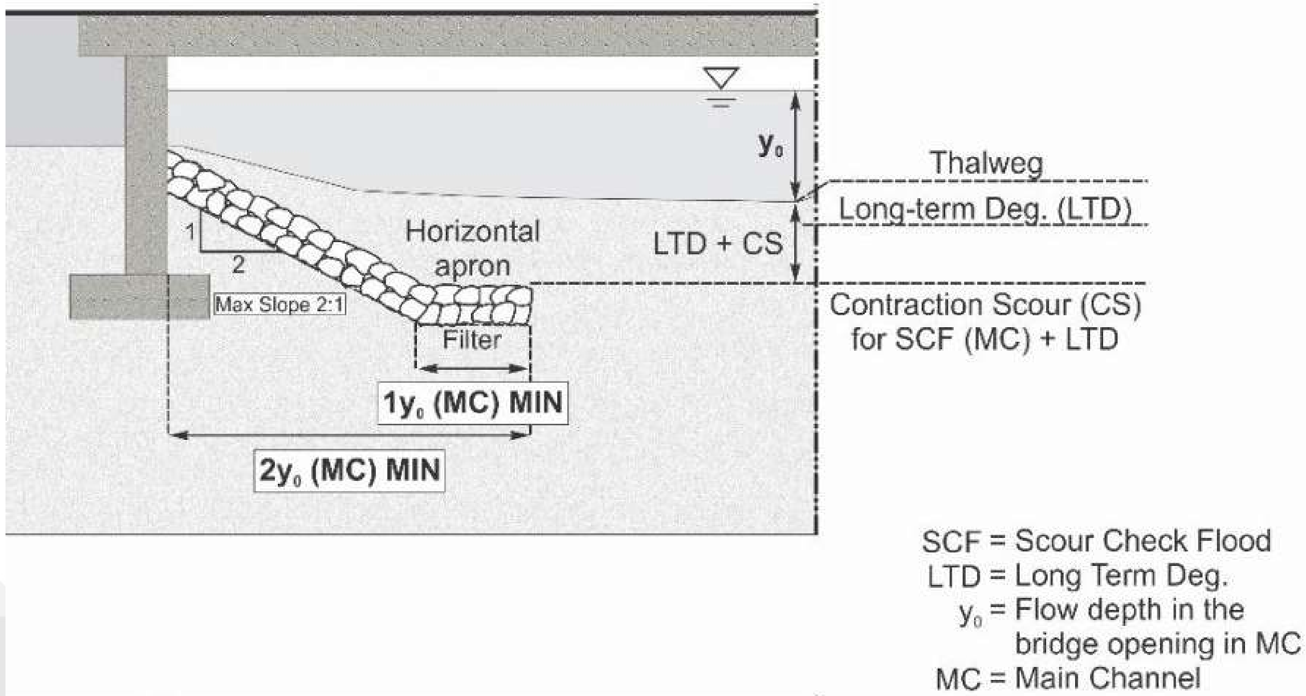


CONSIDERATIONS - Soils

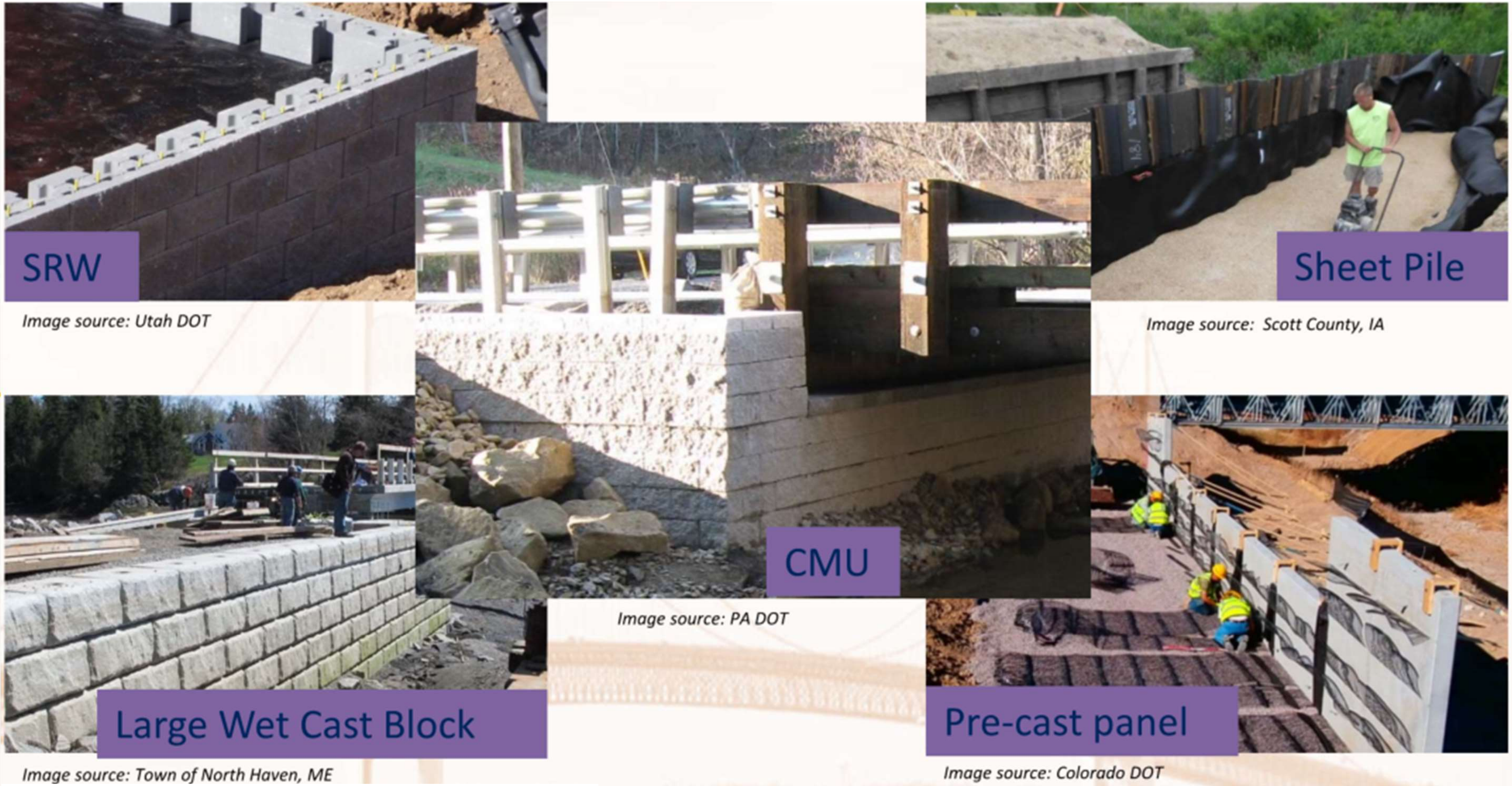
- Existing “Bearing Soils”
  - Stiff Clays/Silts
  - Compact Granular
  - Loose Granular
- Backfill Materials
  - Granular Free Draining
