



D9 Limit Performance and Controllability Testing of Vehicles Towing Utility Trailers

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The goal of this presentation is to demonstrate testing procedures for vehicles towing utility trailers and the resulting data from such tests.

This presentation will impact the forensic science community by making known the available standardized test procedures and providing data demonstrating how towing utility trailers limits vehicle performance.

An investigation was conducted to determine how the weight ratio of the tow vehicle to the trailer being towed influences performance.

Two tow vehicles were tested: a 2005 Honda[®] Pilot[®], weighing 5,176 lbs. and a 14-foot U-Haul[®] Ford[®] F450, weighing 8,559 lbs.

Two trailers were tested: a 6'x12' utility trailer, weighing 4,008 lbs. and a 5'x8' utility trailer, weighing 2,700 lbs.

Testing instrumentation included a steering machine, cameras, accelerometers, and angle rate sensors. The testing included the following test procedures: (1) braking in a turn, consisting of a turn of either 90° on the steering wheel or 180° on the steering wheel. The speed was increased for each test until a physical limitation, such as jackknifing, occurred; and, (2) sine plus dwell involved a reverse steer of magnitude 180° (similar to a sine wave) with a dwell of one second on the second or corrective steer. The speed was increased for each test until a limit, such as jackknifing, occurred.

The conclusions include: (1) for the 90° steer and braking in a turn, loss of control in the form of extreme jackknifing was experienced at 45mph for the Honda[®] pulling the 6x12 trailer. Jackknifing was not experienced at that speed with the 5x8 trailer or with either trailer towed by the Ford[®] truck; and, (2) for the 180° steer and braking in a turn, loss of control in the form of extreme jackknifing was experienced at only 25mph for the Honda[®] pulling the 6'x12' trailer and was not experienced with the smaller 5'x8' trailer or the Ford[®] truck with either trailer.

Similarly, the Honda[®] pulling the 6'x12' trailer experienced jackknifing at 35mph and this was not experienced with the smaller 5x8 trailer or the Ford[®] truck with either trailer.

In conclusion, vehicles towing trailers in which the vehicle/trailer-weight ratio is close to unity, such as the Honda[®] towing the 6'x12' trailer, are more likely to lose control than vehicles towing trailers in which the vehicle/trailer-weight ratio is appreciably greater than unity. This presentation benefits the forensic science community by offering a methodology for standardized stability testing for vehicles towing trailers and provides preliminary data detailing how the vehicle/trailer-weight ratio is related to stability in highway-relevant driving activities.

Utility Trailer Towing, Limit Handling, Vehicle Testing