StrataSlope System
A Reinforced Soil Slope System using Strata Soil Reinforcement Products
A. **QUALITY ASSURANCE**

1. **Geogrid:** StrataGrid shall provide the following minimum properties:
   a. **Allowable Tensile Strength (Ta)** shall be defined as Tull / RF. Where **RF =** FORC / RFD, Reduced Factor for Creep (RF), Reduced Factor for Durability (RFD), and Reduced Factor for Installation Damage (RIFD).
   b. **Ultimate Tensile Strength (Tull)** shall be the minimum average real value (MARV) as tested per ASTM D 6367.
   c. **Reduction Factor for Creep (RF)** shall be based on a 75-year design life determined in accordance with ASTM D 6362 or ASTM D 6992. Reduction Factor for Creep (RF) shall not be less than 1.0.
   d. **Reduction Factor for Installation Damage (RIFD)** shall be based on a reduced backfill type designated above or a reinforced backfill configuration as indicated in the approved shop drawings or specifications, Installation damage testing and material sampling shall be done in conformance with ASTM D 6567 and ASTM D 5818. Reduction Factor for Installation Damage (RIFD) shall not be less than 1.0.
   e. **Reduction Factor for Durability (RFD)** shall be based on polymer fiber testing. Polyester fiber shall have a molecular weight of 23,000 g/mole per GRA-620 and a carbonyl equivalent number of 30 g/mole per GRA-625. Reduction Factor for Durability (RFD) shall be less than 1.0.

2. **Soil Interaction Coefficient (Cv)** value shall be determined from short-term effective stress pullout test per ASTM D 7607 over the range of normal stresses encountered. The minimum Ci value shall not be less than 0.7, determined as follows:

   \[
   C_v = \frac{S}{S_{\text{ref}}}
   \]

   \[
   S = \frac{P}{f_{\text{pullout}}}
   \]

   \[
   f_{\text{pullout}} = \text{Pullout force per ASTM D 7607, lbf (MN)}
   \]

   \[
   S_{\text{ref}} = \text{Resistance of one standard layer to deformation, kPa (MPa)}
   \]

   \[
   \text{p}_{\text{eff}} = \text{Effective normal stress, psf (kPa)}
   \]

   \[
   \theta = \text{Effective pullout angle, degrees}
   \]

C. **Intermediates or Slope Face Wrap Geogrid:** MicroGrid or StrataGrid, as indicated in the approved shop drawings, shall provide the following minimum tensile materials:

1. **Intermediates Slope Face Wrap Geogrid:** StrataGrid or MicroGrid shall provide the following minimum tensile materials:
   a. **Allowable Tensile Strength (Ta)** shall be defined as Tull / RF. Where **RF =** FORC / RFD, Reduced Factor for Creep (RF), Reduced Factor for Durability (RFD), and Reduced Factor for Installation Damage (RIFD).
   b. **Ultimate Tensile Strength (Tull)** shall be the minimum average real value (MARV) as tested per ASTM D 6367 or ASTM D 6992.
   c. **Reduction Factor for Creep (RF)** shall be based on a 75-year design life determined in accordance with ASTM D 6362 or ASTM D 6992. Reduction Factor for Creep (RF) shall not be less than 1.0.
   d. **Reduction Factor for Installation Damage (RIFD)** shall be based on a reduced backfill type designated above or a reinforced backfill configuration as indicated in the approved shop drawings or specifications, Installation damage testing and material sampling shall be done in conformance with ASTM D 6567 and ASTM D 5818. Reduction Factor for Installation Damage (RIFD) shall not be less than 1.0.
   e. **Reduction Factor for Durability (RFD)** shall be based on polymer fiber testing. Polyester fiber shall have a molecular weight of 25,000 g/mole per GRA-620 and a carbonyl equivalent number of 30 g/mole per GRA-625. Reduction Factor for Durability (RFD) shall be less than 1.0.

D. **Drainage Fill:** Fine-drainage, coarse-grained soil placed within subsurface drainage systems.

   1. **100 percent passing a 1-kchi (25 mm) sieve.**
   2. **50 to 75 percent passing a 3/4-inch (19 mm) sieve.**
   3. **0 to 60 percent passing a No. 4 sieve (4.75 mm).**
   4. **0 to 50 percent passing a No. 25 sieve (0.083 mm).**
   5. **0 to 5 percent passing a No. 200 sieve (0.075 mm).**

E. **Reinforced Backfill:** Granular fill with a phi range of 5 to 9, when tested in accordance with AASHO T 289 and graded as follows:

   1. **100 percent passing a 3/4-inch (9.5 mm) sieve.**
   2. **25 to 100 percent passing a No. 4 sieve (4.75 mm).**
   3. **0 to 60 percent passing a No. 20 sieve (0.85 mm).**
   4. **0 to 50 percent passing a No. 200 sieve (0.075 mm).**
   5. **PI ≤ 15**
   6. **LL ≤ 30**

F. **Stone Facing Fill for Rock Dikes:** Graded Dike Wire Fill shall consist of 3-inch (75mm) max, to 2.25 inch (56mm) min. crushed aggregate.

