TO: All Design Section Staff  
FROM: Bijan Khaleghi  
DATE: December 7, 2012  
SUBJECT: STD Plans Noise Barrier Wall Type 11

This memorandum supersedes the design memorandum issued on January 14, 2012 for Type 11 Precast Concrete Noise Barrier Wall on Shaft Foundation. The January 14, 2012 policy memorandum remains effective for all other types of noise barrier walls until further notice.

The design of the Standard Plan Noise Barrier Type 11 shall be in accordance with the requirements of the AASHTO LRFD Bridge Design Specifications, 6th Edition 2012 and the requirements and guidance cited herein:

1. Load factors and load combinations for the design of all structural elements shall be in accordance with AASHTO LRFD Tables 3.4.1-1 and 3.4.1-2.

2. Seismic design shall be in accordance with AASHTO LRFD Article 3.10.2.1-General Procedure, considering site classes B, C, D, and E and the following:
   a. Peak seismic ground acceleration coefficient on Rock (Site Class B).
      • PGA = 0.45g for Western Washington
      • PGA = 0.19g for Eastern Washington
   b. Horizontal response spectral acceleration coefficient at 0.2-sec period on rock (Site Class B).
      • $S_s = 1.00$ for Western Washington
      • $S_s = 0.43$ for Eastern Washington
   c. Horizontal response spectral acceleration coefficient at 1.0-sec period on rock (Site Class B).
      • $S_1 = 0.33$ for Western Washington
      • $S_1 = 0.15$ for Eastern Washington
   d. Modal analysis shall be performed for the first four periods. The elastic seismic response coefficient $C_{sm}$ shall be computed for each modal period in accordance with AASHTO LRFD Article 3.10.4.2 and all four $C_{sm}$ coefficients shall be combined through the SRSS method.
   e. The resultant seismic force shall be considered to act at a height of $0.71H$ above the top of the shaft, where $H$ is the total height measured from the top of the panel to the top of the shaft.

3. Wind loads shall be computed in accordance with AASHTO LRFD Article 15.8.2 considering surface conditions characterized as “Sparse Suburban”. The 50 year return period maximum wind velocity, as determined from AASHTO LRFD Figure 15.8.2-1, is 100 mph for Western Washington and 80 mph for Eastern Washington.
4. Drilled shaft foundations shall be designed for earth pressure distributions as shown in AASHTO LRFD Figure 3.11.5.10-1 considering the following:
   a. Shaft depth, D1
      - 2H:1V fore-slope and a flat backslope
      - Angle of internal friction = 32 degrees
      - Soil unit weight = 125pcf
      - Corresponding $K_p = 1.5$
      - Corresponding $K_a = 0.28$
   b. Shaft depth, D2
      - 2H:1V fore-slope and a flat backslope
      - Angle of internal friction = 38 degrees
      - Soil unit weight = 125pcf
      - Corresponding $K_p = 2.3$
      - Corresponding $K_a = 0.22$
   c. The passive earth pressure distribution shall be assumed to start at the finished grade. However, the uppermost two feet of passive earth pressure shall be neglected, resulting in a trapezoidal passive earth pressure distribution.
   d. In accordance with AASHTO LRFD Table 11.5.7-1 and Article 11.5.8, the resistance factor applied to the passive earth pressure shall be as follows:
      - For the Strength Limit State, the resistance factor is taken as 0.75.
      - For the Extreme Event Limit State, the resistance factor is taken as 1.0.

The details for Type 11 Noise Barrier Walls are attached for immediate use.

**Background:**

WSDOT is in process of upgrading STD Plans Manual M21-01 Noise Barrier Walls to the current AASHTO LRFD Bridge Design Specifications, WSDOT Bridge Design and Geotechnical Manuals. Type 11 is the first of the STD Plans Noise Barrier Walls upgraded to the current requirement.

If you have any questions regarding these issues, please contact David Sawahata at 360-705-6941 (sawahsD@wsdot.wa.gov), Monique Pawelka at 360-705-7754 (powelkM@wsdot.wa.gov), or Bijan Khaleghi at 360-705-7181 (khalegb@wsdot.wa.gov).

