



New Technologies For Ending The “Bump At The Bridge”

County Engineers Association of Ohio

2016 Bridge Workers, Supervisors and Engineers Conference

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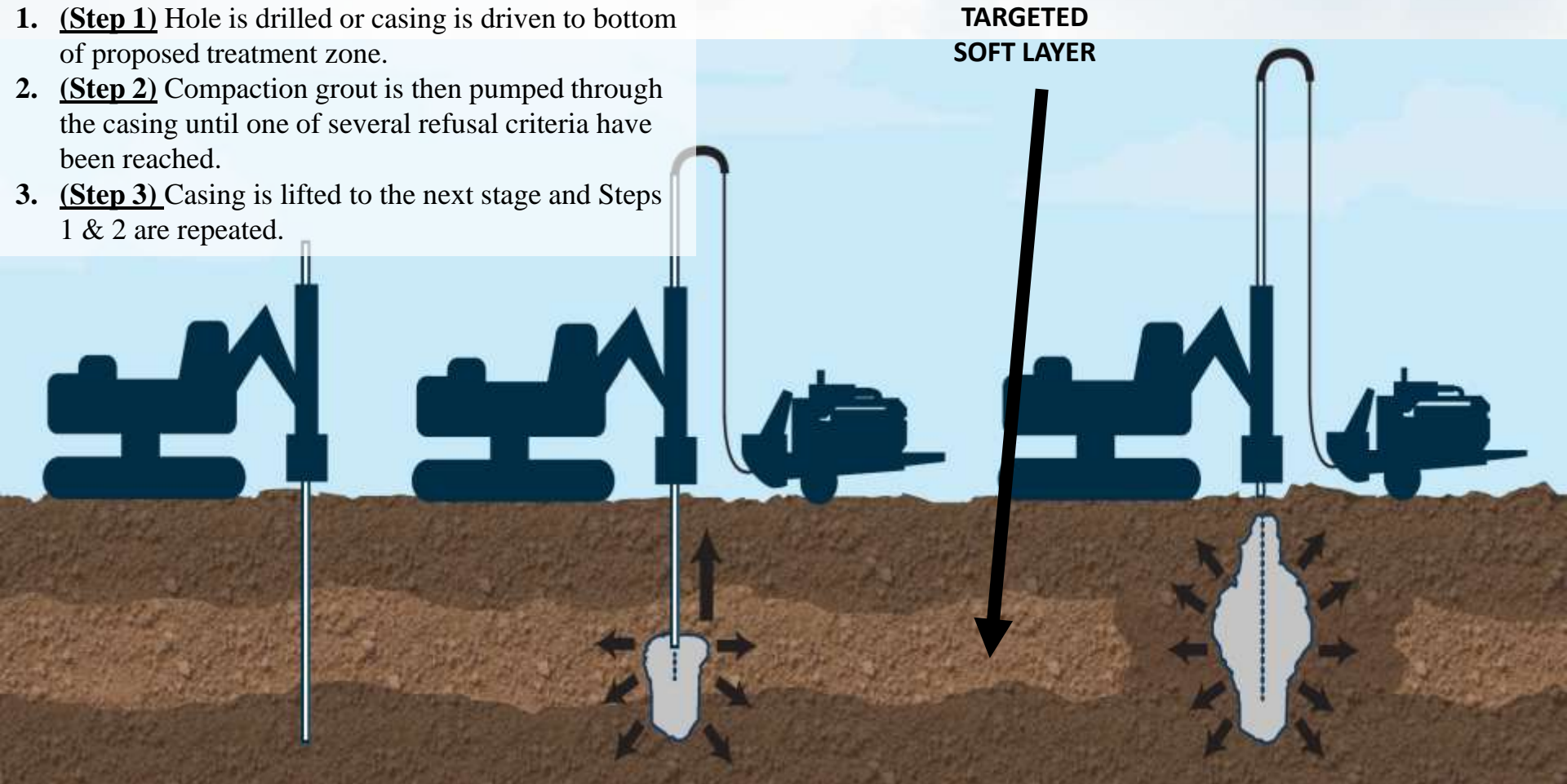
Compaction Grouting

Compaction grouting, otherwise known as Low Mobility Grouting (LMG) is the injection of low slump (typically less than 1") cementitious grout into weak or soft soil layers throughout a weak soil profile in a primary/secondary pattern in order to **densify the soils for the purpose of increasing bearing capacity, decreasing settlement potential or general improvement**



Compaction Grouting

1. **(Step 1)** Hole is drilled or casing is driven to bottom of proposed treatment zone.
2. **(Step 2)** Compaction grout is then pumped through the casing until one of several refusal criteria have been reached.
3. **(Step 3)** Casing is lifted to the next stage and Steps 1 & 2 are repeated.

