

Washington State Cable Median Barrier

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AASHTO TIG

Background

- Cable Barriers have been used on the nations highways since the 1930's or before.



Background

- In the mid 1990's WSDOT began using cable barrier to address median crossovers



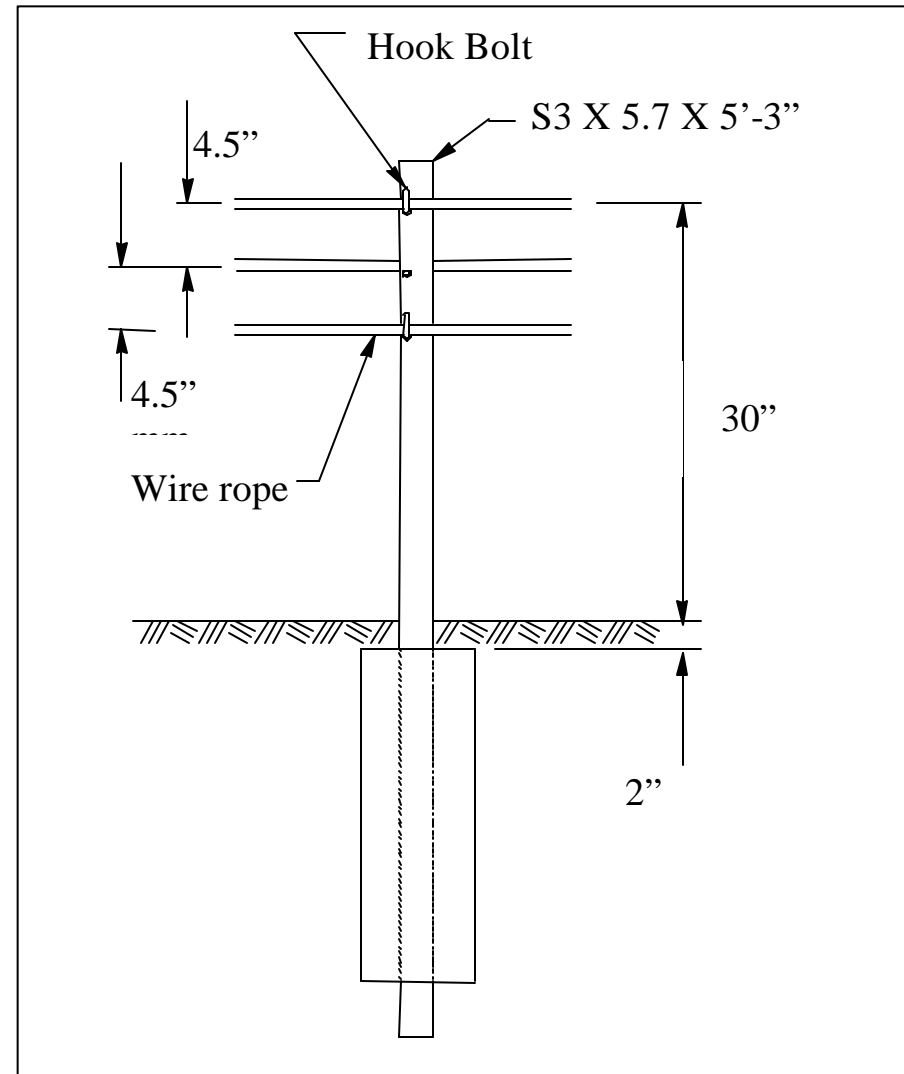
Background

- Cable median barrier evolved from the roadside barrier
- Median application identified in the 1989 Roadside Design Guide



Barrier Design

- Cable heights
 - Top – 30"
 - Middle – 25.5"
 - Bottom – 21"
- Middle cable of opposite side of posts



Barrier Design

- WSDOT uses a terminal design based on one tested by New York DOT



Barrier Design

- WSDOT uses a transition to W-Beam that was developed by South Dakota DOT



Crash Testing

- Cable median barrier has been crash tested in accordance with NCHRP 350, Test Level 3 criteria
- Testing was performed with impact on the side with only one cable



Washington State Experience

The research is based on data associated with 24.4 miles of cable median barrier on Interstate 5 (I-5)

- Installation Cost
- Maintenance Costs
- Maintenance Experiences
- Accident Experiences (before and after installation)

Initial Cost (Bid Prices)

Barrier Installation Costs--Barrier Only

Cable Median Barrier:	\$8.33/ft
W-beam Guardrail:	\$13.65/ft
Precast Concrete Barrier:	\$24.64/ft
Single Slope Concrete Barrier:	\$44.94/ft
Cast in Place Concrete Barrier:	\$79.36/ft

Maintenance Costs

- Data is based on 141 maintenance repairs

	Max.	Min.	Ave.
Number of posts hit:	32	1	6.7
Hours for repair:	70	1	9.4
Parts costs:	\$1,490	\$32	\$328
Total repair costs:	\$2,822	\$72	\$733

Maintenance Repair Cost/Mile/Year **\$2,570**



Maintenance Experiences

A survey of the maintenance staff involved with the maintenance of the barrier revealed the following:

- Crews initially believed rail required more effort and resisted change. However, after some experience, they showed support for additional installations.
- One crew estimated that 30% less time was required than W-beam guardrail.

