Traffic Actions for the Design of Roadway Bridges: A Comparison of International Codes

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1. Summary

Highway Bridge Design Codes and Loads from AASHTO LRFD, EUROCODE and Egyptian Codes are considered. Comparisons of action effects due to Traffic Actions (Live Loads) only, and Traffic actions combined with Permanent actions (Dead Loads) are carried out. Load combinations for ULS & SLS are considered. It is noted that comparing Traffic actions alone, a large difference is observed between codes (about 40%). When combined with Permanent actions (assuming concrete bridges), this difference reduces considerably to about 13%. Comparison of Live Load models in the Codes is not sufficient to give a full comparison of Code requirements. Hence, a brief comparison of resistance of R.C. sections in flexure and axial forces at ULS is also presented.

The parameters considered are summarized as follows: Bridges spans of 30m, 60m, 90m and 120m. Bridge width considered for the comparative study are: 11.0m, 19.8m, 27.1m, equivalent approximately to 2 Lanes, 4 Lanes and 6 Lanes bridges, respectively. Comparison are considered for traffic actions (live loads) and traffic actions combined with permanent loads (dead loads), using the Load Combinations relevant for each Code. The bridge structural systems are assumed –for the sake of this comparative study only, and in order to provide a common basis for the comparison of the loads and load combinations- to be concrete simple span box girders. For each set of parameters, the equivalent uniform distributed load (EUDL) is compared. Conclusions and recommendations useful to the code developers, and bridge designers are given.

2. Main Conclusions

For the cases considered in this paper, some conclusions are given:

1. Concerning traffic actions on bridges, large differences are observed between actions intensities given in the codes considering unfactored traffic actions (Fig. 2a). Smaller difference is observed when considering factored traffic loads (Fig. 2b).
2. When traffic actions are combined with permanent actions, the difference is still observed. However, it decreases, especially at ULS (Fig. 2d).
3. Comparing Resistance of RC sections at ULS, larger differences are observed for axial capacity of RC short columns, than flexural capacity of RC beams, for the cases considered.

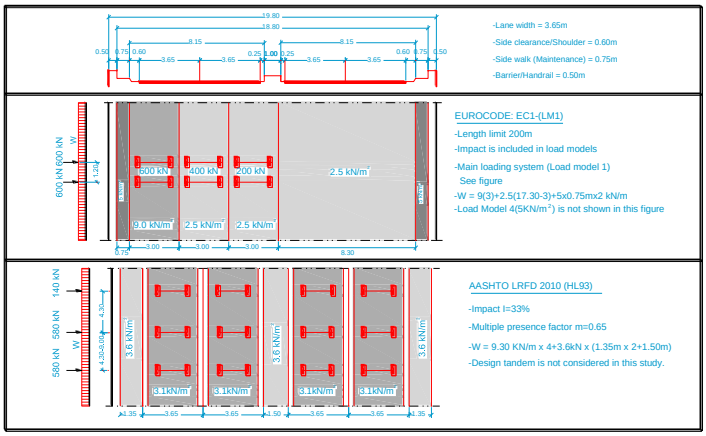

Fig. 1: Traffic Actions (Live Loads) Applied to 4 Lane Bridges

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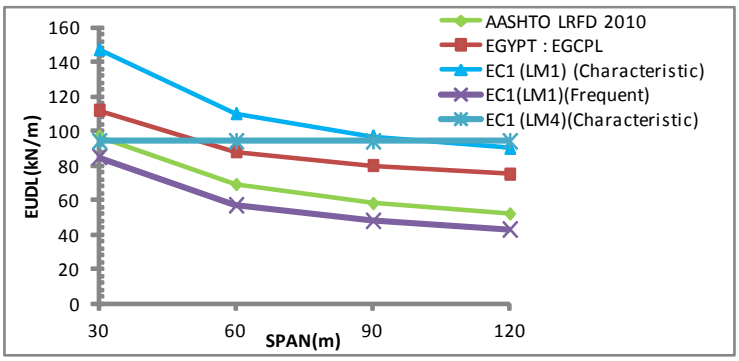
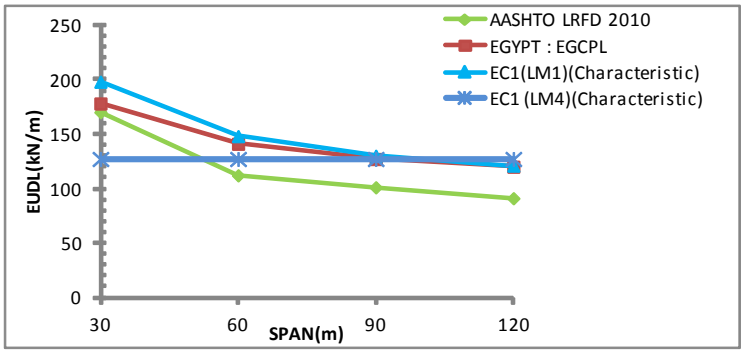
Fig. 2a: (L.L.+Impact) unfactored



