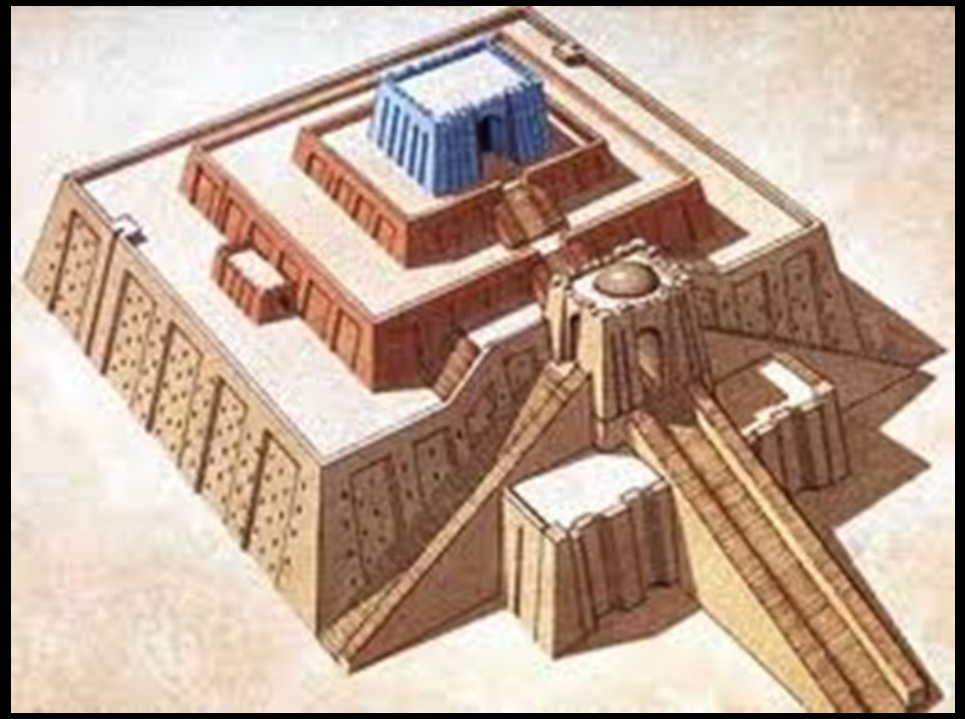
MSE Abutments for Single-Span Bridges

A cost-effective solution

SHANNON & WILSON

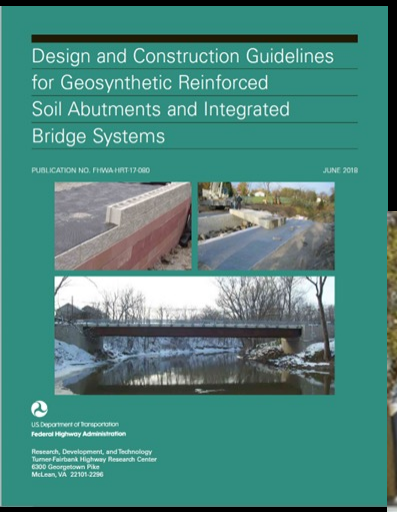
Mechanically Stabilized Earth (MSE) a ~4000-year-old technology

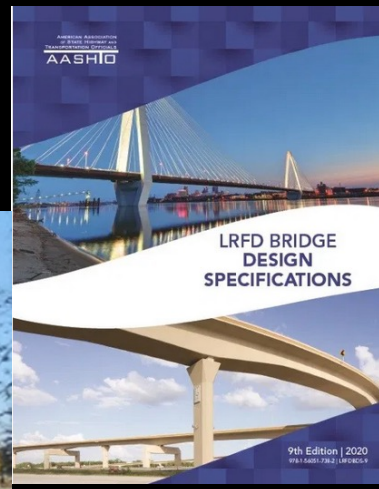


Great Ziggurat Tower in Mesopotamia built ~2016 BC

Walls constructed of mud bricks interlayered with reed mats

In Idaho, our bridges are designed for at least 75 years of service





Why is there interest in MSE abutments?

because… you can build 2 or 3 for the cost of one standard DOT abutment.

MSE abutments are a subset of shallow foundations and should be protected from scour.

When considering an MSE abutment, the Owner's first decision should be the selection of the type of facing.

because…

- The facing width affects the girder or bridge beam length.
- There may be an Owner preference for the aesthetics.

The Idaho Transportation Department maintains a list of pre-qualified MSE wall systems for

- small block facing
- large block facing
- welded wire facing

small block facing…~8-inch width


OVERSIZE LOAD

large block facing…~18-inch to 36-inch widths

welded wire facing…width equal to ~zero

MSE technology

- Single-span bridges 140 feet
- Abutment heights up to 30 feet

Lincoln RD BR in Idaho Falls

Reinforced Backfill

- ¾-inch Type A
- ½-inch chips*

Lincoln RD BR in Idaho Falls

MSE Technology Advantages

- Construct using a roadway crew
- No cost for specialty trades (e.g., carpenters, steel workers)
- Use of concrete may be optional… let's discuss in the following slide
- Cost of QC testing may be substantially eliminated

Contractor Pricing

- ~$38/sf to ~$48/sf installed including aggregate

Concrete Bearing Pad

- Bearing pad may be optional
- Consider forming to the roadway cross-section

Lincoln RD BR in Idaho Falls

Deck

- May use pre-cast rectangular beams
- Other girder sections

Lincoln RD BR in Idaho Falls

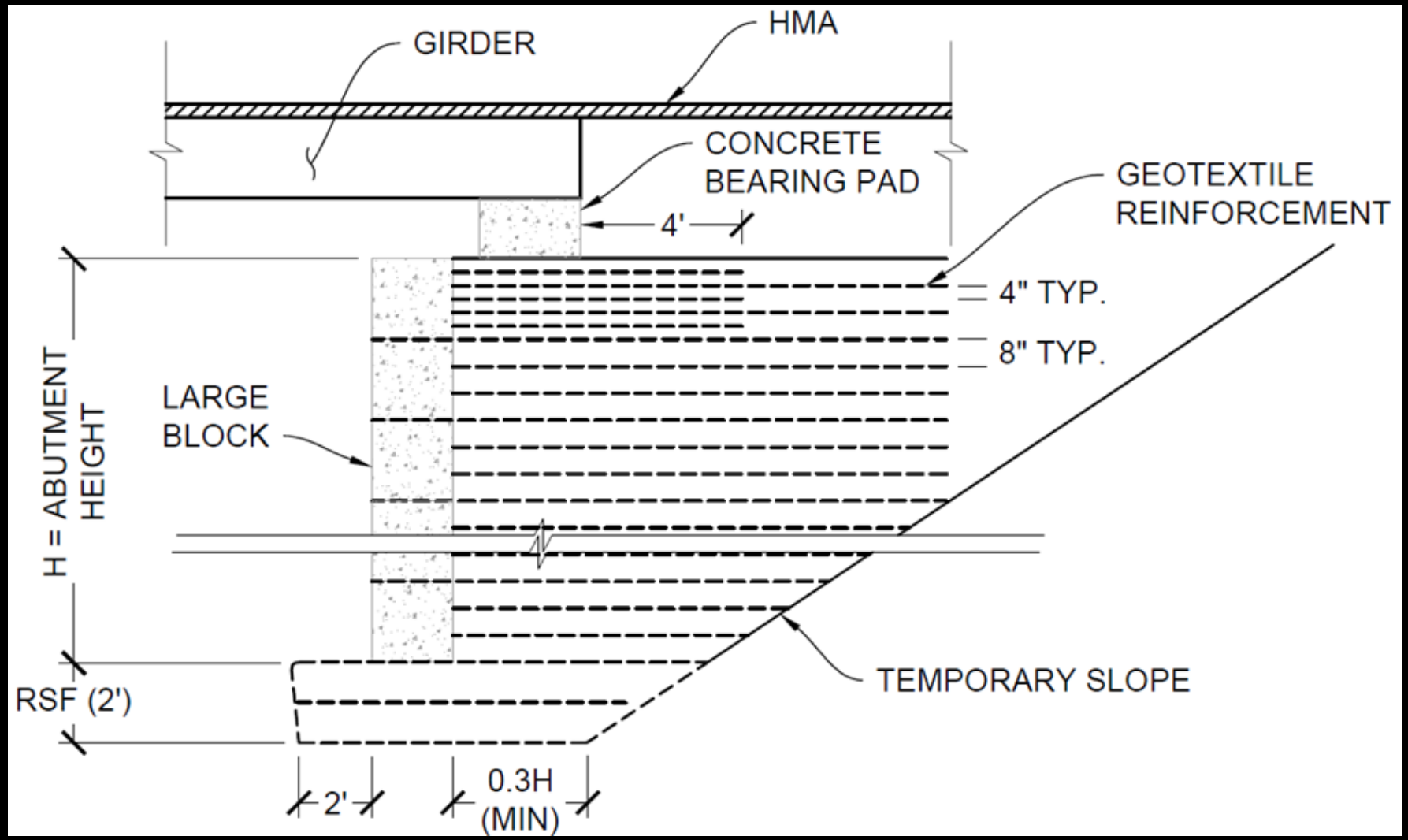
Considerations for large block facing

- They are heavy and do not move as easily as small blocks during compaction of backfill. Heavy to transport
- There are both non-proprietary options and proprietary options
- More difficult to estimate foundation preparation costs when there is near surface undulating bedrock
- Aesthetics need to be considered at wingwall corners.
- Polymer reinforcements are used for the backfill

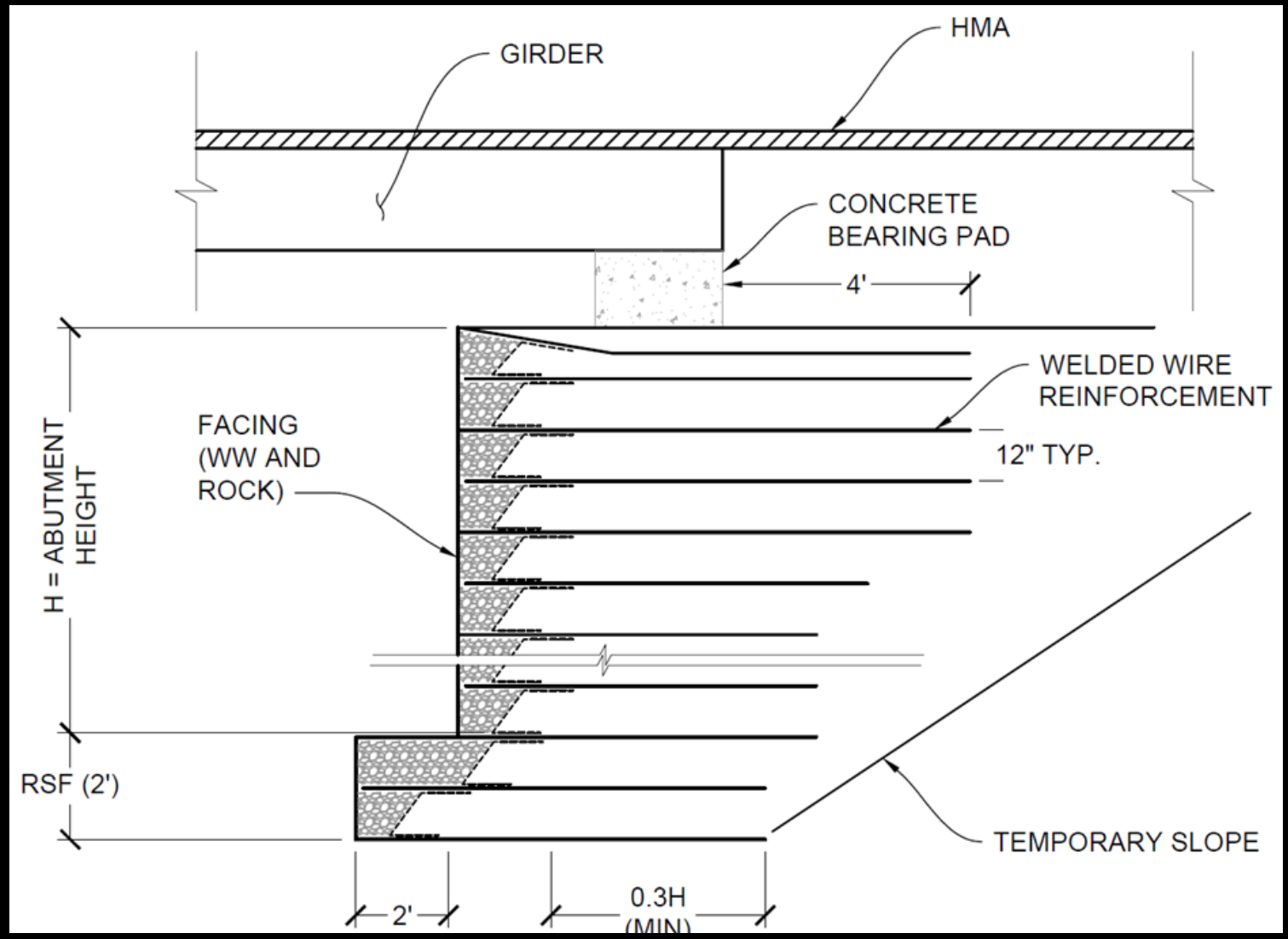
Considerations for welded wire facing

- Convenient to skew wing wall corners and to stage traffic
- Fit near surface undulating bedrock surfaces with little bedrock cut preparation
- Aesthetic is often preferred for rural settings
- Possibly the most cost-effective solution

Some MSE abutment typical sections

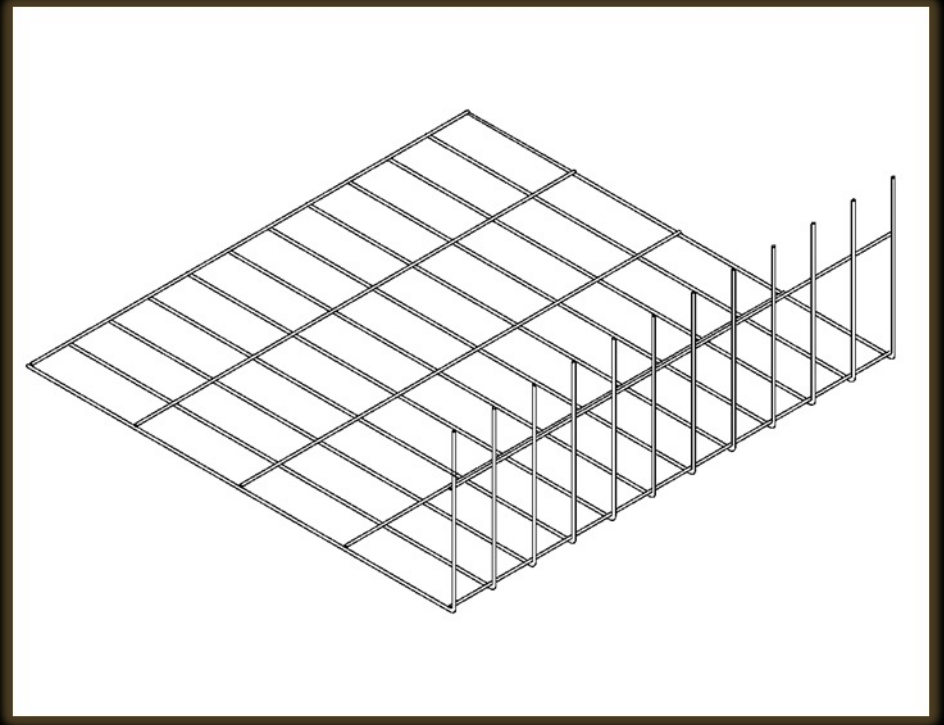


Some MSE abutment typical sections

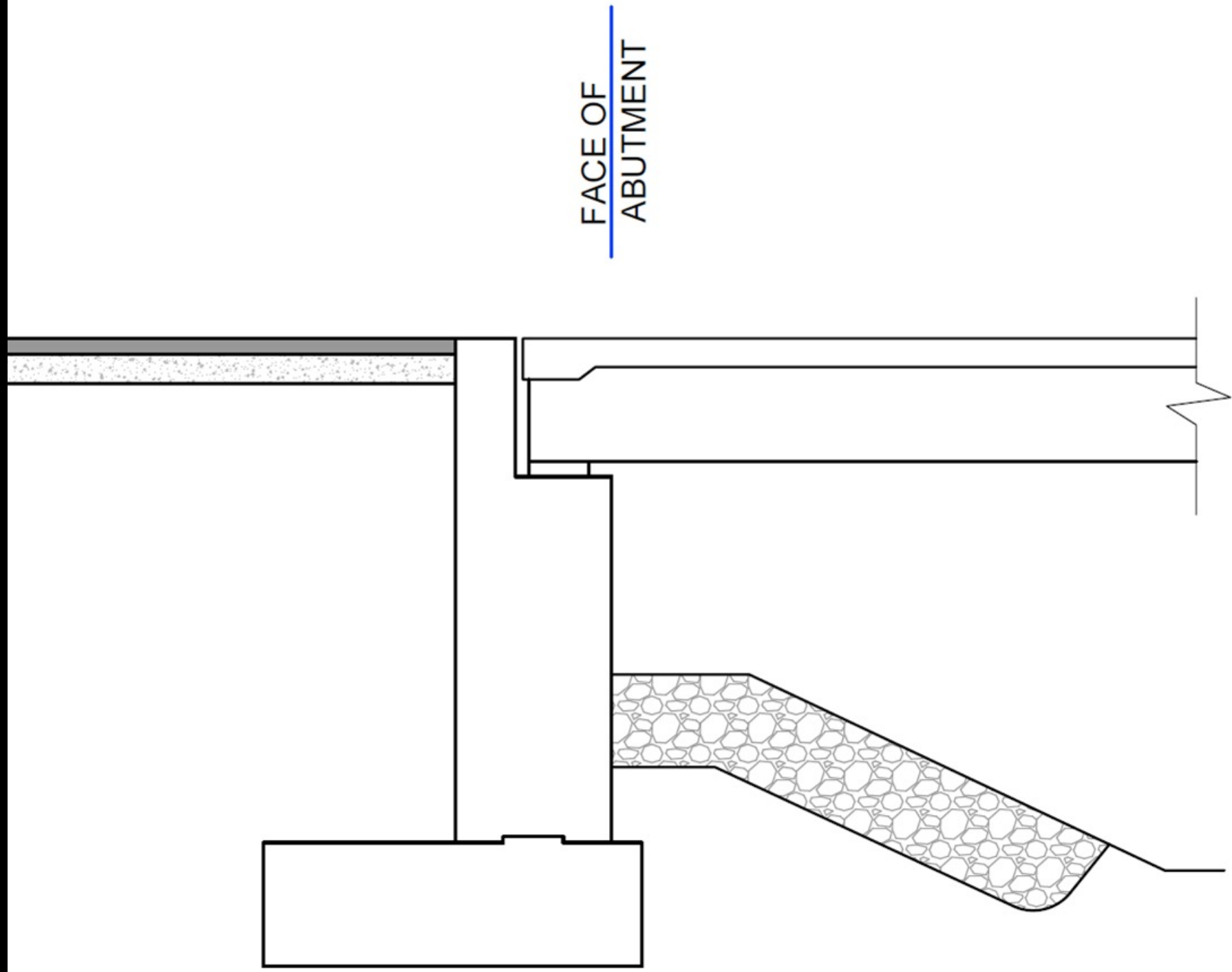


How can you build a welded wire abutment?

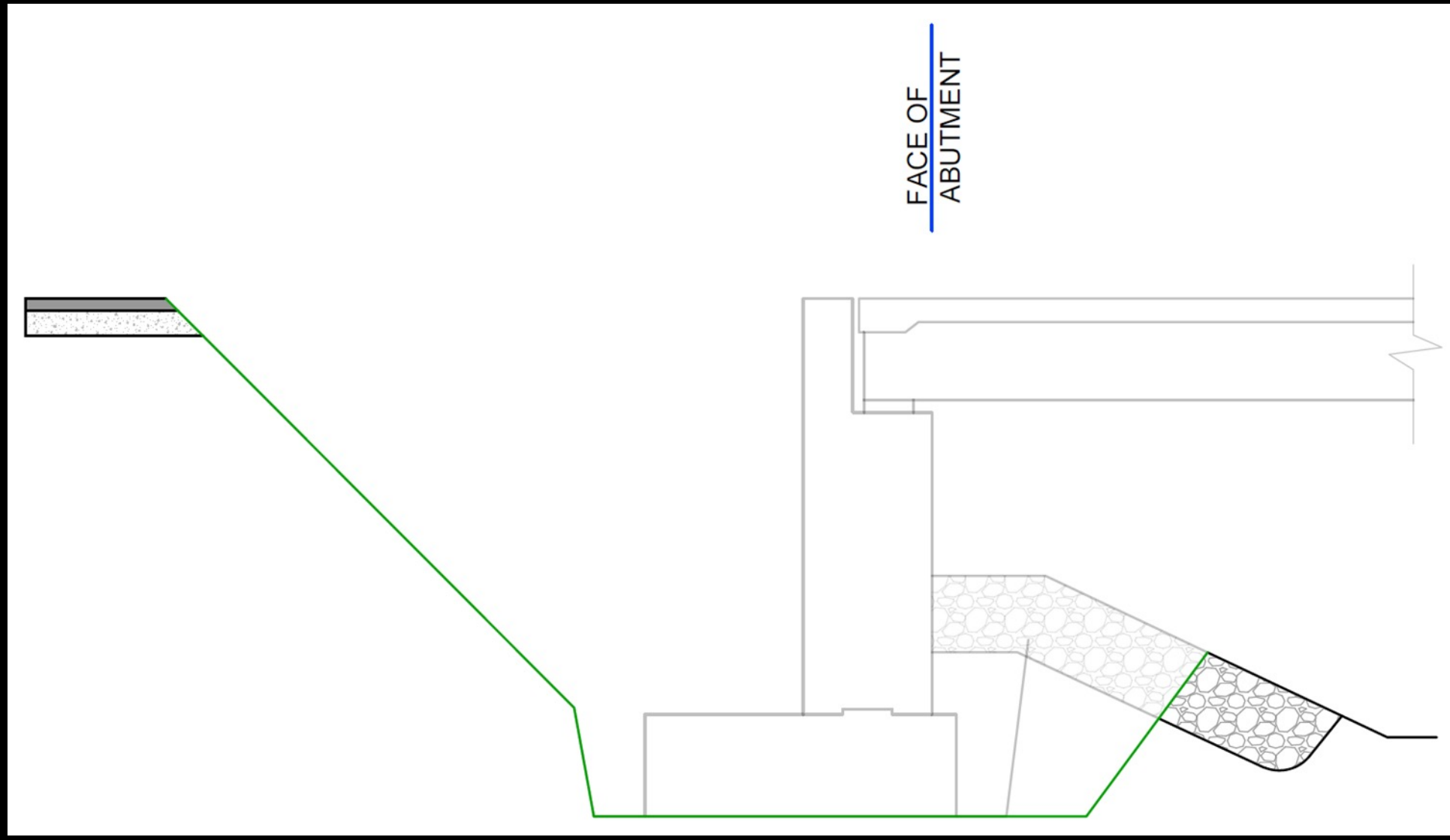
The following is a construction sequence for a welded-wire abutment



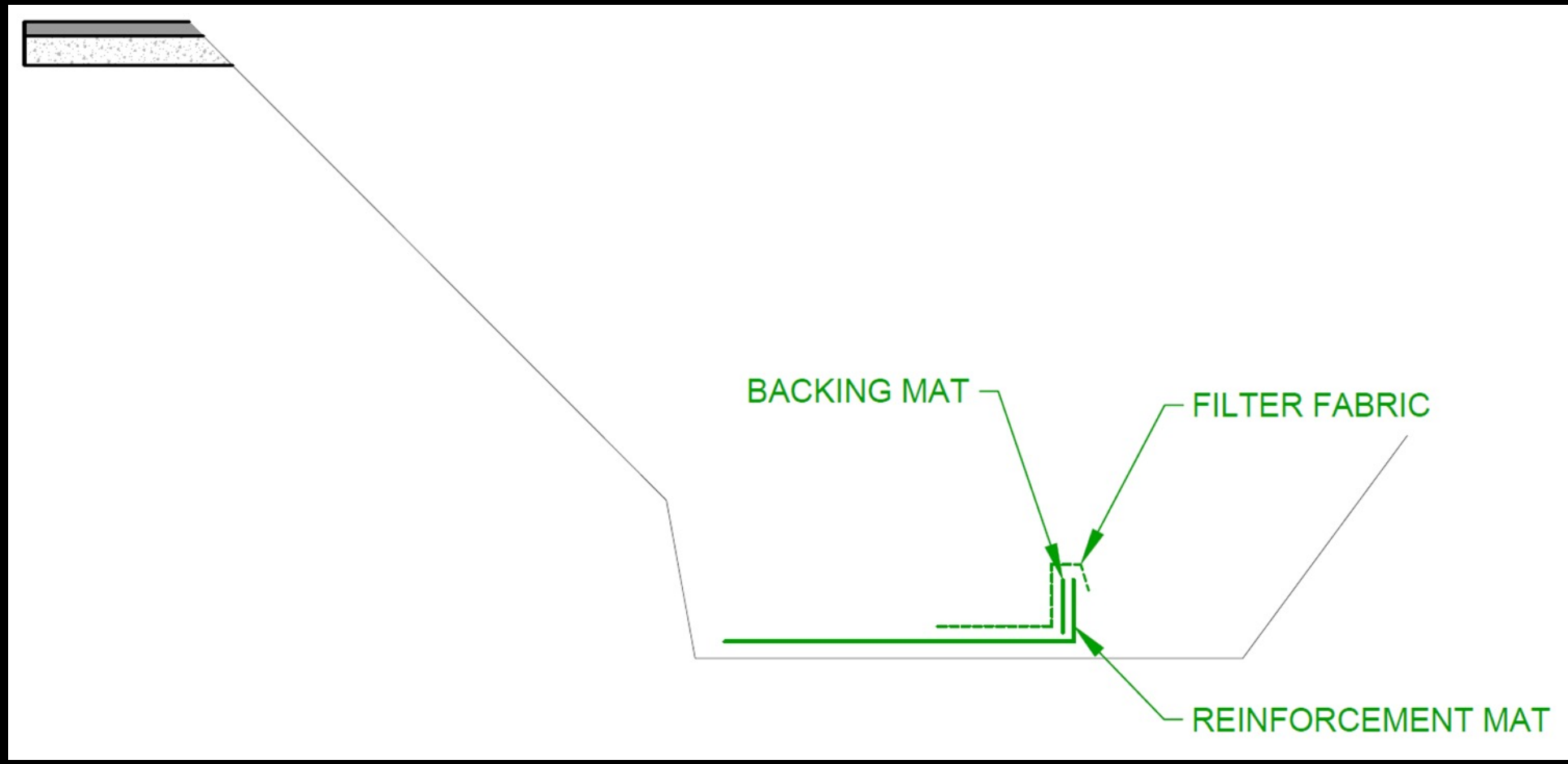
Before Bridge Replacement



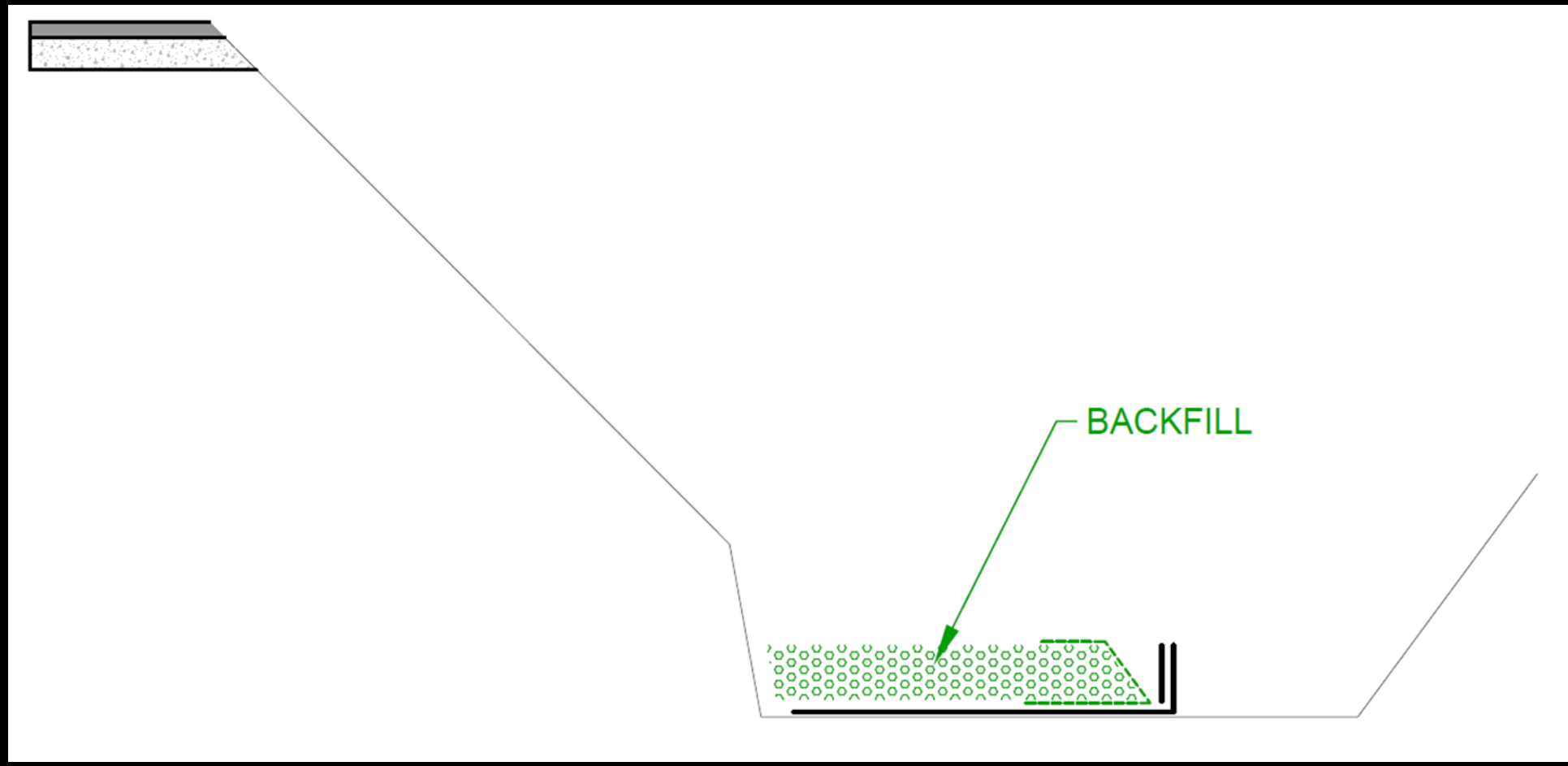
Demolition and Excavation



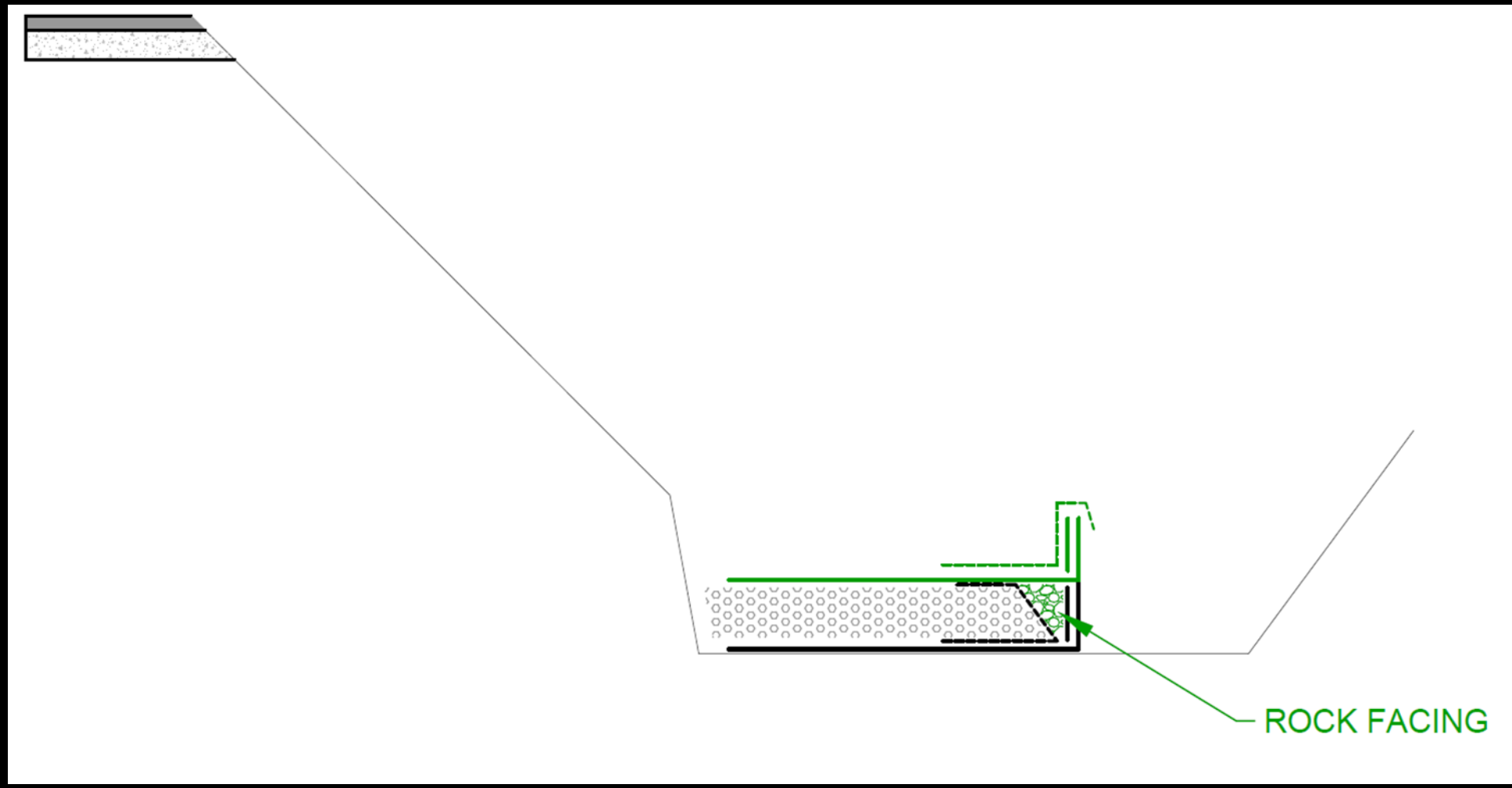
Step 1 – Place the Welded Wire



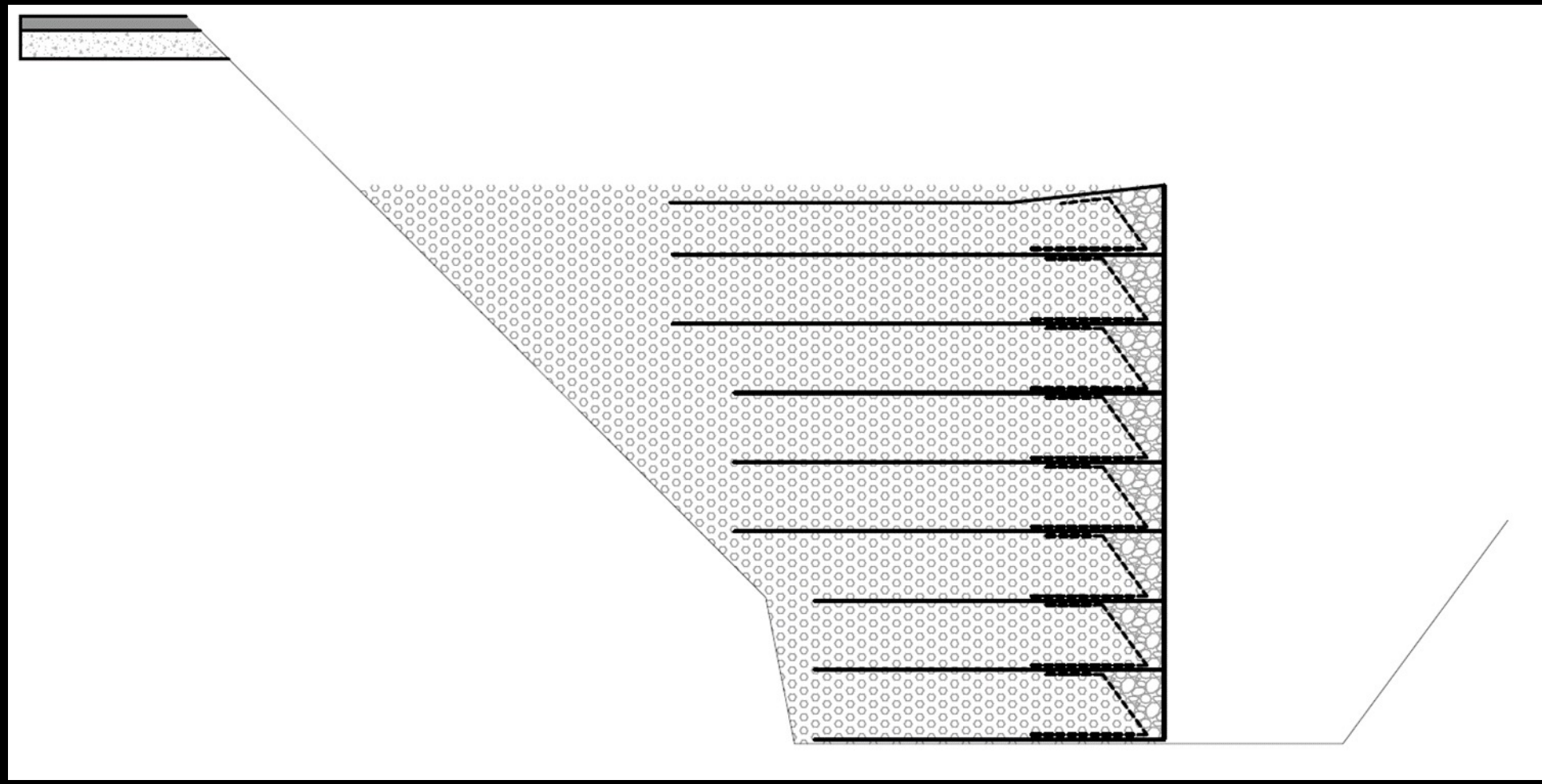
Step 2 – Place the Aggregate



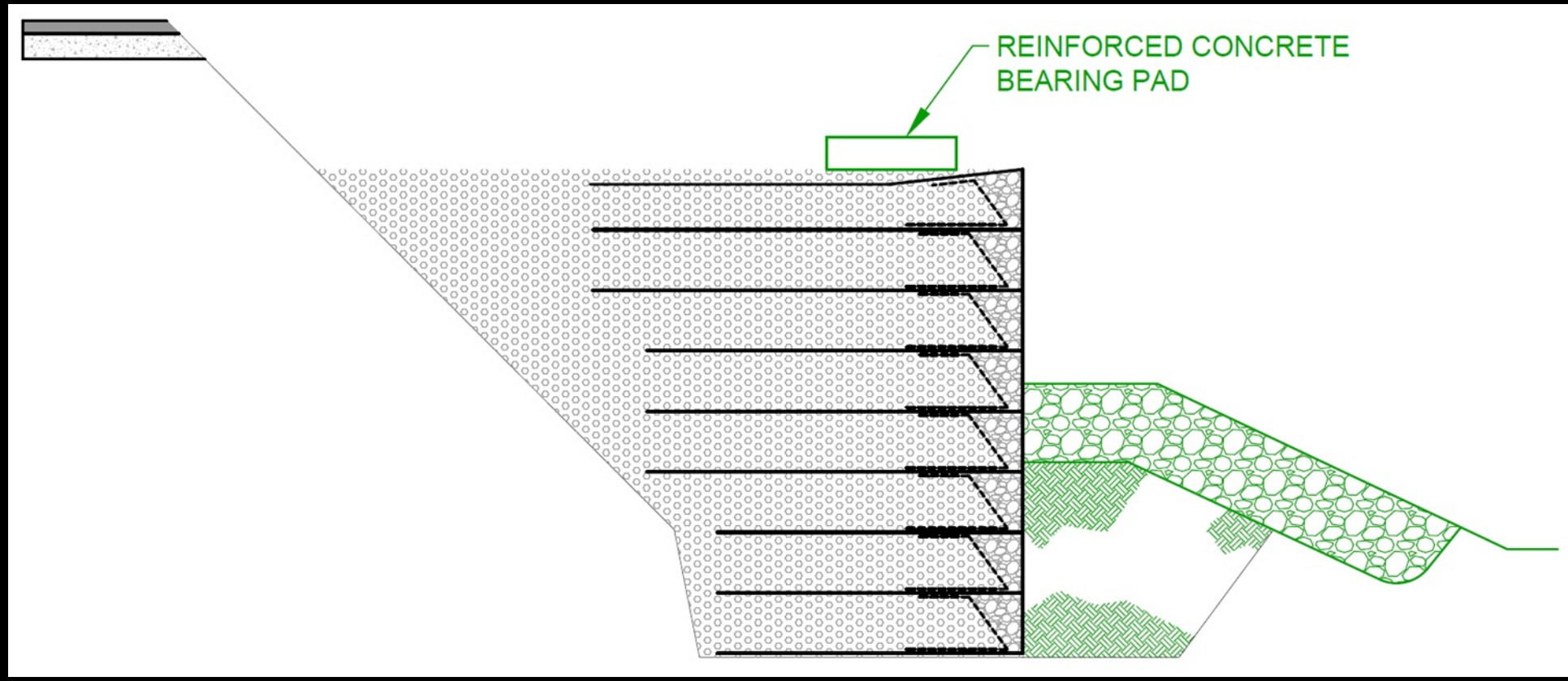
Step 3 – Place the Facing Rock



