



C2 Tractor Trailer Lane Encroachment Estimation

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Attendees will learn a method of determining tractor trailer off-tracking and lane encroachment in a small and variable radius curve of high super elevation when the crash combination is not available for site trials. This presentation will demonstrate an alternative method of solving similar problems to having to make detailed location surveys and procuring and learning expensive computer programs.

A tractor trailer descended Horsepen Mountain on Highway 52 in Mingo County, West Virginia, after dark on a rainy evening. This section of highway is composed of connected very small radius curves that cause standard tractor trailer combinations to offtrack so severely that the vehicles encroach into the oncoming lane by several feet. The trailer of such a combination struck an oncoming ambulance making an emergency run and pushed it against the rock cliff on the inside of the curve.

The dimensions of the crash tractor trailer were not initially available to the authors, so a simulation of its line of travel through the curve by driving a combination of similar dimensions through the crash site twice was developed; once with the rear moveable double axles as far to the rear as possible and again with them as far forward as possible. This yielded the maximum and minimum possible offtracking and encroachment for this vehicle.

The trial runs were made while traffic was stopped and during day-light hours in clear weather. The driver was instructed to steer as far to his right as possible to minimize encroachment and to comply with testimony of the crash trucker. It also gave the crash trucker the benefit of doubt in several ways; including that the driver during the trials could drive more slowly and see the outside guardrail better than the driver at the time of the crash. This allowed him to travel closer to the guardrail than the crash driver. The crash trucker testified a speed of about ten miles per hour at the time of impact and the trials were run at a fast walking speed.

During the trials, assistants spray painted the points of contact between the inside tires of the first and last axles of the combination and the surface of the highway. The resulting painted lines of travel were located by measurement. The amounts of maximum offtracking and encroachment closely agreed with and verified calculations using the dimensions of the trials combination and the radius of the curve at the point of impact.

The first run, with the rear axles rearmost, revealed that there was enough room remaining for the ambulance to have been missed given its location at impact claimed by the plaintiffs and the trucker having driven as far to the right as possible. The former was several feet inside the inside fog line and the latter had his right front tire on the shoulder between the outside edge of the pavement and the guardrail. This indicated that one or both vehicles were not as far to the right as possible.

During the second run the ambulance was placed at the location its driver claimed at impact. Its left rear corner was almost two feet inside the first run's closest point of travel of the trailer. During the second run the trailer missed the ambulance by several additional feet.

Following these trials, a true exemplar of the crash tractor trailer was made available for inspection. This combination was found to be slightly longer than the one used in the trial runs, meaning that its offtracking and encroachment would have exceeded that of the simulations. New calculations were performed refining the expected maximum offtracking and encroachment for the true exemplar combination.

Impact occurred before the combination had achieved maximum off-tracking, so the actual amount of offtracking and encroachment at the point of impact was determined by adjusting the maximum calculated offtracking of the true exemplar by a factor determined by the amount of offtracking developed during the trial runs compared to the maximum offtracking with that combination. This yielded that the crash tractor trailer would have off-tracked and encroached nearly another foot into the oncoming lane more than did the simulation combination. However, there remained almost a foot of clearance for the vehicles to safely pass had both been as far to their right as possible.

A major advantage of re-enacting the travel of the tractor-trailer is that it automatically took into account all the idiosyncrasies of the curve such as its varying radii and widths and high degrees of super elevation; factors not accounted for in the standard equations for offtracking and would otherwise require extensive surveying and calculation.

At trial defense admitted fault.

Offtracking, Encroachment, Tractor-Trailer