Highway Safety: Quarterly Update

Cable Median Barriers Performance: Annual Update

This report presents an update on the performance of cable median barriers and also compares the performance of cable, beam guardrail and concrete barrier systems in state highway medians. The information presented here provides an update on the findings presented in the December 31, 2005 *Gray Notebook* (p. 52). Since the last report was published, WSDOT has installed 63 additional miles of cable barrier and analyzed the collision history for 2005.

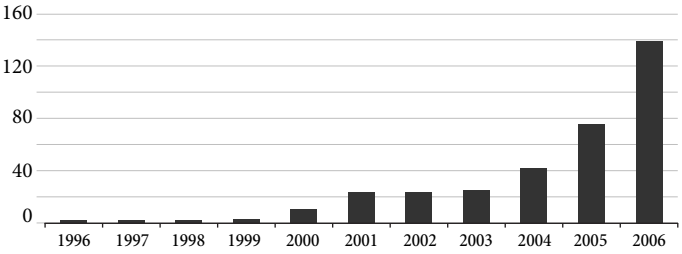
WSDOT Installed 138 Miles of Cable Median Barrier

By the end of 2006, WSDOT placed a total of 138 miles of cable barrier in highway medians. Of the 138 miles, a little more than 35 miles have been in place over six months. This period is long enough to evaluate before and after collision history and cable median barrier performance. Sections that were in place fewer than six months are not included in this study.

Cable Median Barriers Reduce the Frequency and Severity of Median Cross-Over Collisions

The primary purpose of cable median barrier is to reduce the frequency and severity of median cross-over collisions. A cross-over collisions occurs when an out-of-control vehicle enters the median and travels into the opposite-direction traffic lanes. For the 35 miles of cable median barrier evaluated, the frequency of median cross over collisions dropped from 13.3 per year to 4.3 per year after cable barrier was installed in the median. Prior to cable barrier installation, fatal injury median crossover collisions were occurring at a rate of 1.2 per year and disabling injury collisions were also occurring at a rate of 1.2 per year. After installation of cable barrier, there were no fatal collisions in these locations, and disabling median crossover collisions occurred at a rate of 0.5 per year.

Cable Median Barrier
Washington State Highways 1996-2006
Total number of miles by year



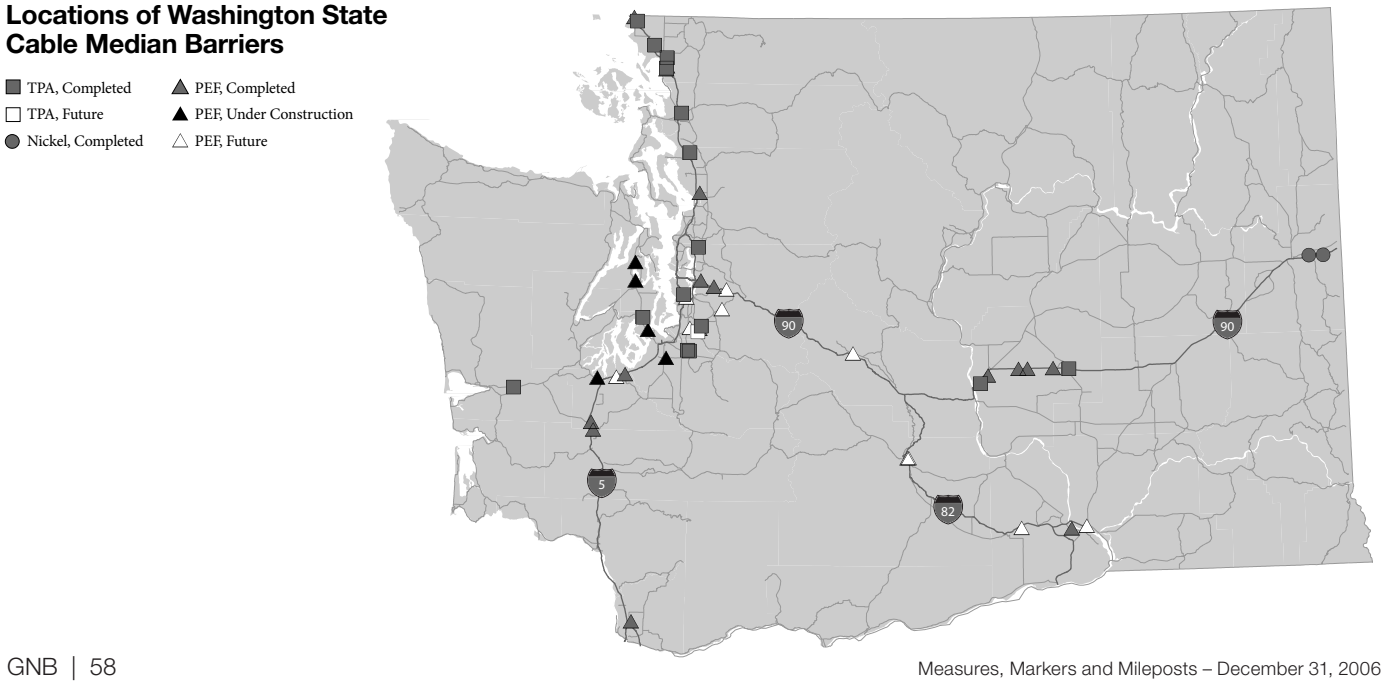
Data Source: WSDOT Design Office

Annual Median Crossover Collisions, Before & After Cable Barrier Placement
For 35 miles of Installed Cable Median Barrier in Washington State by 1995

	Before Cable Barrier *1993 to Date of Installation*	After Cable Barrier *Date of Installation to 2005*
All Cross Median Collisions	13.3	4.3
Fatal Cross Median Collisions	1.2	0.0
Disabling Injury Cross Median Collisions	1.2	0.5

Data Source: WSDOT Design Office
Note: This data does not include the nine miles of cable median barrier on I-5 in Marysville (see p. 60)

Locations of Washington State Cable Median Barriers



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Cable Median Barriers Reduce Societal Costs of Collisions

Installation of cable barriers actually increased the number of reportable collisions; the number of reportable collisions increased from 50.9 per year prior to cable barrier installation to 140.7 per year after. This consequence is expected, as the presence of the barrier increases the opportunity to strike an object within the median. Previously, some out-of-control vehicles crossing the empty median would collide with other vehicles or fixed objects, while other vehicles would regain control before such an event occurred.

Although the frequency of these collisions has increased substantially, overall injuries sustained from these collisions has declined. Prior to cable barrier installation, the societal cost of median crossovers and collisions in the median was $6.9 million per year. After cable barrier installation, the societal cost of those collisions was reduced to $4.4 million per year.

96% of Vehicles that Hit the Cable Median Barrier Did Not Cross the Median

The table below illustrates the performance on cable median barriers along the 35 miles of highway evaluated. These findings are based on collisions in which the first object struck was a barrier and does not include occurrences in which a primary collision redirected the vehicle into the cable barrier. The circumstances of the primary collision have too much influence on injuries to provide reliable evaluation of injuries associated with barrier hits.

Cable Median Barriers Outperform Other Types of Barriers

Cable median barrier demonstrates a reduced potential for injuries compared to concrete median barrier and beam guardrail. This is most apparent in collisions involving a single vehicle. Although injuries are lower for cable barrier, the difference in injury frequency is not nearly as dramatic when multiple vehicles are involved. For all barrier types, the frequency of injuries increases dramatically when multiple vehicles are involved. The table bellow illustrates the number of collisions resulting in reported injuries or death as a percent of all collisions.

Performance of Different Types of Median Barriers: Percent of Collisions Reporting Injuries or Fatalities, 1999-2005

By Type of Collision and Type of Barrier

	Concrete Barrier	Beam Guardrail	Cable
Single Vehicle Collisions	38%	36%	15%
Multiple Vehicle Collisions	50%	52%	40%
All Collisions	41%	42%	18%

Note: This data does not include the nine miles of cable median barrier on I-5 in Marysville (see p. 60)

Although the percentages indicate that the advantages of cable barrier are not as significant with multi-vehicle collisions, cable still surpasses concrete barrier and beam guardrail. A deeper analysis of multi-vehicle collisions provides more insight: sometimes, single vehicles that hit any type of barrier are redirected back into traffic by the barrier system, causing a multi-vehicle collision. However, cable barriers create this situation less often then other barrier systems. Fifteen percent of all cable barrier collisions are multi-vehicle events, compared with 26% for concrete barrier and 35% for beam guardrail.