G. **Geocell:** Non-woven geocell, AASHTO M 258, Class 2 or Class 3 as indicated in the approved shop drawings.

H. **Drainage composite:** StrataDrain 30-2, polyethylene drainage net with 0.54 inch (138 mm) polyester mesh geonet bonded on both sides.

1. **Maximum Allowable Transmissivity of Core Zone:** Not less than 9 gallons per minute per foot of wall (3.29 4 square meters per second) when tested in accordance with ASTM D 4716 at a hydraulic gradient equal to one.

I. **Sediment and Perforated Stabilized Drainage Pipe:** Where indicated in the approved shop drawings, shall be PVC pipe manufactured in accordance with ASTM D 3049 or polyethylene pipe meeting AASHTO M 252 or M254.

J. **Welded Wire Fencing:** Steel welded wire mesh facing form, bent 90 degrees at long center line to form "L" shaped units with vertical section as to face to hill and horizontal leg extending into hill to provide sufficient support to top edge of vertiwall. Fencing forms and struts shall be black wire steel as indicated in the approved shop drawings.

1. **Black Steel Forms:** 4.0 inches by 4.0 inches (100 mm by 100 mm) or Galvanized 9 inches by 2.0 inches.

2. **Wire Mesh Facing Units:** Black in accordance with ASTM B 62 and B 615 or Galvanized in accordance with ASTM A 123, A 122, and A 1223.

3. **Wire Strut Types:** Black in accordance with ASTM A 62 or galvanized per ASTM A 144.

4. **Wire Mesh Spacing:** 4.0 inches by 4.0 inches or 2 inches by 2 inches (vertical x horizontal struts) as indicated on the approved drawings.

5. **Wire Mesh Size:** 6.0 or 6.5 x 9.05 per the approved drawings.

6. **Wire Mesh Spacings:** 6.0 or 6.5 per the approved drawings.

7. **Wire or cable ties to connect vertical struts of adjacent facing units.**
3.1 PREPARATION
A. Do not begin installation until excavation, foundation preparation and leveling work have been completed, properly preserved, and inspected per project specifications.
B. If subgrade preparation is the responsibility of another installer, notify Architect / Owner's Geotechnical Engineer of unsatisfactory preparation. Do not begin work unless satisfactory conditions have been notified as directed by the Owner's Geotechnical Engineer.
C. Excavation:
1. Excavate the subgrade vertically to the plan elevation and horizontally to the extent of the geofill heights.
2. Remove soils not meeting required strength and replace with approved materials as directed by the Owner's Geotechnical Engineer.
3. Protect excavated materials to be used for backfilling the reinforcement zone from the weather.
D. Foundation Preparation:
1. In absence of specified ground improvement requirements in the plans and contract documents, the foundation for the reinforced fill and retained backfill shall be graded level for the entire area of the base of such backfill, plus an additional 12 inches on all sides, or to the limits shown in the shop drawings.
2. If structure is to be positioned on native soils, the top one (1) foot of native soil shall meet the requirements of the reinforced backfill material.
3. The contractor shall perform proof rolling to evaluate the subgrade soils on which the structure will be constructed. Proof rolling shall be performed on the entire areas at the following locations:
   a. At the bottom of over excavation and recompaction/replacement zones.
   b. At the base of all structures.
   c. At the top of native soils that have been stabilized, moisture-conditioned, and recompaed (if different from the bottom of over excavation and recompaction/replacement zones).
4. Proof rolling shall be done immediately after subgrade compaction while the moisture content of the subgrade is at the moisture content that was used to achieve the required compaction.
   a. Proof rolling shall be performed with a pneumatic-tired tandem roller with at least three wheels on each axle, a gross weight of 20 tons (50k), a minimum tire pressure of 75 pounds per square inch, and a minimum rolling width of 75 inches. A Caterpillar MS-306B (MS-306B), Ingersoll-Rand PT-2450, ROMAG BUCHAR, Dynapac CA25T, or equipment with equivalent capabilities shall be used for proof rolling.
   b. Proof rolling equipment shall be operated at a speed between 1.5 and 3 miles per hour, or as required by the Engineer to permit measurements of deformations, ruts and/or pumping.
   c. Proof rolling shall be carried out in two directions at right angles to each other with no more than 24 inches (600mm) between the tracks of adjacent passes. Operate proof roller in a pattern that readily allows recording of deformation data and complete coverage of the subgrade.
   d. Proof rolling shall be carried out in two directions at right angles to each other with no more than 24 inches (600mm) between the tracks of adjacent passes. Operate proof roller in a pattern that readily allows recording of deformation data and complete coverage of the subgrade.
   e. The following actions shall be taken based on results of proof rolling, or as directed by the Engineer:
      1. Rolling less than 1/4 inch - Acceptable,
      2. Rolling greater than 1/4 inch and less than 1 1/2 inches - Scantily recompaed,
      3. Rolling greater than 1 1/2 inches - The compacted area shall be removed and recompaed.
      4. Pumping (deformation that results from materials that are squeezed out of a wheel's path) greater than one (1) inch - Area shall be remediated as directed by the Engineer.
      5. Other excavated areas of the subgrade shall be compacted to maximum base RIs of 10 inches (250 mm) and shall be compacted to a minimum of 95 percent Standard Proctor Dry Density with 1% to 2% of optimum moisture content in accordance with ASTM D99, or more stringent criteria if directed by the Engineer.
      6. Owner's Geotechnical Engineer will instruct the subgrade for the reinforced fill and retained backfill areas to ensure proper bearing strength in accordance with the specified Flexi-Comp Quality Control provisions.
      7. Contractor shall be responsible for maintaining the condition of approved proof rolling throughout the duration of the structure construction. Construction shall not commence until the foundation subgrade has been approved by the Engineer.

