SECTION 32 32 34 - HILFIKER M. S. E. SYSTEM Welded Wire Wall
Addendum B Revisions shown in red
(Commercially Galvanized Wire)

PART 1 GENERAL

1.1 SUMMARY

This work shall consist of a **Welded Wire Retaining Wall (WWW)**, Mechanically Stabilized Earth Retaining Wall [MSE] 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.

1.2 SUBMITTALS

A. Contractor shall contract directly with Hilfiker and have their in-house engineer or outside consultant engineer design the specific wall system that is to be used for this project. The design obtained by Hilfiker shall be stamped and approved by a Registered Professional in the State of CA. The design shall be submitted to the project civil engineer for review and approval prior to commencement of work.
B. The contractor shall also submit a sample of the typical boulder that will be used for the rock faced MSE Walls and topping gabion baskets.

1.3 PERFORMANCE REQUIREMENTS

A single section or 3'x3'x6' Mock-Up section shall be provided prior to wall construction of wall to verify wire to be used and rock size, texture, and shape that will be filling the face and gabion baskets for the varying wall locations.

PART 2 PRODUCTS

2.1 MATERIALS

The Contractor shall make his own arrangements to purchase all **WWW** 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; www.hilfiker.com; info@hilfiker.com.

2.1 Wire Reinforcement and Cap Mesh

Welded wire fabric for facing shall be formed by a 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 and shall be welded into the finished mesh fabric conforming to the minimum requirements of AASHTO M 336 (ASTM A-1064), with a yield strength minimum of 450 MPa (65 ksi). Welded Wire Mesh for the **WWW** shall be as per project specifications, and will be commercial galvanized.

2.2 Backing Materials

2.2.1 Backing Mats

Where required, as shown on the plans, steel backing mat shall be W2.5 minimum (.178" [4.5 mm] nom. dia.) welded wire fabric meeting AASHTO M 336 (ASTM A-1064).

2.2.2 Miramesh® GR (green)

Where required, as shown on the plans, use the Miramesh® GR, composed of green high-tenacity monofilament polypropylene yarns, woven open mesh geotextile with aperture size of 0.08 inches. The Miramesh® GR shall be placed between the backfill and steel backing mat. A minimum vertical lap of 2" and minimum horizontal lap of 2" 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** structure shall be reasonably free from organic and otherwise deleterious materials and shall conform to the following gradation limits:

Sieve Designation	Percent by Weight Passing Standard Sieves AASHTO T 27 & T 11 (ASTM D-422 & C-117)
6 inches (152.4 mm)	100
3 inches (76.2 mm)	100 - 75
No. 200 (75 µm)	0 - 15

The backfill shall conform to all of the following additional requirements:

A. The Plasticity Index (P.I.), as determined by AASHTO T 90 (ASTM D-4318), shall not exceed 6.

B. The fraction finer than 15 microns (15 µm), as determined by AASHTO T 88 **(**ASTM D-422) 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 AASHTO T-236 (ASTM D-3080), utilizing a sample of the material compacted to 95 percent of AASHTO T 99 method C or D (ASTM D-698), with oversize correction, at optimum moisture content (±2%). No testing is required for backfill where 80 percent of the material is greater than ¾ inch (19 mm). Before construction begins, the borrow selected shall be subject to show conformance with this frictional requirement.

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

Resistivity	≥ 3000 OHM-cm (min)	AASHTO T 288 (ASTM G-187)
pH	5.0 to 10.0, inclusive	AASHTO T 289 (ASTM 4-972)
Chlorides	≤ 100 mg/kg (ppm)	AASHTO T 291 (ASTM D-512)
Sulfates	≤ 200 mg/kg (ppm)	AASHTO T 290 (ASTM C-1580)
Organic Content	<1%	AASHTO T 267 (ASTM D-2974)

If the resistivity is greater than or equal to 5,000 ohm-cm, the chlorides and sulfates requirements may be waived.

3.1 Application of Recommendations

The backfill recommendations in this section pertain to the wall designs provided by Hilfiker (or Hilfiker's consulting Engineer). If the wall design is prepared by other parties, it is the responsibility of the wall designer to specify the appropriate backfill requirements.

3.2 Acceptance of Material

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, should also be furnished to the Owner's Engineer.

All testing should be performed according to the most recent testing standard in a laboratory accredited by AASHTO. The ASTM testing standard may be used only with the written consent of the owner's engineer in an ASTM accredited laboratory if an AASHTO accredited laboratory is not available.

The frequency of sampling of Select Granular Backfill necessary to assure the above-mentioned requirements shall be directed by the Owner's Engineer and the project specifications, whichever is greater.

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

3.3 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:

Sieve Designation	Percent by Weight Passing Standard Sieves, AASHTO T 11 and T 27 (ASTM D-422 & C-117)
6" (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.

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.

Care should be taken when handling or working near exposed steel prongs or any overhang of the welded wire mesh. The Contractor shall be responsible for implementing and adhering to all applicable safety practices.

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. The Contractor, at their expense, shall correct any misalignment or distortion of the wall facing due to placement of backfill outside the limits of this specification.

Backfill shall be compacted to 95 percent of AASHTO T 99 method C or D (ASTM D-698), with oversize correction, at optimum moisture content (±2%).

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 equal to or within two percentage points of optimum moisture content (W_{opt} ±2%). Backfill material with placement moisture content in excess or less than W_{opt} ±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 (ASTM D-698), with coarse particle correction according to AASHTO T 224 (ASTM D-4718).

At the discretion of the owner's engineer, AASTHO T-180 (ASTM D-1557) may be implemented for moisture content and compaction requirements.

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.

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 supplied [may differ than installed] wall face area shown on the plans.

Measurement and payment for excavation and backfill quantities performed during **WWW** 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.

• End of Section •

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	

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END SECTION 32 32 34