  - Aggregate
  - Native
- RSF Materials

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



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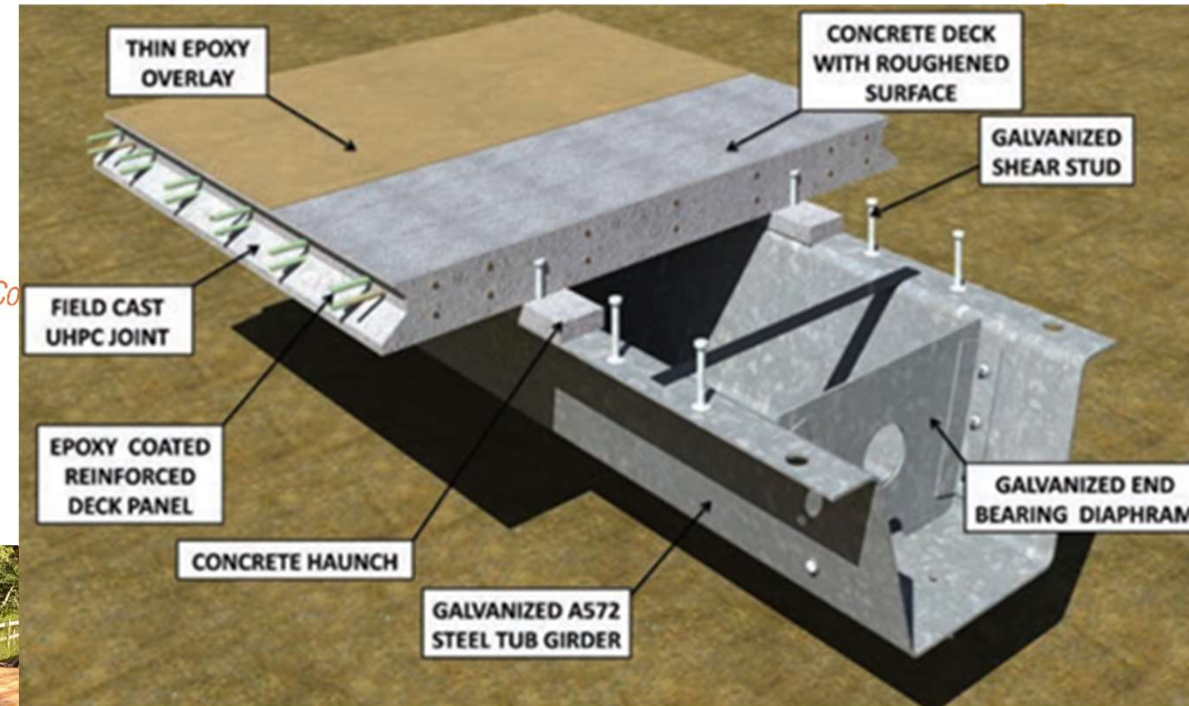
CONSIDERATIONS - Facing Options

