

Dennehotso Bridge

Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)

Robert Kraig
Geotechnical Engineer
Western Federal Lands Highway Division
robert.kraig@dot.gov





Dennehotso Bridge Replacement





Dennehotso Bridge Replacement





Existing Bridge



Existing Conditions:





North Approach





Existing Bridge Superstructure



Site & Subsurface Conditions:

- Alluvium deposit
 - Mapped as Unconsolidated Surficial Deposits of Valley Fill: Mainly Stream-Deposited Silt, Sand, & Gravel, but Includes Some Wind-Blown Sand & Silt Underlain by Navajo Sandstone.
 - Site Materials Encountered—Silty, Very Fine Sand and Fine Gravel. (SM)
 - Scourable & Erodible.
- Navajo Sandstone
 - Very Weak (R1) to Weak (R2) Navajo Sandstone.
 - Erodible.
 - Relatively Few Joints & Fractures.
 - Massive Outcrops Visible.



Existing Conditions:



Existing Conditions:



Existing Conditions:



10.29.2013



Existing Conditions:



10.29.2013



Existing Conditions (Hydraulic):

- Floodwater overtopping stream banks flows across approach roads where the approach roads are flush with the floodplain.
- Floodwater flows parallel to the approach roads where there is fill, causing erosion of the road fill and alluvial soil.
- Flooding can be caused by heavy rains, monsoons, or tropical storm remnants.
- Stream transports a moderate amount of woody debris.
- The left stream bank has migrated to the north, resulting in a sharp stream bend immediately upstream of the existing bridge and a skewed flow alignment through the bridge.



Existing Conditions:



Existing Conditions:



Existing Conditions:



Challenges & Goals:

- **Develop a best-fit alignment that will accommodate a single-span and non-skewed bridge.**
- **Develop a bridge type that eliminates cast-in-place concrete construction.**
- **Use available soils in the area for roadway fill construction.**
- **Provide a project that is reliable, simple to construct, cost effective, that can be constructed without a specialty contractor.**
- **Satisfy hydraulic concerns.**



Replacement Bridge:

- Replacement bridge will be single span about 107' long & 28' wide.
- Seven prestressed 4'-0" wide by 3'3" deep box girders with asphaltic wearing surface.
- Southeast end will be shifted slightly to the northeast to straighten final alignment.
- Temporary culvert put in to provide a temporary detour. Approach road profile will be raised 2 to 5 feet.
- Proposed bridge expected to increase flow conveyance capacity & reduce the amount of debris entangling on the structure.
- The right approach road is predicted to be overtopped for floods equal to and larger than the 100-year event.
- The left approach road is not predicted to be overtopped by the 100-year event.
- The stream channel will be widened to a minimum width of 92 feet.
 - Shortening would increase the frequency of flood water overtopping the stream banks and approach road embankments.

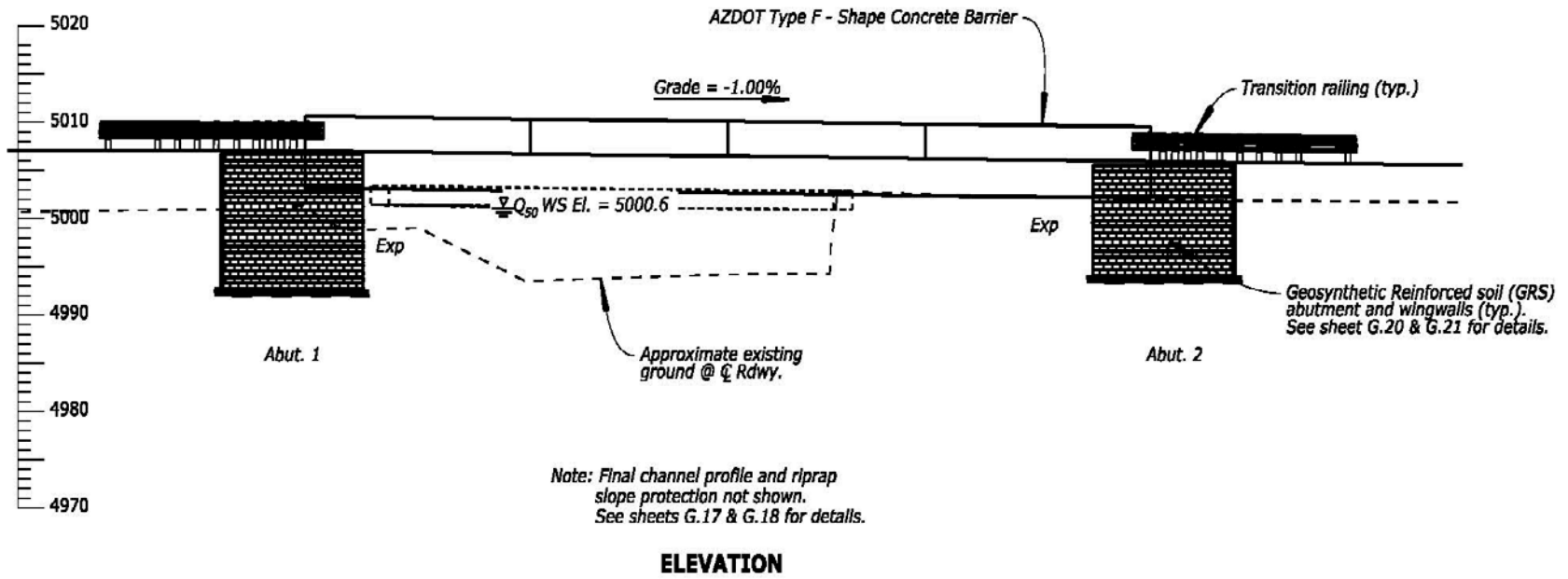


New Bridge Foundations:

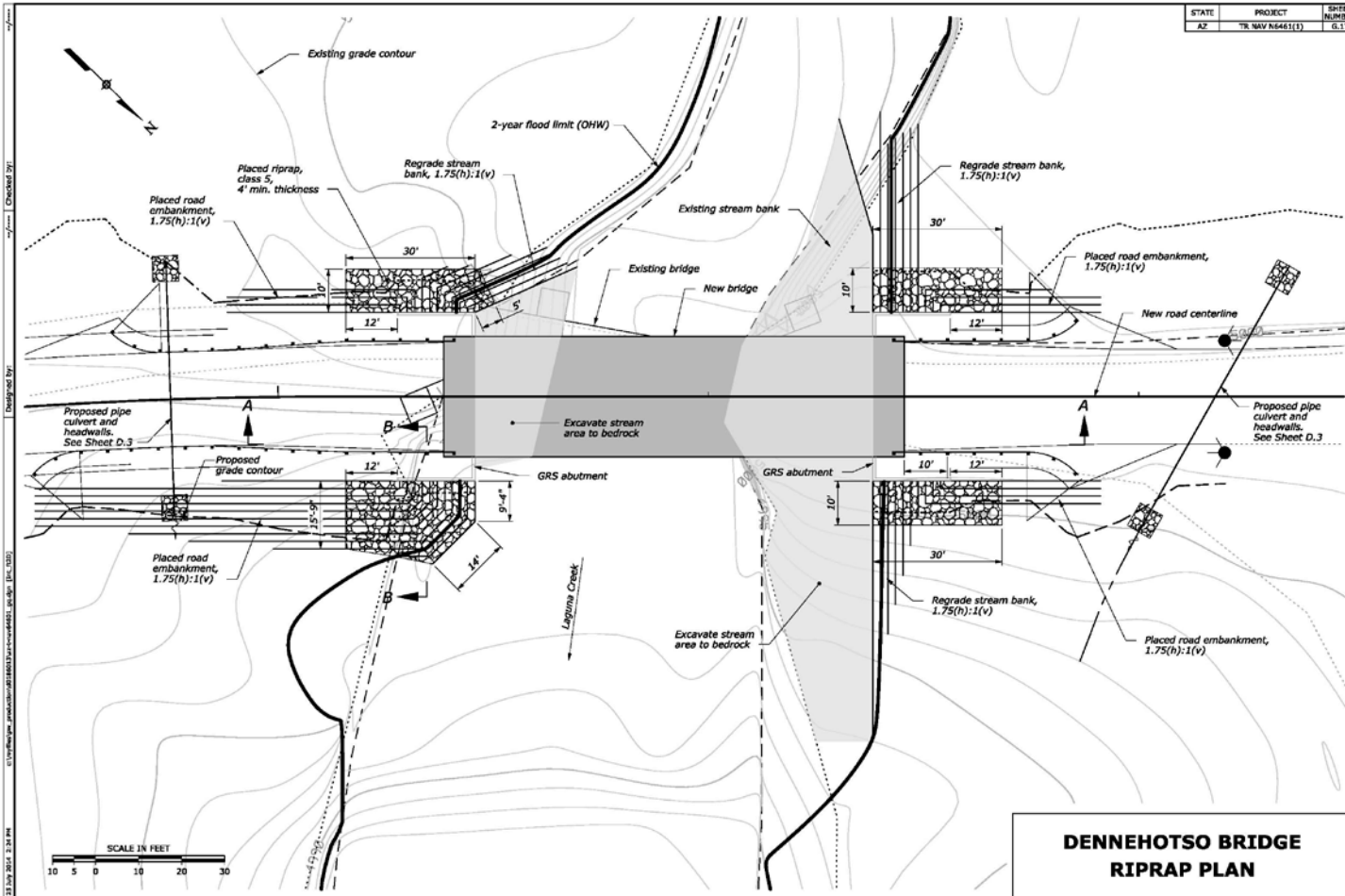
- No CIP construction. No piles.
- Reliable, simple to construct, cost effective.
- No specialty contractor needed.
- Local labor can be used, if desired.
- Supports the Nation's progress toward self-determination.