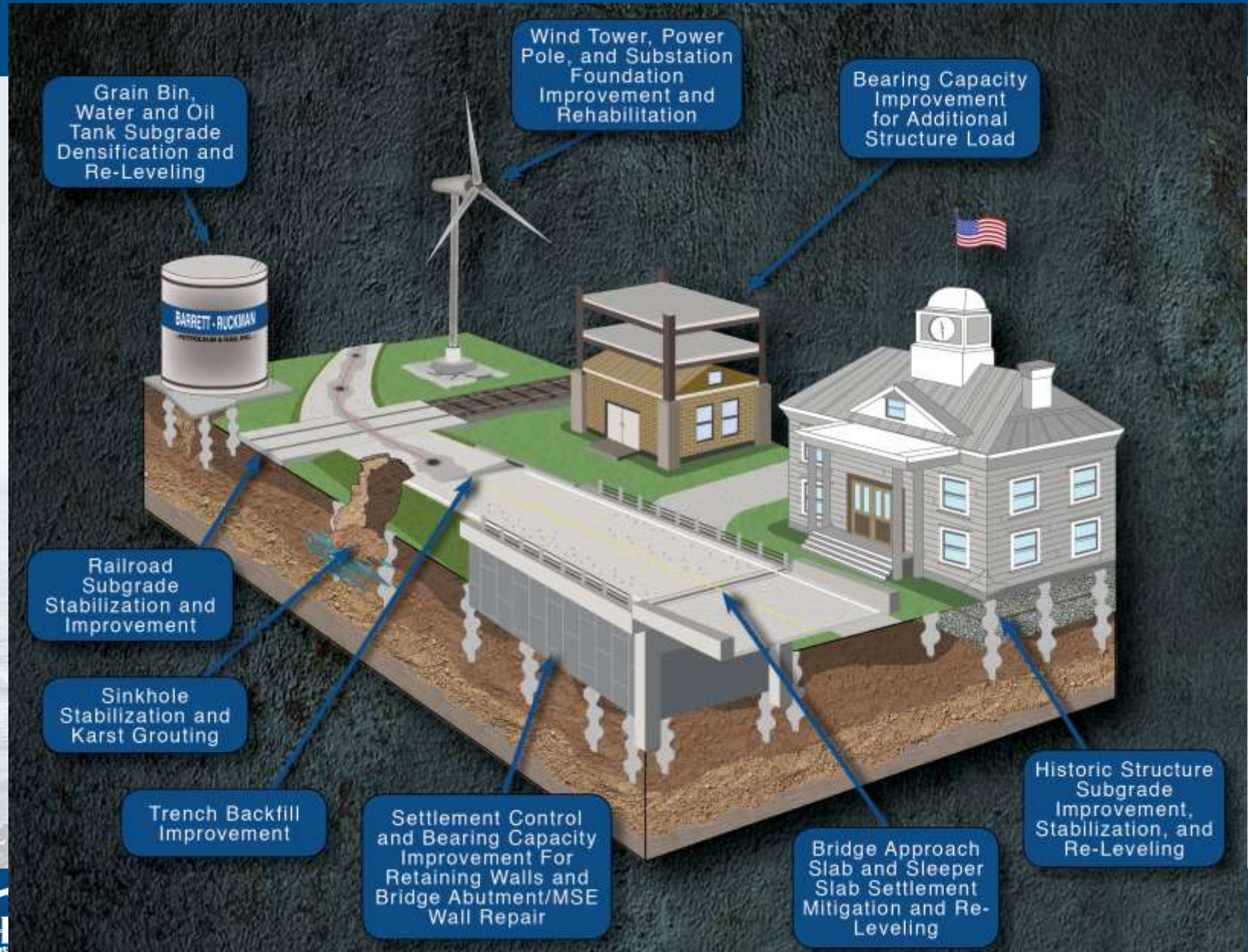


Advantages of Compaction Grouting

- Precise treatment
- **Fast installation**
- Can be performed in very **tight access and low headroom**
- No waste spoil disposal
- Wide applications range
- **Non-destructive** and adaptable to existing foundations
- **Cost effective** alternative to removal and replacement or piling
- Time tested and proven
- Site batching allows for necessary adjustments on the fly to maximize results



Geotechnical Compaction Grouting Applications



Ideal Grout Make-Up

- **Aggregate:**
 - 100 % passing 3/8"
 - 15-25% passing #200
 - Rounded pea gravel helps
- 10-20% cement by volume
- Slump is very important – typically less than 2" for pre-treatment and around 1" for underpinning and piles



Compaction Grouting QA/QC

- Grout logs for every hole at every one ft stage during production
- Pre-production test program can evaluate improvement
- Pre and Post SPT's
- CPT's
- Primary/Secondary nature of the method “notices” improvement between primary and secondary holes
 - Higher pressures
 - Lower grout takes





Day-to-Day Compaction Grouting Applications

Sinkholes

**Karst Related
(nature caused)**



**Culvert/Tunnel/Utility Collapse
(man caused)**

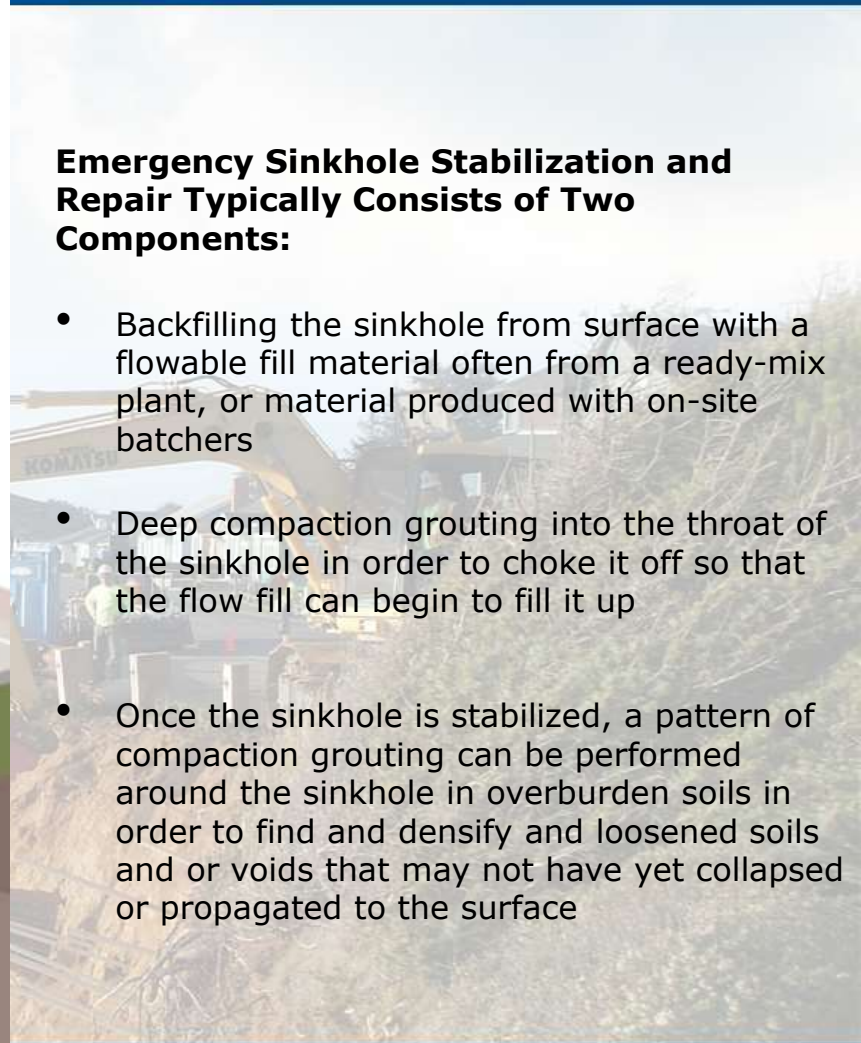


Sinkholes



Emergency Sinkhole Stabilization and Repair Typically Consists of Two Components:

- Backfilling the sinkhole from surface with a flowable fill material often from a ready-mix plant, or material produced with on-site batchers
- Deep compaction grouting into the throat of the sinkhole in order to choke it off so that the flow fill can begin to fill it up
- Once the sinkhole is stabilized, a pattern of compaction grouting can be performed around the sinkhole in overburden soils in order to find and densify and loosened soils and or voids that may not have yet collapsed or propagated to the surface



Collapsing Mine Shafts

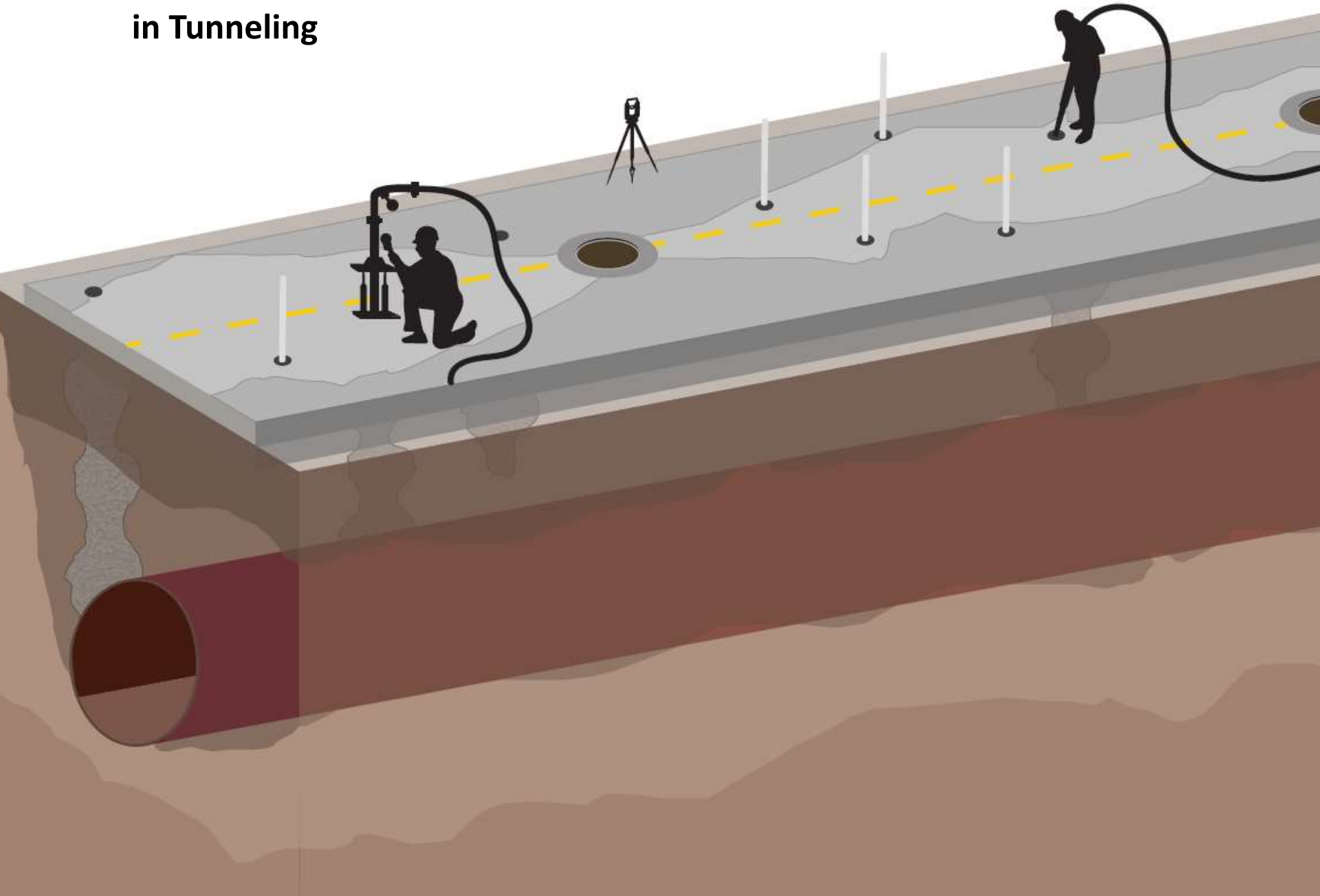


Roadway Embankment Stabilization



Soft soils
on fill side
of
roadway
settle
over time

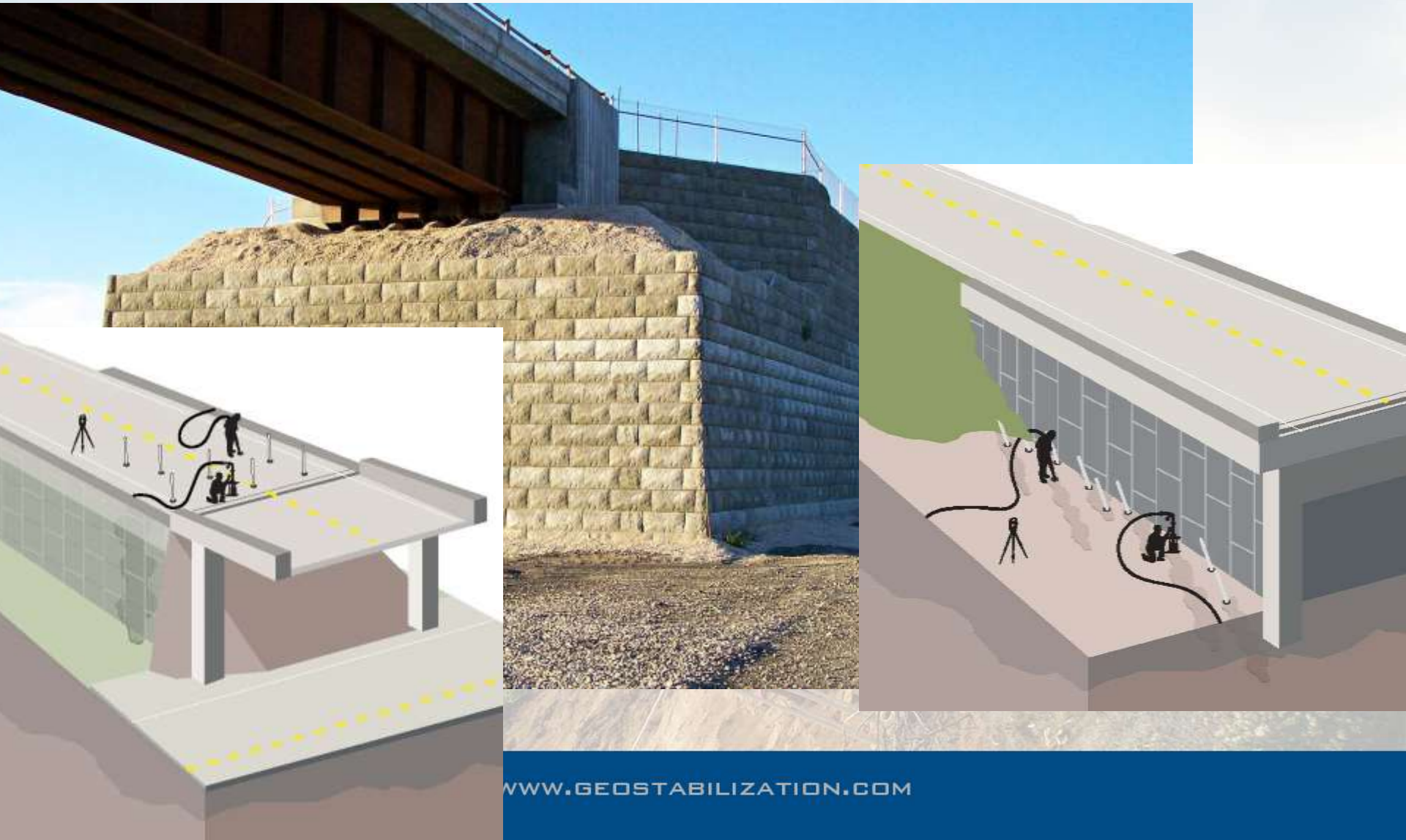
Utility Backfill Settlement Treatment and Ground Loss in Tunneling



