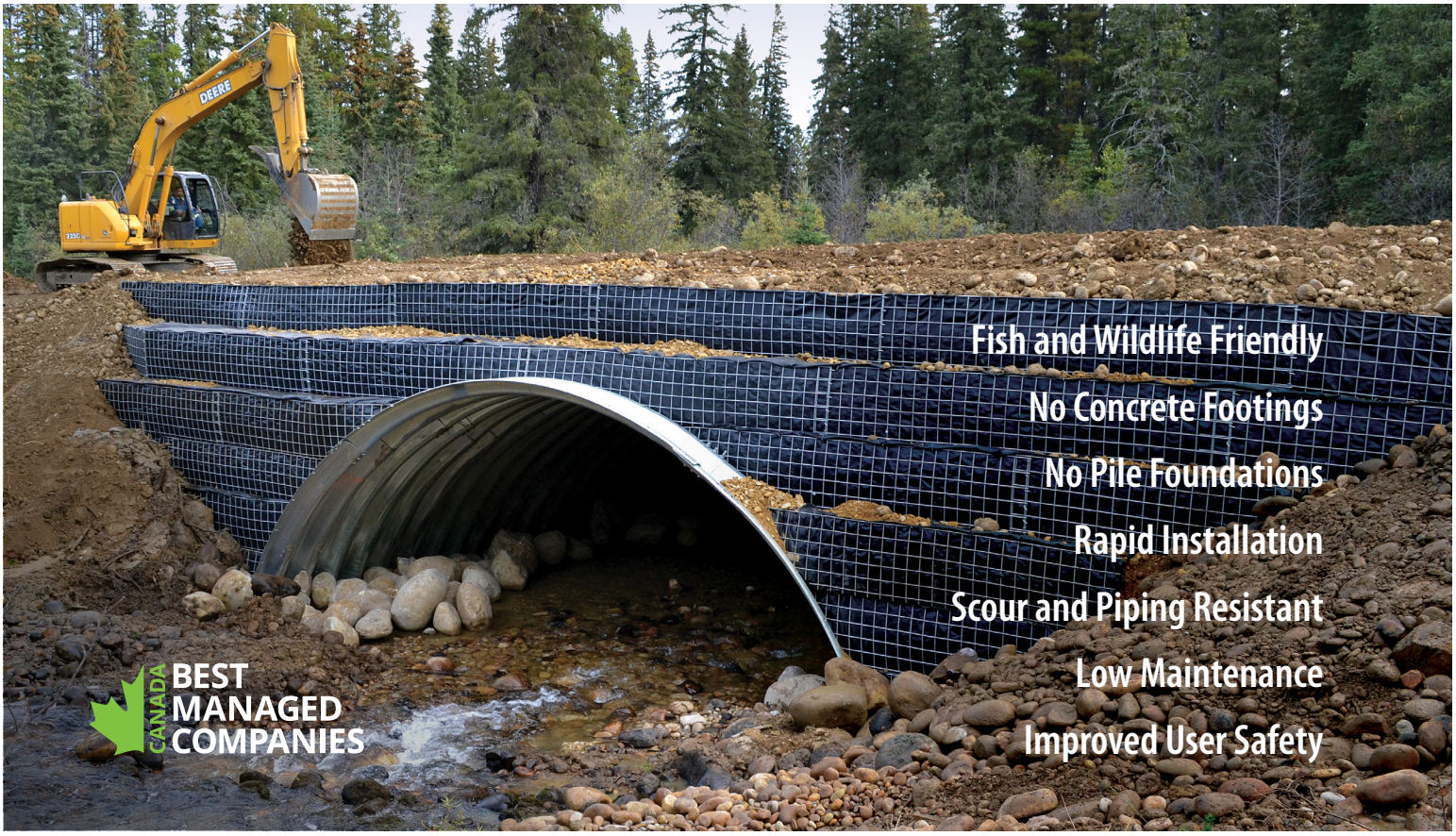
# Geotextile Reinforced Soil Bridges




PRE-ENGINEERED OPEN BOTTOM BRIDGES

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# About GRS Bridges

Geotextile Reinforced Soil Bridges

The AIL GRS Arch is a patented buried bridge system developed for the forestry and resource sectors. GRS buried bridges are typically constructed using local materials and conventional road construction equipment.

