

TECHNICAL SPECIFICATIONS
FOR HILFIKER M. S. E. SYSTEMS
Welded Wire Wall and Eureka Reinforced Soil
(Commercially Galvanized Wire)

1.0 DESCRIPTION

This work shall consist of either **Welded Wire Retaining Wall (WWW) or Eureka Reinforced Soil (ERS) Wall** constructed in accordance with these specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the plans or established by the Owner's Engineer.

2.0 MATERIALS

The Contractor shall make his own arrangements to purchase all **WWW or ERS** M.S.E. materials, including wire mesh reinforcement mats, backing materials, and all necessary incidentals from Hilfiker Retaining Walls, 1902 Hilfiker Lane, Eureka, CA 95503-5711, ph. 707/443-5093.

2.1 Wire Reinforcement and Cap Mesh

Welded wire fabric for facing shall be formed by a 90-degree bend of the soil wire reinforcement mesh and a prong to interlock with the soil reinforcing mesh above. The reinforcing mesh shall be shop fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A-82 and shall be welded into the finished mesh fabric in accordance with ASTM A-185. Fabric for the **WWW or ERS** shall be as per project specifications, and will commercial galvanized (ASTM A-641). Any damage done to the mesh galvanization prior to installation shall be repaired in an acceptable manner and in a galvanized coating comparable to that provided.

2.2 Backing Materials

2.2.1 Backing Mats

Where required, as shown on the plans, steel backing mat shall be W5 vertical x W2.5 horizontal minimum (.2582" [6.6 mm] x .178" [4.5 mm] nom. dia.) welded wire fabric meeting ASTM A-185 and commercially galvanized.

2.2.2 Hardware Cloth

Where required, as shown on the plans, 20-Gauge metallic hardware cloth screen, or 23-Gauge PVC coated (Brown or Green) hardware cloth screen with openings not exceeding ¼ inch (6.4 mm) and a roll width of 26". The hardware cloth screen shall be in accordance with ASTM A-740 and shall be placed between the backfill and steel backing mat. A minimum vertical lap of 2" and horizontal lap of 1" must be maintained to retain the wall backfill.

2.2.3 Filter Fabric

Where required, as shown on the plans, geotextile filter fabric shall be utilized to retain the soil.

3.0 SELECT GRANULAR BACKFILL MATERIALS

As shown on the plans, select granular backfill materials for the **WWW or ERS** wall structure shall be reasonably free from organic and otherwise deleterious materials and shall conform to the following gradation limits as determined by ASTM D-422:

Sieve Designation	Percent by Weight Passing Standard Sieves (AASHTO T 27)
6 inches (152.4 mm)	100
3 inches (76.2 mm)	100 - 75
No. 200 (75 µm)	0 - 15*

*If the percent passing the No. 200 sieve is greater than 15 percent, the backfill shall conform to all of the following additional requirements:

- a. The Plasticity Index (P.I.), as determined by ASTM D-4318 (AASHTO T 90), shall not exceed 6.
- b. The fraction finer than 15 microns (0.015 mm), as determined by ASTM D-422 (AASHTO T-88) shall not exceed 15 percent.
- c. The material shall exhibit an angle of internal friction of not less than 34 degrees, as determined by the standard direct shear test ASTM D-3080-72 (AASHTO T-236), utilizing a sample of the material compacted to 90% percent of ASTM D-1557-92, at optimum moisture content.

In addition, backfill materials shall also meet the following corrosion requirements:

Resistivity	≥ 3000 OHM-cm (min)	AASHTO T 288
pH	5.0 to 10.0	AASHTO T 289
Chlorides	≤ 200 mg/kg (ppm)	AASHTO T 291
Sulfates	≤ 1000 mg/kg (ppm)	AASHTO T 290

No testing is required for backfill where 80 percent of the material is greater than ¾ inch. If the resistivity is greater than or equal to 5,000 ohm-cm, the chlorides and sulfates requirements may be waived.

The Contractor shall furnish to the Owner’s Engineer a Certificate of Compliance certifying that the select granular backfill material complies with this section of the specifications. A copy of all test results performed by the Contractor, which are necessary to assure compliance with the specifications, shall also be furnished to the Owner’s Engineer.

The frequency of sampling of Select Granular Backfill necessary to assure the above-mentioned requirements shall be directed by the Owner’s Engineer.

Backfill not conforming to this specification shall not be used without written consent of the Engineer.

3.1 Free Draining, Permeable Backfill

If the M. S. E. will be subject to water inundation, the following permeable, free-draining backfill material shall be used within the entire soil reinforced zone:

Sieve Designation	Percent by Weight Passing Standard Sieves (AASHTO T 11 and T 27)
3” (76 mm)	100
¾ “ (19 mm)	50 - 90
No. 4 (4.75 mm)	20 - 50
No. 200 (75 µm)	0 - 2

4.0 CONSTRUCTION REQUIREMENTS

4.1 Wall Excavation

Wall excavation shall be in accordance with the requirements of the Project specifications and in reasonably close conformity with the limits and construction stages shown on the plans. All excavation cuts and slopes shall be in accordance with governing safety regulations.

4.2 Foundation Preparation

The foundation for the structure shall be graded level for a width equal to or exceeding the length of the reinforcement mat or as shown on the plans. Prior to wall construction, the foundation, if not in rock, shall be compacted, as directed by the Owner's Engineer.

Any unsuitable foundation material below the reinforced soil volume, as determined by the Owner's Engineer, shall be excavated for the full length of mat reinforcements, and to a depth as directed by the Owner's Engineer. Excavated unsuitable material shall be replaced as directed by the Owner's Engineer.

The maximum calculated applied bearing pressure at the foundation level is as shown on the elevation view for each wall. It is the responsibility of the Owner's Engineer to determine that this calculated applied bearing pressure is allowable for that location.

4.3 M.S.E. Wall Erection

Standard wire mesh reinforcement mats, and applicable facing materials, shall be placed in 24" successive horizontal lifts in the sequence shown on the plans as backfill placement proceeds. Each standard lift must have the ability to compress a minimum of 2" without creating any outward bulge of the facing elements. Vertical tolerance (plumbness) and horizontal alignment tolerance shall not exceed two (2) inches (51mm) when measured at the junction of the wire facing and soil reinforcement along a 10-foot (3 m) straight edge.

The overall vertical tolerance of the wall (top and bottom) after construction of the cast-in-place concrete facing shall not exceed one (1) inch (25 mm) per ten (10) feet (3 m) of wall height, unless the wall design requires a battered facing. For battered facing structures, the overall tolerance from the theoretical battered locations shall not exceed one-half (1/2) inch (13 mm) per ten (10) feet (3 m) of battered wall height.

4.4 Backfill Placement

Backfill placement shall closely follow erection of each course of reinforcement mats. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the facing. Any wall materials, which become damaged or disturbed during backfill placement, shall be either removed and replaced at the Contractor's expense or corrected, as directed by the Owner's Engineer.

Backfill shall be compacted to 95 percent of AASHTO T 99 method C or D, with oversize correction, at optimum moisture content.

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill material shall have a placement moisture content less than or equal to or within two percentage points of optimum moisture content ($W_{opt} \pm 2\%$). Backfill material with placement moisture content in excess or less than $W_{opt} \pm 2\%$, shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift. The Contractor shall decrease the percentage of deviation from optimum moisture, if necessary, to obtain the specified density. The optimum moisture content shall be determined in accordance with AASHTO T 99.

Backfill shall be placed in complete horizontal lifts. The maximum lift thickness after compaction shall not exceed twelve (12) inches (305 mm). The Contractor shall decrease this lift thickness, if necessary, to obtain the desired density.

Compaction within three (3) feet (1 m) of the backface of the wall facing shall be achieved by at least three (3) passes of a lightweight mechanical tamper, roller or vibratory system. Soil density tests are not generally required within this area.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to rapidly direct run-off of rainwater away from the wall face. In addition, the Contractor shall not allow surface run-off from adjacent areas to enter the wall construction.

4.5 Cast-In-Place (CIP) or Precast Full-Height Facing (This Section pertains only to the ERS System.)

Concrete shall conform to the project plans and specifications and shall have a minimum 28-day compressive strength of 4,000 pounds per square inch. Reinforcing steel shall be welded wire fabric conforming to ASTM A-82 and ASTM-185, or deformed bars conforming to ASTM A-615, Grade 60.

The concrete facing shall be constructed after the welded wire panels and backfill are completed to full height. The CIP fascia wall shall be cast as shown on the Project drawings. All expansion joints or deep score joints shall be vertical and continuous from bottom to top of the wall. No horizontal joints will be permitted. Precast Full-Height Fascia panels may also be utilized in place of CIP Facing.

5.0 METHOD OF MEASUREMENT

5.1 Wire Mesh Facing

The unit of measurement for furnishing and fabricating all materials for the walls, including wire mesh reinforcement mats, applicable backing materials and other incidentals will be the square foot

or square meter of wall surface area. The quantity shall be measured on the basis of wall face area shown on the plans.

Measurement and payment for excavation and backfill quantities performed during **WWW or ERS** construction will be in accordance with the applicable sections of the contract specifications.

5.2 Wall Erection

The unit of measurement for wall erection will be the square foot of wall surface area complete and in place. The quantity to be paid for will be the actual quantity erected in place at the site. Payment shall include compensation for all labor and materials required to prepare the wall foundation, place the reinforcement mats, and position the backing mats and screens as shown on the plans.

• End of Section •

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HILFIKER RETAINING WALLS ARE COVERED BY ONE OR MORE OF THE FOLLOWING PATENTS:

3,631,682	4,068,482	4,329,089	
3,922,864	4,117,686	4,324,508	OTHER
243,697	4,051,570	4,343,572	PATENTS
243,613	4,266,890	4,391,557	PENDING
4,154,554	4,260,296	4,505,621	