3.2 CONSTRUCTION
A. Construct reinforced soil slope system in accordance with the approved shop drawings and Construction and Quality Control Manual supplied by the manufacturer.
B. Welded-Wire Facing Form Installation:
1. Place the first course of welded mesh facing forms with the horizontal legs resting on the foundation material.
2. Verify that the first row of facing forms is level from end to end and from back to back.
3. Overlap or butt the adjacent facing units, as indicated in the approved shop drawings. Tie together vertical wires of adjacent facing units as required to maintain alignment and prevent escape of backfill material.
4. Use a string line or equivalent to align straight sections.
5. Place subsequent courses of facing forms on previous courses, at a setback, if any, as shown on shop drawings.
6. Align subsequent courses of facing forms using a string line or other suitable method that is independent of the final position of the underlying course of facing forms.
C. Geogrid placement:
1. Geogrid shall be burred (covered) within one (1) week of placement.
2. Unroll the geogrid and cut to the length indicated in the approved shop drawings.
3. Place geogrid on level and compacted reinforcement fill locations indicated in the approved shop drawings.
4. Primary strength direction of the structural geogrid shall be placed perpendicular to the wall.
5. Unroll and place slope face wrap geogrid parallel to the slope face unless otherwise shown on shop drawings. Slope face wrap geogrids may be cut or to the required width prior to unrolling.
6. Extend the geogrid and any required erosion control or geotextile beyond the slope face by the amount required for the wrapped face and for anchorage at the top of the wrap, as detailed in the approved shop drawings.
7. Wrap the backfill as indicated on the approved shop drawings.
8. When the structural geogrid is used as the slope face wrap geogrid, place the structural geogrid across the horizontal leg and up the flanks of the facing form. Dispense the anchorage length of the structural geogrid over the top of the facing form. Place geotextile and/or erosion control blankets inside the wire facing form anchored into the fill top and bottom as indicated in the approved shop drawings.
9. When using slope face wrap geogrid, place the slope face wrap geogrid, geotextile and/or the erosion control blanket inside the wire facing form anchored into the fill top and bottom as indicated in the approved shop drawings. Place the structural geogrid over the horizontal leg of the facing units and face wrap materials. The edge of structural geogrids shall be positioned immediately behind vertical face of the unit.
10. After placement of geogrid and any required face wrap, place all (minimum) wire support struts on approximately 24-inch (600mm) centers connecting the upper horizontal wire on the face of the facing form to the transverse wire at the top of the facing form. Place one of the support struts at each end of the facing unit between the outer two vertical wires.
11. Prior to wall placement, pull the structural geogrid to remove slack. Stakes or pins at the geogrid near the end to maintain alignment and prevent development of slack during backfill placement.
12. The top portion of the face wrap geogrid shall be pulled taut and secured (rope or pin) prior to placement of next wire form and backfill. Face wrap geogrid shall be laid without wrinkles or slack.
13. Place and compact the face fill and reinforced backfill in accordance with the project specifications and approved shop drawings.
14. Adjacent embankment lengths of structural geogrid shall be provided to 100% cover at all locations requiring geogrid reinforcement, as indicated in the approved shop drawings.
15. Overlap ends of adjacent sections of slope face wrap geogrid a minimum of 3 inches (75mm) for RIs required between 3.4 (165mm) overlapped slope face wrap geogrid.
16. Place a minimum of 3 inches (75mm) of fill between overlapping layers of structural geogrid where overlapping occurs between curves and corners of a wall.
17. Construction vehicles shall not be operated directly on the geogrid. A minimum of 8 inches (200mm) of fill over the geogrid to be required for operation of construction vehicles in the reinforced zone.
18. Topping of vehicles should be avoided to prevent displacement or damage to the geogrid and the facing units.
19. Primary geogrid may be overlapped or connected mechanically to form splices in the primary strength direction. The splice method must develop 100% of the Taf of the reinforcement layer. The minimum overlap length shall be 3 feet (900mm). Splices shall not be used within 6 feet (1800mm) of either end of the reinforcement layer or within 6 inches (150mm) of finished grade. No overlapping is required between adjacent rows. Splice requirements shall be made as detailed in the approved shop drawings.
20. Overlap splice shall not be utilized with slope face wrap geogrid.
D. Reinforced battery:
1. Place the reinforced battery material in maximum compacted lift of 9 inches (229 mm) and compact to a minimum Standard Proctor Density of 95 percent within ±1 to ±3 percent of optimum moisture content, per ASTM D 698.
2. Use only walk-behind compaction equipment within 1 foot (1 meter) of the facing units. Use a minimum of 3 passes to compact this zone.
3. Required level of compaction shall be achieved throughout the entire reinforced battery zone, as measured from the back of the facing unit to the end of geogrid reinforcement. Reinforced fill zone limits shall be as indicated on the approved shop drawings.
4. Smooth and level the battery as indicated so that the geogrid lies flat. Grade shall not slope towards facing units.
5. Separate reinforced battery from the adjacent soil with geotextile, as indicated in the approved shop drawings.

