Appendix XXV

Superstructure Cracking Analysis for the Steel Girder Bridges

f_c' of the slab for the West Bound and East Bound bridges = 4000 psi [Brown, 1993]

The cracking stress of the slab:

$$f_r = 7.5\sqrt{f_c'} = 7.5\sqrt{4000} = 474\,psi = 0.474\,ksi$$

After applying the 0.262-k/in and 0.327-k/in uniformly distributed loads, which were respectively the equivalent earthquake forces for the West Bound and East Bound bridges obtained using the uniform load method from section 4.15.1, along the superstructure, the maximum stress in the superstructure was calculated:

$$\sigma_a = \frac{M_a y}{I_{yy}}$$

σ_a = maximum stress in the superstructure

M_a = maximum moment in the superstructure

y = distance from the y-y axis to the most extreme point of the superstructure (edges of the slab)

I_{yy} = Moment of inertia of the superstructure about the y-y axis

West Bound:

$$\sigma_a = \frac{(91{,}700k - in)(264in.)}{2.56\times10^7\,in^4} = 0.946ksi$$

East Bound:

$$\sigma_a = \frac{(119{,}000k - in)(338in.)}{5.05\times10^7\,in^4} = 0.798ksi$$

$\sigma_a > f_r$, thus the superstructures (slabs) for both bridges were cracked during the maximum considered earthquake.