

FHWA Every Day Counts - Geosynthetic Reinforced Soil Integrated Bridge System

Regional Local Roads conference
October 21, 2015
Rapid City, SD

Efficiency through technology and collaboration





What is GRS IBS?

- GRS-IBS is an accelerated construction technique for bridge systems that utilizes alternating layers of compacted granular fill and geosynthetic reinforcement.

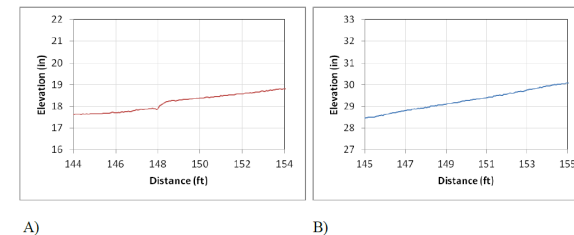


GRS IBS – Cross Section



Image source: FHWA

Road profile data



A)

B)

Figure 18. Surface profile for bridge joints a) on a bridge without GRS-Abutments (CR 27 Bridge Nr. 3340760) as compared to b) the GRS-Abutment at CR 27 Bridge Nr. 3340730



GRS IBS – Primary construction materials



Geosynthetics

Geogrids



Geotextiles



Facing types



Facing Blocks



Reinforced fill materials

Open Graded Fill



Well Graded Fill



PA – SR 2001, Rausch Road, Over Kettle Creek (2014)



Why Consider the GRS IBS?

- Up to 60% lower costs
- Accelerated bridge construction
- Smooth transition eliminating the “bridge bump”



Layout Creek Bridge US Forest Service, WA



Did we save time and \$\$\$?

• Cost

- 13-41% design savings vs. conventional
- 8-21% overall cost savings vs. conventional
 - (Overall cost includes Drafting, Design, & Construction)

Comparison Table	GRS-IBS Design	Conventional Design	% Saved
Design Cost	\$17.5K	\$20K-\$45K	13 - 61%
Overall Project Cost	\$267K	\$290K-\$340K	8 - 22%

• Timing

- Faster than conventional CIP methods
- Shorter field schedules with fully precast ABC

Spokane County, WA New Cheney Plaza Bridge



Cheney Plaza Bridge Replacement

Cost to Construct with County Forces plus select Contract work.

■ Bridge	\$175,931
■ Bypass Road	\$14,577
■ Approach Roadway	\$36,666
■ Total	\$227,174

*Comparison of Bridge Square Foot Costs
(Substructure + Superstructure) / Deck Area*

GRS-IBS
137 \$ / sq. ft.

Typical Bridge
250 \$ / sq. ft.

Kaw Nation GRS- IBS Bridges In Kay County, Oklahoma

Tom Simpson, P.E.
Regional Road Engineer
Bureau of Indian Affairs
Anadarko, Oklahoma





GRS – IBS CONSTRUCTION

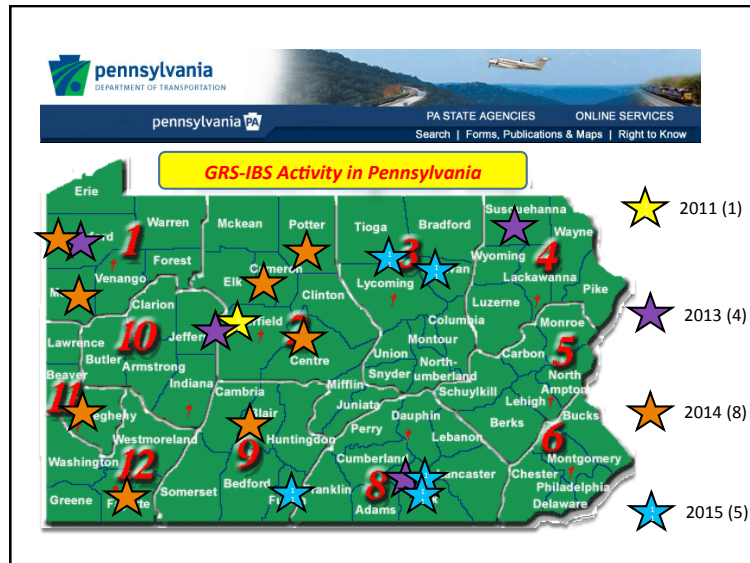
- 1 Conventional County Bridge (H piles w/ Steel girders)
- 1 GRS Abutments w/CMU facing Steel Girders
- 1 GRS Abutments w/CMU facing precast panels
- 1 Steel Pile Abutment w/ precast panels
- 2 GRS w/ sheet piling face & used Steel Girders