Dennehotso GRS-IBS:



Dennehotso GRS-IBS:

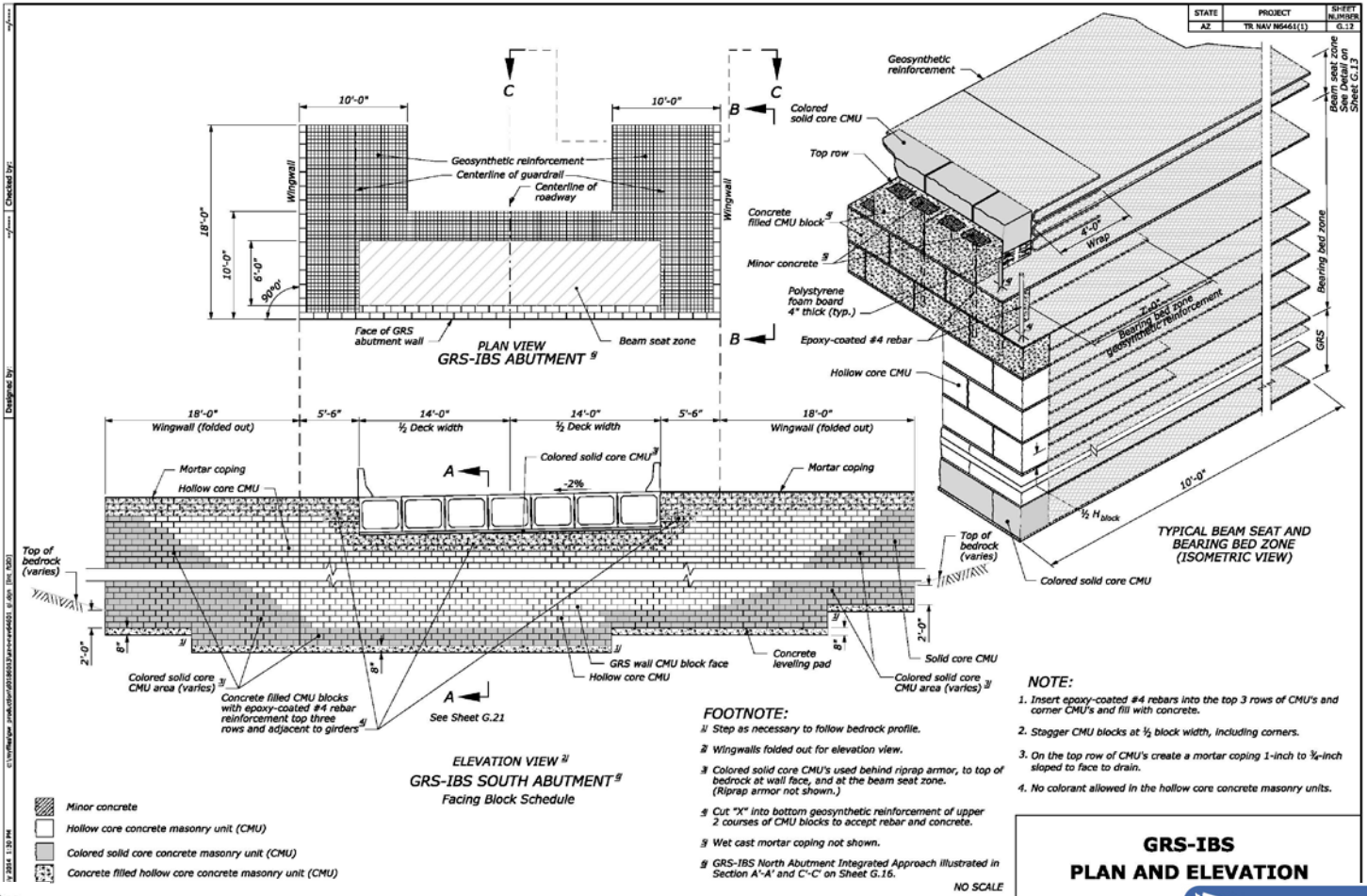


Expectations:

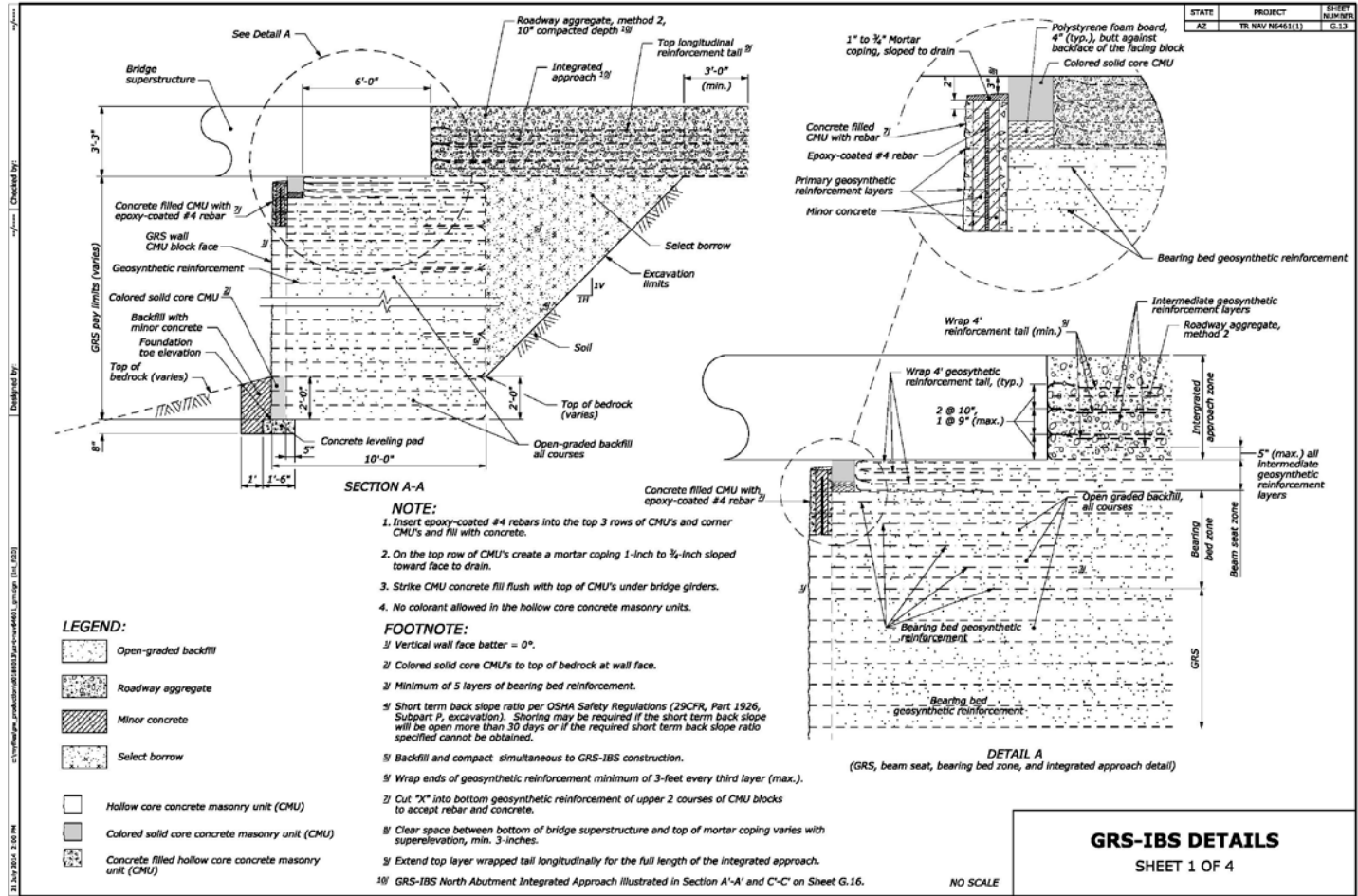
- Flood water fill flow along the approach roads for floods larger than the 50-year event.
- Erosion might expose and remove fill soil behind the GRS abutment.
- The approach road embankments will be protected by installing riprap extending from the front face of the GRS to the end of the integrated approach.
- The GRS abutments are designed to resist erosion of the road embankment material.



Dennehotso GRS-IBS:

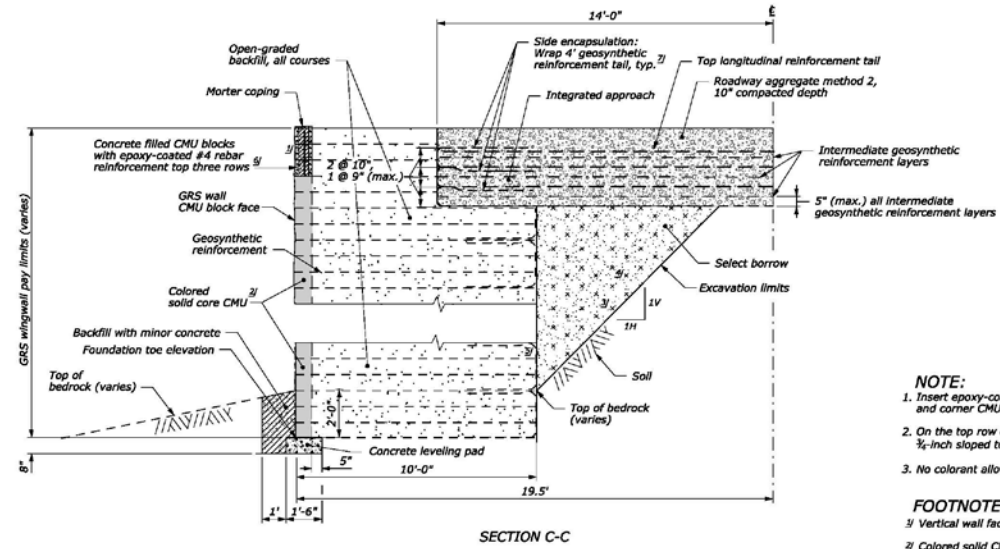


Dennehotso GRS-IBS:



Dennehotso GRS-IBS:

STATE	PROJECT	SHEET
AZ	TR. NAV 16461(1)	G.15



SECTION C-C

LEGEND:

- Select borrow
- Open-graded backfill
- Roadway aggregate
- Minor concrete
- Hollow core concrete masonry unit (CMU)
- Colored solid core concrete masonry unit (CMU)
- Concrete filled hollow core concrete masonry unit (CMU)

NOTE:

1. Insert epoxy-coated #4 rebars into the top 3 rows of CMU's and fill with concrete.
2. On the top row of CMU's create a mortar coping 1-inch to 1/2-inch sloped toward face to drain.
3. No colorant allowed in the hollow core concrete masonry units.

FOOTNOTE:

- 1/ Vertical wall face batter = 0°.
- 2/ Colored solid CMU's behind riprap armor.
- 3/ Short term back slope ratio per OSHA Safety Regulations (29CFR, Part 1926, Subpart P, excavation). Shoring may be required if the short term back slope will be open more than 30 days or if the required short term back slope ratio specified cannot be obtained.
- 4/ Backfill and compact simultaneous to GRS-IBS construction.
- 5/ Wrap ends of reinforcement to embed min. of 3-feet every third layer (max.).
- 6/ Cut "X" into bottom geosynthetic reinforcement of upper 2 courses of CMU blocks to accept rebar and concrete.
- 7/ Wrap top layer tail of side encapsulation so that it is above top longitudinal reinforcement tail.

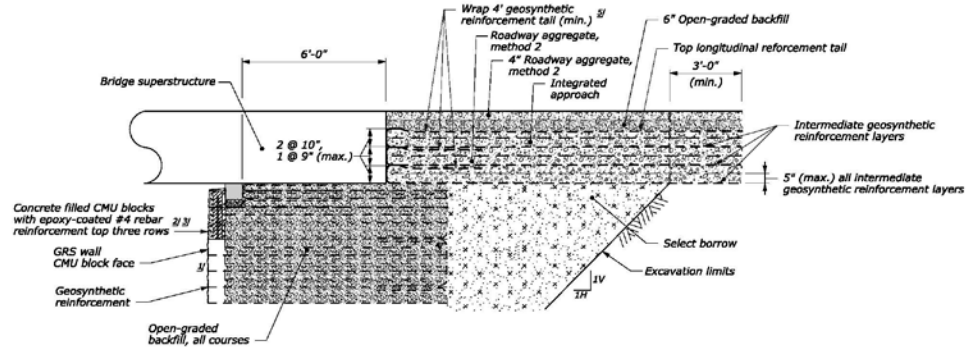
GRS-IBS DETAILS
SHEET 3 OF 4

NO SCALE

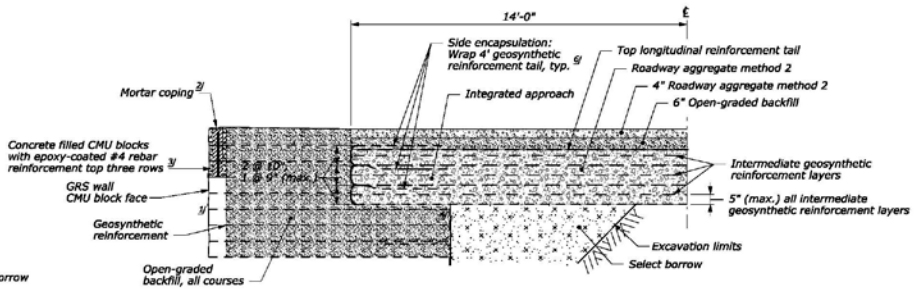


Dennehotso GRS-IBS:

STATE	PROJECT	SHEET
AZ	TR. NAV 1646(1)	6.18



SECTION A'-A'
GRS-IBS NORTH ABUTMENT
INTEGRATED APPROACH



SECTION C'-C'
GRS-IBS NORTH ABUTMENT
INTEGRATED APPROACH

LEGEND:

- Select borrow
- Open-graded backfill
- Roadway aggregate
- Minor concrete
- Hollow core concrete masonry unit (CMU)
- Colored solid core concrete masonry unit (CMU)
- Concrete filled hollow core concrete masonry unit (CMU)

FOOTNOTE:

- 1/ Vertical wall face batter = 0°.
- 2/ On top row of CMU's create a mortar coping 1-inch to 3/4-inch sloped toward face to drain.
- 3/ Cut "X" into bottom geosynthetic reinforcement of upper 2 courses of CMU blocks to accept rebar and concrete.
- 4/ Wrap ends of geosynthetic reinforcement minimum of 3-feet every third layer (max).
- 5/ Extend top layer wrapped tail longitudinally for the full length of the integrated approach.
- 6/ Wrap top layer tail of side encapsulation so that it is above top longitudinal reinforcement tail.

GRS-IBS DETAILS

SHEET 4 OF 4

NO SCALE



Every Day Counts - www.fhwa.dot.gov/everydaycounts

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Every Day Counts

The Utah DOT received a grant from FHWA's Highways for LIFE program to use innovations on the \$5 million project. User delay costs for autos, single trucks and truck-trailer combinations incurred up to nearly \$430,000 for the baseline delay method of construction. But with the innovations and maintaining traffic on I-84, total delay costs were estimated at just \$49,000.

One important benefit of GRS-IBS is that it integrates the roadway approaches to the bridge. The whole structure is connected to the same foundation—the GRS mat. That way, bridge settlement is the same as the approaches. The result is the elimination of the bump commonly felt between the approach and the bridge.

"One year later, and there is still no bump or crack across that joint," said Altomera. "The bridge is performing as expected. More than 8,000 vehicles per day use this road, of which 40 percent are truck-trailer combinations, so it's a very heavily traveled roadway."

Using GRS-IBS technology helped save time and money on a Utah bridge project.

January/February Innovator is here.

Pause Previous Next 1 2 3 4 5

What is EDC?

Every Day Counts (EDC) is a state-based model to identify and rapidly deploy proven but underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce congestion and improve environmental sustainability. [Read more.](#)

EDC-3 Innovations (2015-2016)

Featured

U.S. DOT Announces \$2.47 Million for Innovative Projects

The Federal Highway Administration (FHWA) announced funding for projects that will speed deployment of innovative road and bridge work in ME, PA and WA. [Read More.](#)

The January/February Innovator is here

EDC News

February 13, 2015
Florida Focuses on Local Agency Program

February 6, 2015
Geosynthetic Reinforced Soil-Integrated Bridge System



FHWA's Geosynthetic Reinforced Soil Integrated Bridge System (GRS IBS) Team

Name	Office	Phone	Email
Daniel Alzamora	Resource Center Lakewood, CO	(720) 963-3214	Daniel.Alzamora@dot.gov
Mike Adams	Turner Fairbank McLean, VA	(202) 493-3025	Mike.Adams@dot.gov
Jennifer Nicks	Turner Fairbank McLean, VA	(202) 493-3075	Jennifer.Nicks@dot.gov
Khalid Mohamed	Office of Bridges and Structures Washington, DC	(202) 366-0886	Khalid.Mohamed@dot.gov
Scott Hogan	Resource Center Lakewood, CO	(720) 963-3742	Scott.Hogan@dot.gov
Derrell Manceaux	Resource Center Lakewood, CO	(720) 963-3205	Derrell.Manceaux@dot.gov



Questions/Comments:

