The HL-93 Notional Live Load Model: What Nature of Truck Does It Represent

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In the Summer 2009 issue of *ASPIRE,*™ Part 1 of the discussion of the HL-93 notional live load model discussed the reason for developing the new model and compared HL-93 with the HS20-44 live load model of the *AASHTO Standard Specifications for Highway Bridges*. In Part 2, the nature of the truck it represents is defined.

The HL-93 notional live-load model, in which HL stands for "highway load" and 93 designates the year of its development of the *AASHTO LRFD Bridge Design Specifications* is the superposition of a vehicle and a lane load. The vehicle is either the traditional HS20-44 truck, now termed the design truck, or a design tandem consisting of two 25-kip axles 4 ft apart, similar to the traditional interstate or alternative military load; whichever produces the greater force effect. The design lane load is the traditional HS20-44 lane load, but without the supplementary concentrated loads associated with it. Thus, traditional load components are combined to produce the HL-93 load.

For long-span bridges, the *design lane* load becomes the predominant load component with the vehicle becoming more and more insignificant with increasing span lengths. For short- and medium-length spans, the design tandem or design truck loads are the predominant load components with the design lane serving to amplify the vehicle loads to loads of greater magnitude. Thus, for these span lengths, the force effects of the vehicles, which have a gross vehicle weight less than the legal loads, are magnified to super-legal load levels for design. Therefore, highway bridges are implicitly designed for loads above the legal limits without explicitly specifying individual super-legal vehicle loads in the specifications.

The three components of the HL-93 notional live load model—the design tandem, the design truck, and the design lane—can be used to define short-, medium- and long-span bridges. Bridges for which the design tandem is the predominant load component can be thought of as short-span bridges; those for which the design truck is predominant, as medium-span bridges; and those for which the design lane is predominant as long-span bridges.

To understand the magnitudes of the force effects of the HL-93 notional live-load model, an explanation of its origins is useful. Originally, a live-load model similar to that of the original *Ontario Highway Bridge Design Code* was envisioned for the *LRFD Specifications*. As such, a single 55½-ft-long, 57-ton design truck (without any coincident lane load) was developed to produce the desirable uniform bias across all span lengths, as discussed in the previous issue of *ASPIRE*. This design truck was to be termed the HTL-57 (HTL stands for "highway truck load" and 57 designates 57 tons gross vehicle weight). A schematic drawing of the HTL-57 design truck that was proposed is shown below in Fig. 1.

The specification writers realized the potential political ramifications of specifying a super-legal design load, the HTL-57 design truck, in the *LRFD Specifications*. They decided instead to use the superposition of sub-legal loads, the HL-93 notional live-load model, to produce super-legal load effects. The moments and shears due to the HL-93 notional live-load model and the HTL-57 design truck are comparable for all span lengths. Thus, the moments and shears due to the superposition of the load components of the HL-93 notional live-load model are those of a relatively long, 114-kip, 6-axle truck.

Figure 1 – The HTL-57 Design Truck.