National Transportation Safety Board
Office of Highway Safety
Washington, DC 20594

HWY23MH004

HIGHWAY FACTORS GROUP

Group Chair's Factual Report

October 17, 2023

Table of Contents

A. CRASH INFORMATION

Location: Williamsburg, York County, Virginia
Date: December 16, 2022
Time: 1:36 a.m. Eastern Standard Time (EST)

B. HIGHWAY FACTORS GROUP

Group Chair	Dan Walsh, P.E., Chair Senior Highway Factors Investigator NTSB
Group Member	Joseph M. Ludwig, P.E. Peninsula Area Construction Engineer Virginia Department of Transportation (VDOT)

C. CRASH SUMMARY

For a summary of the crash, refer to the *Crash Information and Summary Report*, which can be found in the NTSB docket for this investigation.

D. DETAILS OF THE INVESTIGATION

The Highway Factors Group Chair's Factual Report begins with a discussion on prefatory data that includes the crash location, construction history, average daily traffic volumes, traffic accident summary, and vehicle classification count. The report also focuses on roadway data that includes speed limit, minimum speed limit, typical section, horizontal alignment, vertical alignment, signage prior to the crash, highway markings, rumble strips, highway lighting, and the guardrail located in the median. The report summarizes an inventory of damaged guardrail performed by NTSB staff after the crash. Finally, the report concludes with a discussion of guidelines for selecting and placing median barriers suitable for use by all government agencies.

1.0 Crash Location

The crash occurred on Interstate 64 (I-64) at mile marker 240.4 in the eastbound travel lanes near Williamsburg, in York County, Virginia. **Figure 1** is a crash map that illustrates the crash location was approximately 45 miles southeast of Richmond.

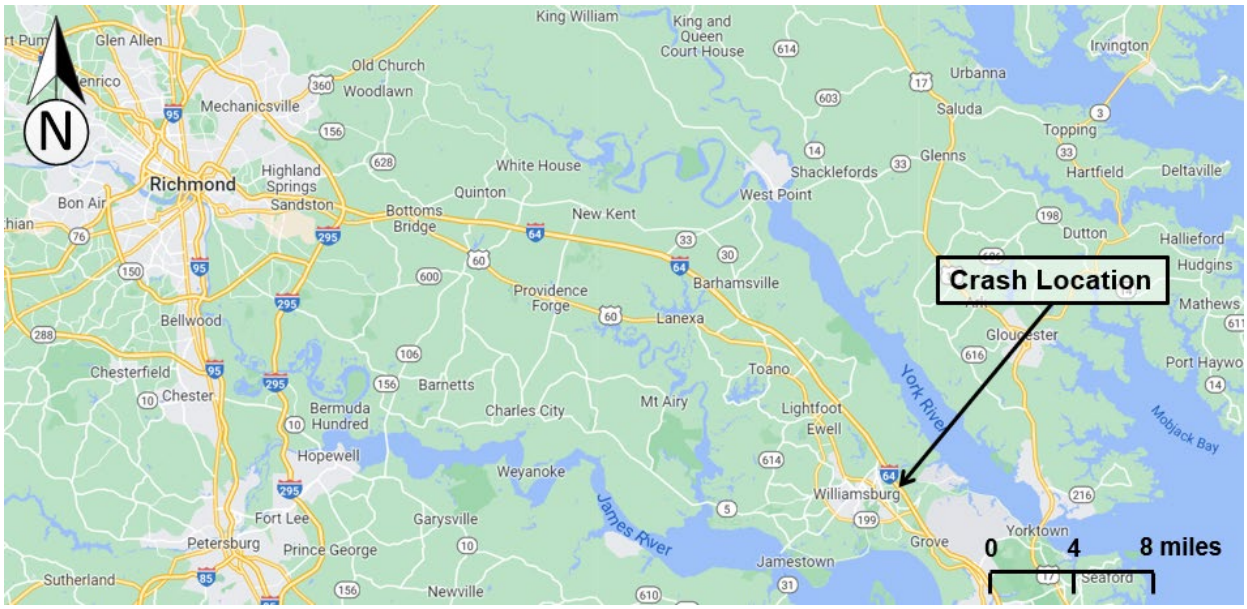

Figure 1 – Crash map (Source: Google Maps revised)

Figure 2 is a more detailed crash map that illustrates the crash location was on I-64 immediately north of the bridge overpass to Colonial National Historical Parkway near Williamsburg, Virginia.