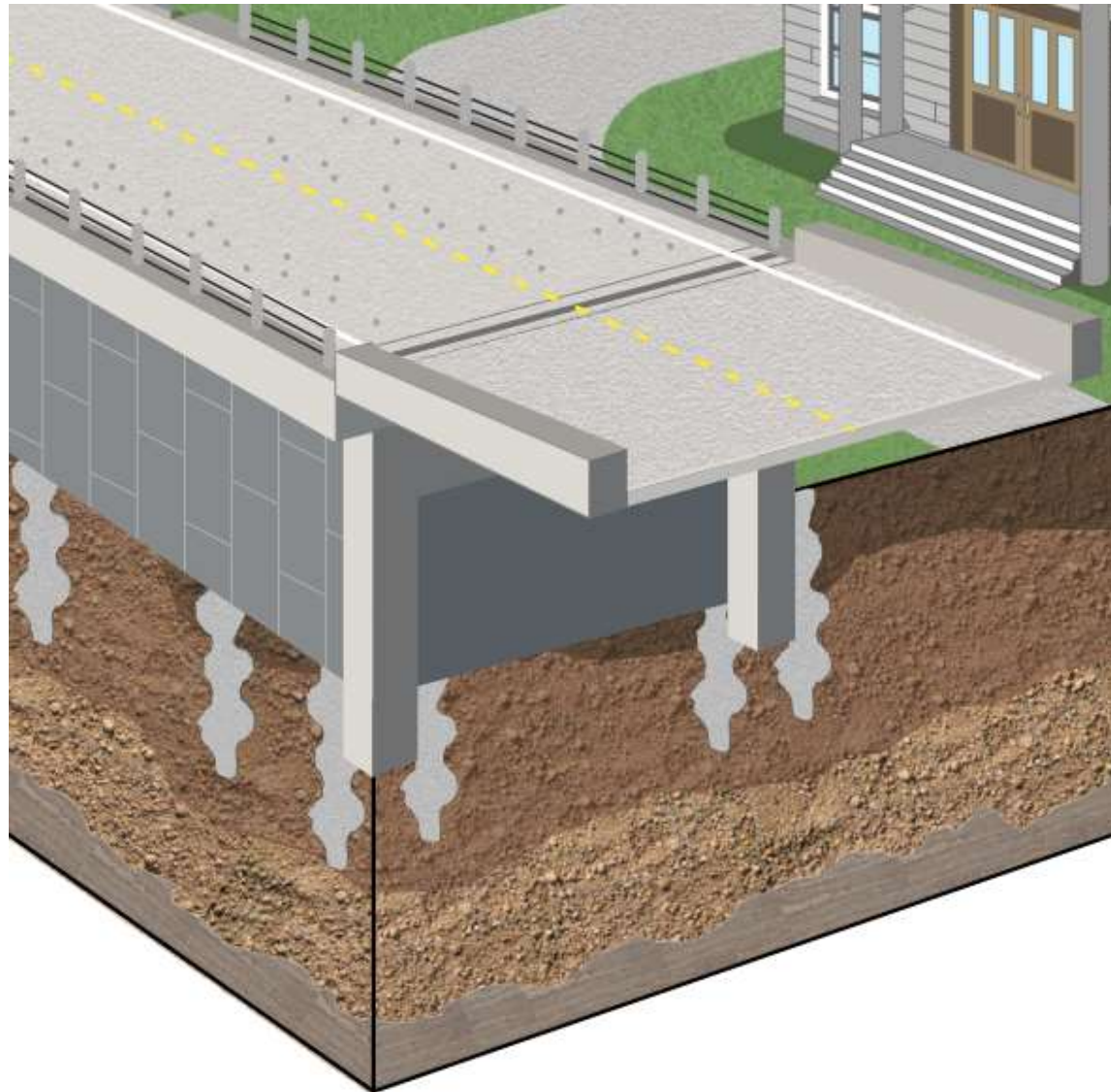
Night Work on Roadways Allows Road Reopening During Day



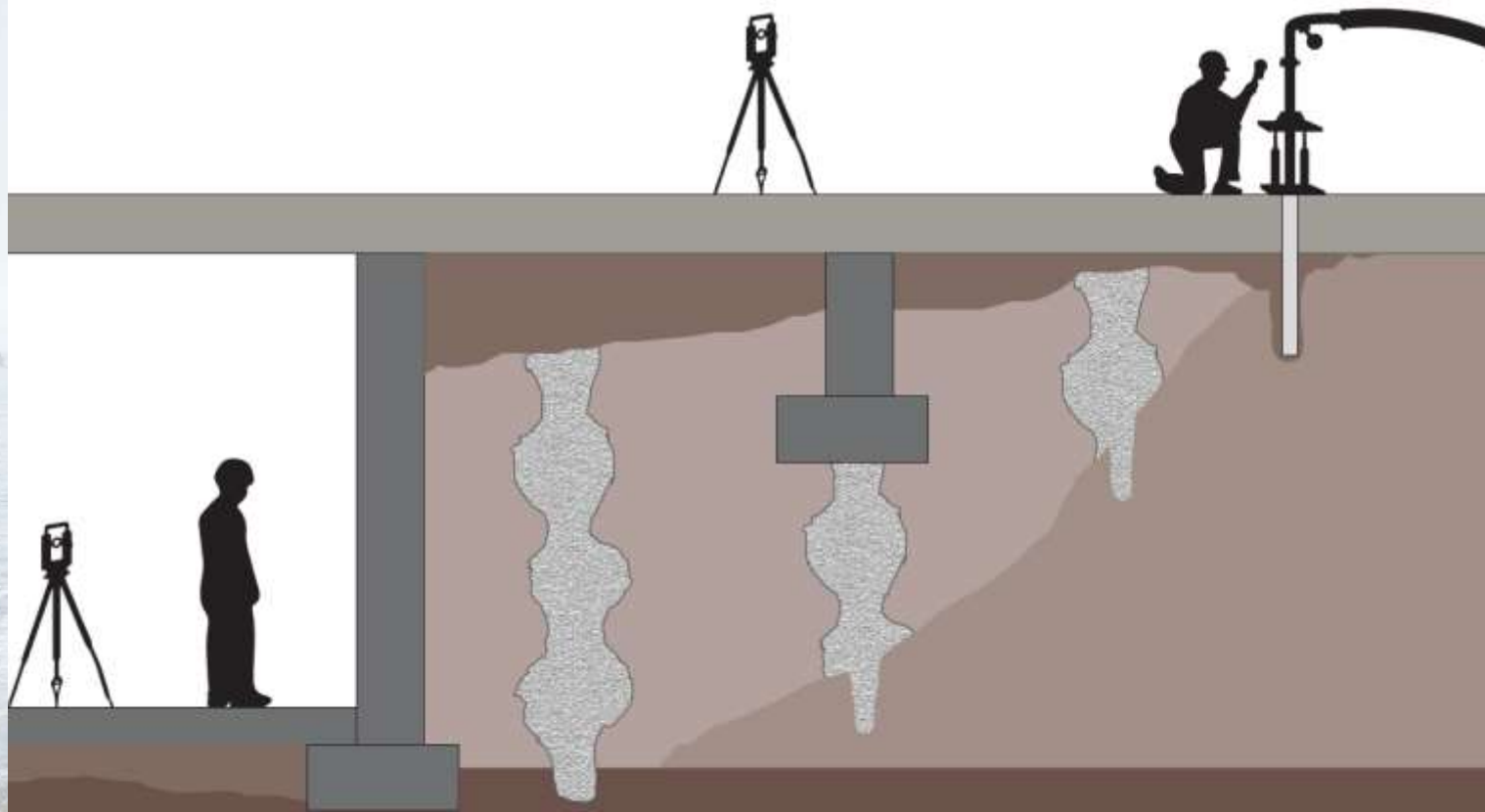
Settlement Reduction From Fill Loads



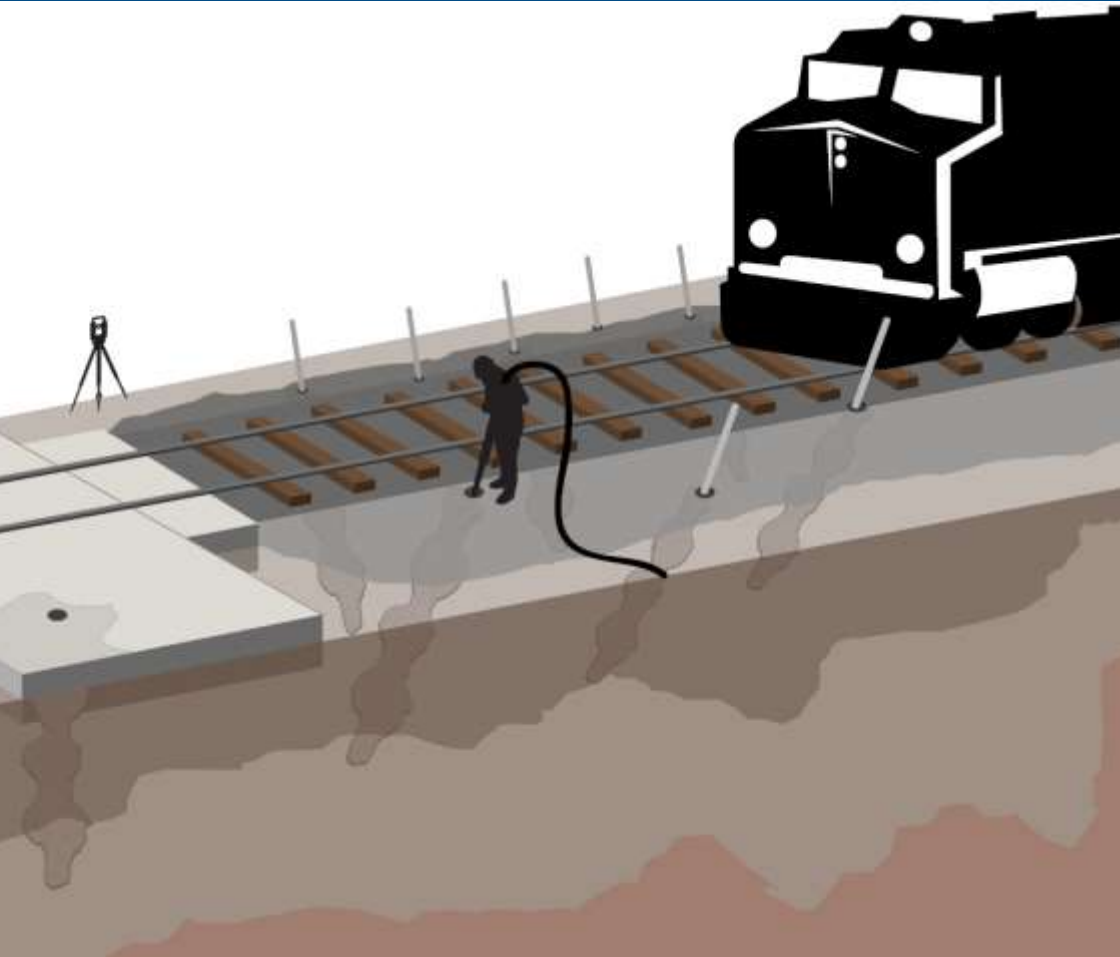
Bridge Approach Mitigation

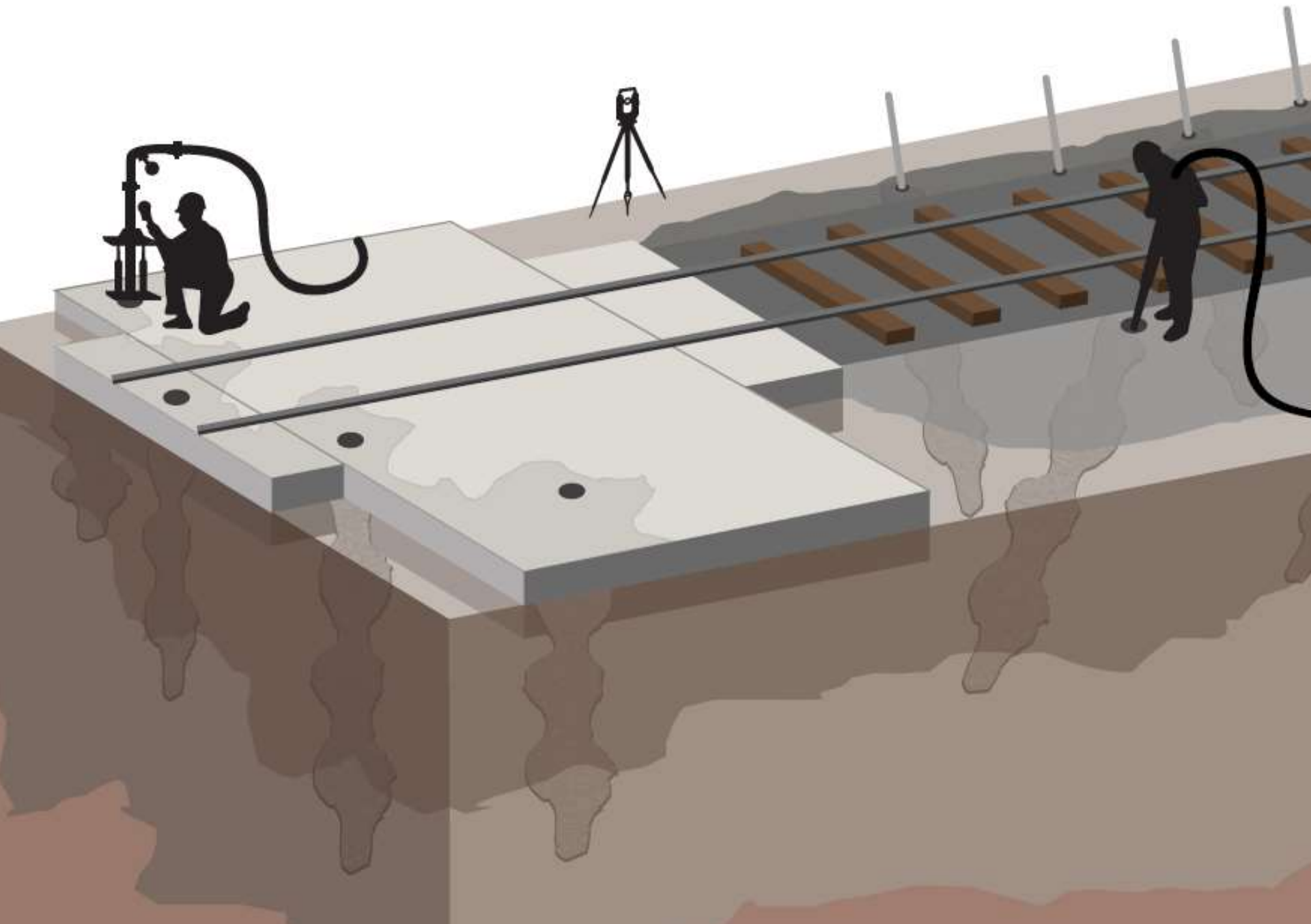


Abutment and Fill Settlement Reduction

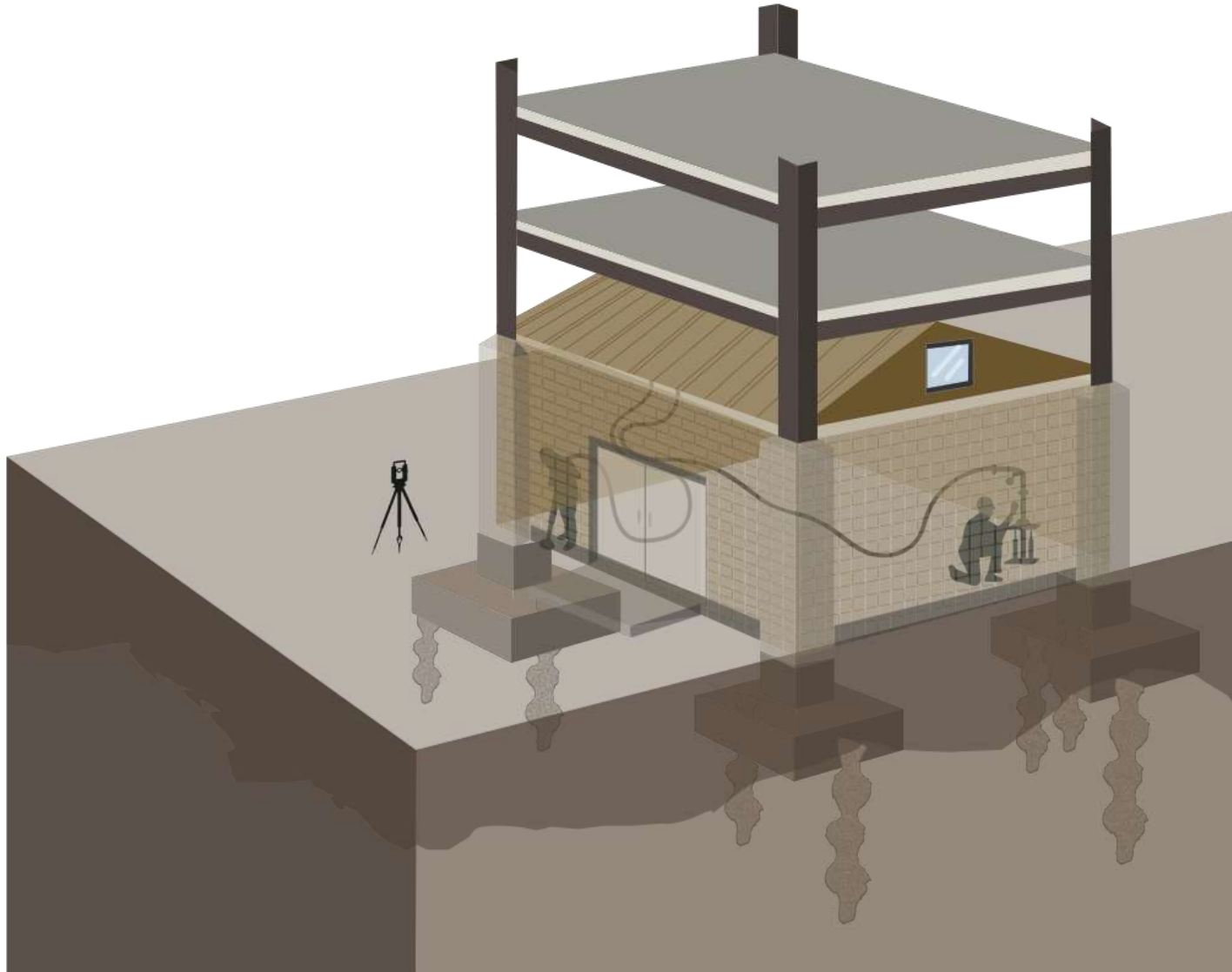


RR Subgrade Treatment





Bearing Capacity Improvement



Historic Structure Stabilization



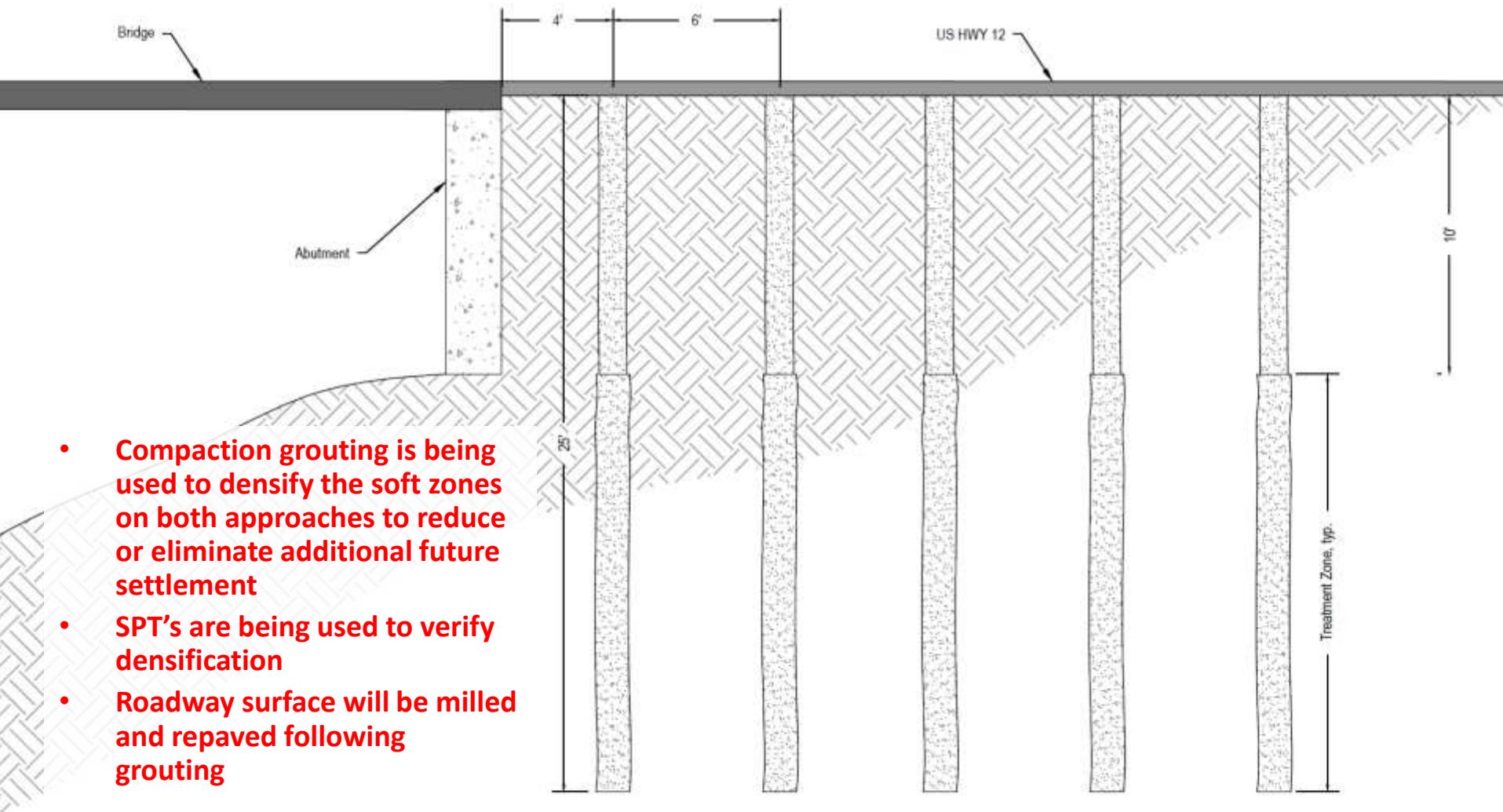
US HWY 12- Cooper Creek Bridge Approach Settlement Mitigation

White Sulphur Springs, MT



- Bridge was replaced several years ago
- Approaches started settling immediately afterwards
- Approaches were repaved several times
- Subsequent borings showed loose abutment fill from 10 – 25 ft bgs





A Plan View
F-1 Not to Scale









38 Road Improvements MSE Wall Repair

Grand Junction, CO

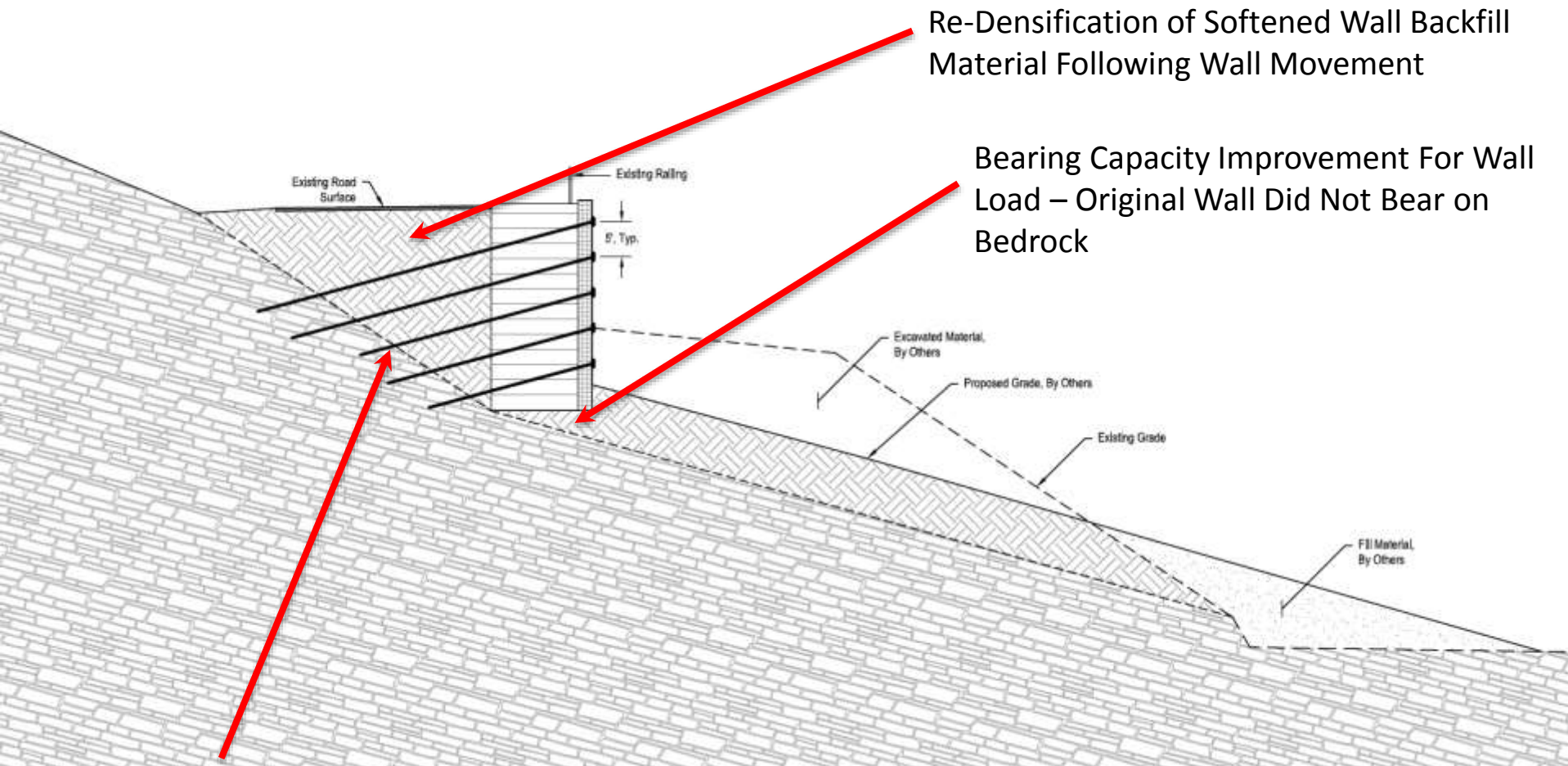


**MSE Wall Rotated Outward and Settled
Immediately After Completion of
Construction**





38 Road Improvements MSE Wall Repair



MSE Wall Was Stabilized In-Place With Soil Nails

38 Road – Emergency Wall Stabilization

- Purpose of the Grouting
 - At top of wall
 - Once the wall had been stabilized, compaction grouting was used to densify softened and voided zones that were created as a result of the slope/wall movement in order to reduce future settlement potential of the roadway surface in the following years (decreasing future maintenance costs)
 - At base of the wall
 - Compaction grouting was used to increase the bearing capacity of the soil under the wall face and wall backfill within approximately 4 ft of the wall face in order to prevent additional wall settlement and potentially resulting rotation leading to further pavement distress thereby decreasing future maintenance costs

Casing Installation

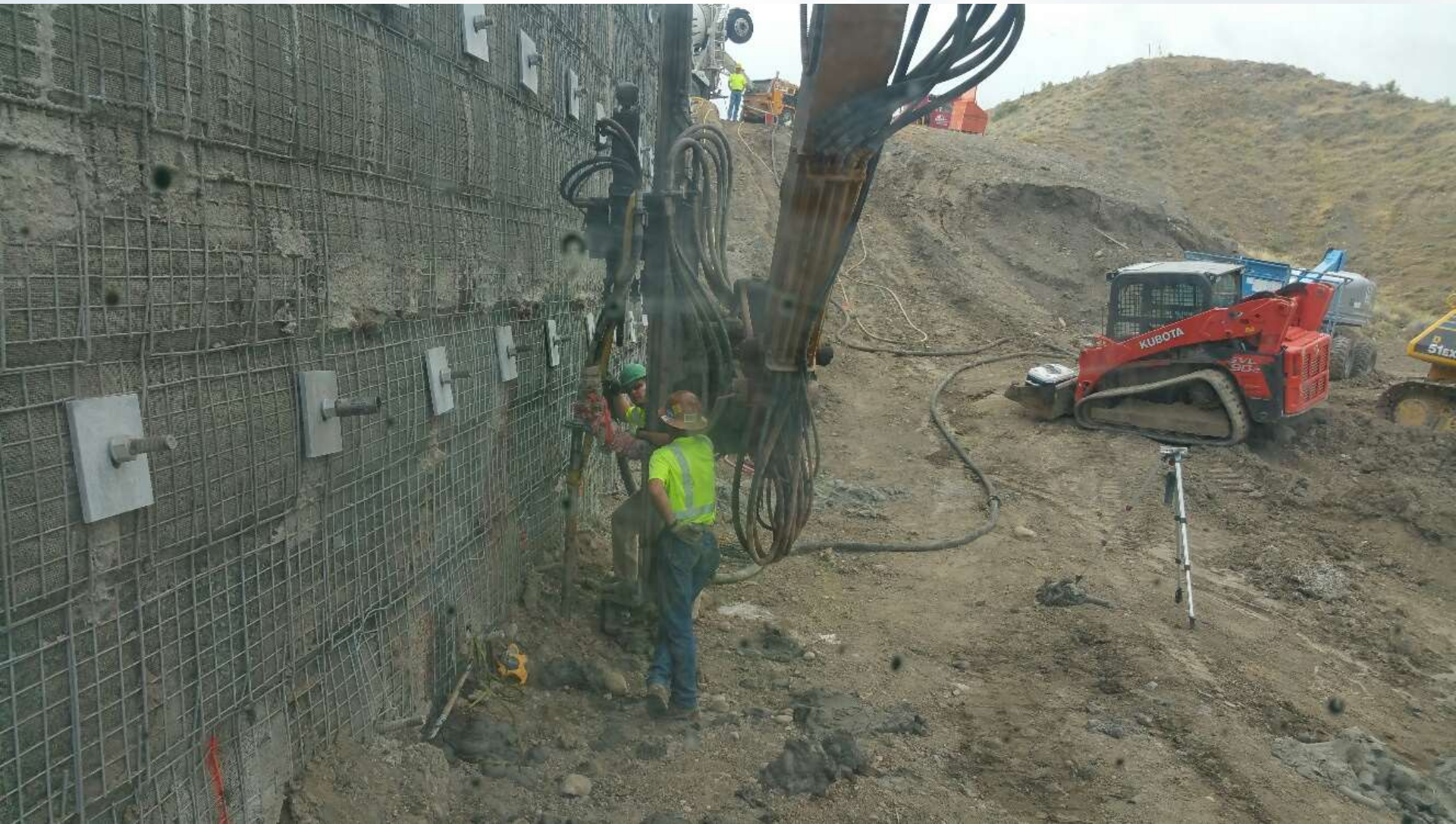




Compaction Grouting — While monitoring injection pressures, quantities, and ground movement



Casing Installation for improvement below existing MSE wall





THANKS!