## Fish and Wildlife Friendly:

GRS buried bridges maintain the original streambed, reducing the impact on fish and wildlife. Where the streambed does not exist, streambed reconstruction is part of the GRS bridge design. Structures can be sized wider than the natural streambed to permit passage of other wildlife. Flexible headwall designs help to minimize the structure's footprint.

**Before** – Neither fish or wildlife passable

**After** – Passable by both fish and wildlife

## Rapid Installation:

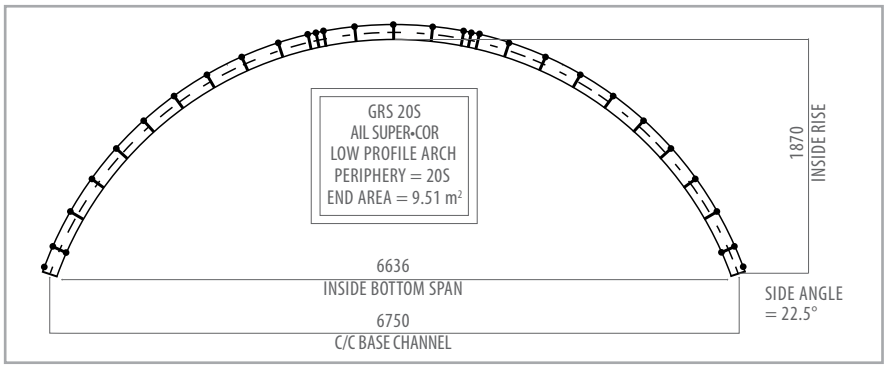
Boulder foundation preparation eliminates concrete footings and in many cases, pile foundations. Components ship on a single truck to be installed with conventional road building equipment and local labour in only a matter of days. Natural boulder foundations and backfill are typically sourced locally, reducing hauling costs and accelerating construction in regions with limited infrastructure.

# Benefits of GRS Solutions

Geotextile Reinforced Soil Bridges

## Pre-Engineered:

GRS structures are available in spans up to 8.3 m, supporting L-100 logging trucks/CL-800 vehicles. All shipped components are standardized with custom bridge lengths available to accommodate the desired road widths.




## Scour and Piping Resistant:

The structural backfill is wrapped in an envelope of geotextile which reduces the risk of backfill materials piping or foundation scouring during high water events.

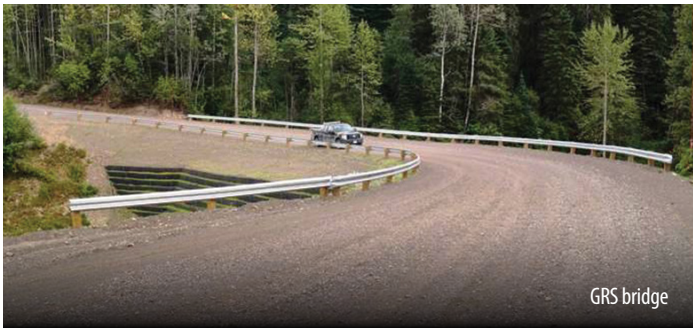
## Low Maintenance:

Walls "green up" with vegetation and/or can be covered with boulders or rock fill for a gabion style appearance. There is no bridge deck or complex barriers to maintain. In typical conditions structures do not require maintenance for the entirety of their design life.

## Improved Safety:

With no approaches or decks, GRS bridges ensure smooth transitions, even on unpaved roads. Plus, custom lengths can accommodate wider, multiple lane roads.

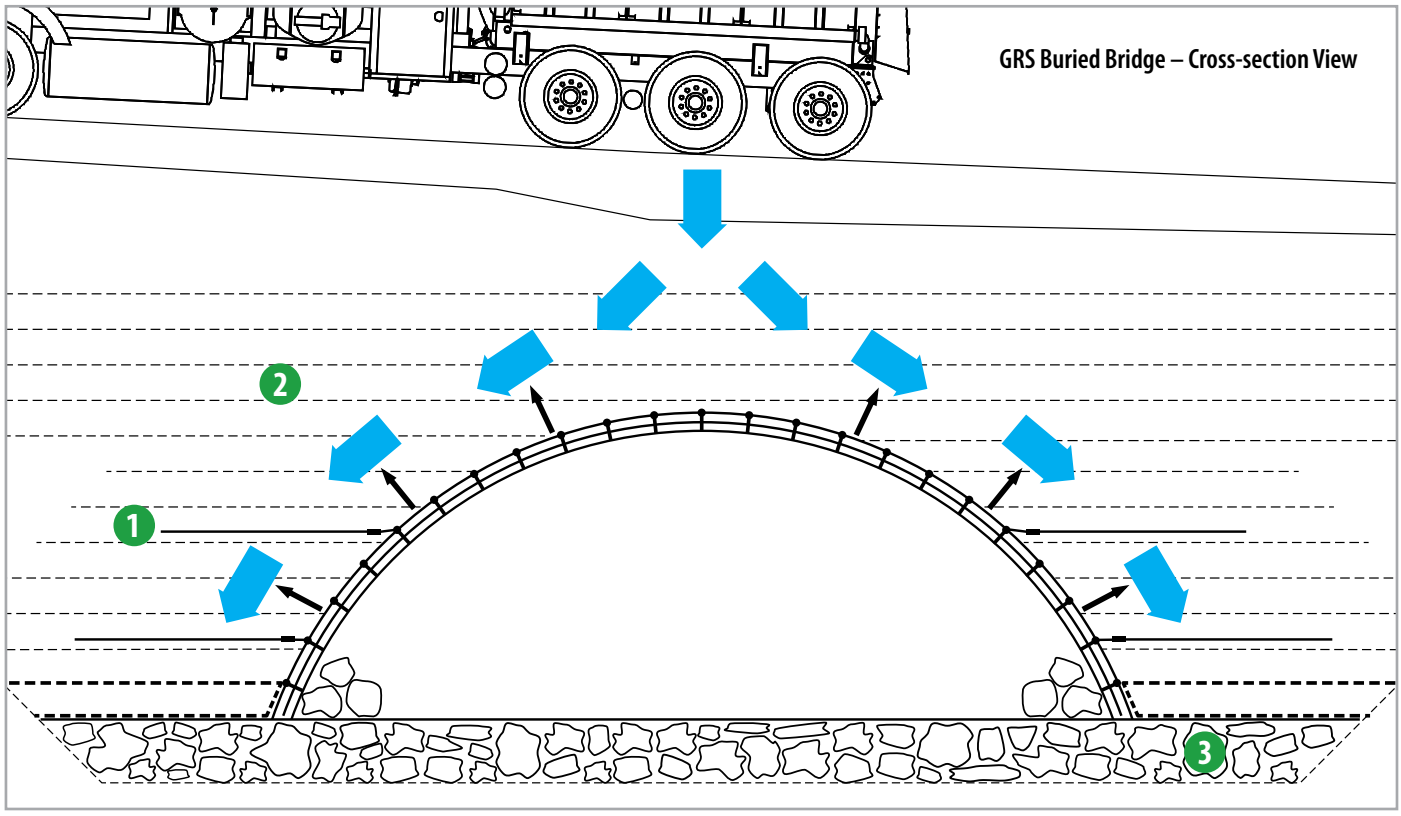

Clear span bridge


GRS bridge

# How it Works



GRS buried bridges are a soil-steel geotextile composite structure. Dead and live loads are supported by the reinforced soil, structure and natural or improved subgrade soils.