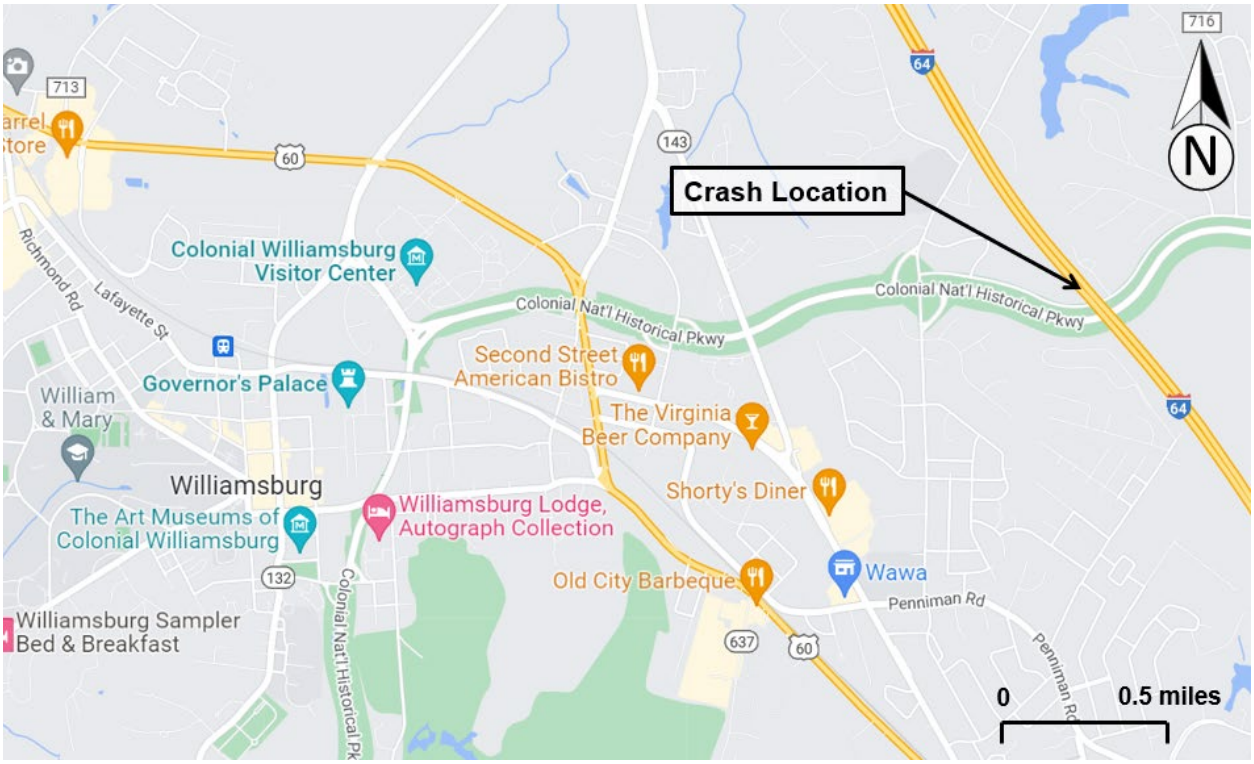

Figure 2 – Detailed Crash map (Source: Google Maps revised)

2.0 Construction History of I-64

An approximate 8-mile segment of I-64 in the vicinity of the crash was reconstructed in December of 2021. The project limits were from approximately 1.3 miles west of Lightfoot Road (mile post marker 234) to approximately 1.1 miles west of Humelsine Parkway (mile post marker 242). The crash occurred within the project limits at mile post marker 240.4.