3.3 FIELD QUALITY CONTROL

A. Quality Assurance Testing and Inspection will be provided by the Owners Testing Agency as specified in Section 01400 Testing and Inspection Services. Notify the Architect / Owner's Geotechnical Engineer 72 hours in advance of testing.

B. Quality Control Testing and Inspection shall be provided by an independent laboratory provided by the Contractor and acceptable to the Architect / Owner's Geotechnical Engineer.

C. The reinforced battery shall be sampled and tested by the Contractor for acceptance and quality control in accordance with the following:

1. Gradation Test - ASTM D 422
   a. One test per 2,000 cubic yards at job site.
   b. Change in appearance or behavior of battery.
   c. Change in borrow source.

2. Plasticity Index - ASTM D 434
   a. One test per 2,000 cubic yards at job site.
   b. Change in appearance or behavior of battery.
   c. Change in borrow source.

3. Soil pH - ASTM D 427
   a. One test per 2,000 cubic yards at job site.
   b. Change in appearance or behavior of battery.
   c. Change in borrow source.

4. Field Density Tests - ASTM D 1556, D 2167, or D 2992 as appropriate for material handled and Make sure Test - ASTM D 3017
   a. Compaction control testing of the reinforced battery should be performed on a regular basis during the entire construction project. Conduct compaction control test (Density and Moisture) at a minimum rate of
      1) One test within the reinforced battery zone per every 500 square (15 m) of vertical height for every 100 ft (30 m) of length, approximately every 1000 square feet (90.5 square meters) of vertical face area.
      2) One test per 2,000 cubic yards at job site.
   b. The higher frequency of testing shall be required.

5. Internal effective friction angle - ASTM D 5968
   a. One test per material change.
   b. One test per change in borrow source.
   c. New test shall be required for each source regardless of whether the USCS designation changes or not.

6. Proctor and Optimum Moisture by ASTM D 698
   a. One test per material change.
   b. One test per change in borrow source.
   c. New test shall be required for each source regardless of whether the USCS designation changes or not.

The retained battery shall be sampled and tested by the Contractor for acceptance and quality control in accordance with the following:

1. Gradation Test - ASTM D 422
   a. One test per 5,000 cubic yards at job site.
   b. Change in appearance or behavior of battery.
   c. Change in borrow source.