GRS – IBS COST

1) Piles w/ Precast Panels	\$175,000
2) GRS w/ Precast Panels	\$170,000
3) GRS w/ Sheet Piling Steel Girder	\$ 85,000
4) GRS w/ Sheet Piling Steel Girder	\$ 85,000
5) GRS w/ CMU Blocks Steel Girder	\$ 74,000
6) Piles w/ Steel Girders (Conventional)	\$110,000





New Specification: Local Roads

Publication 447 New Products for Low Volume Roads

•NP-0050

- Local Roads Only
- Township, Borough, City
- Less than 400 ADT

•Approved June 6, 2013

•<http://www.dot.state.pa.us>

- PennDOT Organizations
- Bureaus and Offices
- Services for Local Govts.
- Forms and Publications
- PUB 447

Approved Products for Lower Volume Local Roads

*"Municipal Services
Building Relationships"*



PA-447 (9-11)

pennsylvania
DEPARTMENT OF TRANSPORTATION
www.dot.state.pa.us



GRS-IBS Activity in Pennsylvania Sandy Township, Clearfield County



GRS-IBS Activity in Pennsylvania
North Hopewell Township, York County

- Approximate Cost \$120,000.00
- Abutment costs: \$48,000 (40%)



GRS-IBS Activity in Pennsylvania
PENNDOT District 1-0, SR 2016



- Crawford County
- Approximate Cost: \$250,000.00
- Approx. Abutment Cost: \$122,000.00

GRS-IBS Activity in Pennsylvania
PENNDOT District 4-0, SR 2063

- SR 2063, Susquehanna County, Marcellus Gas Project
- Construction cost: \$310,000
 - Included a temporary stream crossing.
- Abutment costs: \$124,000.00



GRS-IBS Activity in Pennsylvania
PENNDOT District 11-0



- Allegheny County
- \$386,548.64

- Project Issues
 - Rock encountered
 - Material supply
 - Logistics
 - Equipment
 - Labor
 - Site Survey
 - Weather/Time of Year

**GRS-IBS Activity in Pennsylvania
PENNDOT District 2-0, SR 2001**



- Potter County
- Total Costs: \$354,931.00
- Abutment Costs: \$50,400.00



**GRS-IBS Activity in Pennsylvania
Grove Township, Cameron County**

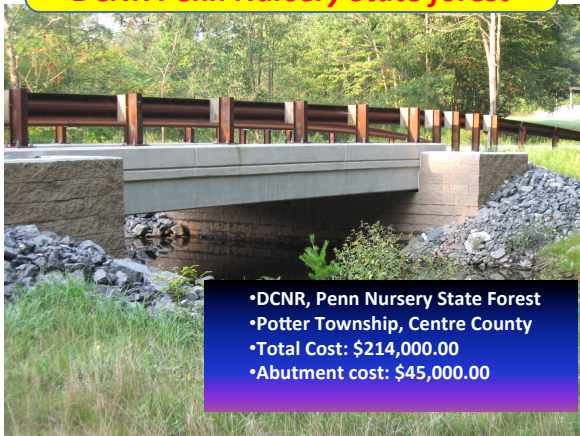
- Total cost: \$258,000.00
- Abutment Costs: \$21,194.00 (single)



Reuse of one stone abutment (above).
New GRS-IBS behind existing abutment for
scour protection (right).



**GRS-IBS Activity in Pennsylvania
DCNR Penn Nursery State forest**



- DCNR, Penn Nursery State Forest
- Potter Township, Centre County
- Total Cost: \$214,000.00
- Abutment cost: \$45,000.00

**GRS-IBS Activity in Pennsylvania
T-606, Blair County**



- Construction cost: \$431,000
- Included a temporary roadway/
stream crossing.
- Abutment costs \$88,000.00

GRS-IBS Activity in Pennsylvania
T-315, Greenwood Township, Crawford Co.



GRS-IBS Activity in Pennsylvania
Liberty Township, Tioga county



Average GRS Abutment Costs

✓ **Per Square Foot of GRS
Wall Face Area**

- ✓ Includes the **GRS Wall Face**
- ✓ Includes **Wing Wall Face**

- ✓ Includes **Labor, Equipment and Material**

Mt Pleasant	\$71.02
Old Bliss	\$110.53
Huson	\$54.84
Brown Hill	\$231.49
Harford	\$143.35
Rausch	\$96.15
Sportsman	\$77.26
DCNR	\$55.90
Lick Island	\$60.29
Mattocks	\$45.66
Liberty	\$190.48

Comparable
Cost Data

Need more evidence?

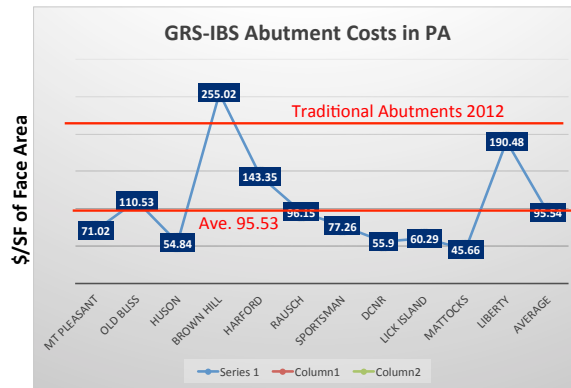
Traditional Abutments
(local 2012 project)
\$208.54/SF

GRS-IBS Abutments
\$95.53/SF

Potential Savings
\$113.01/SF
54% Savings over
traditional abutments!

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Comparable Abutment Costs



GRS IBS – Example Projects from 30 states

- Different types of crossings
- Different types of superstructures
- Different roadway geometries
- Different types of facings
- Different types of fill materials
- Different types of geosynthetics
- Different designers, from in-house to consultant
- Different construction delivery method, in-house to contracted



CA – Disney Bridge, Sequoia National Park (2012)



CO – State Highway 71 over Ft. Lyon Canal (2012)



DE – Chesapeake City Road over Guthrie Run (2013)



FL – CR 107 over Lanceford Creek Nassau County (2014)



HI – Saddle Road Bridge (2012)



Image source: FHWA

IA – Slattery Bridge, Victor Ave over Prairie Creek, Buchanan County



Image source: Buchanan County

**Project Example: IL – Great Western Trail over Grace St.
(2011)**



Image source: FHWA and Village of Lombard

**MA – SR 7A over
Housatonic RR (2014)**



MD – Allegany County (2014)



ME – Knox County Beach Bridge (2013)

Built in a tidal area



Image source: Town of North Haven, ME

MI – Keefer Rd. (2014)**MN - CR 55 over MN Southern Railway (2013)****MO – Rustic Road Project (2015)****MT – SR89, Dupuyer (2013)**

NE – Sand Creek (2014)



NJ – Gloucester County Bridge #4-H-5 over Edward's Run on Jessup Mill Road (2015)



NV – Strawberry Creek Bridge, Great Basin National Park (2011)



Image source: FHWA

NY – CR 38 St. Lawrence County (2013)



OH – Bowman Rd Bridge (2005)



OK – Kay County (2014)



PA – Mattocks Rd Bridge, Greenwood Township (2014)



PR – Yauco PR2 (2014)



SC – Airline Rd, Anderson County (2014)



SD – 8th Street Bridge, Custer (2014)



UT – I-84 Echo Bridge (2013)

First GRS IBS on the Interstate; utilized SIBC

Constructed summer 2013

- No approach slab
- ADT > 8,000
- Truck ~ 40%



Summer 2014

- No bumps
- No cracks
- Excellent performance



Image source: FHWA

VA – Towiston Rd, Great Falls (2014)



WA, Gifford Pinchot National Forest Layout Creek Bridge (2014)



WI – STH 40 Bloomer, WI (2012)



WV – VA Hospital, Clarksburg (2013)



AZ – Dennehotso



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Additional Resources

www.fhwa.dot.gov/everydaycounts

- Design and Construction Guidelines
- Construction Training Video
- Standard Plans
- Sample Guide Specifications
- Presentations
- FAQs
- Case Histories
- Event Calendar



Questions and Comments