3.0 Average Daily Traffic Volumes

The average daily traffic volumes (ADT) on I-64 in both the eastbound and westbound directions for 2021 was 68,360 vehicles per day.

4.0 Traffic Accident Summary

Table 1 summarizes the traffic accident summary on I-64 within a 1-mile radius of the crash for the last 5 years in the eastbound and westbound directions.

Table 1 – Traffic accident summary on I-64 within a 1-mile radius of the crash

Year	Rear End	Sideswipe Same Direction	Fixed Object in Road	Fixed Object Off Road	Other	Total
2022[1]	1	0	1	5	1	**8**
2021[2]	3	1	1	2	2	**9**
2020	7	2	0	2	0	**11**
2019	8	0	0	3	0	**11**
2018	3	0	0	0	0	**3**
Grand Total	**22**	**3**	**2**	**12**	**3**	**42**

5.0 Vehicle Classification Count

The vehicle classification count on I-64 in the eastbound and westbound directions for 2021 consisted of the following:

- Total average daily traffic – 68,360 vehicles per day
- 4 tire vehicles – 63,520 vehicles per day (93% of the traffic mix)
- Buses – 360 buses per day (0.5% of the traffic mix)
- 2 axle trucks – 680 trucks per day (1% of the traffic mix)
- 3+ axle trucks – 1,040 trucks per day (1.5% of the traffic mix)

[1] A fatal crash occurred on May 8, 2022, in which a vehicle travelling eastbound on I-64 at a high rate of speed ran off the road to the left and struck the median barrier; then ran off the road to the right and struck the guardrail twice.
[2] 2021 showed a collision type as "Other Animal", it was grouped with "Other" crash type.

- 1 trailer truck – 2,760 trucks per day (4% of the traffic mix)

The percentage of trucks in the traffic mix was 6.5 percent, and the percentage of buses was 0.5 percent.

E. ROADWAY DATA

1.0 Speed Limit

The posted regulatory speed limit for I-64 in the vicinity of the crash was 70 miles per hour (mph).

2.0 Minimum Speed Limit

The minimum speed limit in Virginia was established under state code 46.2-877. Virginia state code 46.2-877 indicated the following:

> *"No person shall drive a motor vehicle at such a slow speed as to impede the normal and reasonable movement of traffic except when reduced speed is necessary for safe operation or in compliance with law.*
>
> *Whenever the Commissioner of Highways or local authorities within their respective jurisdictions determine on the basis of a traffic engineering and traffic investigation that slow speeds on any part of a highway consistently impede the normal and reasonable movement of traffic, the Commissioner or such local authority may determine and declare a minimum speed limit to be set forth on signs posted on such highway below which no person shall drive a vehicle except when necessary for safe operation or in compliance with law."*

VDOT has not implemented or posted minimum speed limits. VDOT does not have any record of a minimum speed limit being established or requested on an interstate highway or on a State maintained highway.

3.0 Typical Section

The typical section for I-64 in the vicinity of the crash consisted of 3 eastbound travel lanes. Each of the eastbound travel lanes was approximately 12-feet wide. The total width of the 3 eastbound travel lanes was approximately 36-feet wide.[3]

Figure 3 illustrates the typical section for I-64. The crash occurred in the right lane denoted by the red highlighted text. A paved shoulder existed adjacent to the rightmost and leftmost travel lane that was approximately 14 feet wide. A 36-foot-wide

[3] See Highway Factors Attachment – Typical section on I-64 in the vicinity of the crash.

median separated the eastbound travel lanes from the westbound travel lanes.[4] A strong post blocked-out W-beam guardrail was continuous along the left shoulder approaching the crash site in both the eastbound and westbound direction of travel.

