



Oregon

Theodore R. Kulongoski, Governor

Department of Transportation

Transportation Building
Roadway Engineering Services,
355 Capitol St. NE, Room 222
Salem, OR 97301-3871
Telephone: (503) 986-3714
Fax: (503) 986-3749

File Code:

August 30, 2005

To: Thomas J. Lauer
State Roadway Engineer

From: Daniel MacDonald
Sr. Roadside Design Engineer

Subject: Why Cars Under-ride Cable Barrier

In July 2005 you asked me to investigate why vehicles are starting to under-ride the low tension cable rail that exists in the median of I-5 between Keizer and Wilsonville. What prompted the inquest was two reported under-rides in four months in early 2005. We were assuming at the time that under-riding was a new phenomenon occurring with the cable barrier, but further investigation has exposed information which proves interesting.

We are not alone. In speaking with engineers from Washington DOT, they have experienced 6 fatal cable rail breaches in 6 years. They claim that ten percent of the hits on their cable rail result in breaches. Admittedly, they don't see a large occurrence of under-rides, but the breaching is demanding attention. North Carolina reports that they have experienced "dozens" of under-rides, eight of which were fatal. This looks bad at first, but they have 600 miles of low tension cable rail, we have 21 miles with one fatal. The fatal rate with cable under-rides in North Carolina is within their tolerable limits.

The Research Group from ODOT made a report in July 1998 outlining the performance of the nine miles of new cable rail installed in December 1996. In the 14 months of the reporting period there were 53 known hits. Half of those resulted in the vehicle leaving the scene before emergency vehicles responded, so obviously damage to the vehicle was minor. Police reports indicate one vehicle in the 14-month reporting period under-ride the cable. Three vehicles went "through" the cable, (one of them was a semi, the driver having suffered a seizure). Two vehicles rolled over after impacting the cable. The rest of the reported impacts were redirects or vehicle captures.

A subsequent follow-up report from Research made in February 2000 indicates that after 150 reported hits there were four under-ride/roll events per year. Unfortunately, there is no distinction made between under-ride and roll event. If the data in the paragraph immediately above is useable there should be a 1:2 ratio of under-rides to roll events. If we extrapolated that ratio (say one under-ride a year) to the present we should have eight under-rides. I can account for only four, but I don't have data for the years 2000 to present. District 3 Assistant DM recalls a Corvette under-ride some time since 2000, but the information is sketchy.

The stand-out fact in the 2000 report is that approximately half of the hits on the cable were determined to be “Potential Crossovers” which is a very heartening statement. That means that the cable is doing a remarkable job of negating a lot of potential head-on collisions.

In reviewing the four known under-rides, three of them can be attributed to a combination of two factors. First, the three vehicles were all low profile cars with sloped front ends and fairly low front bumpers. The bottom cable of the array is situated, by design, 21 inches above ground line. A flat-profiled vehicle can easily slip under the cables as it approaches the cable. The three cars, a Corvette, a Honda Accord, and a Mazda Protégé all have a front bumper at or below 21 inches in addition to the sloped front end shape. The fourth car, a “red 4-door Chrysler”, year and body style unknown, probably has a square front end with a higher bumper. The second factor could explain the Chrysler under-ride. At two of the under-ride sites, the Honda and the Mazda, with accidents occurring in the wet months of January and May, there is photographic evidence of plowing of the median soil more than an inch deep. The plowing could aid in dropping the front of the car to a height where the cable could ride over the hood. The Chrysler accident occurred in February 1997.

The location of the cable rail, on centerline, in the bottom of the ditch, lies within acceptable limits according to FHWA. The ditch slopes are flat and don’t appear to contribute to suspension compression which would enable taller vehicles to slip under the bottom cable if the slopes were steeper and the ditch bottom more defined.

Coral Construction has kept records of all hits on the low tension cable rail on I-5. To date there have been approximately 320 impacts with one fatality, an under-ride. The other three known under-rides resulted in the vehicle stopping in the median before crossing over into the opposing lanes of traffic. The one fatality happened to involve speed as an extra factor, in that an eyewitness claims the Honda was racing another car. The speed is probably what took the Honda under the cable and into the opposing lanes, thereby causing the fatality. There would likely be no fatal statistic at this time if the cars had not been racing.

I believe that, with all of the evidence at hand, and without a spate of future under-rides, we have a good system that undoubtedly has saved many lives since it was installed. I feel that under-rides could be a potential problem but current evidence does not indicate a pattern out of the ordinary. We have better statistics than the two other states I queried and I see no reason why our system would become worse. I would like to collect as much data as I can obtain, whether through Coral or through the State Police of all of the accidents on cable rail on I-5 in which reports were made, so we can stay informed rather than make guesses.

C: