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MSE WALL MAINTENANCE MANUAL



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INTRODUCTION

This manual is intended for Indiana Department of Transportation (INDOT) field maintenance personnel who are involved in the maintenance of mechanically stabilized earth (MSE) walls. It aims to offer an overview of routine maintenance activities for MSE walls. The guidelines provided here are intended to address the most common issues that have been encountered. However, this manual cannot address every possible scenario, so field personnel should use their best judgment for any specific or unusual situations that arise. Additionally, field personnel should contact INDOT's Geotechnical Engineering Division when issues are encountered that cannot be handled by INDOT maintenance personnel. Any questions about this manual or suggestions for improvement should be directed to INDOT's Geotechnical Engineering Division.

MAINTENANCE WORKS TO ADDRESS THE MOST COMMON ISSUES WITH MSE WALLS

Even if the best construction methods are followed by the contractor, poor drainage and the general effects of weather shorten the service life of MSE walls. To bolster the service life of MSE walls, the following maintenance practices should be undertaken:

- (i) Address erosion at the bench in front of the MSE wall
- (ii) Address erosion at the back of the face wall (up to 3 feet)
- (iii) Address erosion in the backfill zones
- (iv) Control of vegetation growing through panel joints
- (v) Management of vegetation grown on the top of the backfill zones
- (vi) Filling of wide panel joints to prevent soil leaking
- (vii) Repair of cracks and spalls of the MSE wall panels
- (viii) Maintain concrete bridge rail joints on top of MSE wall
- (ix) Repair of damaged drainage curbs
- (x) Maintain drainage inlets and connected pipes
- (xi) Grubbing, cleaning, and correction of overall drainage system

(i) Address erosion at the bench in front of the MSE wall

Erosion of the bench material in front of the MSE wall can be a serious threat to the stability of the wall. After observing erosion, it needs to be treated as soon as possible. The following strategy can be used to correct the erosion issue:

- Remove all frozen materials, perishable materials, and unstable materials from the void.

- Fill the void up to a depth of 12 inches from the surface with No. 8 aggregate. The maximum loose lift thickness shall not exceed 5 inches. Compaction should be done by means of a minimum of five passes with a lightweight mechanical tamper, roller, or an alternative vibratory system. If such equipment is not available, use manual tamping for compaction.
- Cover the compacted aggregate surface with geotextile Type 2B.
- Encase the remaining top 12 inches with either silty clay or silty clay loam.
- Do the necessary adjustment of the final finished grade to ensure drainage away from the wall.
- Install the appropriate erosion control product (e.g., rolled straw matting and seeding) on top of the finished grade to stabilize the area, as shown in Figure 1.



Figure 1: Rolled straw matting on the bench of the MSE wall

(ii) Address erosion at the back of the face wall (up to 3 feet)

If erosion occurs in the area at the back face of the wall, as shown in Figure 2, water can accumulate and weaken the backfill soil, which compromises the overall stability of the MSE wall. After observing erosion, it should be properly addressed. The following actions should be taken to prevent further damage:

- Remove all frozen materials, perishable materials, and unstable materials from the void.
- Fill the void with removable flowable fill.

- The top of the flowable fill should be graded longitudinally to ensure the water flows away from the MSE wall.



Figure 2: Erosion at the back face of the wall

(iii) Address erosion in backfill zone

Erosion in the reinforced and retained backfill zones can hinder the stability of the MSE wall. After observing erosion (Figure 3), the following strategy can be used to correct existing issues and minimize the likelihood of future erosion:

- Remove all frozen materials, perishable materials, and unstable materials from the void.
- Fill the void up to a depth of 12 inches from the surface with No. 8 aggregate. The maximum loose lift thickness shall not exceed 5 inches. Compaction should be done by means of a minimum of five passes with a lightweight mechanical tamper, roller, or an alternative vibratory system. If such equipment is not available, use manual tamping for compaction.
- Cover the compacted aggregate surface with geotextile Type 2B.

