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I  Introduction

This manual is intended as an instruction guide to the Contractor responsible for building the SINE WALL MSE Panel System. While SINE WALL provides installation guides, materials, and on-site assistance, it is the ultimate responsibility of the Contractor to follow all project specifications and contract plans. If the Contractor, inspector, owner, or owner’s representative has any questions concerning this manual or the drawings provided by SINE WALL for a particular project please contact SINE WALL.

II  MSE Panel System Components

The following items comprise the MSE Panel System:

Concrete Leveling Pad and Foundation Preparation:  Leveling pads are typically smooth surfaces constructed of unreinforced cast-in-place concrete. Refer to the project plans for details and specifications.

Concrete Panels:  The typical SINE WALL Large A Panel is 5 feet tall by 10 feet wide. The first row of panels will have a step configuration of half height panels and full height panels. The top row of panels may have smaller or larger height panels or sloping panels depending on the project geometry.

Rubber Bearing Pads:  Two 3 inch x 6 inch x 3/4 inch (1 inch maximum) pads for each non top panel or non bottom panel are required.

SINEstrips:  The SINEstrips will arrive at the jobsite in bundles. The typical strip is 2 inches wide and will have varying lengths depending on the project plans. The strips will either be black steel, galvanized, or aluminized depending on the project plans.

Bolt, Washer, Nut Assembly:  The standard connection detail consists of a 1.5 inch long bolt with 1/2 inch diameter, and nut. One set is required for each SINEstrip.

Geotextile Fabric and Adhesive:  The fabric is placed on the soil side of the wall and provides a barrier over the panel joints. The fabric is typically applied using adhesive.

Granular Backfill:  Granular backfill used in the reinforced zone must follow the project specifications and contract drawings.

Drainage System:  All drainage systems should be installed to the project plans and specifications.

III  Materials

The following materials are typically provided by SINE WALL:

- Final Design Drawings for the SINE WALL MSE Panel System
- Concrete Facing Panels with SINEstrip Connectors and embedded lift inserts
- Rubber Bearing Pads
- SINEstrips
- Bolt, Washer, and Nut Assembly
- Geotextile Fabric with adhesive
- Initial on-site assistance per agreement

NOTE: It is the responsibility of the Contractor to verify the condition of all materials delivered on-site as well as verify the materials comply with the project specifications and contract plans. SINE WALL will provide material certifications upon request.

The following materials are typically provided by the Contractor:

- Crane or boom truck with capability to lift a minimum of 20,000 pounds
- Cables, slings, and lifting hardware
- Concrete Leveling Pad
- Drainage System
- Equipment for excavation, backfill, and compaction (including small vibratory roller equipment)
- Wooden clamps, wedges, and shims
- Miscellaneous small tools: Hammer Drills, Pry Bars, Panel Bracing, Carpenter Levels, Chalk Lines, Wrench and Socket Set, Sledge Hammer, Plumb Bob, Survey Equipment, etc

NOTE: The work provided by the Contractor will include the necessary excavation, constructing the concrete leveling pad, building the MSE Panel System including placing the panels, backfill, joint material, connecting the SINEstrips, backfill compaction, and placing the necessary wall coping or traffic barrier.

IV    Material Handling

The material delivery date will be agreed upon in writing between SINE WALL and the Contractor during the design plan submittal stage and documented on the signed quotation. This date is necessary for the proper scheduling of manufacturing and delivery of the system materials.

Most materials, including the concrete panels and SINEstrips will arrive to the jobsite on flatbed trailers. Offloading the materials and storing them on the jobsite will be the responsibility of the Contractor. If any materials are damaged and will not meet the project specifications, SINE WALL must be notified by properly documented photographs electronically transmitted within the first 48 hours after delivery to the site.

NOTE: Proper safety techniques must be adhered to during loading and unloading of all materials. Properly examine the load for any shifting or movement prior to removing tie down straps. Make sure the truck is on level ground to avoid shifting or rolling of material. Check all lifting equipment for wear or damage.

Precast Concrete Panels: The panels will arrive on a flatbed truck, typically in stacks of five or less. The delivery site will be coordinated between the Contractor and the truck driver.

NOTE: A maximum of two hours is allowed for the offloading of each truck. Agreed upon demurrage charges will be assessed for any offloading in excess of two hours.
It is recommended that the panels be lifted off of the flatbed truck one stack at a time using a crane or boom truck. A forklift is not recommended, but may be sufficient for smaller panels. The panels can be lifted using an appropriate sling or by using the rapid-lift hooks in the top of the panel. Please note that off-loading and re-stacking panels will often lead to chipping on the panel edges.

![FIGURE 1: PANEL STORAGE](image1)

The panels should be restacked on a firm and level surface after removing them from the truck. As shown in Figure 1, the panels should always be stacked using the necessary dunnage to avoid concrete staining or bending of the SiNEstrip Connectors protruding from the face of the panel. Figure 2 shows the proper technique for lifting individual panels to avoid chipping and cracking.