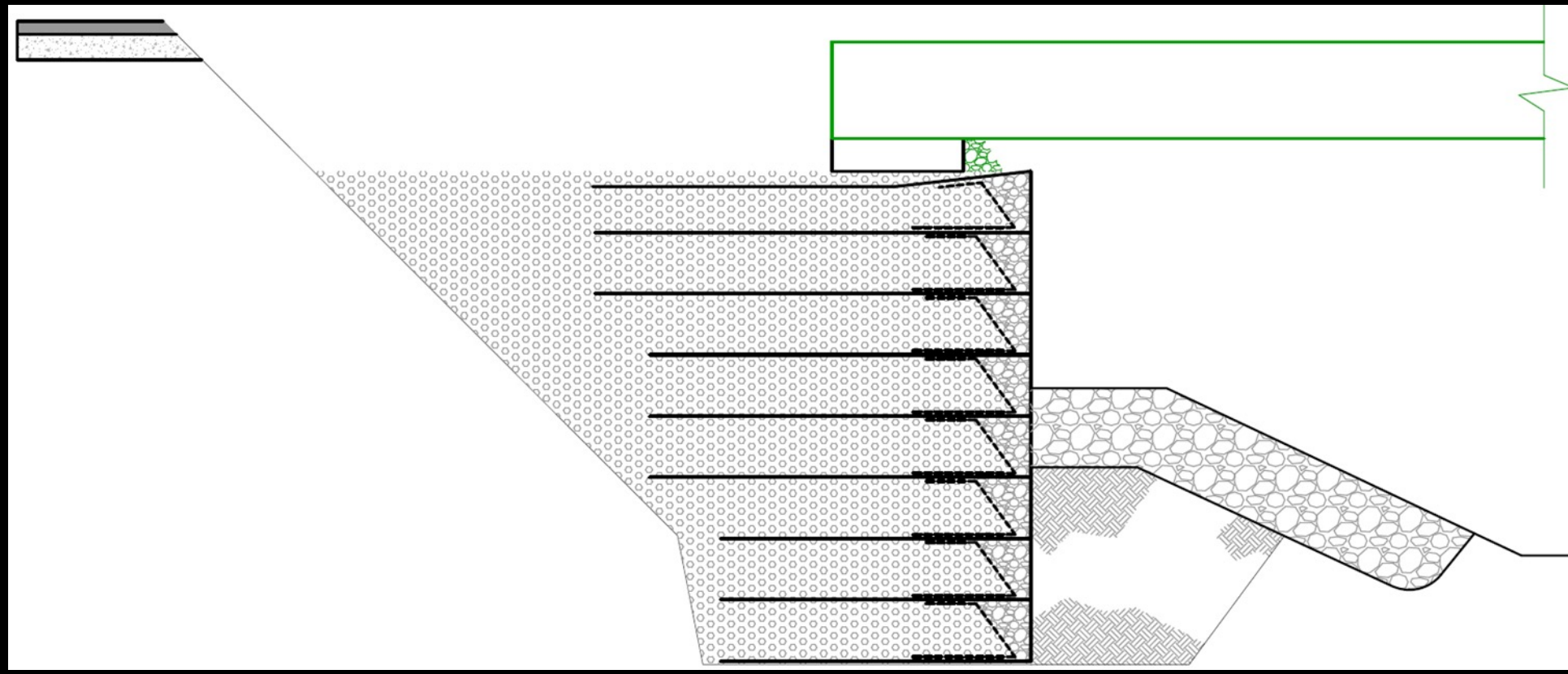
Repeat Steps 1 through 3



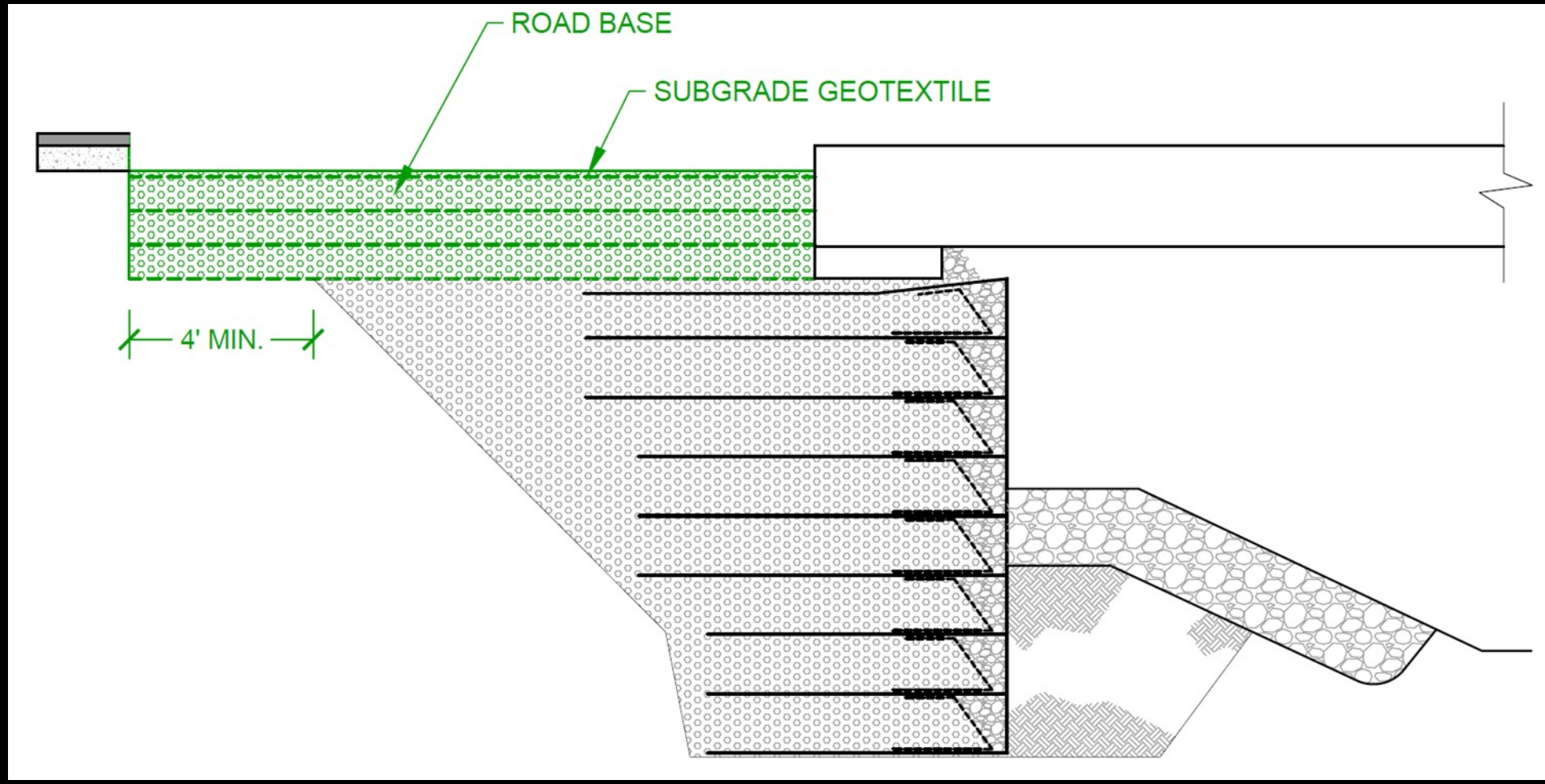
Install scour countermeasures



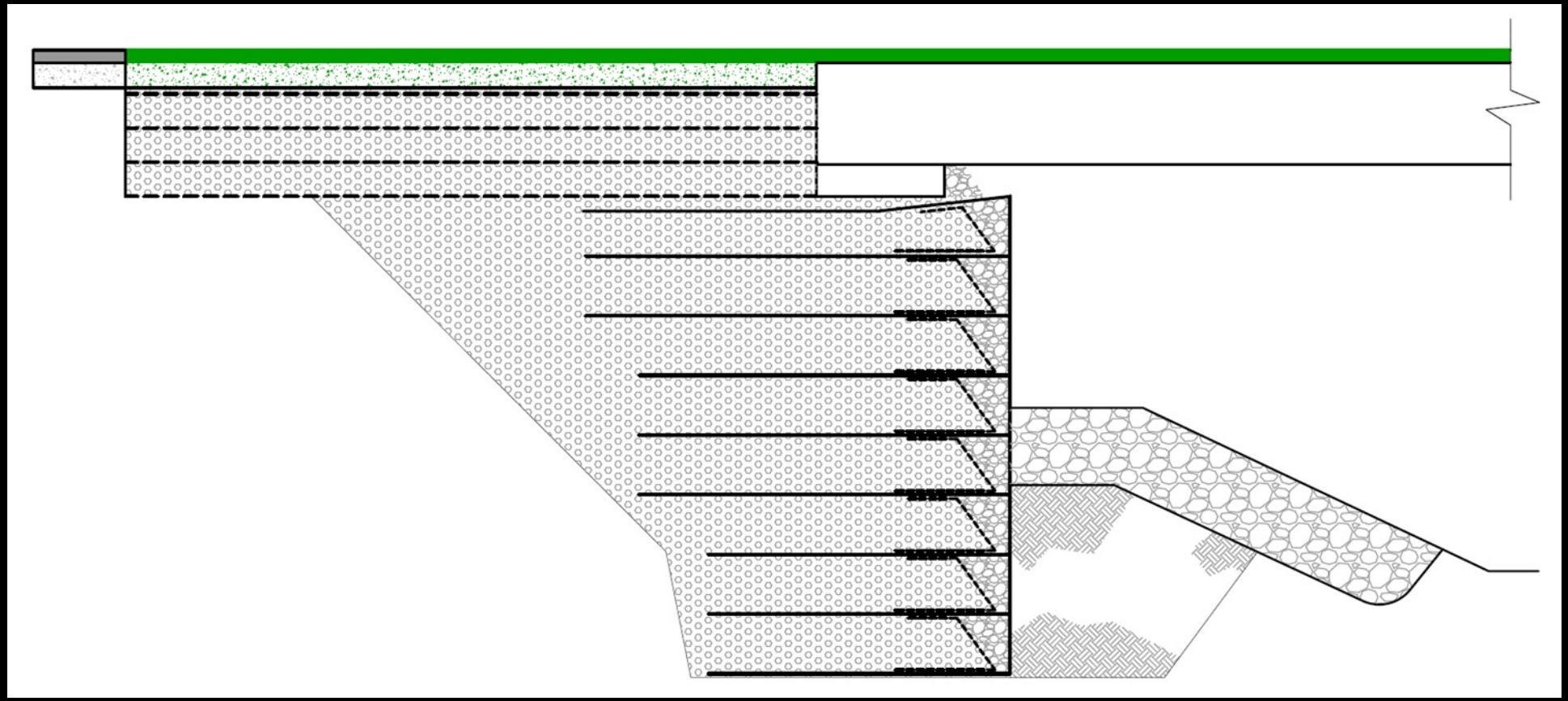
Place the bridge beams



Construct roadway approach



Pave



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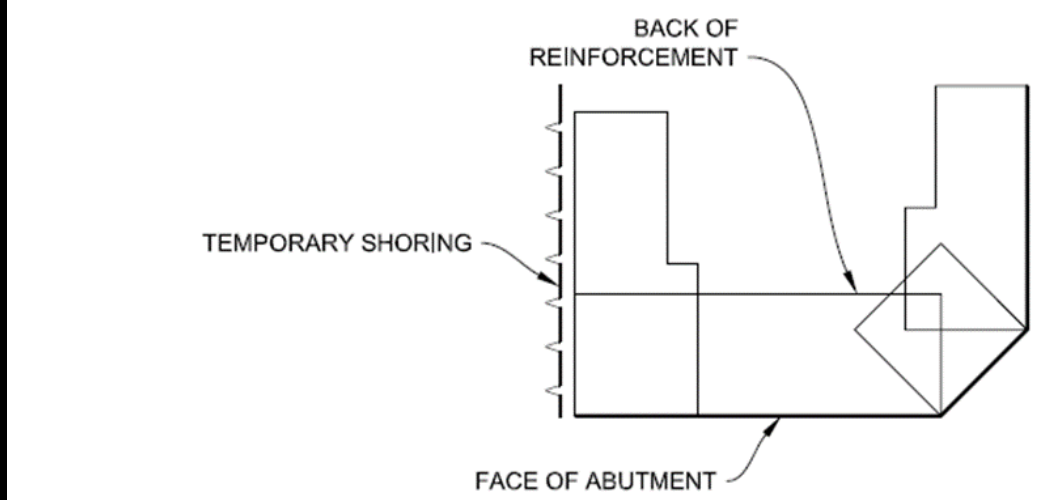
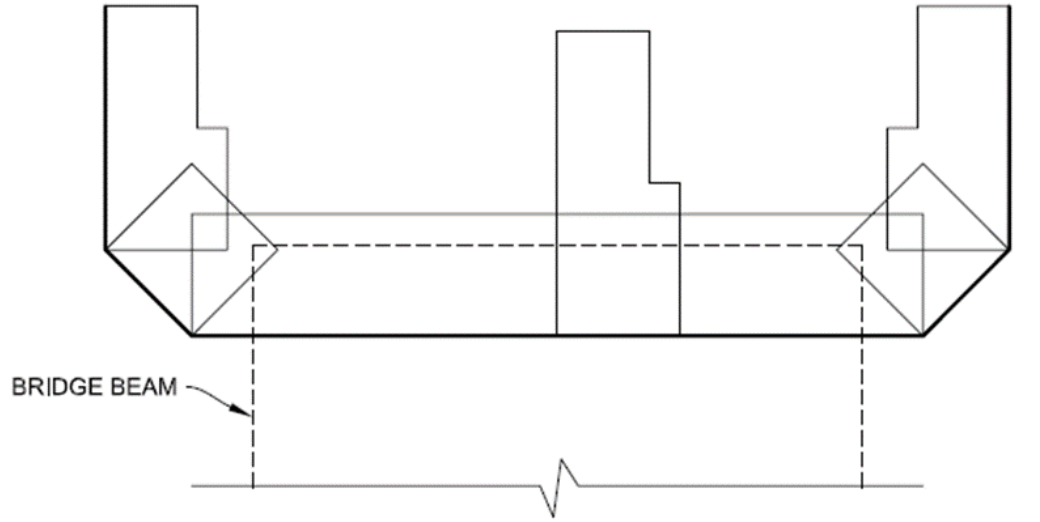
USFS Bridge