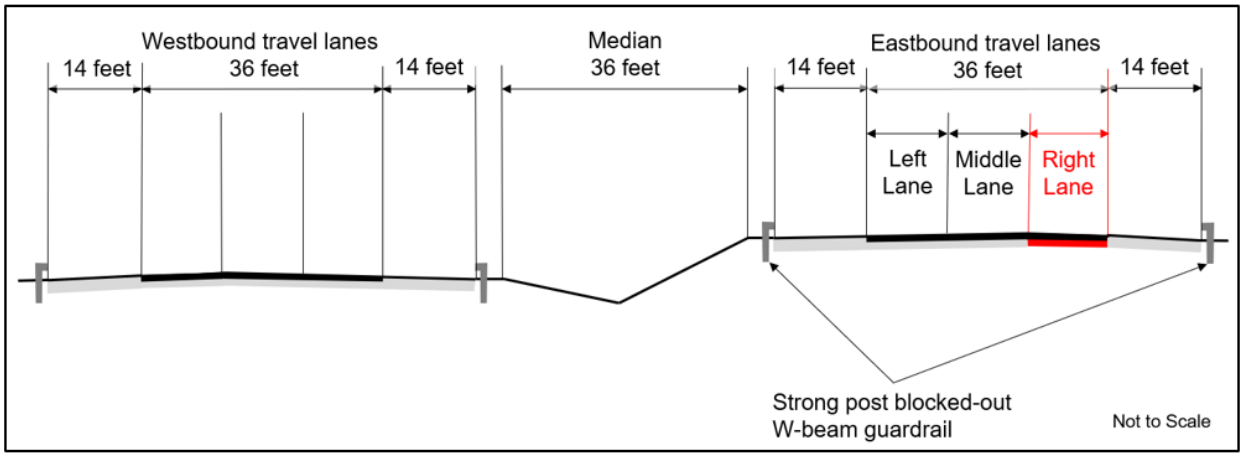

Figure 3 – Typical section for I-64

4.0 Horizontal Alignment

The horizontal alignment in the vicinity of the crash was a tangent (straight) segment.[5] The nearest horizontal curve preceding the crash site was a 11,400-foot radius curve that turned to the left for motorists travelling in the eastbound direction of travel on I-64. The horizontal curve ended approximately 508 feet prior to the crash site.

5.0 Vertical Alignment

The vertical alignment in the vicinity of the crash consisted of an upgrade slope positive (+) 2.96% grade for motorists travelling in the eastbound direction of travel.[6]

6.0 Signage Prior to the Crash

Table 2 summarizes the signage prior to the crash on I-64 in the eastbound travel lanes.

Table 2 – Signage prior to the crash on I-64 in the eastbound travel lanes

Signage	Distance from Signage to Crash
	1.3 miles

[4] See Highway Factors Attachment – Cross sections on I-64 in the vicinity of the crash.
[5] See Highway Factors Attachment – Horizontal alignment on I-64 in the vicinity of the crash.
[6] See Highway Factors Attachment – Vertical alignment on I-64 in the vicinity of the crash.

	1.4 miles
	5.6 miles
	5.7 miles

7.0 Highway Markings

The highway marking separating the paved shoulder from the rightmost travel lane consisted of a permanent 6-inch-wide solid white line.[7] The highway markings separating the 3 eastbound travel lanes consisted of permanent 6-inch-wide broken white lines that were each 10-feet long and had 30-feet spacing between them. The highway marking separating the paved shoulder from the leftmost travel lane consisted of a 6-inch-wide solid yellow line. All the highway markings were retroreflective.

8.0 Rumble Strips

Grooved longitudinal rumble strips existed in the paved shoulder adjacent to the rightmost travel lane and leftmost travel lane in the eastbound direction of travel. The rumble strip dimensions were approximately 16-inches long and 7-inches wide.[8] The rumble strips were spaced approximately 12-inches apart measured from the centerline of the rumble strip. The depression of the rumble strip into the pavement was approximately 1/2-inch. The rumble strips were offset from the edge of traveled way by approximately 5-inches.

