Finite Element Simulations and Testing of Washington State Precast Concrete Barrier

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ABSTRACT

Since the early 1970's, the Washington State Department of Transportation (WSDOT) has used precast concrete barrier (as shown in Figure 1) for both temporary and permanent installations. The use of this barrier in high impact areas has increased through the years and is one of the primary barriers currently used on Washington State highways due to its inherit ease of installation and repair.

However, there had been no crash testing of Washington State's design. To evaluate this need, computer simulation of the impact performance of this design and 2 alternate designs was performed prior to full-scale crash testing to identify possible failure issues with the current design. Five simulations were performed to evaluate the alternate designs. The simulations were performed using the explicit finite element code (LS-DYNA). The simulation model was set up to represent the National Cooperative Highway Research Program (*NCHRP Report 350)* Test level 3-11. For each simulation, the vehicle impacted the critical impact point (CIP) at 25 degrees and 100 km/hr (62 mph). Finite element simulations indicated a relatively severe impact event between the vehicle and the CMB system for all configurations considered. However, one alternate design showed better performance relative to the other designs. The current barrier design and the promising alternate design were then crash tested in accordance

with the (NCHRP) Report 350. Figure 2 shows final joint position (alternate design B) for both LS-DYNA simulation as well as crash test.

Computer simulations showed fairly good correlation with the full scale crash tests in terms of joint performance, vehicle dynamics and barrier lateral movement and thus reduce the total cost of obtaining relative design performance by eliminating three full-scale crash tests.

Figure 1 Washington State Precast Concrete Barrier.

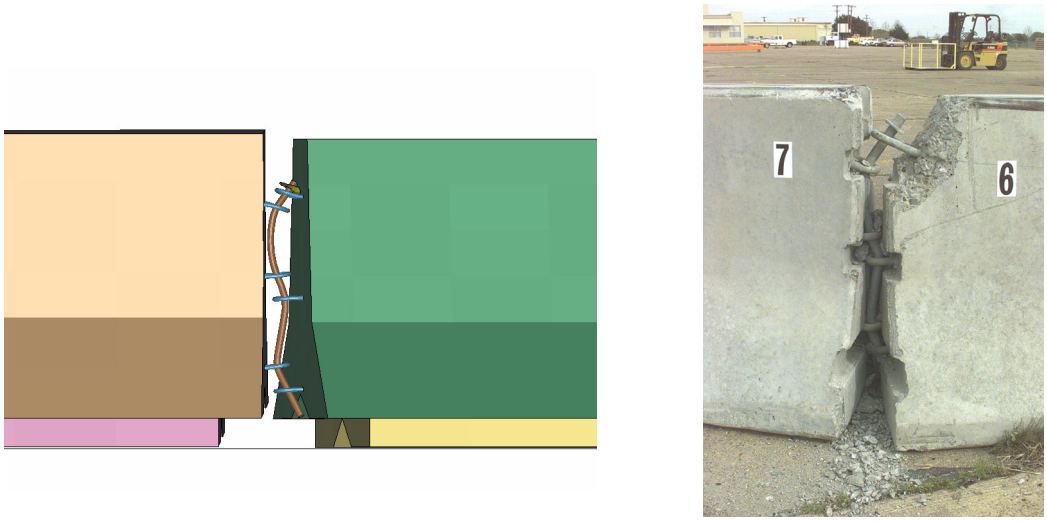

Figure 2 Joint Deformation (LS-DYNA and Crash Test).