OHM Advisors®

CONSIDERATIONS - Facing Options

Image Source : Allan Block

CONSIDERATIONS - Facing Options

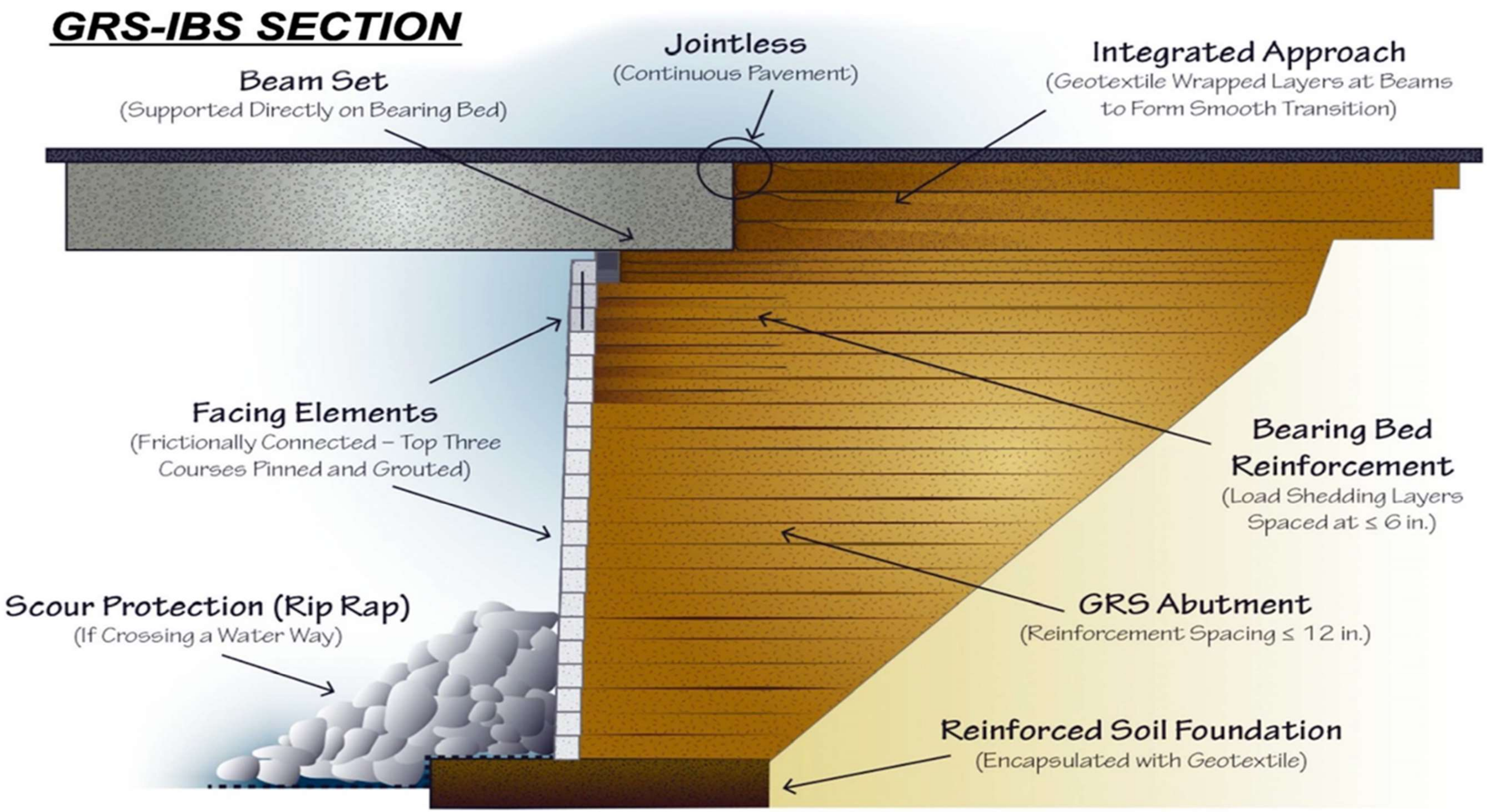


CONSIDERATIONS – Superstructure

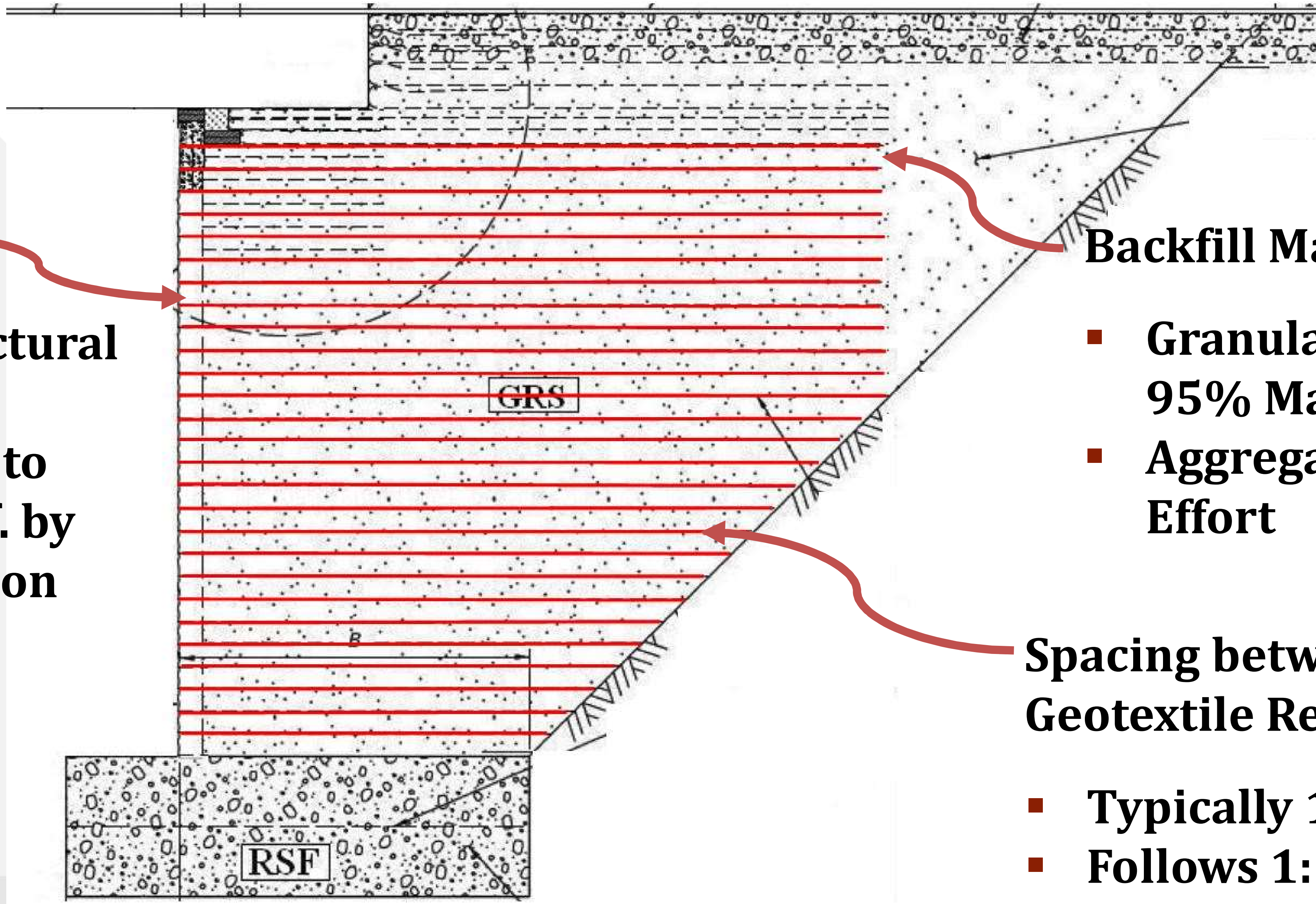
CONSIDERATIONS - Longevity

- **Geosynthetics have 100 year design life**
- **Facing is cosmetic**
- **No bridge bump, reduced impact**
- **Oldest structure built in 2005**

KEY DESIGN ELEMENTS



ELEMENTS - GRS “Mass”



Facing

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

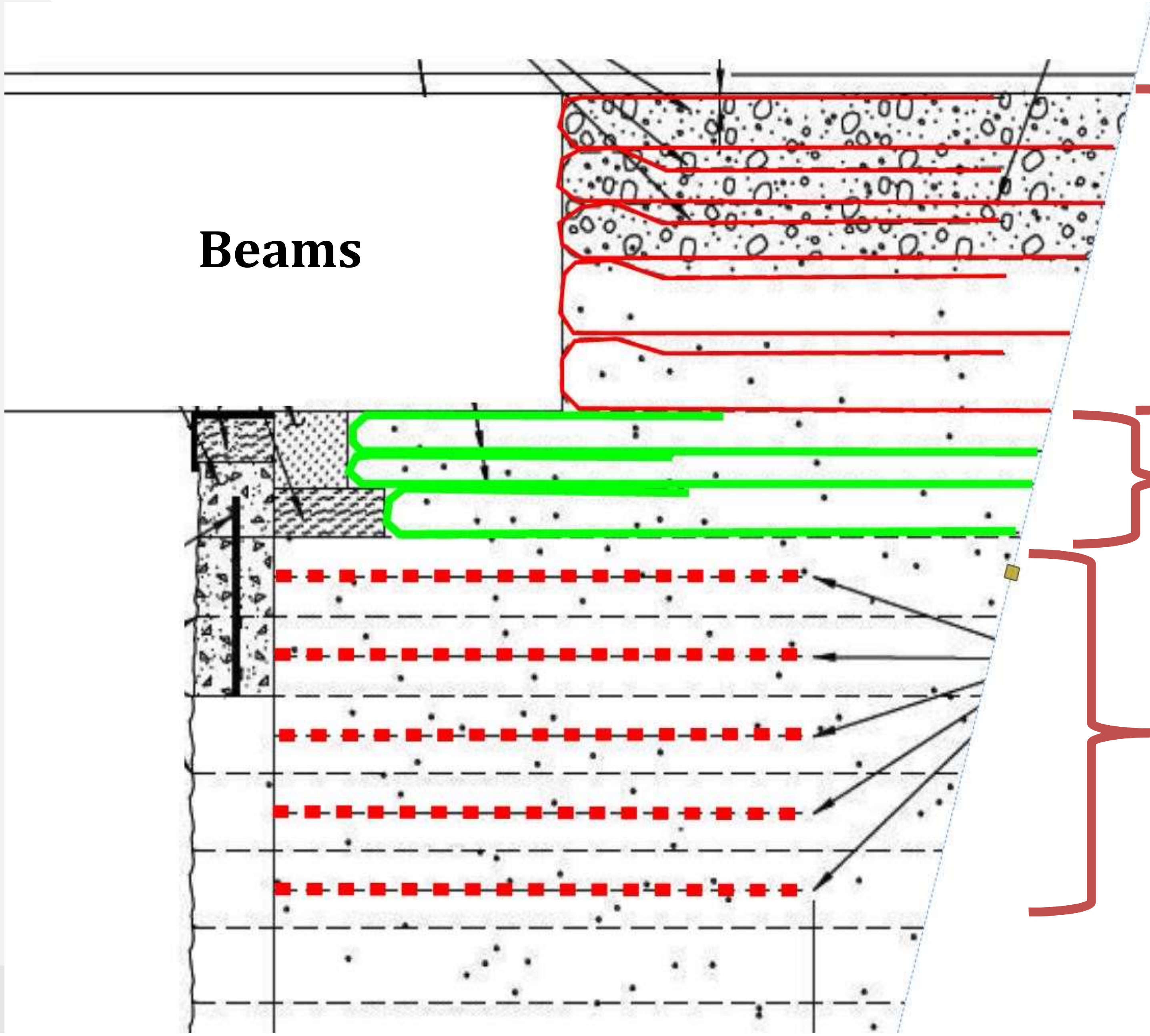
Backfill Material

- **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

- ½ Reinforcement spacing