**cc:** Mark Gaines, Bridge Construction - 47354  
F. Posner, Bridge and Structures – 47340
BDM Revisions:

8.1.3 Design

F. Noise Barrier Walls

The design of the Standard Plan Noise Barrier Type 11 walls shall be in accordance with the requirements of the AASHTO LRFD Bridge Design Specifications, 6th Edition 2012 (AASHTO LRFD) and the requirements and guidance cited herein:

1. Load factors and load combinations for the design of all structural elements are in accordance with AASHTO LRFD Tables 3.4.1-1 and 3.4.1-2.

2. Seismic design shall be in accordance with AASHTO LRFD Article 3.10.2.1-General Procedure, considering site classes B, C, D, and E and the following:
   a. Peak seismic ground acceleration coefficient on Rock (Site Class B).
      i. PGA = 0.45g for Western Washington
      ii. PGA = 0.19g for Eastern Washington
   b. Horizontal response spectral acceleration coefficient at 0.2-sec period on rock (Site Class B).
      i. $S_s = 1.00$ for Western Washington
      ii. $S_s = 0.43$ for Eastern Washington
   c. Horizontal response spectral acceleration coefficient at 1.0-sec period on rock (Site Class B).
      i. $S_1 = 0.33$ for Western Washington
      ii. $S_1 = 0.15$ for Eastern Washington
   d. Modal analysis shall be performed for the first four periods. The elastic seismic response coefficient $C_{sm}$ shall be computed for each modal period in accordance with AASHTO LRFD Article 3.10.4.2 and all four $C_{sm}$ coefficients shall be combined through the SRSS method.
   e. The resultant seismic force shall be considered to act at a height of $0.71H$ above the top of the shaft, where $H$ is the total height measured from the top of the panel to the top of the shaft.

3. Wind loads shall be computed in accordance with AASHTO LRFD Article 15.8.2 considering surface conditions characterized as “Sparse Suburban”. The 50 year return period maximum wind velocity shall be determined from AASHTO LRFD Figure 15.8.2-1 is 100 mph for Western Washington and 80 mph for Eastern Washington.

4. Drilled shaft foundations shall be designed for earth pressure distributions as shown in AASHTO LRFD Figure 3.11.5.10-1 considering the following:
   a. Shaft depth, $D_1$
      i. 2H:1V fore-slope and a flat backslope
      ii. Angle of internal friction = 32 degrees
      iii. Soil unit weight = 125pcf
iv. Corresponding $K_p = 1.5$

v. Corresponding $K_a = 0.28$

b. Shaft depth, D2
   i. 2H:1V fore-slope and a flat backslope
   ii. Angle of internal friction = 38 degrees
   iii. Soil unit weight = 125pcf
   iv. Corresponding $K_p = 2.3$
   v. Corresponding $K_a = 0.22$

c. The passive earth pressure distribution shall be assumed to start at the finished grade. However, the uppermost two feet of passive earth pressure shall be neglected, resulting in a trapezoidal passive earth pressure distribution.

d. In accordance with AASHTO LRFD Table 11.5.7-1 and Article 11.5.8, the resistance factor applied to the passive earth pressure shall be as follows:
   i. For the Strength Limit State, the resistance factor is taken as 0.75.
   ii. For the Extreme Event Limit State, the resistance factor is taken as 1.0.

The design criteria and Details for Type 11 Noise Barrier Walls are attached for immediate use.
1. ALL ROD No AND ANCHOR BOLTS SHALL BE ASTM A311 GRADE 60.

2. ANCHOR BOLTS, NUTS, WASHERS AND BOLTED NUTS SHALL HAVE A PROTECTIVE COATING OR OTHER APPROPRIATE MEANS TO PREVENT CORROSION. WASHERS AND NUTS MUST MEET THE SPECIFICATIONS FOR HARDWARE OF HERENumber 8 FOR WASHERS AND NUTS.

3. FOR INTERMEDIATE WALL HEIGHTS USE THE NEXT HIGHER PL.

4. PANELS SHALL HAVE AT LEAST 5 FEET OF LEVEL GROUND ON EACH SIDE.

5. THE CONSTRUCTION SPACER FOUNDATION REQUIREMENTS OF DC 2.

6. MAXIMUM PANEL LENGTH SHALL BE 12 FEET.