FINAL REPORT

EVALUATION OF THE INTERNATIONAL BARRIER CORPORATION'S MARK VII MEDIAN BARRIER

B. H. Cottrell, Jr.
Senior Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

Virginia Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the
Virginia Department of Transportation and
the University of Virginia)

In Cooperation with the U.S. Department of Transportation
Federal Highway Administration

Charlottesville, Virginia

September 1992
VTRC 93-R1

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438

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/VA-93-R1		

4. Title and Subtitle	5. Report Date
Evaluation of the International Barrier Corporation's Mark VII Median Barrier	September 1992
	6. Performing Organization Code
7. Author(s) B. H. Cottrell, Jr.	8. Preforming Organization Report No. VTRC 93-R1
9. Performing Organization Name and Address Virginia Transportation Research Council Box 3817, University Station Charlottesville, Virginia 22903-0817	10. Work Unit No. (TRAIS) 11. Contract or Grant No. 2765-081
12. Sponsoring Agency Name and Address Virginia Department of Transportation 1401 E. Broad Street Richmond, Virginia 23219	13. Type of Report and Period Covered Final Report January 1989 – July 1992 14. Sponsoring Agency Code

15. Supplementary Notes

In cooperation with the U.S. Department of Transportation, Federal Highway Administration.

16. Abstract

The International Barrier Corporation's (IBC) Mark VII median barrier consists of a steel frame (10 ft long, 42 in high, and 44 in wide at its widest point) filled with sand and covered with a top plate. The barrier has the ability to absorb some of the impact energy of a collision, which should reduce the severity of the impact. An experimental section of the IBC median barrier (1.63 miles) was installed on Route 29 in Amherst County, Virginia, just north of the city of Lynchburg. The objective of this research was to evaluate the IBC median barrier from three perspectives: (1) lateral placement of vehicles traveling in the lane closest to the barrier, (2) reported accidents and impacts with the barrier, and (3) costs. To the extent possible, the performance of the IBC median barrier was compared with that of a nearby control section of concrete median barrier.

Results of the study showed that vehicles tend to travel a little farther from the IBC median barrier than from the concrete median barrier. Because only a limited number of reported accidents and impacts occurred, no conclusions were drawn concerning the safety performance of the IBC median barrier. No maintenance was performed on the barrier during the 2 1/2-year study period. The installation cost of the IBC median barrier was more than twice that of the concrete median barrier.

It was recommended that VDOT continue monitoring the IBC median barrier section to make further assessments of the barrier.

17. Key Words	18. Distribution Statement
median barrier, IBC Mark VII	No restrictions. This document is available to the public through NTIS, Springfield, VA 22161.

19. Security Clasif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	18	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

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Results of the study showed that vehicles tend to travel a little farther from the IBC median barrier than from the concrete median barrier. Because only a limited number of reported accidents and impacts occurred, no conclusions were drawn concerning the safety performance of the IBC median barrier. No maintenance was performed on the barrier during the 2 1/2-year study period. The installation cost of the IBC median barrier was more than twice that of the concrete median barrier.

It was recommended that VDOT continue monitoring the IBC median barrier section to make further assessments of the barrier.

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INTRODUCTION

The International Barrier Corporation's (IBC) Mark VII median barrier consists of 10-ft-long side panels of corrugated sheet steel 42 in high and spaced approximately 44 in apart it its widest point. These side panels are attached to each other with bulkheads and are joined end to end to form a continuous barrier. The steel frame is filled with sand and covered with a steel plate to produce a barrier weighing approximately 1,100 lb per linear foot. The barrier was designed to distort and move laterally to allow the impact energy of a collision to be absorbed and to redirect the vehicle. This energy absorption and redirection reduce the severity of the crash. More specifically, for a minor impact, the sheet metal panel sides deform locally and the sand is compressed, thereby attenuating some of the impact forces. For severe impacts, particularly with a large vehicle at a high angle, the barrier will move laterally, absorbing energy until the vehicle is redirected.

The Virginia Department of Transportation (VDOT) typically uses a concrete median barrier (CMB) when a median barrier is specified for a median width up to 18 ft.[1] Either CMB or double steel beam guardrail may be used for median widths of 18 to 24 ft.[1] The CMB is designed to allow a vehicle to hit it at a small impact angle, ride up the CMB and reduce vehicle speed and therefore the energy, and then redirect the vehicle into the travel lane in the same direction. The CMB is the most commonly used rigid traffic barrier because of its relatively low cost, generally effective performance with passenger cars, and maintenance-free characteristics.[2] A disadvantage of the nondeflecting CMB is that passenger vehicles may become partially airborne and in some cases may reach the top of the barrier for a high-angle, high-speed impact.[2] The semirigid IBC median barrier is 10 in higher, 20 in wider at the widest point, and about twice the weight of the CMB. In general, it appears that this semirigid barrier system is more forgiving than the rigid CMB and performs better for a wider range of vehicle sizes.[2] The major disadvantages of the IBC median barrier are its higher installation cost and the need for repairs following repeated hits and/or major impacts.[2]

VDOT decided to use the IBC median barrier in an experimental installation to evaluate its performance. The Location and Design Division requested that the Virginia Transportation Research Council (VTRC) conduct the evaluation.

OBJECTIVE AND SCOPE

The objective of this research was to evaluate the performance of the IBC Mark VII median barrier from three perspectives: (1) lateral placement of vehicles near the barrier, (2) reported accidents and impacts involving the barrier, and (3) costs. To the extent possible, the performance of the IBC median barrier was compared to that of the CMB.

METHODS

The IBC median barrier (Figure 1) was installed on a 1.63-mile section of U.S. Route 29, the Lynchburg Expressway, in Amherst County, Virginia, just north of the city of Lynchburg and the Carter Glass Bridge. The barrier replaced a 4-ft-wide raised concrete curb median. The average daily traffic (ADT) was about 26,870.

For comparison, a 1.17-mile section of VDOT's CMB (Figure 2) on Route 29 immediately south of the study site was used as a control section. The ADT for the control section was about 33,072 in 1991. About 25 percent of the vehicles traveling on the study and control sections were trucks. The posted speed limit is 55 mph. The study and control sections are shown in Figure 3.

Four activities were conducted to accomplish the study objective:

1. *Literature review.* Literature on median barriers in general and the IBC median barrier in particular was reviewed. Reports on the use of the IBC median barrier in Florida, Colorado, and Pennsylvania were reviewed.

