FOREST ENGINEERING RESEARCH INSTITUTE OF CANADA
Western Division

FERIC

INSTITUT CANADIEN DE RECHERCHES EN GÉNIE FORESTIER
Division de l'ouest

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ROLLOVER STABILITY OF LOG-HAULING VEHICLES

BACKGROUND

The Western Division of the Forest Engineering Research Institute of Canada (FERIC), in conjunction with the National Research Council's (NRC) Vehicle Dynamics Laboratory, has recently completed a study of the rollover stability of log trucks (El-Gindy and Woodrooffe 1990). This project, partially funded by Transport Canada, was specific to the on-highway log-hauling vehicle combinations that are commonly used by the forest industry in British Columbia and Alberta (i.e. those vehicles with variable-length drawbars between the tractor and trailer, commonly referred to as a compensating reach). The rollover stability portion of the analysis was conducted by NRC through computer modelling.

Typically, the log-hauling vehicles that FERIC studied have a high centre of mass (centre of gravity) which contributes to a low rollover threshold. Rollover threshold is defined as the maximum severity of steady turn that a vehicle can tolerate without rolling over, and is expressed as a measure of lateral acceleration (in units of g's) beyond which overturn occurs.

Two vehicle parameters that present opportunities for improving this condition were identified during the research. They are: increased track width of axles, and minimal bunk lash (or free play) at the outboard bolster-mounted supports.

INCREASED TRACK WIDTH

The research found that significant improvements in rollover stability of log-hauling vehicles can be obtained by increasing the track width, and by increasing overall width across the tires. Historically, axle manufacturers have built their dual-tired assemblies for the Class 8 truck market with an overall dimension (outside of left tire to outside of right tire) of 2.4 m (8 ft). Wider-tracking axle products with a dimension of 2.6 m (8.5 ft) have been available for the non-driven (i.e. trailer axles) application for some time, and, more recently, wide-track drive axles have become available. The full stability benefit of the increased axle width, however, is only realized with a similar increase in the spacing between the attachment points of the suspension on the axle. Figure 1 illustrates the comparison of the rollover stability of

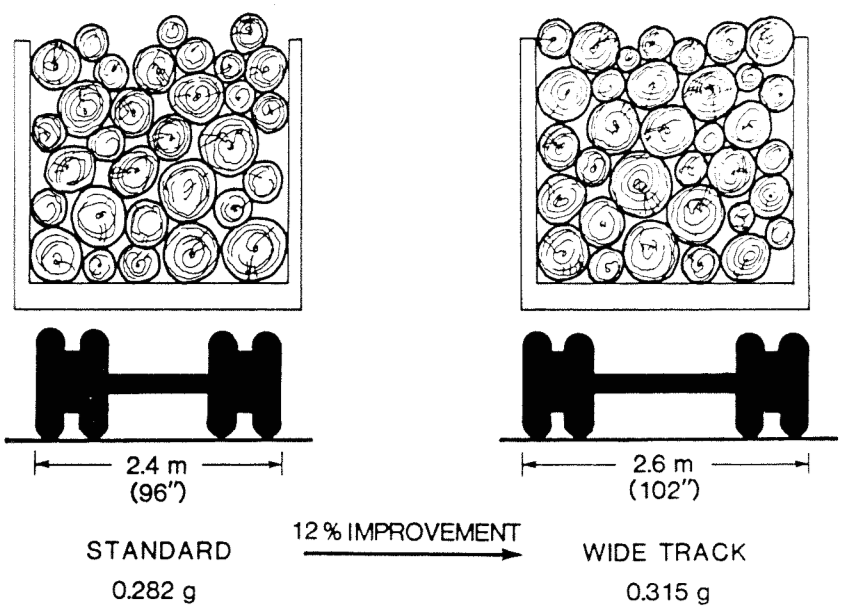

Figure 1. Rollover threshold improvement with wide-track drive and trailer axles.