The supplied dunnage will remain the property of SINE WALL and must be returned after the job is complete. Contractor is responsible for coordinating return shipment. The Contractor will be responsible for any damaged or misplaced dunnage.

![FIGURE 2: LIFTING STACKED PANELS FROM THE GROUND OR TRUCKBED](image2)
Rubber Bearing Pads: The rubber bearing pads will be delivered to the Contractor’s yard or jobsite in 3 inch x 6 inch sizes with either 3/4 inch or 1 inch thicknesses and are packaged in bundles.

SINEstrips: The SINEstrips will arrive to the jobsite in bundles of 10,000 pounds or less. The strips can vary in length from 8 feet up to 40 feet in length. The SINEstrips should not be placed directly on the ground.

NOTE: Aluminized SINEstrips are manufactured from steel coils that have been hot dip coated in pure aluminum. The coil is then slit into the required width. As a result of the slitting process, the edges of the SINEstrip will have the base steel uncoated. In normal atmospheric exposure the aluminum coating does not galvanically sacrifice to the base steel. Oxidation of the edge is possible and may cause rust discoloration. The rust is nonprogressive and not a concern. As an additional step, paint has been applied to the edge at the manufacturing location, which may however become scratched or exposed during handling, shipping and installation of the product. The design strength of the SINEstrip conservatively accounts for the uncoated condition.

Bolt, Washer, and Nut Assembly: The necessary bolts and nuts will be delivered to the Contractor’s yard or jobsite in bundles, typically in quantities of 300 per bucket.

Geotextile Fabric and Adhesive: Fabric will be supplied in rolls that are 12 inches wide. Adhesive will be supplied in cases, typically of 12 each. The geotextile fabric and adhesive should be kept dry and stored out of direct sunlight.

V Wall Erection Procedures

A typical SINE WALL MSE Panel System is constructed in the following sequence:

1. Reinforced zone excavated to project plans: Excavation shall be in accordance with the project specifications and plan requirements and in reasonably close conformity to the limits and construction stages shown on the plans.

2. Drainage, concrete leveling pad, and foundation construction: The foundation for the structure shall be graded level for a width equal to the length of the soil reinforcements plus 1.0 ft or as shown on the plans. Prior to wall construction, except where constructed on rock, the foundation shall be compacted with a smooth wheel vibratory roller. Any foundation soils found to be unsuitable shall be removed and replaced with structure fill per the project specifications and contract drawings.

NOTE: All excavation, foundation, and backfill material approval is the responsibility of the Project Engineer.

At each panel foundation, a leveling pad of the type shown on the plans should be constructed. Leveling pads are typically smooth surfaces constructed of unreinforced class B cast-in-place concrete. Concrete leveling pads must cure a minimum of 12 hours before placement of wall panels. Leveling pads are typically 1 ft wide and 6 inches thick. Leveling pad tolerances should
not exceed ¼ inch. Refer to the project plans for details. The leveling pad surface should be clean of all debris prior to setting the precast panels.

All drainage systems should be installed in accordance with the project plans and specifications.

3. **First course of panels is braced and set using alternating half and full height panels:** As backfill material is placed behind the panels, the panels should be maintained in position by means of temporary wedges and bracing. As shown in Figure 3, two braces, typically 2x4 lumber and wooden clamps are appropriate for SINE WALL Standard A Panels. Half panels can be supported by clamps attached to full size panels and may not need 2x4 bracing.

**NOTE:** The braces are to be constructed and fastened prior to disconnecting the panel from the crane and shall remain in place until all SINEstrips have been connected and the backfill has been compacted to the top of the panel.

![Figure 3: Bracing for Initial Row of Panels](image)

**FIGURE 3: BRACING FOR INITIAL ROW OF PANELS**

During the initial placement, each panel should maintain a necessary batter such that after backfill is placed and compacted the panel will correct to a vertical position. The starting point for this batter is typically 1/2 inch in 4 feet toward the backfill and should be corrected as the wall is built. This batter can vary depending on backfill conditions.

Concrete panel facing vertical tolerances and horizontal alignment shall not exceed 3/4 inch when measured with a 10 ft straight edge. During construction, the maximum allowable offset in any panel joint shall be 3/4 inch. The overall vertical tolerance of the wall (top to bottom) shall not exceed 3/4 inch in 10 feet of wall height. Check the horizontal and vertical alignment at each course and adjust appropriately using wooden shims and wedges.

**NOTE:** Wooden shims and wedges are removed after the wall has been filled to a height of 15 feet above the wedge elevation (or to the finished grade). Failing to remove the wedges can cause damage to the panel.
4. **Wooden Wedges and Clamps**: Wooden wedges and clamps should be cut from a hard wood source to the dimensions shown below. Wooden shims can also be used and should be cut with the wood grain running parallel to the lengthwise dimension of the shim.