Cable Median Barrier Performance by Resulting Injury, 1999-2005

	Possible Injury	Evident Injury	Disabling Injury	Fatal	Total	No Injury	% of Total
Restrained[1], Redirected[2], or Contained in the Median[3]	17	12	3	0	223	191	96%
Cross Median[4]	1	2	2	0	10[5]	5	4%
Total	**18**	**14**	**5**	**0**	**233**	**196**	

Data Source: WSDOT Design Office

Note: This data does not include the nine miles of cable median barrier on I-5 in Marysville (see p. 60)

[1]Cables contained the vehicle, did not allow it to reach opposing traffic lane, and did not redirect into other vehicles or objects.

[2]Cables contained the vehicle but it disengaged from the barrier and struck another vehicle or object.

[3]Vehicle was contained within the median, but went under, over, or through the cables. This category includes 11 collisions in which vehicles overturned, rolling over the cable barrier.

[4]Vehicle traveled across the median, reaching the opposing traffic lane, regardless of whether it was contained by the cable or got through them.

[5]There is an additional crossover where cable barrier is the second object struck resulting in evident injury.

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WSDOT has Improved Cable Median Barriers in Marysville

As discussed in the December 31, 2005 *Gray Notebook*, the cable median barrier in the Marysville area has reduced the frequency of median cross over collisions, but hasn't changed the overall severity of these collisions, unlike installations elsewhere in the state. An engineering analysis of the cable barrier in the Marysville area revealed that the placement of the cable resulted in an increased potential for vehicles to pass under the bottom cable, and lift the cables over the top of the vehicle. As a vehicle's front tire passes through the low point in the median, the front suspension compresses, allowing the front of the vehicle to slide under cables placed immediately behind the low point in the median. For more information on this study, please see the December 31, 2005 *Gray Notebook*, pp. 52-53.

To address this issue, a second run of cable barrier was installed on the other side of the median in this area to intercept the vehicles before they reach the low point. Consequently, the nine miles of cable median installed in the Marysville area along I-5 will be presented separately and is excluded from the statewide evaluation of cable barrier performance. The outcome of these changes will be presented in a future *Gray Notebook* article when more data is available.

Motorcycles Striking Cable Median Barriers

Information on types of vehicles striking the barriers is available from 2002 forward. An analysis of collisions where cable barrier was the first or second object struck reveals that 97% of the vehicles striking cable barrier are passenger cars, pickups, and van sized vehicles. These same vehicle types account for 83% of the cross median collisions. There have been an increasing number of inquiries about the consequences of motorcyclists striking cable barriers. Through calendar year 2005 there was only one recorded incident of a motorcycle collision involving cable barrier. This incident was a result of a front tire blowout which left both the driver and the passenger with minor injuries. The driver lost control, and the motorcycle went down and slid into the cable barrier. The investigating officer's report is unclear as to whether either rider ever actually made contact with the barrier. Similarly, reports from other states which have installed cable barrier have not identified this as a problem area.

WSDOT will continue to track data on motorcycles striking cable median barriers and report that data in future editions of the *Gray Notebook*. The table below provides a breakdown of vehicle types for all cable barrier collisions within the 35 mile evaluation section occurring between Jan. 1, 2002 and Dec. 31, 2005.

Future Reporting on Cable Median Barriers

During 2005 and 2006, the number of miles of cable barrier increased significantly, presenting an opportunity for an expanded evaluation of installation sites in the future.

The next report will also contain a comparison of two types of cable median barriers, low tension and high tension, and also a discussion of how WSDOT maintains the cable median barriers.

A cable median barrier restrains a semi truck on I-5 at mile post 252.

Performance of Cable Median Barriers by Type of Vehicle, 2002-2005

	Passenger Cars	Pickups, Panel Trucks, Vans (under 10,000 lb)	Truck (Flatbed, van, etc.)	Truck Tractor & Semi-Trailer	Motorcycle	Total
Restrained[1], Redirected[2], or Contained in the Median[3]	126	83	2	2	1	214
Cross Median[4]	7	2	1	1	0	11
Total	133	85	3	3	1	225

Data Source: WSDOT Design Office
Note: This data does not include the 9.08 miles of cable median barrier on I-5 in Marysville (see p. 60)
[1]Cables contained the vehicle, did not allow it to reach opposing traffic lane, and did not redirect into other vehicles or objects.
[2]Cables contained the vehicle but it disengaged from the barrier and struck another vehicle or object.
[3]Vehicle was contained within the median, but went under, over, or through the cables.
[4]Vehicle traveled across the median, reaching the opposing traffic lane, regardless of whether it was contained by the cables or got through them.