9.0 Highway Lighting

No artificial highway lighting was present, nor was it required, on I-64 in the vicinity of the crash. VDOT's Instructional and Informational Memorandum on roadway lighting indicated *"If roadway lighting is to be provided, illumination is best when*

[7] See Highway Factors Attachment – Signage and marking plans on I-64 in the vicinity of the crash.
[8] See Highway Factors Attachment – Virginia Department of Transportation (VDOT) rumble strip detail plan sheet.

limited to partial interchange lighting, intersections, midblock crosswalks, and roundabouts."[9] NTSB investigators conducted a nighttime scene drive-through of the crash site in the eastbound direction on December 19, 2022, which revealed the reflectivity of the signs and highway pavement markings were in excellent condition. The signs and highway pavement markings were installed in December 2021 with reconstruction of the approximate 8-mile segment of I-64 in the vicinity of the crash.

10.0 Guardrail Located in the Median

Figure 4 illustrates the strong post blocked-out W-beam guardrail located in the median.[10] The W-beam rail element was blocked-out from the posts by plastic block-outs measuring 12-inches in length and 14-inches in depth. The strong post blocked-out W-beam guardrail was continuous along the left shoulder approaching the crash site in both the eastbound and westbound direction of travel.

The W-beam rail element was raised approximately 18-inches from the pavement surface. The height of the W-beam rail element was approximately 12 inches. The total height from the pavement surface to the top of the W-beam rail element was approximately 30 inches. The height of the W-beam rail element conformed to the American Association of State Highway and Transportation Officials (AASHTO) *Roadside Design Guide* which states *"the nominal mounting height of the rail is 29 inches. A construction tolerance of +/- 1 inch applies to all strong-post W-beam installations"*.[11]

The strong posts that connected to the plastic block-outs consisted of W 6 x 9 steel I-beam posts that were spaced 6 feet 3 inches apart. The W 6 x 9 steel I-beam posts were embedded in the ground.

[9] VDOT Traffic Engineering Division Instructional and Informational Memorandum, Roadway Lighting, May 10, 2019, page 1 of 13.
[10] VDOT Guardrail Standard GR-MGS1.
[11] *Roadside Design Guide*, American Association of State Highway and Transportation Officials (AASHTO), 4th Edition, 2011, page 6-10.