1. Anchor Rods – The arch structure is connected to the GRS soil mass composite with soil anchor rods. The anchor rods ensure the structure maintains shape during backfilling.
2. GRS – Closely spaced geotextile between layers of compacted backfill act to confine the soil particles.
3. Boulder layer foundation – Used in lieu of conventional strip footings or pile foundations.

# Standard Pre-Engineered Designs

**Geotextile Reinforced Soil Bridges**

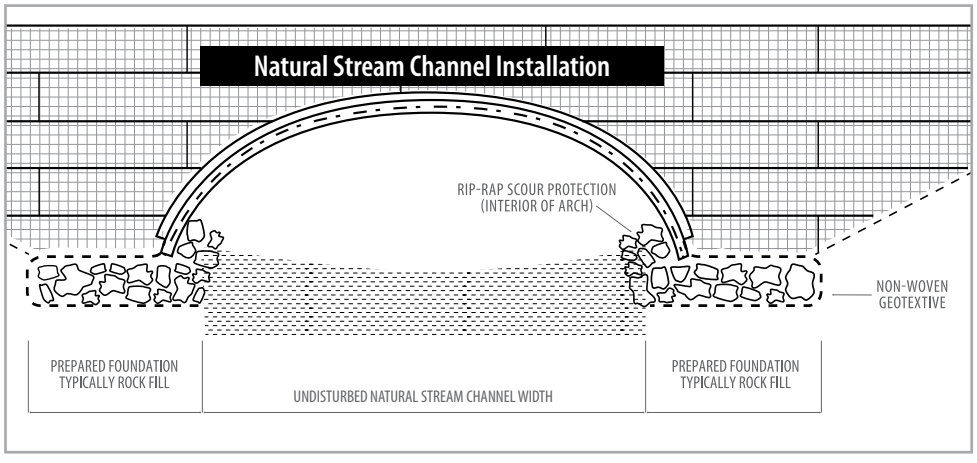
| Inside Span (mm) | Inside Rise (mm) | End Area ($m^2$) | Minimum Cover (m) | Maximum Cover (m) |
|---|---|---|---|---|
| 3,660 | 1,910 | 5.48 | 0.8 | 3.7 |
| 4,270 | 2,210 | 7.43 | 0.9 | 3.1 |
| 6,636 | 1,870 | 9.51 | 1.4 | 6.0 |
| 8,271 | 3,075 | 19.96 | 1.7 | 3.0 |

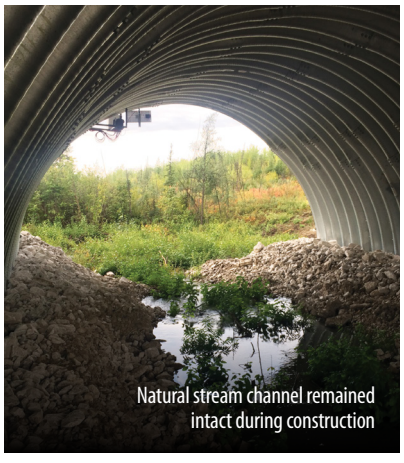
*Note – other custom designs available – larger spans/live loads/different foundation systems can be considered.