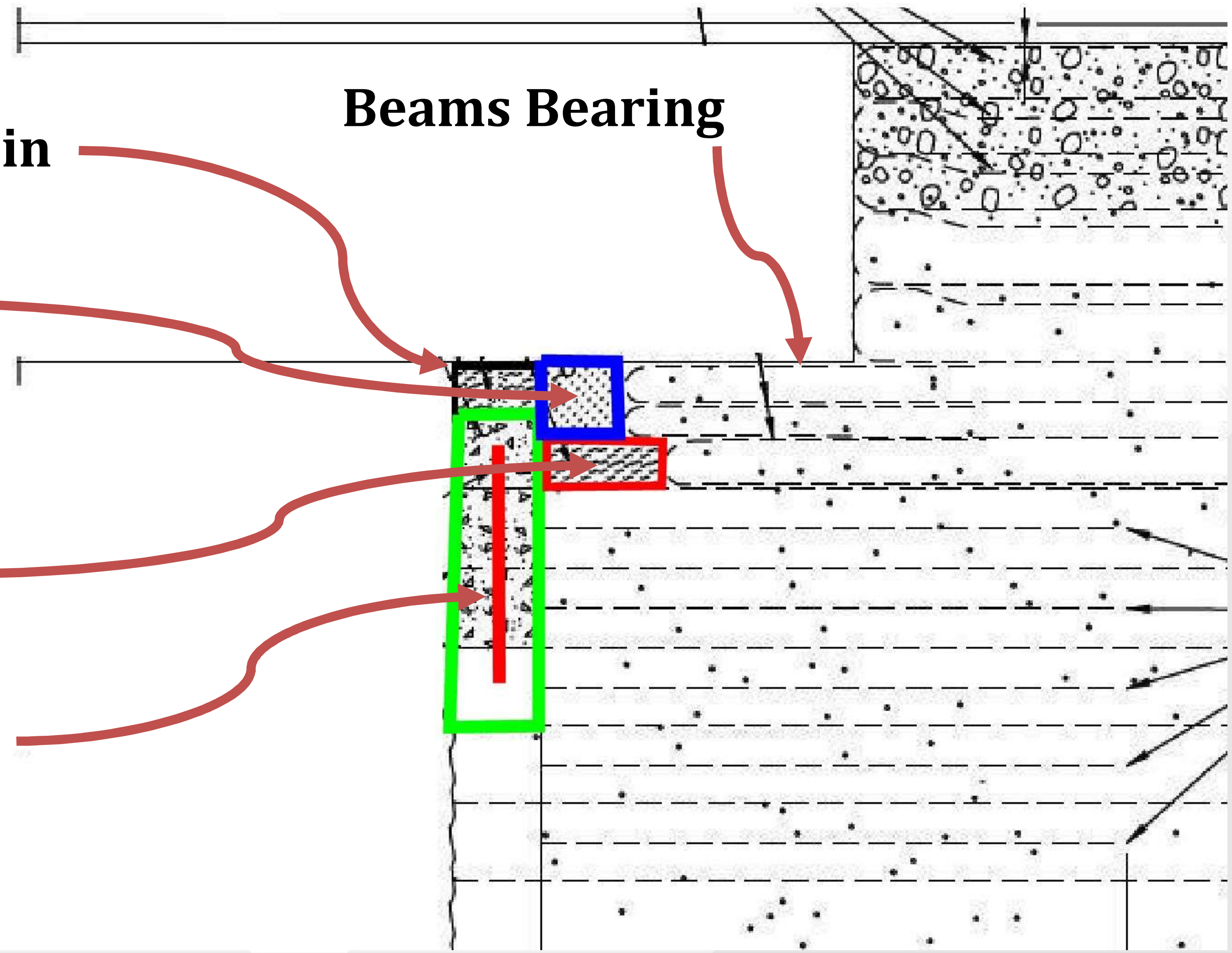
ELEMENTS - Beam Bearing

Clear Space (different than seen in manuals)

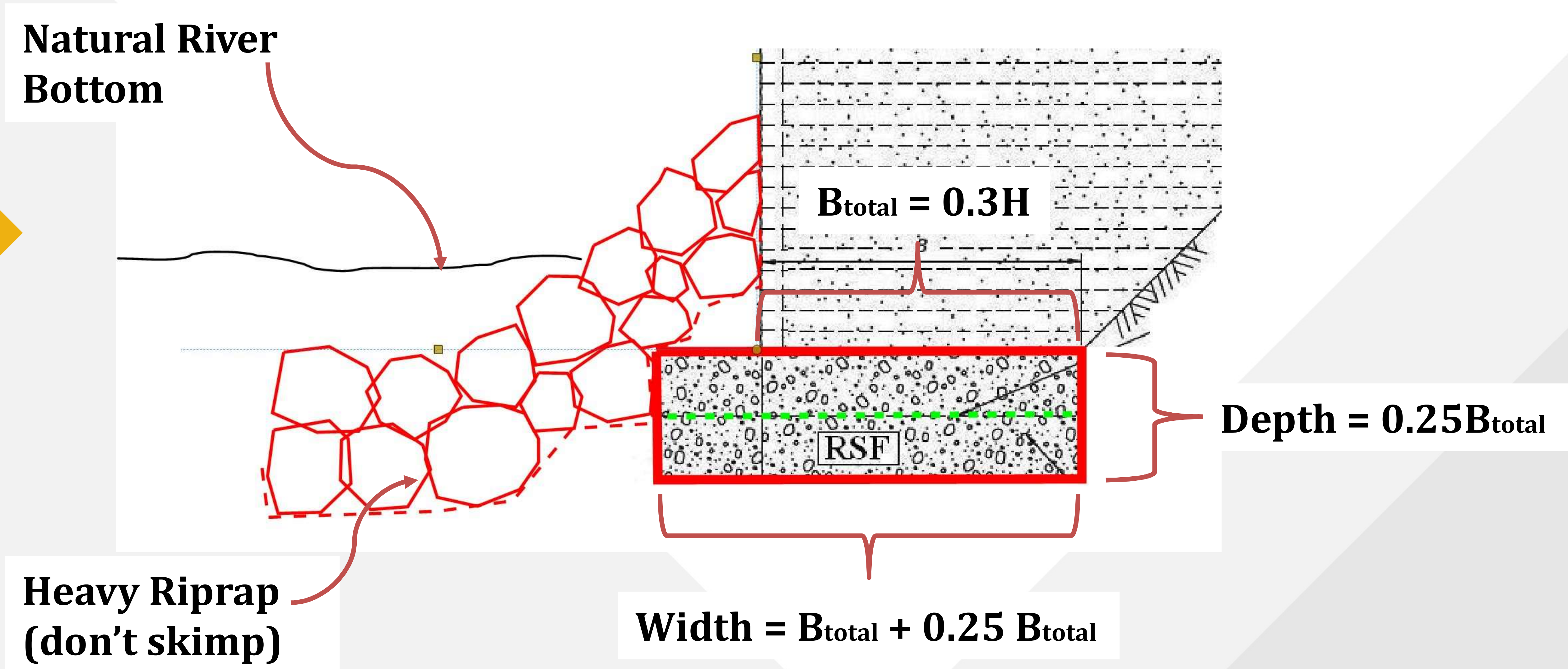
Solid Block Facing Unit (Beam in contact)