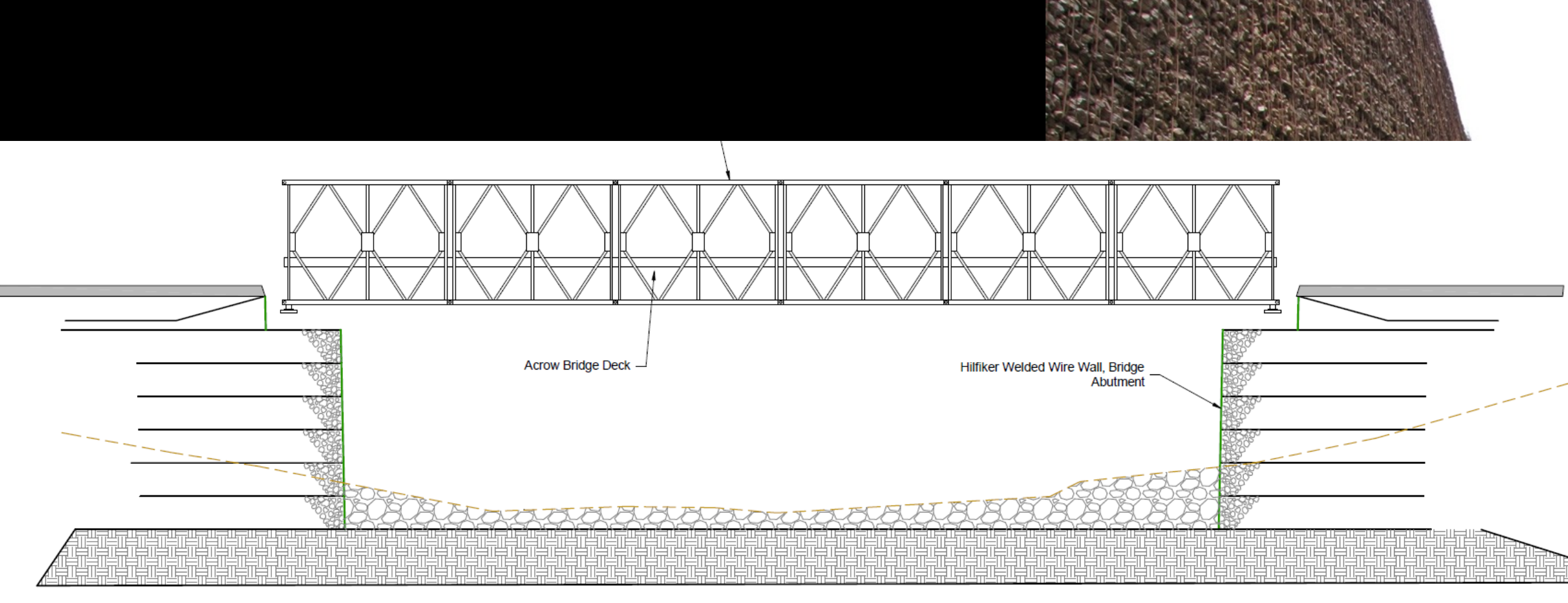
Staged Construction



STAGE 1



STAGE 2

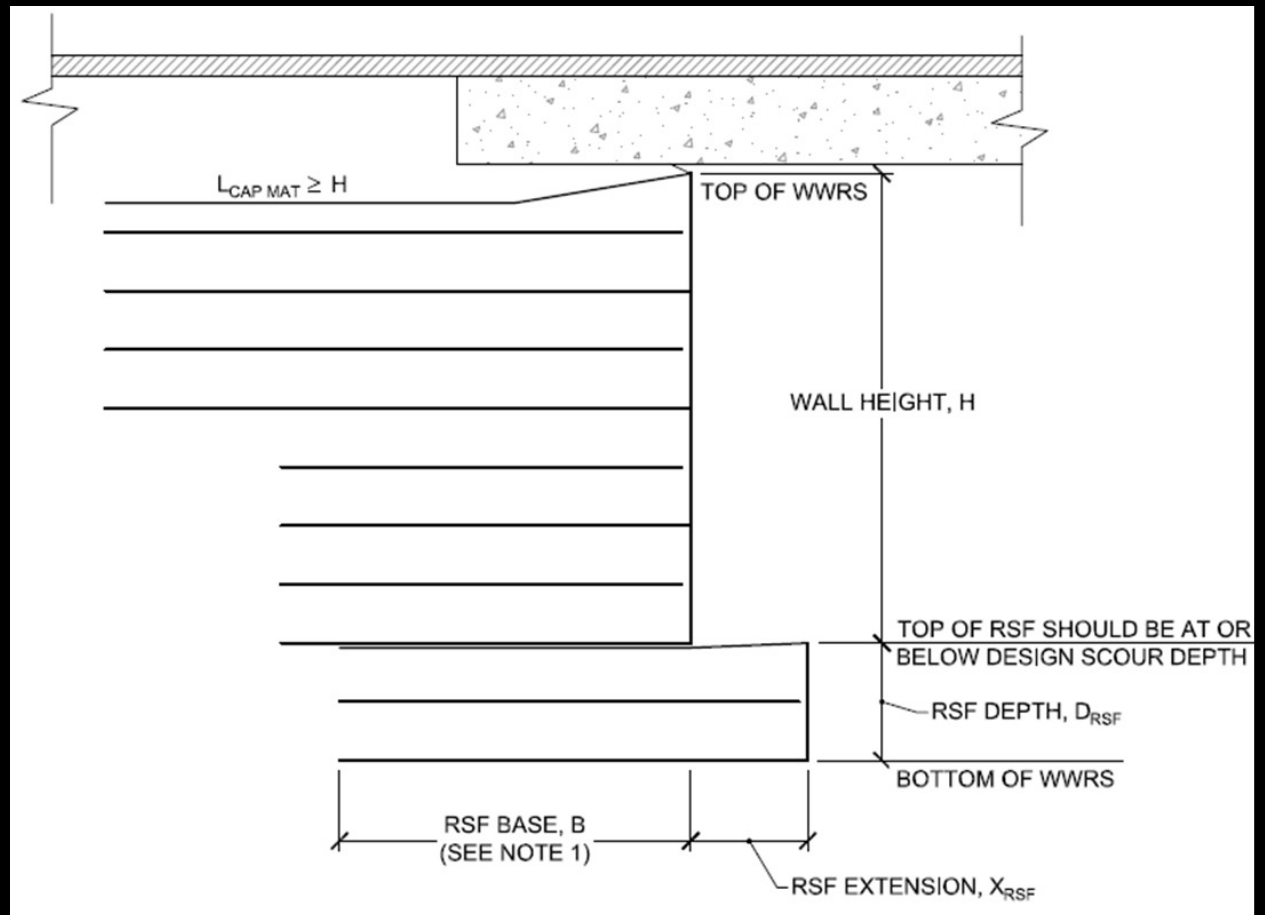

Acrow Bridge Deck
Hilfiker Welded Wire Wall, Bridge Abutment

Leave the Existing Abutment Walls

- Permitting simplified
- Cofferdam benefit
- Reduced Demolition

Idaho Department of Parks and Recreation

Construct a 12-foot-high WWRS abutment in just two days.



A major advantage of an MSE abutment is the smooth ride across the bridge.

Thank you

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