Maintenance Experiences

A survey of the maintenance staff involved with the maintenance of the barrier revealed the following:

- Cable system requires additional parts to be stocked.
- The system requires additional training.
- No-one has ever been injured while repairing cable barrier

Accident Experience

Of the 141 documented maintenance repairs, 51% were matched to an accident report. This is consistent with previous research by Ray et al that found that 54% of impacts with a cable barrier were reported.

Accident Experience

To evaluate the before and after performance of the barrier, the following types of accidents were analyzed:

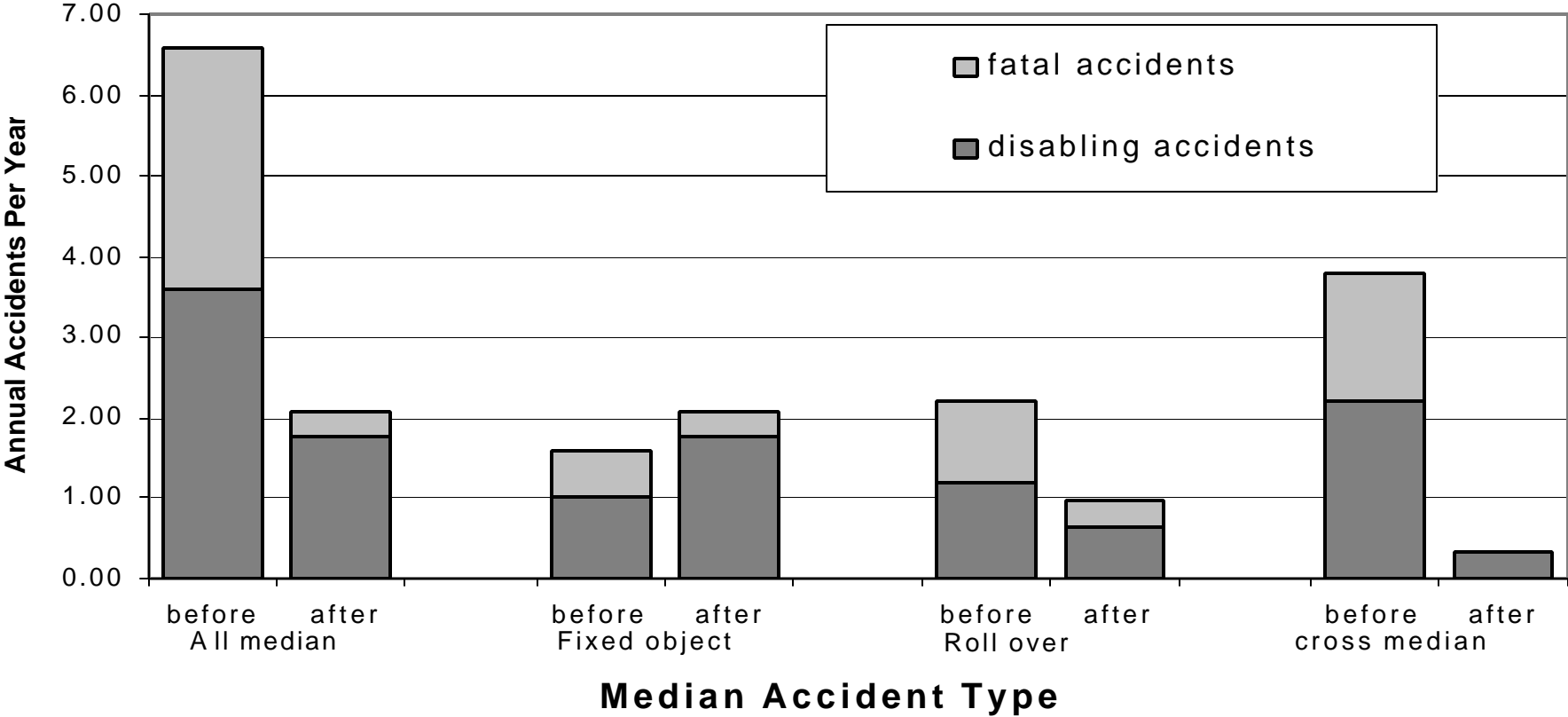
- All Median Related Accidents
- Median Fixed Object Accidents
- Cable Median Barrier Accidents (After only)
- Median Roll-Over Accidents
- Median Crossover Accidents

