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Technical Memorandum

Subject: Guardrail & Barrier Loading

Technical Information:

A common design issue is determining the applied lateral load due to collision loading for a barrier or guardrail installed on a precast modular retaining wall.

Older versions of the AASHTO specifications provided a prescriptive load for rigid barriers. These are self-supporting systems with moment slabs that resist overturning and distribute impact forces. Current AASHTO standards do not prescribe a load on the barrier, but require crash testing for the barrier itself. The high-magnitude lateral forces prescribed by these older specifications were generally not applicable to post and beam guardrails.

Unlike rigid barriers, steel guardrails are generally flexible systems that are expected to deflect and dissipate energy. A steel W-beam guardrail will transfer load along its length, further reducing the load magnitude applied to the retaining wall. At the point of impact, posts are expected to shear or deflect to allow deflection of the rail beam. This deflection dissipates energy and transfers load along the length of the guardrail beam.

For post and beam guardrail systems, a collision load of 300 pounds per lineal foot (4.4 kN/m) should be applied at ground level above the wall (AASHTO 11.10.10.2). Guardrail posts can often be installed within the cells of 24SF and 6SF units using a sleeve or directly burying the posts within the unit fill. Where moderate to higher speed traffic is expected, timber or rubber offset blocking should be used to set the face of the guardrail at least 3 feet (900 mm) from the face of the wall to allow for deflection. In the case of parking bumpers or low-speed applications, this offset may not be necessary.

For rigid barriers with a moment slab, a collision load of 500 pounds per lineal foot (7.3 kN/m) should be applied at the base of the moment slab (AASHTO 11.10.10.2). The moment slab should not be connected to the wall units, and a flexible separation should be provided between the top of the wall and the moment slab. A 1 to 2 inch (25 to 50 mm) thick layer of polystyrene insulation placed over the top of the wall units is sufficient separation in most applications.

Note that collision loads are applied over a very short duration. Since earth pressures cannot respond as quickly, a reduced earth pressure may be appropriate for stability calculations when applying the 300 plf lateral load in working stress design. As an alternative, reduced safety factors may be applied, similar to seismic loading (75% of the normal safety factors). In limit state design, reduced load factors for gravity loads are typically used in the extreme collision load case.