2. Plasticity Index - ASTM D 434
   a. One test per 5,000 cubic yards at job site.
   b. Change in appearance or behavior of battery.
   c. Change in borrow source.

3. Field Density Tests - ASTM D 1556. D 2167, or D 2992 as appropriate for material handled and Make sure Test - ASTM D 3017
   a. Compaction control testing of the reinforced battery should be performed on a regular basis during the entire construction project. Conduct compaction control test (Density and Moisture) at a minimum rate of
      1) One test within the reinforced battery zone per every 7 ft (2.1 m) of vertical height for every 100 ft (30 m) of length, approximately every 1000 square feet (90.5 square meters) of vertical face area.
      2) One test per 5,000 cubic yards at job site.
   b. The higher frequency of testing shall be required.

4. Internal effective friction angle - ASTM D 5968
   a. One test per material change.
   b. One test per change in borrow source.
   c. New test shall be required for each source regardless of whether the USCS designation changes or not.

5. Proctor and Optimum Moisture by ASTM D 698
   a. One test per material change.
   b. One test per change in borrow source.
   c. New test shall be required for each source regardless of whether the USCS designation changes or not.

E. Minimum Frequency of Test for leveling pad and subgrade (foundation) soils, or as stated in the contract documents:

51. Levelling Pad (Trench): A minimum rate of one test per 100 feet (30 m) of branch.

52. Subgrade Soil: A minimum rate of one test per 50 feet (15 m) length of structure.
### Offset Between Each Wire Form

**Notes:**
- Offset between each wire form shall be field adjusted to achieve final wall batter. Contractor shall survey wall face every 20 feet and adjust wire form offset to maintain specified final structure batter. Offset shall be increased or decreased to achieve final structure batter.

<table>
<thead>
<tr>
<th>Offset Value</th>
<th>Nominal Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.184&quot;</td>
<td>18 INCHES (460mm)</td>
</tr>
<tr>
<td>0.164&quot;</td>
<td>15.5 INCHES (393mm)</td>
</tr>
<tr>
<td>0.134&quot;</td>
<td>11 INCHES (280mm)</td>
</tr>
</tbody>
</table>

### Strata Primary Reinforcement

- **Profile for Type, Elevation, and Length**

### Strata Secondary Reinforcement

- **Profile for Type, Elevation, and Length**

### Notes:
- Offset between each wire form shall be field adjusted to achieve final wall batter. Contractor shall survey wall face every 20 feet and adjust wire form offset to maintain specified final structure batter. Offset shall be increased or decreased to achieve final structure batter.

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NOTES:
1. FIELD TO CONSIDER OF PREFABRICATED HOT-DIP GALVANIZED STEEL WIRE.
2. WIRE W/4.5" SWIVEL HEAD (1/4" SWIVEL HEAD - 6.8mm x 5mm) (STANDARD WIRE FORMS).
3. ALL FORMS AND STRUTS SHALL BE GALVANIZED.
4. STEEL WIRE AND STRUTS SHALL COMPLY WITH ASTM A62.
5. WIRE FORMS SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A 231/A231M.
6. FIELD ASSEMBLED WIRE FORMS 15'-0" (4572mm).
7. OVERALL LENGTH OF WIRE FORMS IS 15'-0" (4572mm).
8. EFFECTIVE CONSTRUCTED LENGTH IS 15'-0" (4572mm).
9. PROVIDE SUPPORT STRUTS AT ALL OUT LOCATIONS.

Reinforced Soil Slope
90° - Hot-Dip Galvanized Steel Wedge Wire Form Details

Design By: RLC
Date: March 31, 2010
Revision: 002
Scale: Not to Scale

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Reinforced Soil Slope
Welded-Wire Form - Outside Corner

**Description**

**Option 1:**
- Design shoulder layout such that geosites
- Elevations along adjacent wall faces are
- Separated by a minimum of one facing unit.

**Option 2:**
- Modify geotechnical analysis such that geosites
- Elevations in area of overlap are
- Separated by a minimum of one facing unit.
- Return geosites elevations to offset geotechnical
- Elevations beyond area of overlap.

**Option 3:**
- In area of geosites overlap space 3-inch (75mm) soil
- Cover between overlapping layers of geosites.
- Then geosites at adjacent wall face such that
- Geosites does not overlap between facing units.

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The information provided is a suggestion only and is supplied by Strata Systems, Inc. Any issues of safety, or any Strata product contained in the information are the responsibility of the user as per project design engineers of record. The user or project design engineer of record must assume all risk of loss and damage of any kind arising from use of the alternatives or any product of Strata Systems, Inc.

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