Accident Experience

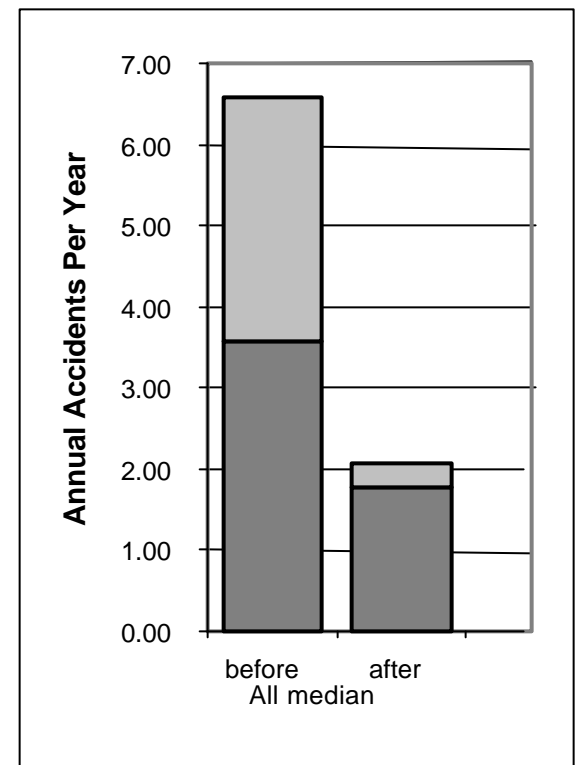
Median Accidents Before the Installation of Cable Barrier					
	annual accidents	accident rate (100 mvmt)*	annual fatal accidents	annual disabling accidents	annual societal costs (all severities, stated in millions)
all	49.00	6.50	3.00	3.60	\$13.58
fixed object	25.60	3.40	0.60	1.00	\$6.45
cable barrier	na	na	na	na	na
rollover	11.40	1.51	1.00	1.20	\$4.50
crossover	16.00	2.12	1.60	2.20	\$7.13
Median Accidents After the Installation of Cable Barrier					
	annual accidents	accident rate (100 mvmt)*	annual fatal accidents	annual disabling accidents	annual societal costs (all severities, stated in millions)
all	100.43	13.35	0.33	1.76	\$3.32
fixed object	91.71	12.17	0.33	1.76	\$2.48
cable barrier	58.56	4.05	0.33	0.88	\$3.44
rollover	9.40	1.25	0.33	0.65	\$1.71
crossover	3.83	0.51	0.00	0.33	\$0.18

Accident Experience

Comparison of Annual Accidents Before and After Cable Median Barrier Installation



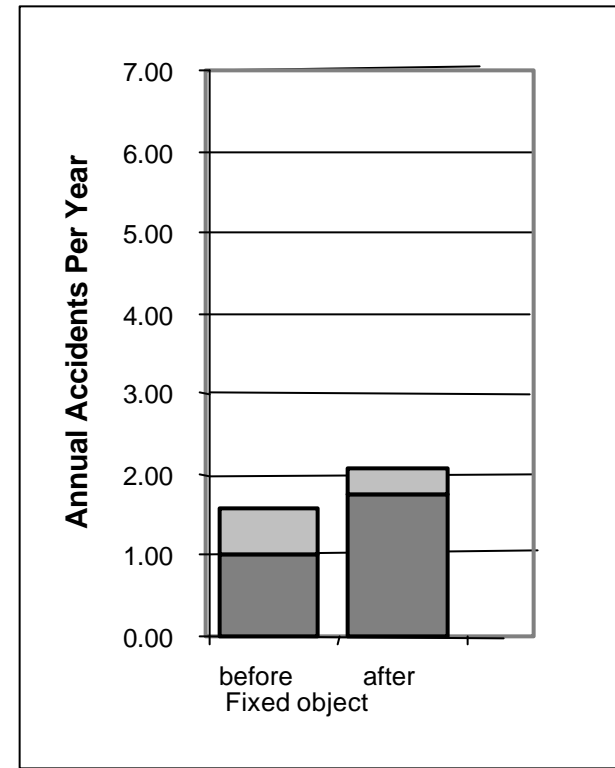
All Median Accidents



	Annual Accidents	Accident Rate (per 100 MVMT)	Fatal Accidents	Disabling Accidents
Before	49	6.5	3.0	3.6
After	100	13.4	0.3	1.8

