SECTION _____
Mechanically Stabilized Earth (MSE) Retaining Walls

1.1 **General** – The MSE wall design and submittals shall be in accordance with AASHTO LRFD Bridge Design Specifications 4th Edition 2007 (2009 Interim) Section 11, with materials and installation in accordance with Section 7 of AASHTO LRFD Bridge Construction Specifications 2nd Edition 2004 (2007 Interim).

1.2 **Systems** - The Contractor shall choose one of the following MSE systems and that system shall be used for all MSE walls on the Project.

1. KeySystem™ I by Keystone Retaining Wall Systems, Inc.
2. Mesa® HP System by Tensar Earth Technologies, Inc.
3. Reinforced Earth® Classic Panel by The Reinforced Earth Company

2.1 **Components** - MSE wall facing components shall comply with either of the following:

a) Segmental retaining wall (SRW) units shall conform to ASTM C1372 with a minimum 28-day compressive strength of 4000 psi (28 MPa). The color shall be concrete gray and the face finish shall be a sculptured rock finish in an angular multi-planar configuration with a minimum 1-1/2“ (35 mm) relief on each face unit unless otherwise shown on the plans. The minimum SRW unit depth (front to back) shall be 10.0 inches (260 mm).

b) Precast reinforced facing panels shall conform to AASHTO Bridge Construction Specifications Section 8.13 with a minimum 28-day compressive strength of 4000 psi (28 MPa). The color shall be concrete gray and the face finish shall be textured with a fractured face finish with a minimum 1-1/2” (35 mm) relief on each panel unless otherwise shown on the plans. The minimum panel thickness shall be 5.5 inches (140 mm) plus the architectural finish. The maximum panel size shall be less than 30 sf (2.8 m3).

3.1 **Design** - To further clarify the department’s intent, the following additions and/or clarifications of AASHTO shall apply:

1. The minimum reinforcement shall length shall be the greater of 8 feet (2.4 m) or 0.7H. All reinforcement shall be the same length in a single section (no short intermediate reinforcement).
2. The minimum wall embedment at the toe shall be in accordance with FHWA NHI-00-043 with an absolute minimum of 2.0 feet (600 mm) measured from the top of the leveling pad to finished grade at the toe.
3. For SRW systems, the maximum vertical spacing of the soil reinforcement shall be 2.0 times the absolute facing thickness as measured from the front face to the back face of the unit regardless of connection type.
4. For internal design the Simplified Method shall be used. For inextensible systems, the Meyerhof Coherent Gravity Method or Simplified Method shall be used using K/Ka factors based on the system’s stiffness at the end of the service life of the wall.
5. For inextensible reinforcement, the tensile strength resistance factor shall be 0.75 (0.65 for bar mat or wire systems with 3 or more longitudinal members per mat) at the end of the design life.
6. The reinforced backfill shall comply with AASHTO Bridge Construction Specifications, Section 7.3.6.3 and the maximum particle size for inextensible systems shall be 4.0 inches (100 mm) and for extensible systems, 0.75 inches (19 mm).
7. Extensible reinforcement coverage shall be 100% (no gaps) and the facing connection shall connect a minimum of 85% of the reinforcement width to the facing units.
8. All connections and related components shall be designed and evaluated strictly in accordance the AASHTO Bridge Construction Specifications and Appendix A.3 of FHWA NHI-00-043. Long-term connection testing of extensible reinforcement systems is required.

9. All materials and the resulting Reduction Factors (RFs) shall be the same as used in the system's HITEC review, as applicable.

3.2 Design Parameters – Unless otherwise shown on the plans, the KeySystem shall use the following design parameters:

1. The following load factors shall be used:
   i. For Strength I and Extreme I load combinations.

Designation	Maximum	Minimum
EH (Horizontal Earth)	1.50	0.90
EV (Vertical Earth and Slope Wt.)	1.35	1.00
ES (Dead Load)	1.50	0.75

   ii. The load factors for live loads shall be 1.75 and 0.50 for Strength I and Extreme I load combinations respectively.
2. The following resistance factors shall be used:
   i. For Strength I and Extreme I load combinations, 1.0 shall be used for sliding, soil to soil and soil to reinforcement.
   ii. For tensile and pullout resistance, 0.90 and 1.20 shall be used for Strength I and Extreme I load combinations respectively.
3. Eccentricity, e shall be < B/4
4. Design life ≥ 75 years
5. The design shall be based on:

Soil Zone	∅'	c'	Unit weight
Reinforced	34°	0	125 pcf (19.6 kN/m3)
Retained	30°	0	120 pcf (18.8 kN/m3)
Foundation	30°	0	120 pcf (18.7 kN/m3)

6. Seismic acceleration, a_{max} = 0.00g
7. Uniform surcharge live load, q = 250 psf (12 kPa)
8. Barrier impact load, if applicable, = 500 plf (7.3 kN/m)
9. Global stability, settlement & bearing capacity are the responsibility of the Owner or the Owner's geotechnical engineer.

3.3 Submittals – Submittals shall be made a minimum of 30 days prior to commencing construction. All design related submittals shall be signed and sealed by a professional engineer registered in the state of the project. Submittals shall include:

3. Shop drawings showing all information needed to fabricate and construct the retaining walls including:
   i. An elevation or profile view showing top and bottom of wall, finished grade and reinforcement elevations and type and length of reinforcement.
   ii. Typical cross sections for each design condition.
   iii. A plan view with each wall labeled and the beginning and end of each wall shown with ties into project stationing.
   iv. Standard and project specific details.
   v. Wall system specifications.
4. Calculations including but not limited to:
   i. Calculations for each wall section.
   ii. Calculations for determination of the allowable design strength of the reinforcement and the facing connection strength for each reinforcement used.
5. Engineer's certification that the retaining wall plans are in accordance with this specification and the bid drawings.
6. Manufacturer's certifications that the components used in the wall system meet the material requirements of this specification.
7. Results of backfill testing documenting compliance with this specification.
8. An installation manual for the retaining wall system.

4.1 **Measurement** – MSE wall measurement shall be the number of square feet of wall face surface area measured from the minimum embedment line below finished grade (2.0' feet (600 mm) minimum) or the minimum grade shown on the bid plans to the top of the coping or gutter line if a traffic barrier is placed directly on the wall.

4.2 **Payment** – MSE wall shall be paid at the contract unit price, which shall be full compensation for furnishing and installing all materials, including face units leveling pad, excavation, reinforced backfill, soil reinforcement, coping, moment slab (if applicable), any incidentals necessary to complete the work and MSE wall design.