2. *Installation monitoring.* The installation of the IBC median barrier at the study site was monitored, and information on the installation was provided to the researcher by the VDOT project inspector.

3. *Performance data collection.* Data were collected on the lateral placement of vehicles traveling in the lane closest to the barrier, reported accidents and impacts involving the barrier, and installation and maintenance costs for the IBC median barrier. Accident data were collected for the 2 1/2-year period before and after the installation. Data on lateral placement and reported accidents were also collected for the CMB control section. Lateral placement data were used because it was suspected that the farther vehicles traveled from the barrier, the lower the chance that a collision with the barrier would occur. The chance of a collision may be lower because the potential for incidental contact is lower due to a wider recovery area for driver error. Two other related factors are also important. First, driving in the center of the lane is the predominantly recommended driver position in Virginia. Second, the higher the variance in lateral placement, the higher the hazard potential and number of accidents.[3] Statewide installation costs for the CMB were obtained.

4. *Data analysis and evaluation.*

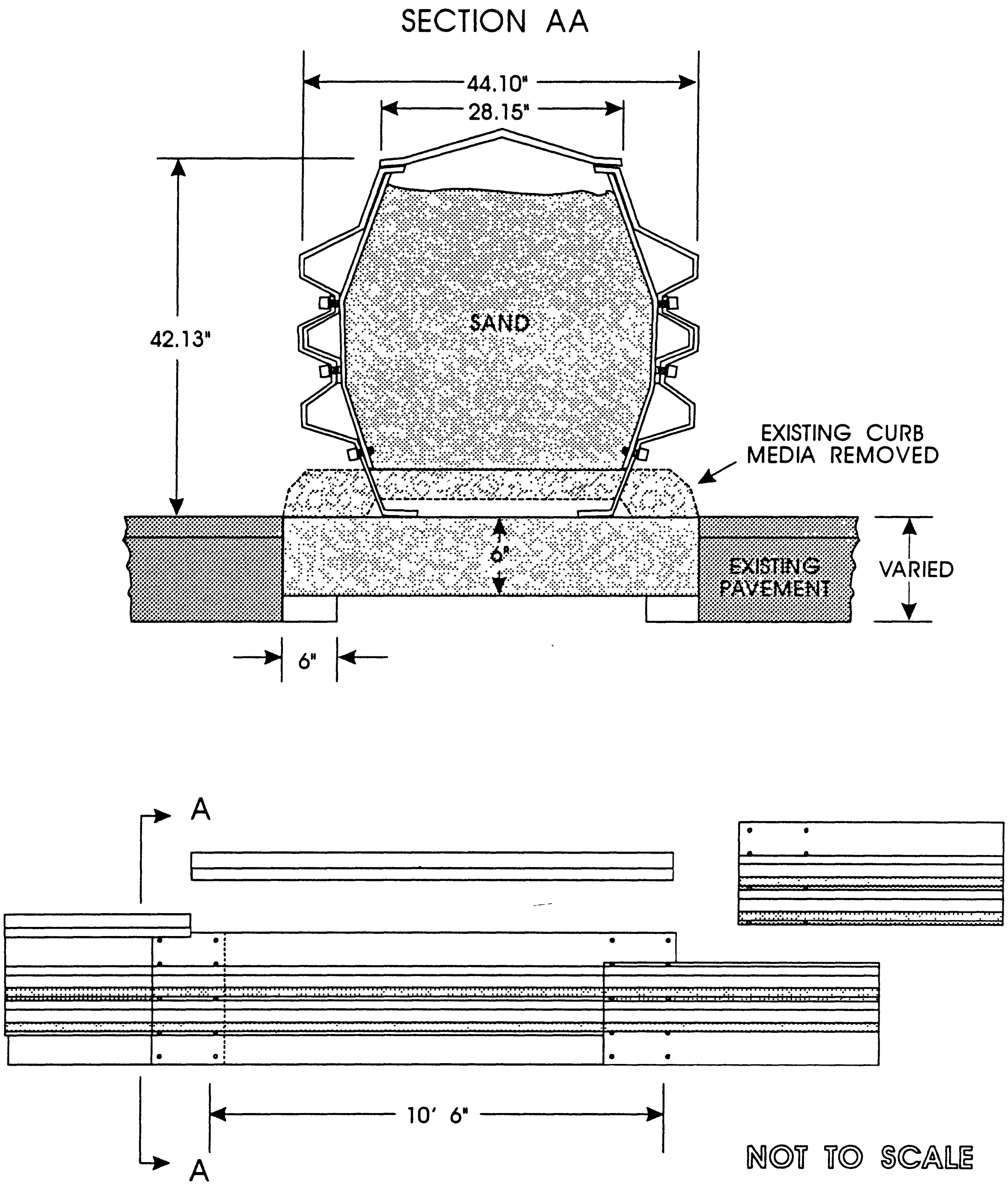

Figure 1. IBC Mark VII Median Barrier.

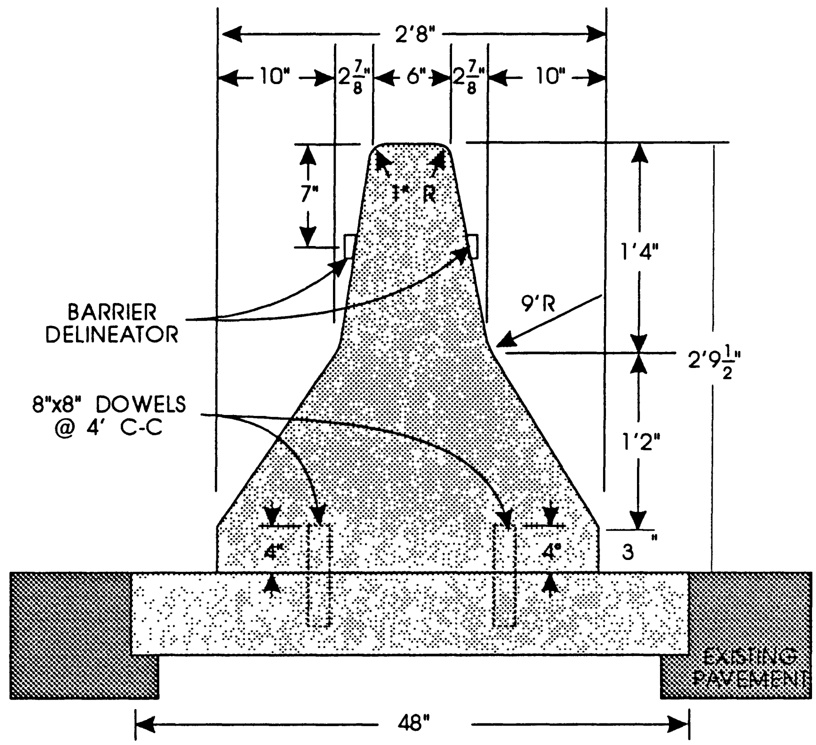

Figure 2. VDOT Standard Concrete Median Barrier (MB-7A).