- Encase the remaining top 12 inches with either silty clay or silty clay loam, as shown in Figure 3.
- Do the necessary adjustment of the final finished grade to ensure drainage away from the wall.



Figure 3: Recompacted eroded backfill of MSE wall

(iv) Control of vegetation growing through panel joints

Vegetation growing through panel joints, as shown in Figure 4, indicates poor performance of an MSE wall's overall drainage system. Roots damage the geotextile fabric that lines the backside of the panel joints, leading to potential leakage of backfill material. Additionally, as the roots grow, they may cause harm to the panels. Therefore, addressing vegetative growth promptly is crucial to the longevity of MSE walls. The following strategies should be taken to prevent further damage:

- Vegetation growing through MSE wall panel joints should be controlled through the application of a non-corrosive herbicide. Contact INDOT's Roadside Maintenance Specialist for recommendations.
- If the geotextile membrane at panel joints is damaged, the joints should be filled with a durable and flexible joint filler (e.g., free drainage seal or baker rod) and sealed with silicon sealant to prevent future vegetation establishment.
 - Free draining seal (<https://www.fds-freedrainingseal.com/>)



Figure 4: Vegetation growing through panel joints

(v) Control of vegetation growing on top of backfill zones

Woody vegetation (Figure 5) should not be allowed to grow on top of the reinforced or retained backfill zones as the roots can damage the MSE wall reinforcement. No pulling or hoeing of woody vegetation is permitted in these zones as damage to the reinforcement may occur. Grassy and other herbaceous vegetation is permitted to grow in this area and is preferred over bare ground conditions to minimize topsoil erosion potential. The following actions must be taken to manage the vegetation in the backfill zones.

- See INDOT Standard Operation Procedures (SOPs) for guidance. Consult with INDOT Roadside Maintenance Specialist for questions/concerns.



Figure 5: Grown tree on top of the MSE wall

(vi) Filling of wide panel joints to prevent soil leaking

If any panel joint is wider than 3/4 inch (Figure 6), it needs to be sealed to prevent damaging of the geotextile layer behind the panel and to prevent soil leakage through the joints. Therefore, the wide joints should be filled with a durable and flexible joint filler (e.g., free drainage seal or baker rod) and sealed with silicon sealant to prevent soil leaking. Periodic monitoring should be conducted to evaluate if the joints are widening. The INDOT Geotechnical Engineering Division should be notified if the movement is progressive.



Figure 6: Soil leaking through wide panel joints

(vii) Repair of cracking and spalling of the MSE wall facing panels

Cracked or spalled corners of the face panels (Figure 7) can be a path through which backfill soil can be leaked upon failure of the geotextile layer. Therefore, the cracked or spalled corners of the face panels need to be fixed with epoxy injection or concrete patching depending on the extent of the damage.



Figure 7: Spalling in the concrete panel

(viii) Maintain concrete bridge railing joints on top of MSE wall

The sealing between expansion joints of concrete bridge railing degrades over time. When the seal is broken, water from the bridge can be directed to the top of the MSE wall reinforced zone. Therefore, periodic monitoring should be done to check if any joint seal is broken. The broken joint seals need to be resealed with pre-compressed foam joint sealer, as shown in Figure 8.



Figure 8: Pre-compressed foam sealer for bridge rail joints

(ix) Repair of damaged drainage curbs

Drainage curb, as shown in Figure 9, is used to direct the surface water away from the reinforced backfill. Any broken curb needs to be repaired with concrete patching to prevent water from draining on the reinforced backfill zone.



Figure 9: Drainage curb to direct rainwater away from backfill zone

(x) Maintain drainage inlets and connected pipes

The drainage inlets and pipes should be inspected periodically to investigate if they are working properly. If any of the inlets and drainage pipes are clogged (Figure 10) or disconnected, they need to be cleaned or reattached.



a) Clogged manhole



b) Clogged pipe

Figure 10: Clogged drainage inlet and pipe

(xi) Grubbing, cleaning and correction of overall drainage system

Periodic grubbing and cleaning should be done to improve the overall drainage performance of the MSE wall.



Figure 11: Blocked MSE wall drain