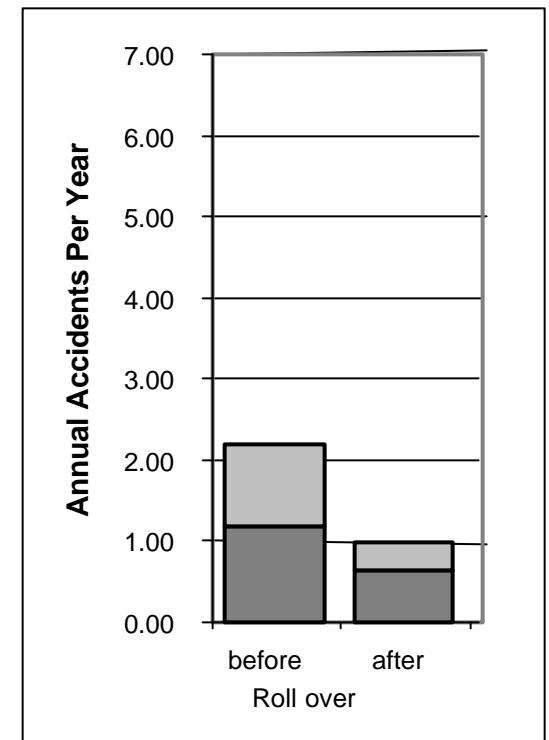
Fixed Object Accidents

*After Data includes 0.3 Fatal and 0.9
Disabling Accidents involving the Cable
barrier



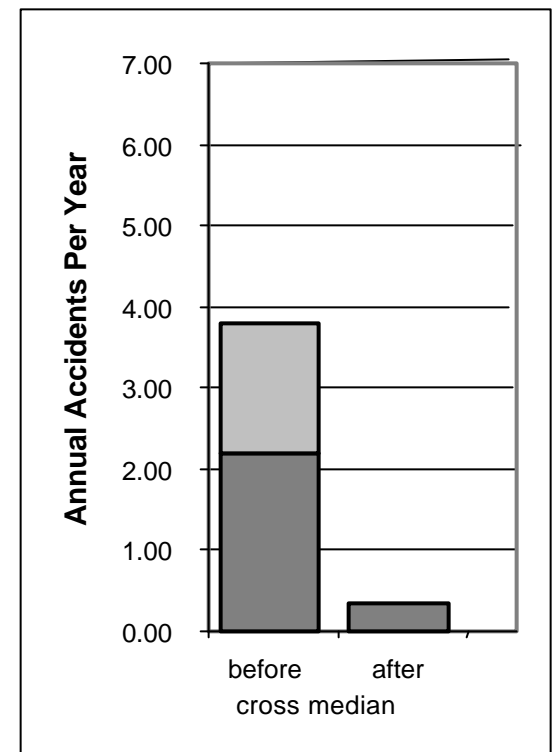
	Annual Accidents	Accident Rate (per 100 MVMT)	Fatal Accidents	Disabling Accidents
Before	25.6	3.4	0.6	1.0
After	91.7	12.2	0.3	1.8

Roll Over Accidents



	Annual Accidents	Accident Rate (per 100 MVMT)	Fatal Accidents	Disabling Accidents
Before	11.4	1.5	1.0	1.2
After	9.4	1.3	0.3	0.7

Cross Over Accidents



	Annual Accidents	Accident Rate (per 100 MVMT)	Fatal Accidents	Disabling Accidents
Before	16.0	2.1	1.6	2.2
After	3.8	0.5	0	0.3

Summary

- Average installation cost
\$44,000/mi.
- Average cost per repair
\$733
- Annual Maintenance repair cost per mile
\$2,570/yr.

Summary

- Total accidents increased significantly after barrier installation
- Severe accidents (fatal and disabling) decreased significantly.
- This societal benefit of cable median barrier was \$420,000 per mile annually.

Conclusions

- Based on WSDOT's In-service evaluation of cable barrier at locations having prior cross median accidents

Appears to be a cost effective solution to median crossover accidents.

Does not require excessive maintenance resources and limited concerns are reported by personnel with cable barrier experience

Installations to Date

- Total of 58 miles
 - 20 miles of High Tension
- Projects to install Approximately 50 miles by the end of 2005



High Tension



High Tension



High Tension Repair

- 18 hits
- Avg # posts – 5.4
- Avg Repair Cost - \$634