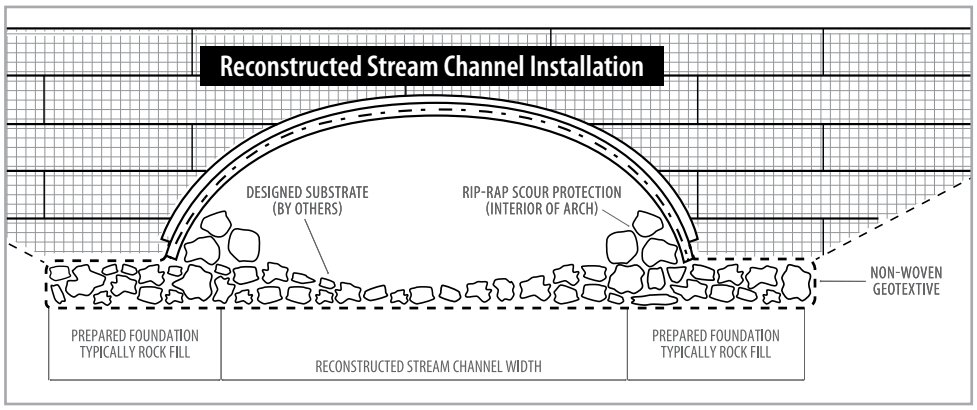
### Design Guidelines

- Maximum Live Load = L-100 or CL-800 (200,000 lbs)
- Medium-dense coarse-grain foundation soil or better ($\Phi \geq 38$ degrees)
- Minimum 0.5 m deep x 3 m wide boulder foundation with sand and gravel compacted in voids
- Durable, well graded engineered backfill with low fines
- AIL design guideline drawings are available on request. Scope by others includes:
  - Foundation investigation and design by a qualified geotechnical engineer
  - Structure size and armour design completed by a qualified hydrotechnical engineer

## Stream Channel Crossing Options (note minimum arch span > 1.2 x typical natural stream width).





Natural stream channel remained intact during construction





Reconstructed scour-resistant channel bottom

# Typical Culvert Replacement



1. Following installation of a stream diversion and culvert removal, construct the boulder foundation and scour resistant stream channel in lieu of conventional footings or piles. Voids are to be filled with clean sand/gravel.

2. Lift pre-assembled arch sections onto the leveled foundation after placing armour material and stream channel structures (i.e. groins) along the length of the structure.

3. Place non-woven geotextile to envelope the first layer of backfill and create a wick drain.

4. Scribe wire forms to accommodate the curve of the arch and lock together to extend wall length. Wire forms must overlap by 100 mm to reduce the potential for hinging at the joints.

5. Drape woven geotextile over the forms, taut to the inside corner. Hook struts over the top and bottom of the forms, puncturing the geotextile.

6. Replace circumferential seam bolts with anchor rods as specified in the design.

7. Compact backfill according to the design-specified lift heights between layers of woven geotextile and welded wire forms.

8. Continue to lay wire forms, geotextile and compacted backfill layers until the full height of the wall is achieved.

9. Seed slopes and cover with coconut matting for erosion control. Place silt fencing, as appropriate, to control sediment.

# Custom Designs



In addition to standard, pre-engineered designs, GRS Bridges can also be custom designed to suit a wide variety of spans, covers, live loads and subsurface conditions. Consulting services can be provided to review the applications on a project specific basis.

Example projects are shown below:

Image courtesy of British Columbia Ministry of Forests, Lands & Natural Resource Operations

## 7 m span Super•Cor Arch

- 17 m of cover
- Foundation was a compacted layer of gravel encased in non-woven geotextile
- Partially constructed in sub-zero weather
- Permitted wide running surface for the road on a horizontal curve

Image courtesy of Government of the Northwest Territories, Department of Transportation

## 10 m span Ultra•Cor Arch

- Constructed in discontinuous permafrost in sub-zero winter conditions
- Installation services and instrumentation supply was provided
- Delivery to site possible despite winter road restrictions

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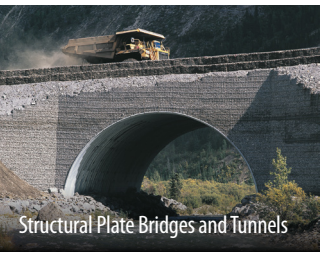
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AIL Atlantic Industries Limited

**Head Office:**
PO Box 6161, 32 York St.
Sackville, New Brunswick
Canada E4L 1G6
Phone: (506) 364-4600

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