Polystyrene Board (to crush)

#4 Epoxy Rebar & Concrete fill top 3-4 rows



ELEMENTS - RSF



LESSONS LEARNED

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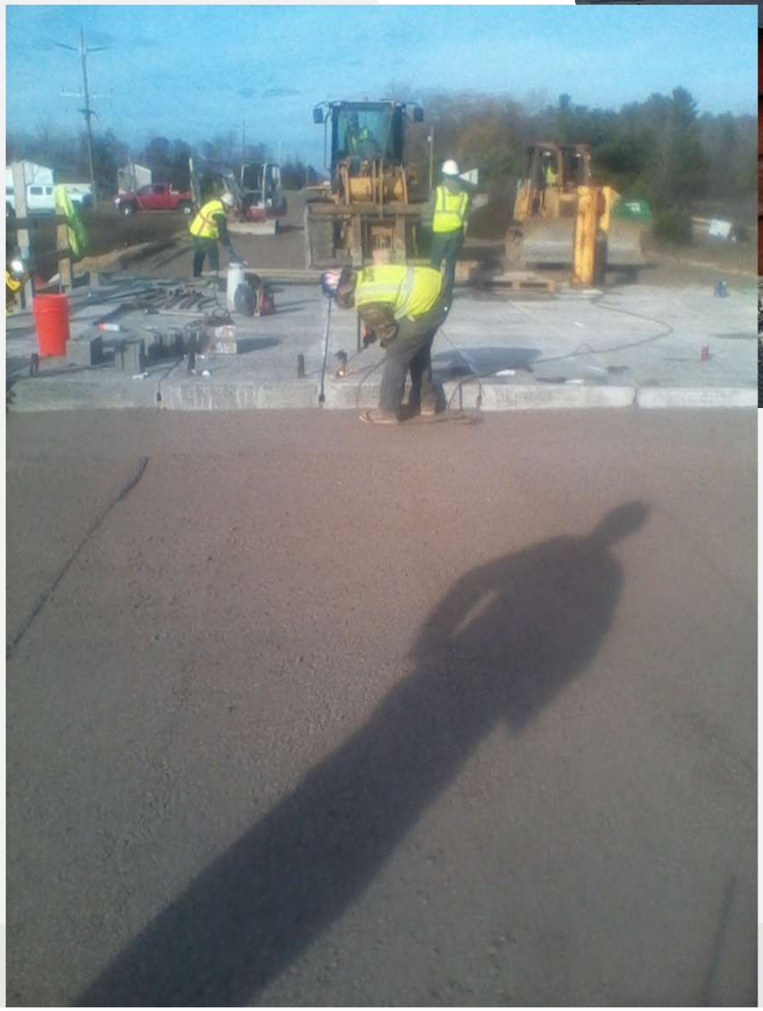


