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Fatigue Truck Modification Factor for Design Truck (CL-625)

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Abstract : Design trucks in standard codes are selected based on the amount of damage they cause on structures-specifically bridges- and roads to represent the real traffic loads. Some limited numbers of trucks are run on a bridge one at a time and the damage on the bridge is recorded for each truck. One design track is also run on the same bridge “n” times -“n” is the number of trucks used previously- to calculate the damage of the design truck on the same bridge. To make these damages equal a reduction factor is needed for that specific design truck in the codes. As the limited number of trucks cannot be the exact representative of real traffic through the life of the structure, these reduction factors are not accurately calculated and they should be modified accordingly. Started on July 2004, the vehicle load data were collected in six weigh in motion (WIM) sites owned by Alberta Transportation for eight consecutive years. This database includes more than 200 million trucks. Having these data gives the opportunity to compare the effect of any standard fatigue trucks weigh and the real traffic load on the fatigue life of the bridges which leads to a modification for the fatigue truck factor in the code. To calculate the damage for each truck, the truck is run on the bridge, moment history of the detail under study is recorded, stress range cycles are counted, and then damage is calculated using available S-N curves. A 2000 lines FORTRAN code has been developed to perform the analysis and calculate the damages of the trucks in the database for all eight fatigue categories according to Canadian Institute of Steel Construction (CSA S-16). Stress cycles are counted using rain flow counting method. The modification factors for design truck (CL-625) are calculated for two different bridge configurations and ten span lengths varying from 1 m to 200 m. The two considered bridge configurations are single-span bridge and four span bridge. This was found to be sufficient and representative for a simply supported span, positive moment in end spans of bridges with two or more spans, positive moment in interior spans of three or more spans, and the negative moment at an interior support of multi-span bridges. The moment history of the mid span is recorded for single-span bridge and, exterior positive moment, interior positive moment, and support negative moment are recorded for four span bridge. The influence lines are expressed by a polynomial expression obtained from a regression analysis of the influence lines obtained from SAP2000. It is found that for design truck (CL-625) fatigue truck factor is varying from 0.35 to 0.55 depending on span lengths and bridge configuration. The detail results will be presented in the upcoming papers. This code can be used for any design trucks available in standard codes.

Keywords : bridge, fatigue, fatigue design truck, rain flow analysis, FORTRAN
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