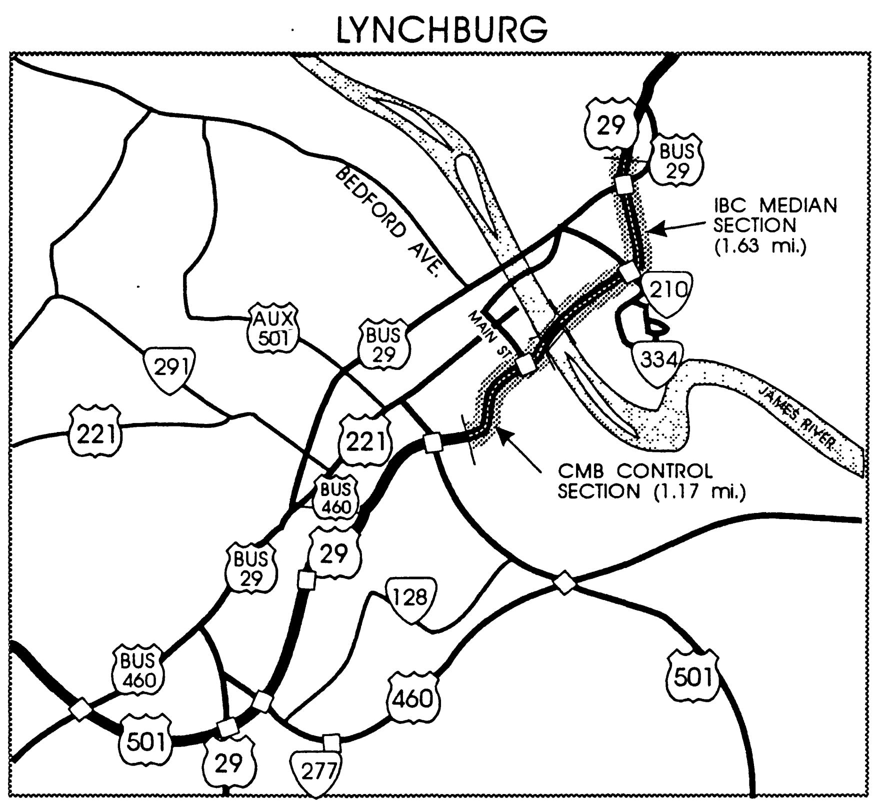

Figure 3. Map of Study and Control Sections.

RESULTS

Installation of the IBC Median Barrier

Installation began on October 3, 1988. In the first phase, a section of the existing concrete curb median strip was removed and concrete was poured to make the median flush with the travel lanes. The VDOT design engineers believed that a 6-in cement concrete base would provide a more stable base for the IBC barrier than an unpaved or earth base. Although the project plans called for the installation of slotted drain pipes at the existing drainage inlets, this installation was deemed neither feasible nor cost-effective because it involved the cutting of old concrete pavement. Therefore, the existing drainage inlets were left in place.

The curb median was removed a section at a time; then the concrete was poured. The existing curb median was removed because if the IBC median barrier was installed on the curb median, the barrier height would be 6 in higher relative to the roadway than the barrier design height.

In the second phase, for the section with the curb median removed, the IBC median barrier structure was constructed, filled with sand, and covered with the top panels. As sand filling began, it was determined that the sand being used was too light to obtain the specified weight, causing the contractor to switch to a heavier sand. No delay was caused by the change. IBC had developed a method to unload a dump truck filled with sand for the IBC median barrier in 5 to 10 minutes. Unfortunately, this method was not used because the IBC conveyor would have blocked both travel lanes, which was not acceptable. Therefore, the contractor devised a method to unload the sand in 30 to 45 min with only one lane closed.

Initially, there was no transition component installed that attached the CMB on the Carter Glass Bridge to the IBC median barrier because the IBC standard transition component was too wide to fit in the space provided. Subsequently, guardrail was used to attach the CMB and IBC median barrier at the transition because such a transition was necessary and important for safety.

The installation was completed on June 23, 1989. The work was performed by MAKO, Inc. of Charlottesville.

Lateral Placement

The objective of this analysis was to determine whether barrier type affects the lateral position of vehicles near the barrier. Data were collected by videotaping, from an overpass, the northbound and southbound lanes adjacent to both the IBC median barrier and the CMB. Pavement markings were used to identify lateral placement distances of 1, 2, 3, and 4 ft from the barrier. For passenger cars (average width = 6 ft) and trucks (average width = 8 ft), lateral placements of 3 ft and 2 ft, respectively, represent driving in the center of the lane. Table 1 shows the dates and times of data collection.

4.3

Table 1
LATERAL PLACEMENT DATA COLLECTION TIMES

Time	IBC Barrier	CMB
7–9 AM	August 2, 1989 September 26, 1990	August 9, 1989 November 14, 1990
4–6 PM	August 8, 1989 September 25, 1990	August 1, 1989 October 16, 1990

IBC = International Barrier Corporation; CMB = concrete median barrier.

The data were analyzed for each time period and each direction. The vehicles were classified as cars (passenger vehicles) or trucks (commercial vehicles) and designated as influenced (the presence of a vehicle in the outer or right lane) or uninfluenced (no outer-lane vehicle present). Since there were no substantial differences in lateral placement by time period or direction, all 8 hr of data were combined for each barrier. There were 3,006 cars and 175 trucks for the IBC median barrier analysis and 5,192 cars and 417 trucks for the CMB analysis.