LESSONS LEARNED

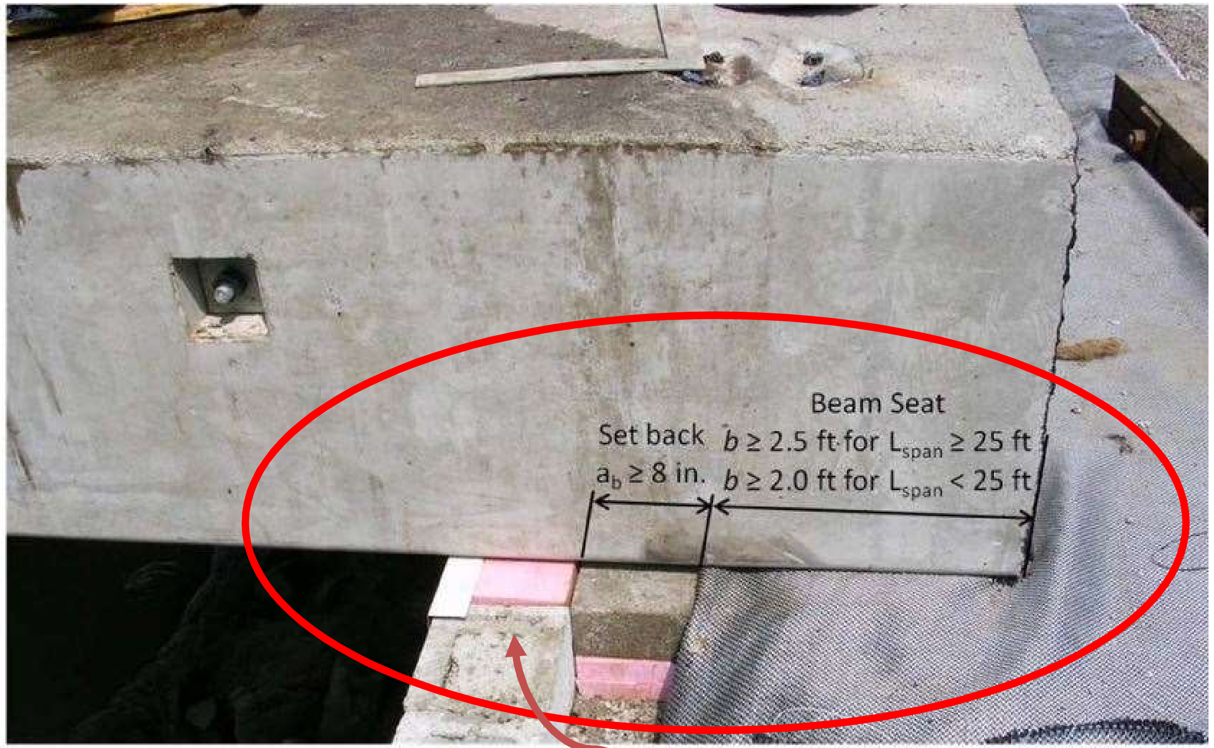
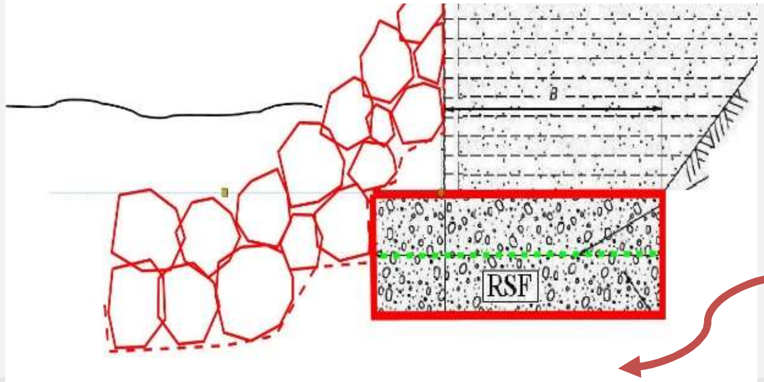


Figure 10. Photo. Bridge seat and setback distances.



Face thickness & Bearing area

Over-excavate

Geotextile strength

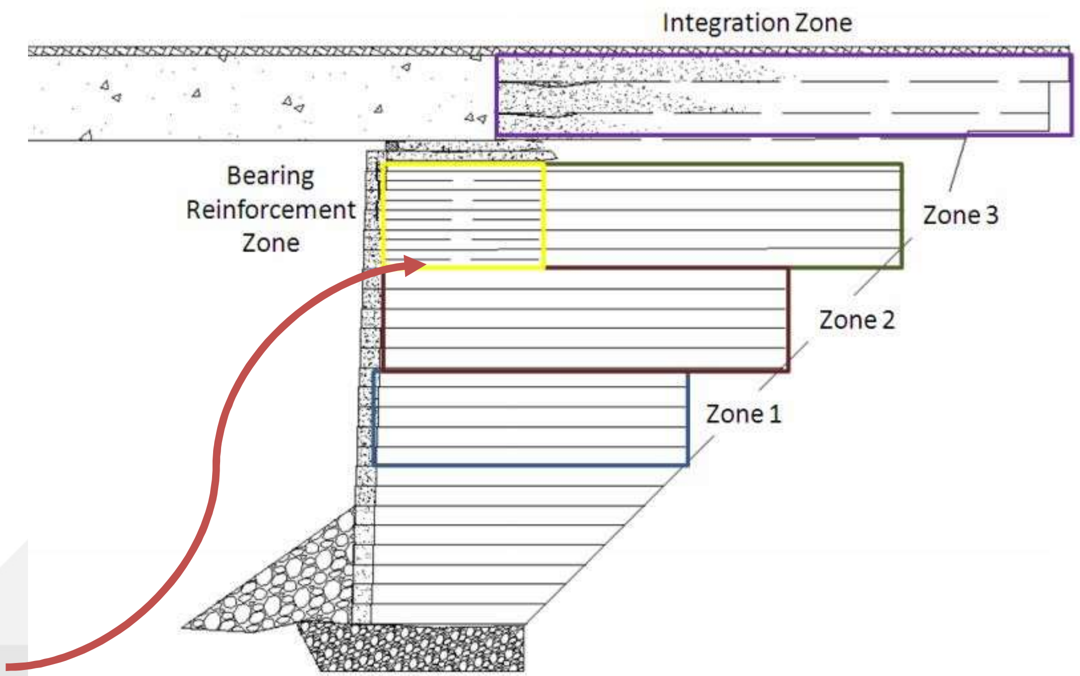


Figure 13. Illustration. Reinforcement schedule for a GRS abutment.

WHAT IS THE FUTURE?

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

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