![Spacer and Wedge Diagrams]

**FIGURE 4: WEDGE AND CLAMP**

5. **Geotextile is attached to the soil side joints between panels**: An appropriate geotextile fabric is provided to prevent the loss of select material through the joints between panels. The fabric is attached to the concrete panels using construction adhesive.

6. **Rubber bearing pads are placed on the horizontal panel edges at each lift**: The rubber bearing pads should be placed on the horizontal panel edge according to the project plans prior to the placement of the next panel. Typically, a minimum of two rubber pads are placed per panel until wall heights reach 30’ or more. Refer to the project plans for the proper number of pads per panel. Rubber bearing pads are not to be used between the leveling pad and the first row of panels. Shimming material should be used to level the first course. Refer to the contract drawings for details.

7. **Backfill is placed and compacted to the height of the first SINEstrip Connection**: Conformance to the project specifications for the select backfill is critical to the performance of the SINE WALL MSE Panel System. It is the responsibility of the Contractor to certify to the Engineer or Owner that the backfill meets all project specifications and contract drawings. Note: The drainage system must be complete before initial backfill placement.
Backfill should be placed and compacted to the height of the first row of SINEstrip Connectors plus +0.1 feet on the backside of the panel. Backfill should not be compacted in lifts exceeding 10 inches. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density. Compaction should be made with a large smooth-drum vibratory roller.

**NOTE:** Backfill should not be compacted within the first 3 feet of the panel height until after the first row of SINEstrips are attached and backfilled. Further, no heavy vibratory compaction equipment should be used at any time within the first three feet behind the panel. Smaller, hand operated compaction equipment only may be used in this zone.

Material gradation, moisture content, compaction, and testing requirements shall be specified by the Project Engineer. However, at a minimum, structure fill shall be compacted to 95 percent of the maximum density as determined by AASHTO T99, Method C or D (with oversized corrections as outlined in Note 7). For backfill material that contains more than 30 percent retained on the 3/4 inch sieve, a method of compaction consisting of at least 4 passes by a heavy roller shall be used. For applications where spread footings are used to support bridge or other structural loads, the top 5.0 feet below the footing elevation should be compacted to 100 percent density per AASHTO T99.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall have a placement moisture content less than or equal to the optimum content. Backfill placement with moisture content in excess of optimum shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

Compaction within 3 feet of the back face of the wall height shall be achieved by at least three passes of a lightweight mechanical tamper, roller or vibratory system.

At the end of each day's operation, the Contractor shall slope the last level of structure fill away from the wall facing to rapidly direct runoff away from the wall face. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

8. **SINEstrips are placed and bolted to the concrete panel:** SINEstrips shall be placed normal to the face of the wall, unless otherwise shown on the plans. Prior to placement of the reinforcing strips, backfill shall be compacted in accordance with the project specifications. At each reinforcement level, the backfill shall be placed to the level of the connection +0.1 feet before placing the soil reinforcement. All soil reinforcements shall be tensioned to remove any slack in the connection.

Insert the SINEstrip between the two exposed plates of the SINEstrip Connector until the three bolt holes align. Scoop soil out from underneath the connector and insert the bolt upward through the hole. Then place a nut on the topside of the connector and using a socket wrench, tighten to the project specifications.
NOTE: Construction equipment using steel tracks should never come in contact with the SINEstrips. When the subgrade permits, rubber tired equipment may be used directly on the strips, but is not recommended.

9. Each subsequent course is placed until final grade is reached: The construction of the second row of panels must not start until backfill compaction has reached the top of the half-height base panels. Construction sequence is show below in Figure 5.

![Figure 5: Construction Sequence](image)

Only remove two clamps at a time at the location where the next panel is being placed. Removing clamps or placing the next panel when backfill has not reached the full height of the lower panel can create an unstable and dangerous situation.

The process is repeated until the wall reaches the design height on the project plans.

10. The top of wall height achieved: All wedges and clamps are then removed and the coping or traffic barrier is constructed according to the project plans.

NOTE: IF UNSAFE ACTIVITY OR NEGLIGENCE AT ANY TIME IS OBSERVED IN THE AREA OF CONSTRUCTION OF THE SINE WALL MSE PANEL SYSTEM, STOP CONSTRUCTION IMMEDIATELY AND CONTACT A SINE WALL REPRESENTATIVE.
SINE WALL PROVIDES
THE FOLLOWING SERVICES:

DESIGN
+ Design Manual and CAD Details

PROJECT BID
+ Preliminary Design and Estimating

PROJECT SUBMITTAL
+ Final Design  + Detailed Shop Drawings

CONSTRUCTION
+ Material Delivery and Coordination
+ On-Site Assistance