The lateral placement for the total number of vehicles is graphed in Figures 4 and 5 for uninfluenced and influenced vehicles, respectively. Four trends were observed: (1) a slightly higher percentage (5 to 7 percent) of cars were within 2 ft of the CMB than the IBC median barrier; (2) about 16 percent more trucks were with-

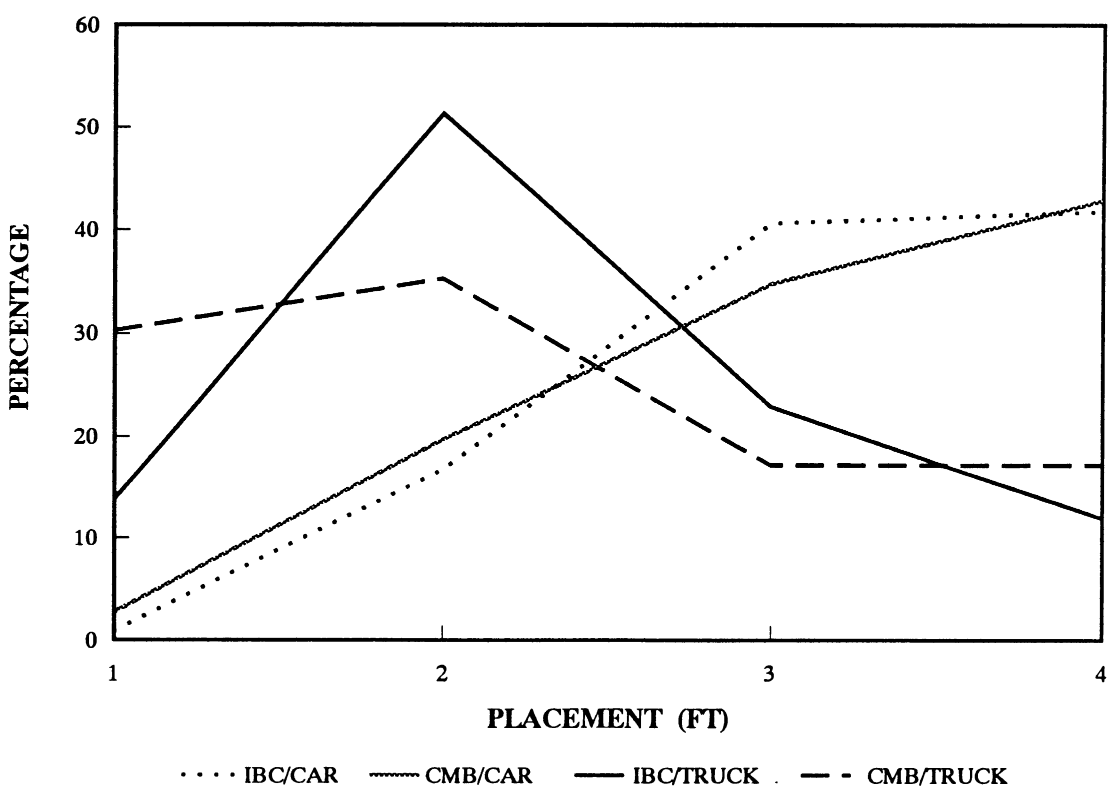

Figure 4. Lateral Placement of Uninfluenced Vehicles (NB and SB).

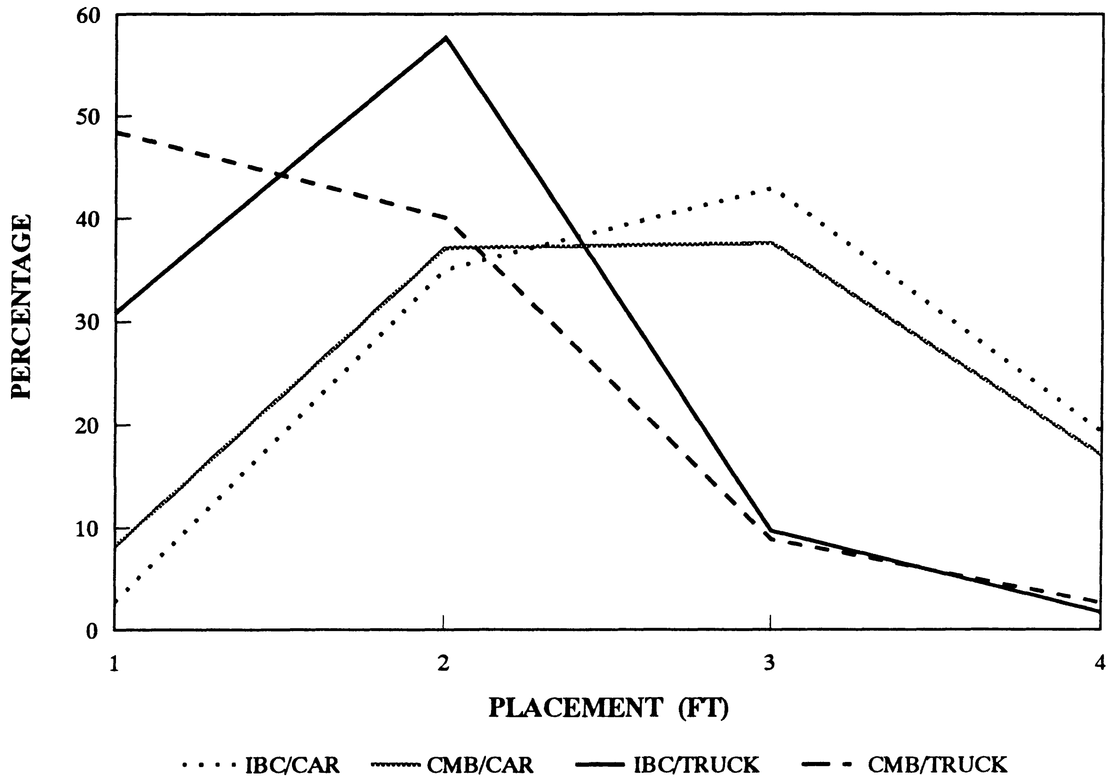

Figure 5. Lateral Placement of Influenced Vehicles (NB and SB).

in 1 ft of the CMB than the IBC median barrier; (3) for trucks, the lateral placement variance was lower for the IBC median barrier than the CMB; and (4) the incidence of driving in the center of the lane was greater for the IBC median barrier than for the CMB for cars and trucks. This tendency to travel farther from the IBC median barrier is probably due to a perception that the larger, wider IBC median barrier is more threatening.

Accidents

The 2 1/2-year before and after periods were July 1986 through December 1988 and July 1989 through December 1991, respectively. The analysis is described in two parts: (1) a summary of the before and after accident data for the study and control sections, and (2) a review of the after accidents involving the IBC median barrier. Only accidents involving the median barrier were considered for both parts.

