World Academy of Science, Engineering and Technology
International Journal of Transport and Vehicle Engineering
Vol:9, No:07, 2015

Analysis of Wheel Lock up Effects on Skidding Distance for Heavy Vehicles

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Abstract : The road accidents involving heavy vehicles have been showing worrying trends and, year after year, have increased the concern and awareness levels on safety of roads and transportations especially in developing countries like Malaysia. Statistics of road crashes continue to show that there are many contributing factors on the capability of a heavy vehicle to stop on safe distance and ultimately prevent traffic crashes. However, changes in the road condition due to weather variations and the vehicle dynamic specifications such as loading conditions and speed are the main risk factors because they will affect a heavy vehicle's braking performance due to losing control and not being able to stop the vehicle, and in many cases will cause wheel lock up and accordingly skidding. Predicting heavy vehicle skidding distance is crucial for accident reconstruction and roadside safety engineers. Despite this, formal tools to study heavy vehicle skidding distance before stopping completely are totally limited, and most researchers have only considered braking distance in their studies. As a possible new tool, this work presents the iterative use of vehicle dynamic simulations to study heavy vehicle-roadway interaction in order to predict wheel lock up effects on skidding distance and safety. This research addresses the influence of the vehicle and road conditions on skidding distance after wheel lock up and presents a precise analysis of skidding phenomenon. The vehicle speed, vehicle loading condition and road friction parameters were all varied in a simulation-based analysis. In order to simulate the wheel lock up situation, a heavy vehicle model was constructed and simulated using multibody vehicle dynamics simulation software, and careful analysis was made on the conditions which caused the skidding distance to increase or decrease through a method using to predict skidding distance as part of braking distance. By applying many simulations, the results were quite revealing relation between the heavy vehicles loading condition, various sets of speed and road coefficient of friction and their interaction effect on the skidding distance. A number of results are presented which illustrate how the heavy vehicle overloading can seriously affect the skidding distance. Moreover, the results of simulation give the skid mark length, which is a necessary input data during accident reconstruction involving emergency braking.

Keywords : accident reconstruction, Braking, heavy vehicle, skidding distance, skid mark, wheel lock up
Conference Title : ICTTE 2015 : International Conference on Traffic and Transportation Engineering
Conference Location : Istanbul, Türkiye
Conference Dates : July 29-30, 2015