Introduction

In worldwide use since 1982, the Sierra® Slope Retention System continues to be the premier reinforced soil slope (RSS) solution of choice among owners and developers, engineers, architects and contractors alike. Developed by Tensar International Corporation (Tensar), the world leader in geogrid technology and engineering ingenuity, Sierra Slopes ensure a combination of performance, economy and beauty that is unmatched by other types of earth retention systems.

The Sierra System is a complete and fully integrated Mechanically Stabilized Earth (MSE) System. Each of the system’s components have been specifically designed and detailed to work together for optimum efficiency and performance. Furthermore, these components create a structural solution whose integrity and dependability have been proven in a variety of challenging site conditions such as the support of buildings and earthquake loadings.

The following steps provide a general guideline for installing the Sierra Slope Retention System. These steps will help you through standard installation procedures from your project’s start to finish. If you are installing a Sierra Slope and require more detailed information, please refer to the project’s installation instructions, the drawings within the contract bid documents or consult your local Tensar representative.

TOOLs REQUIRED

• Circular saw with masonry blade
• Sawhorses and plywood for constructing a worktable to cut the geogrids
• Steel pipe for unrolling geogrids on the worktable
• Steel “U” pins for securing geogrid to the ground
• Spray paint (one color for each type of geogrid, if more than one type of Tensar Geogrid is used)

Easier installation makes the Sierra® Slope Retention System a more affordable alternative to conventional retaining walls.

SIERRA System Components

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<th>COMPONENT</th>
<th>FUNCTION</th>
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<tr>
<td>Tensar Uniaxial (UX) Geogrids</td>
<td>Primary reinforcement that internally reinforces structure and fill materials.</td>
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<tr>
<td>Tensar Biaxial (BX) Geogrids</td>
<td>Secondary reinforcement that ensures surficial stability of the slope structure.</td>
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<tr>
<td>Site-Specific Facing System</td>
<td>Provides aesthetic value by offering multiple facing options, including bioengineering.</td>
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<tr>
<td>Full Engineering and Construction Services</td>
<td>Detailing, design, construction services, drawings, quality control testing, construction installation.</td>
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TENSAR® GEOGRIDS

The Sierra System owes its strength and durability to Tensar Uniaxial (UX) Geogrids, Tensar International Corporation’s patented reinforcement geogrids. Due to their stiff interlocking capabilities, these geogrids stand the test of time, performing better than other commercially available geosynthetics. For more information, visit www.tensar-international.com.
1. Cutting Tensar Geogrids

- Color code the ends of the Tensar Geogrid rolls if more than one type of Uniaxial (UX) Geogrid is specified (Figure 1).
- Cut Tensar Geogrids to the lengths shown on the construction drawings (from the first rib to the last rib). Lengths shown on drawings do not include “fingers”. Make the cut next to the heavy transverse ribs that span the width of the geogrid roll. Cut geogrids flush at the nearest transverse bar beyond the measured length (Figure 2).
- To easily cut geogrids, use a circular saw on a worktable (Figure 3).
- As geogrid lengths are cut, mark and tag them according to the length and type, and then stockpile them for later use.

Note: The correct geogrid type and lengths must be used at each lift level according to the project’s design.

2. Site Excavation & Drainage

- Excavate to the lines and grades shown on the construction drawings or as directed by the engineer.
- To improve stability, it is recommended that the sidehill embankments be benched into competent soil or rock (Figure 4, top of page 3).
- Use drainage composite as specified in the drawings, and install the drainage system according to the construction drawings (see Figure 4, inset top of page 3).
4. Primary Geogrid Placement

- Tensar UX Geogrids are most often used as "primary" reinforcement, and Tensar BX Geogrids are typically used as "secondary" or "surficial" reinforcement. UX Geogrids are supplied in roll widths of 4.3 ft (1.3 m). The use of BX Geogrids as surficial reinforcement is discussed in Section 6 of this guideline.
- Place geogrid rolls perpendicular to the slope (Figure 5) with the transverse bar end of the geogrid at the slope face.
- Geogrid strips should extend back from the slope face to the distance specified on the construction drawings and must be placed at the elevations shown on the construction drawings.
- Adjacent geogrid strips should be butted together side-by-side without overlap unless a gap between the strips is specified.

Note: A small covering may be specified for "wrap around" construction. Check construction drawings.

5. Fill Placement

- Short pieces of UX Geogrids can be spliced using flat polymer "bodkin" slats available from Tensar (shown right).
- Fill can be placed and spread directly upon the geogrids with rubber tired equipment (Figure 6). Keep speeds slow and avoid turns and stops on the geogrids. If needed, the geogrids can be secured into place to prevent movement during fill placement. Use pins, staples, sandbags, small piles of soil, etc. as anchors.
- Spread and level the soil (Figure 7). Do not drive tracked equipment on exposed geogrids.
6. Compaction

- Compact the soil to the specified density using standard compaction equipment and procedures (Figure 8). The lift thickness should be great enough to ensure that sheepsfoot cleats will not come in direct contact with the geogrid.
- For curved slope faces, the primary geogrids butt edge-to-edge at the slope face (unless shown otherwise on the construction drawings) and either fan out or overlap into the fill (Figure 9).

7. Surficial Reinforcement

- Embedments of BX Geogrids may be required to provide stability of the slope surface. Generally, the BX Geogrids will be unrolled parallel to the slope (Figure 10). Tensar BX Geogrids are supplied in roll widths of 9.8 ft (3 m) or 13.1 ft (4 m). The geogrid rolls may be cut to a specified width before unrolling.
- Fill can be spread directly upon the geogrids.
- Spread and level the fill. Do not drive tracked equipment directly upon the exposed geogrids.
- BX Geogrids may be cut to conform to horizontal curves.
8. Erosion Control

- Grade to top of the completed slope to ensure that water runoff is directed away from the face of the new slope. Positive drainage must be provided so that water does not collect above or behind the reinforced soil.
- Place the North American Green® turf reinforcement mat (TRM) in position on the face of the slope and pin it in place (Figure 11).
- For steeper slopes, face angles greater than 1H:1V, a geogrid wrap around and form system may be used. Wire forms (Figure 12) can be utilized in conjunction with a BX Geogrid wrap (Figure 13) to aid in maintaining facing alignment.
9. Special Considerations

- BX Geogrids typically have different design tensile strengths in the along-the-roll and the across-the-roll directions. Therefore, it is important to install Tensar BX Geogrids in the orientation indicated on the construction drawings.

- If the BX Geogrid strips are placed perpendicular to the slope face, it is not necessary to overlap adjacent strips (Figure 15). However, if the geogrid strips are placed parallel to the slope face, adjacent strips should be overlapped (Figure 16) or alternatively bodkined as indicated on the construction drawings.

- When using LH800 Geogrids in Sierra Slope installations, it is important to note that LH800 Geogrids have design strengths across-the-roll. Therefore, it is important to install them parallel to the slope face.

The Engineered Advantage™

Tensar understands the need for sound engineering as well as proper construction techniques to assure the success of any project. To support this belief, we have a full, in-house professional engineering staff to support your design needs, and a construction operations group to provide on-site installation assistance when necessary. This additional hands-on expertise assures that your project is handled professionally and you will get the results you intend.

For more information on the Sierra System, please call 800-TENSAR-1, visit www.tensar-international.com or e-mail info@tensarcorp.com. We are happy to supply you with additional Sierra Slope product information, complete design guidelines, system specifications, design details, preliminary cost estimates, summaries of completed projects and much more.