Before and After Accident Analysis

The accident analysis was limited to trends and did not include a before and after study with a control statistical analysis for two reasons:

1. The purpose of a control section (or group) is to account for changes in safety between the before and after period not otherwise taken into ac-

count. According to Hauer, a control group that is sufficiently large to achieve this purpose would begin to be useful if there were more than 150 accidents in each period for a ±20 percent change in safety.[4] (Sample size determination procedures in other references confirm the need for such a large sample given certain assumptions.)[5] Obviously, the control section in this study would not be useful because there were so few accidents during the periods.

2. The focus of the accident analysis was to assess those accidents involving the IBC median barrier. The purpose of a before and after study is to determine if the IBC barrier is more effective than the before treatment.

Accident data for reported accidents involving collisions with the barrier are shown in Table 2 by accident type, direction of travel, number of vehicles, type of collision, and light and pavement conditions for the IBC median barrier and the CMB.

The following trends were noted:

1. The number of accidents by the 16 categories in Table 2 decreased or showed no change for both sections with one exception.
2. The exception was that the number of single-vehicle accidents increased on the IBC median barrier study section from 1 to 3. Prior to the installation of the IBC median barrier section, accidents resulting from a vehicle crossing the raised median accounted for 5 of the 8 accidents, including the only fatal accident. These median crossover accidents would likely become single-vehicle accidents in the after period.
3. Fatal accidents decreased from 1 to none for both sections, and injury accidents decreased from 4 to 1 (IBC) and 10 to 1 (CMB).
4. The total number of accidents decreased from 8 to 4 (IBC) and 11 to 4 (CMB).

Accidents Involving the IBC Median Barrier

There were four reported accidents involving the IBC median barrier (see Table 3):

1. On Sunday, July 16, 1989, at 4 AM, an automobile was traveling southbound in the shoulder lane about 0.3 miles south of Route 210. The vehicle began hydroplaning and then skidded and struck the IBC median barrier. The driver was injured in the collision. No charges were filed against the driver. The estimated vehicle speed and safe speed were 45 and 40 mph, respectively.

Table 2
ACCIDENT DATA

	Accident Type				Direction of Travel		No. of Vehicles			Type of Collision (First Event)					Light Condition		
	Fatal	Injury	Property Damage	Total	NB	SB	1	2	3+	Hit Median	Side-swipe	Rear-end	Angle	Other	Dark	Light	PC[a]
IBC Study Section																	
Before	1	4	3	8	5	3	1	4	3	5[b]	0	0	2	1	6	2	1
After	0	1	3	4	1	3	3	1	0	4	0	0	0	0	3	1	1
% Change	–100	–75	0	–50	–80	0	200	–86	–100	–20	0	0	–100	–100	–50	–50	0
CMB Control Section																	
Before	1	10	13	24	11	13	11	10	3	18	2	1	0	3	10	14	14
After	0	1	7	8	5	3	4	3	1	5	2	1	0	0	2	6	3
% Change	–100	–90	–46	–67	–55	–77	–64	–69	–67	–72	0	0	0	–100	–80	–57	–79

[a] Pavement condition (wet/ice/snow/other).
[b] In the IBC before period, hit median collisions were median crossover events that resulted in second event collisions.

Table 3
ACCIDENTS INVOLVING THE IBC MEDIAN BARRIER

Date	Location	Direction	Type of Collision (1st Event)	Type of Accident	Alignment	Weather	Surface Condition	Light Condition
06/06/91	Rt. 210 exit ramp	SB	Forced to hit median	PDO	Grade-curve	Clear	Dry	Daylight
06/01/91	3/10 mi. S Rt. 1040	NB	Hit median	PDO	Level-curve	Clear	Dry	Darkness—unlighted
07/16/89	3/10 mi. S Rt. 210	SB	Hit median	I	Grade-straight	Mist	Wet	Darkness—unlighted
09/18/89	500 ft. N Rt. 210	SB	Hit median (hit tire)	PDO	Level-straight	Clear	Dry	Darkness—unlighted

PDO = property damage only; I = injury.

2. On Monday, September 18, 1989, at 6:15 AM, a pickup truck traveling southbound in the median lane about 500 ft north of Route 210 struck a large tire in the road and then struck the IBC median barrier, swerved to the right then to the left, and struck the IBM median barrier a second time. No charges were filed. The estimated vehicle speed and safe speed was 55 mph.
3. On Saturday, June 1, 1991, at 3 AM, an automobile traveling northbound in the outside lane failed to negotiate a right curve about 0.3 miles north of Route 1040 and struck the IBC median barrier. The vehicle left the scene and was located several hours later. The driver was charged with reckless driving. The estimated vehicle speed and safe speed were 60 and 35 mph, respectively.
4. On Thursday, June 6, 1991, at 4:20 PM, a pickup truck was traveling southbound near the Route 210 entrance ramp in the outside lane when a second vehicle entered the right lane from the entrance ramp. The first vehicle was forced to change lanes to avoid a collision. The first vehicle glanced off the IBC median barrier, swerved to the right onto the shoulder, and struck the guardrail. (This description of a forced maneuver was provided by the driver involved in the accident.) No charges were filed. The estimated vehicle speed and safe speed were 50 and 45 mph, respectively.

The following trends were noted: (1) three of the four accidents were southbound, and all three near Route 210; (2) three accidents occurred under darkness-unlighted conditions; and (3) two accidents involved external non–weather-related factors (forced to hit median and hit tire).

An attempt was made to match these four accidents with the impacts identified on the IBC barrier. However, because it was difficult to match the reported accident location with the observed impact location with any degree of confidence, this effort was declared unsuccessful.

Impacts With the IBC Median Barrier

An inventory of impacts with the IBC median barrier was made on Thursday, February 6, 1992. Three categories of impacts were identified: (1) rubs (surface marks such as tire marks), (2) scratches (shallow cuts in the surface), and (3) dents (depressions or hollows such as are made by force). The results of the inventory are shown in Table 4 by type and direction of travel. The majority of impacts were on the side of the IBC median barrier on the bottom half (i.e., the height of a vehicle bumper). There were two dents on top of the barrier: one was caused by the accident on September 18, 1989, and the other was possibly caused by an overhanging load, according to the Amherst Residency staff. Figures 6 through 9 show a sample of the dents identified on the IBC median barrier. Although the photographs display some sizable impacts, the IBC median barrier has not sustained a major impact that would have required immediate structural repairs.