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standard and wide-tracked drive axles on a typical 5-axle pole trailer combination operating within the parameters of the British Columbia highway regulations. A 12% improvement in rollover stability is achieved. This magnitude of improvement is also valid for the 6- and 7-axle log-hauling combinations.

MINIMAL BUNK LASH

Another significant improvement in rollover stability can be achieved by minimizing, or eliminating, the bunk lash or free-play at the outboard (bolster) slipper supports (Figure 2 and 3). The cup and saucer assembly (bunk pivot bearing) generally allows for some freedom in the roll of the bunk which is, in turn, controlled by these slipper supports. Any free play at these supports will allow the bunk, and its log load, freedom to roll, thus reducing the rollover threshold. It is recognized that there is a need for the bunk to rotate by sliding atop these supports; however, it is recommended that these clearances be minimized or eliminated through the use of roller mechanisms. Figure 2 illustrates the significance with which this clearance can influence roll stability. If bunk lash is completely eliminated, the rollover threshold of the baseline vehicle is increased by 10%, and, as the lash is increased, the rollover threshold decreases rapidly.

RECOMMENDATIONS AND CONCLUSIONS

When operators are considering a new truck purchase, the increased axle track width and related suspension spacing should be explored for tractor units as well as trailers.

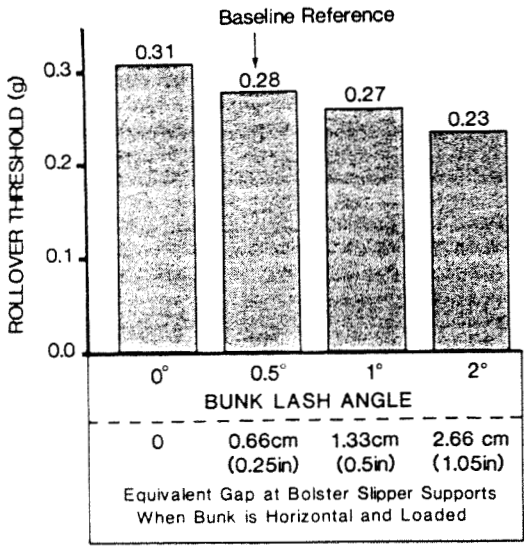

Figure 2. Influence of bunk lash on rollover threshold.

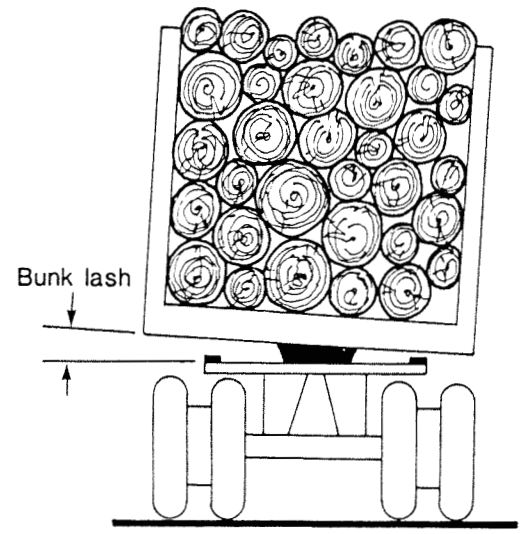

Figure 3. Minimizing bunk lash can improve rollover stability.

The reduction of bunk lash through good maintenance practices will improve the rollover threshold of log-hauling vehicles.

The combination of these two improvements has the potential to improve rollover stability by about 20%.

REFERENCE

El-Gindy, M.; Woodrooffe, J.H.F. 1990. *Study of Rollover Threshold and Directional Stability of Log Hauling Trucks*. National Research Council of Canada, Division of Mechanical Engineering, Vehicle Dynamics Laboratory, Ottawa. Technical Report NRCC No.31274. 113 p.

DISCLAIMER

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