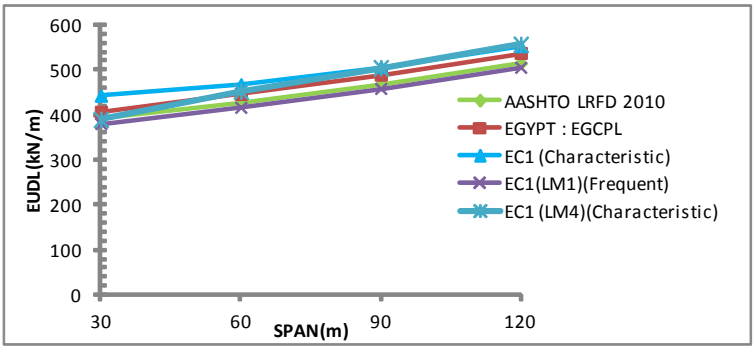
Rel.load w.r.t.(EC1)		
Code	Span (m)	
	30	90
AASHTO	0.66	0.60
EGCPL	0.76	0.82
EC1(Freq)	0.58	0.49
EC1(Ch)	1.00	1.00

Fig. 2b: (L.L.+Impact) factored for ULS:



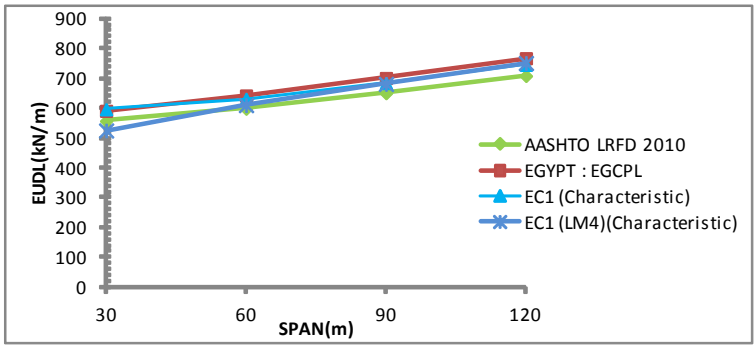
Rel.load w.r.t.(EC1)		
Code	Span (m)	
	30	90
AASHTO	0.86	0.78
EGCPL	0.90	0.98
EC1	1.00	1.00

Fig. 2c: (L.L.+Impact + D.L.+S.D.L.) factored for SLS:



Rel.load w.r.t.(EC1)		
Code	Span (m)	
	30	90
AASHTO	0.89	0.92
EGCPL	0.92	0.97
EC1(Freq)	0.86	0.91
EC1(Ch)	1.00	1.00

Fig. 2d: (L.L.+Impact + D.L.+S.D.L.) factored for ULS:



Rel.load w.r.t.(EC1)		
Code	Span (m)	
	30	90
AASHTO	0.93	0.95
EGCPL	0.99	1.02
EC1	1.00	1.00

Notes:1)EUDL:Equivalent Unif. Dist. Load,gives same max. moment as in simply supported bridge
2) Fig.2a,b: Traffic Actions only (LL,IM) --- Fig.2c,d: combined with Permanent Actions (DL,SDL)
3) DL Intesity:Assume Conc.Br., B=19.8m, t_{av}.=0.512,0.64,0.745,and 0.85m for spans 30,60,90,120m

Fig. 2: Comparison of Bending Moment for Traffic Actions (Live Loads) on 4 Lane Bridges