Table 4
INVENTORY OF IMPACTS INVOLVING THE IBC MEDIAN BARRIER

Impact Type	Southbound	Northbound	Total
Rubs	11	7	18
Scratches	5	3	8
Dents	7[a]	9	16
Total	23	19	42

[a]One top dent, direction unknown, is included.

The number of minor impacts may be, in part, attributed to the placement of the IBC median barrier with a maximum width of 44 in in a 48-in-wide median with little clearance between the pavement edgeline and the barrier. In most cases, median barriers have a clearance area or median shoulder area of about 3 ft or more that would allow vehicles a recovery area to avoid a barrier collision.[6]

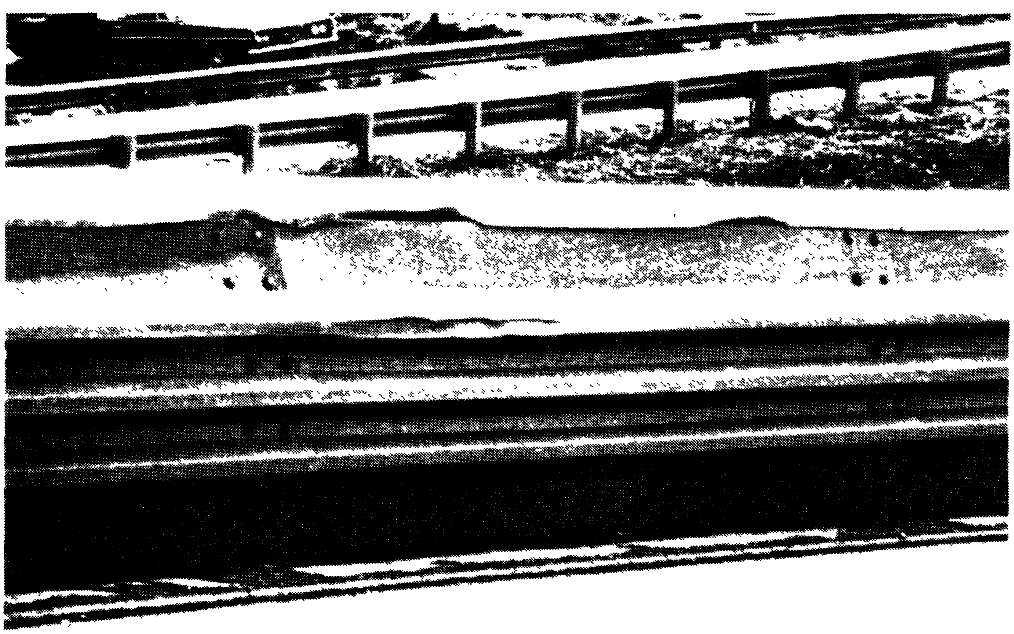

Figure 6. Southbound About 320 ft South of the Route 210 Exit Ramp Gore Area.

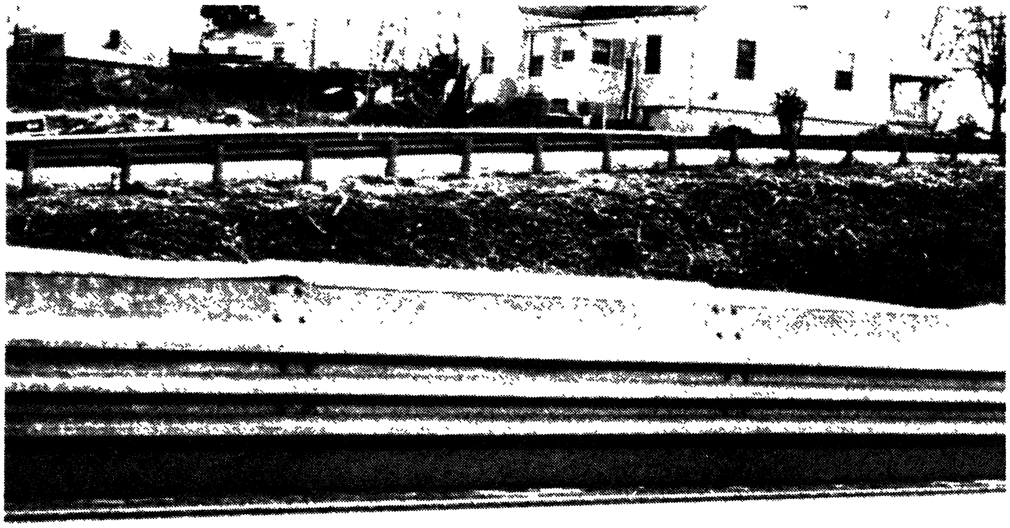

Figure 7. Southbound About 390 ft South of the Route 210 Exit Ramp Gore Area.

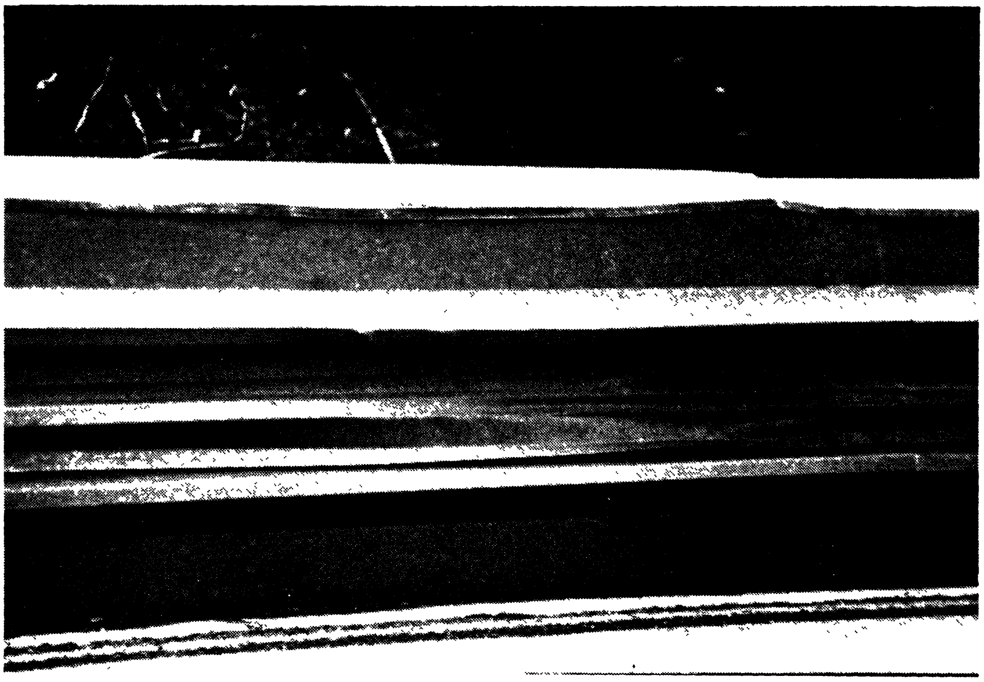

Figure 8. Southbound About 550 ft From the Route 210 Exit Ramp Gore Area.

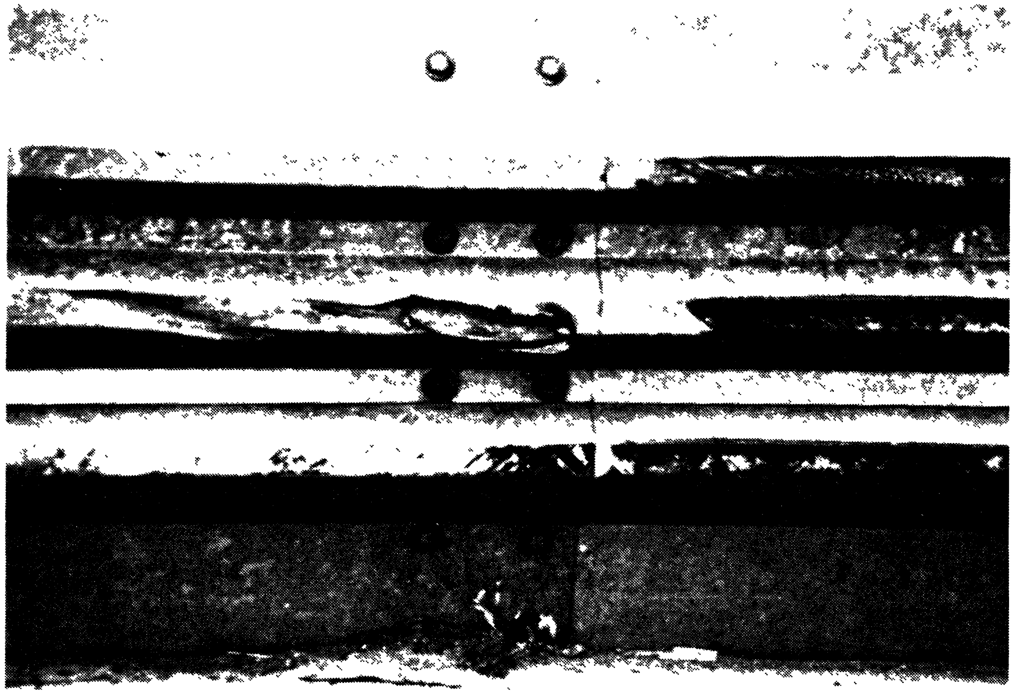

Figure 9. Northbound About 5,030 ft North of the Carter Glass Bridge.

Installation and Maintenance Costs

The total project cost to install the IBC median barrier was $892,465. Table 5 shows the cost for the major project activities. The total cost for IBC median barrier installation was $560,138, or 62.8 percent of the total cost. The cost of the IBC median barrier was $65 per linear foot. From the statewide bid costs for rural and suburban areas for July 1990 through December 1991, the installation cost for the CMB (VDOT model MB-7A) was $28.64 per linear foot. Thus, the IBC median barrier costs were more than twice those of the CMB.

Table 6 shows the installation costs for the IBC median barrier and CMB for Virginia and three other states. For Pennsylvania and Colorado, the percentage difference is about the same (87 and 89 percent, respectively) although the cost per linear foot varies substantially. For Florida, the percentage difference of the actual costs is 231 percent, well above that of the other three states, whereas the percentage difference of the average/standard costs is well below that of the other three states.

The costs shown in Table 6 are for the barrier only. In Virginia, an additional cost of $5.52 per linear foot was expended for the 6-in concrete base used with the IBC barrier. One reason for using concrete instead of asphalt was that it is difficult to place asphalt in a narrow space (4-ft median). A 7-in concrete base used in Colorado costs an additional $17.34 per linear foot in Colorado. In Pennsylvania,

Table 5
TOTAL PROJECT COSTS FOR THE IBC MEDIAN BARRIER

Activity		Cost ($)	% of Total
Startup (mobilization and grading)		85,045	9.5
Median Removal		47,406	5.3
Median strip removal	32,128		
Curb removal	14,190		
Guardrail	1,088		
Median Replacement		99,079	11.1
Asphalt (wide median at north end)	51,519		
6-in cement concrete base	47,560		
IBC Median Barrier Installation		560,138	62.8
Impact Attenuator		15,000	1.7
Work Zone Traffic Control		82,287	9.2
Electronic arrow panel	34,080		
Channelizing devices	20,006		
Impact attenuators	15,000		
Warning lights	9,743		
Flaggers	3,458		
Miscellaneous		3,510	0.4
Total		892,465	100.0

Table 6
INSTALLATION INFORMATION FOR THE IBC AND CONCRETE MEDIAN BARRIERS

	Cost per Linear Foot				
State	IBC	CMB	% Difference	Year IBC Installed	IBC Barrier Length (mi)
Virginia	$65.00	$28.64	127	1989	1.63
Pennsylvania[a]	$39.50[b]	$20.85	89	1988	4.9
Colorado[c]	$60.24	$32.20	87	1986	0.46
Florida[d] (actual)	$46.36	$14.00	231	1982	0.95
(average/standard)	$35.00	$27.00	30		

[a] *Source*: Highlands, K. L. 1990. *IBC MK-7 Highway barrier system.* Report No. FHWA-PA-89-014-86-53A. Harrisburg: Pennsylvania Department of Transportation.

[b] The cost does not include the barrier backfill; therefore, the actual cost is higher.

[c] *Source*: Woodham, D. 1991. *IBC Median barrier demonstration.* Report No. FHWA-SA-91-006. Denver: Colorado Department of Highways.

[d] *Source*: Florida Department of Transportation, Safety Office. 1986. *Cost-effectiveness of median barriers: Section 86070—I-95 Broward County.* Tallahassee.

no major problems were experienced when a portion of the IBC median barrier was installed on an unpaved or earth base. However, it was necessary to grade the surface carefully and align the barrier after initially setting it. Because the concrete base appears to be an option rather than a requirement, the costs of the base were not included in Table 6.

There were no maintenance costs for the IBC median barrier because no maintenance activity was performed during the study period. The Amherst Residency staff has discussed the possibility of scheduling all repairs to be made at one time with one traffic lane closed. Although the Amherst Residency has replacement parts for the IBC median barrier, no special maintenance equipment was purchased. The residency staff is confident that existing equipment can be adapted for IBC median barrier maintenance.

DISCUSSION

Use of the IBC Median Barrier by Other States

The states of Florida[7] and Colorado[8] have reported on the performance of the IBC median barrier.

Florida

In 1983, a 0.95-mile section of IBC median barrier was installed on I-95 in Broward County. Barrier impacts on this section were compared to barrier impacts along 7.77-mile sections of CMB (a section at each end of the IBC median barrier). Thirty-nine reported accidents occurred on the IBC section, and 88 impacts (scratches and dents) were recorded in a 2-year period. No repairs were made to the IBC median barrier. However, the anticipated maintenance cost per mile for the IBC median barrier and CMB was estimated at $3,912 and $1,801, respectively. Vehicle overturning occurred in 12 accidents involving the CMB and in no accidents involving the IBC median barrier. There was no significant difference in average injury severity or the ratio of injury accidents to total accidents for the two barriers.

Because the estimated accident costs were slightly lower for the IBC median barrier than the CMB, it was concluded that the IBC median barrier would be cost-effective at locations where more than 10 reported accidents per mile per year are predicted. This conclusion is suspect because of its reliance on anticipated rather than actual costs. It was recommended that the IBC median barrier compete with the CMB on a construction bid price basis. In Florida, the unit cost of the IBC median barrier was 37 percent higher than the average cost of the CMB.

Colorado

In 1986, 0.44 miles of IBC median barrier was installed on I-70 in Denver (ADT = 89,600) and monitored for 2 1/2 years with an adjacent 1-mile section of w-beam median barrier as a control. The limited number of accidents on the sections prevented the researcher from making any statistically valid conclusions on the relative safety performance of the barriers. In nine accidents, the IBC median barrier performed well based on the judgment of the researcher. However, costs for two completed repairs were deemed excessive. The maintenance cost per linear foot repaired was $44.67 for the IBC median barrier versus $4.68 for the CMB for urban freeways in Colorado in fiscal year 1988-1989. It was recommended that, unless the costs (installation and repair costs are assumed) of the IBC median barrier decrease substantially, this barrier not be adopted as a standard barrier in Colorado. The IBC median barrier may prove to have additional safety performance characteristics that could warrant its use in high-hazard locations, but proof of this performance needs to be documented on a large scale before further installations can be recommended.[8]

Future Use of the IBC Median Barrier in Virginia

The FHWA has approved the use of the IBC median barrier on a federal-aid highway project provided that (1) the barrier is supplied through competitive bidding with equally suitable patented items or (2) the state highway agency certifies that the barrier is essential for synchronization with existing facilities or that no equally suitable alternative exists, or (3) the barrier is used for research or for a distinctive type of construction or relatively short sections of road for experimental purposes.[9] Given the high installation cost of the IBC median barrier, options 2 and 3 represent the likely approaches to use of the IBC median barrier in Virginia. However, at this time, there is no foreseeable justification for employing options 2 and 3.

Moreover, in Section 1058, Roadside Barrier Technology, Title I of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), it is required that "not less than 2 1/2 percent of the mileage of new or replacement permanent median barriers included in awarded contracts along federal-aid highways within the boundaries of a state in each calendar year shall be innovative safety barriers. Innovative safety barrier means a median barrier (other than a guardrail) classified by FHWA as experimental or that was classified as operational after January 1, 1985."[10] Because the IBC median barrier was classified as operational December 26, 1985,[11] and its assemblies (special and ancillary items) were classified as operational June 7, 1989,[9] the ISTEA requirement increases the chances that additional IBC median barrier may be installed in Virginia. In fact, the Location and Design Division considered including about a 6-mile section of the IBC median barrier in a design project to satisfy these requirements for the first year the requirements were in effect. However, a constant slope barrier was selected instead.

CONCLUSIONS

1. Lateral placement of vehicles is slightly better for the IBC median barrier than for the CMB because (1) vehicles tend to travel a little farther from the IBC median barrier and more toward the center of the lane, and (2) the lateral placement variance for trucks is smaller.

2. No conclusions could be reached regarding the safety performance of the IBC median barrier because of the limited number of reported accidents and impacts. However, the IBC median barrier did satisfactorily eliminate median crossover accidents by converting them to single-vehicle accidents.

3. The installation cost of the IBC median barrier was more than twice the cost of the CMB ($65.00 per linear foot versus $28.64 per linear foot). No conclusions were drawn concerning IBC median barrier maintenance costs because no maintenance on the barrier was performed during the study period.

4. There is a possibility that VDOT may install the IBC median barrier at other locations to comply with the ISTEA requirement that not less than 2 1/2 percent of permanent median barriers in awarded contracts for federal-aid highways in each calendar year be innovative safety barriers.

RECOMMENDATIONS

1. The Amherst Residency should continue monitoring the performance of the IBC median barrier, especially recording maintenance costs and other related activities and accidents. This information should be forwarded to the VTRC semiannually (July 7 and January 7) for 1992 through 1994.

2. VTRC should provide an update and an analysis of the information in May 1994 as a technical assistance effort.

ACKNOWLEDGMENTS

The contributions of the following are appreciated: J. D. Shelor, Jan Kennedy, and Steve Blackwell for data collection and analysis; Dan Carpenter, Amherst Residency, for providing information on the IBC barrier installation and performance; F. D. Shepard for conducting much of the research; Eileen F. Aiken and Linda Barsel for preparing the final report; Linda Evans for report editing; and Mike Perfater, G. R. Allen, B. L. Smith, C. B. Stoke, and Location and Design Division staff (C. F. Boles, R. A. Atherton, K. F. Phillips, and F. J. Kiiffner) for reviewing the final report. This study was supported by HPR funds administered through the FHWA.

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