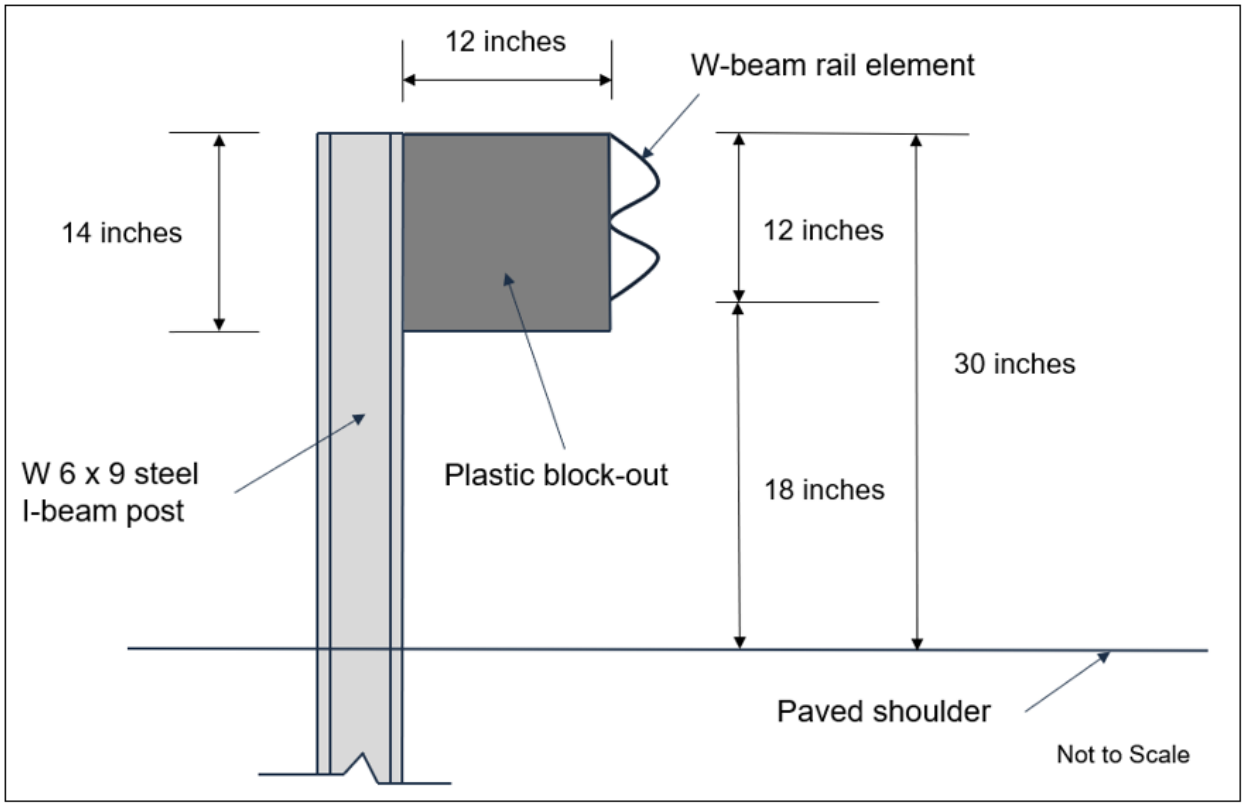

Figure 4 – Strong post blocked-out W-beam guardrail

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Photographs 1 and 2 show the Freightliner combination vehicle in the median, behind the W-beam guardrail.[12]

Photograph 1 – View of Freightliner combination vehicle in the median, behind the W-beam guardrail standing in the leftmost travel lane in the westbound direction looking to the northwest (Source: Virginia State Police)

[12] Information on the impact angle at the guardrail can be found in the Technical Reconstruction Group Chair's Factual Report.

Photograph 2 – View of Freightliner combination vehicle in the median, behind the W-beam guardrail standing in the leftmost travel lane in the westbound direction looking to the southeast (Source: Virginia State Police)

F. INVENTORY OF DAMAGED GUARDRAIL

NTSB staff inventoried the damaged guardrail on December 18, 2022. The total distance of displaced guardrail in the eastbound direction of travel was approximately 210 feet. The total number of W 6 x 9 steel I-beam posts deformed was 34.

The total distance of displaced guardrail in which W 6 x 9 steel I-beam posts were deformed or missing in the westbound direction of travel was approximately 64 feet. The total distance of missing W-beam rail element in which the W 6 x 9 steel I-beam posts were intact in the westbound direction of travel was approximately 164 feet.

G. NCHRP RESEARCH REPORT 996

National Cooperative Highway Research Project (NCHRP) Research Report 996, *Selection and Placement Guidelines for Test Level 2 through 5 Median Barriers*, was developed as a result of three median crossover crashes investigated by the NTSB: Slinger, Wisconsin in 1997; Munfordville, Kentucky in 2010; and Orland, California in 2014. NCHRP Research Report 996 provides guidelines for selecting and placing Test Levels 2 through 5 median barriers suitable for use by all government agencies at state and local levels.[13]

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[13] *Selection and Placement Guidelines for Test Level 2 through 5 Median Barriers*, NCHRP Research Report 996, Christine E. Carrigan and Malcolm H. Ray; Roadsafe, LLC; 2022.

Table 3 summarizes the three median crossover crashes investigated by the NTSB and the status of the recommendations.

Table 3 – Three median crossover crashes investigated by the NTSB and the status of the recommendations.

Crash Location	U.S. Route 41 near Slinger, Wisconsin	I-65 near Munfordville, Kentucky	I-5 in Orland, California
Crash Date	February 12, 1997	March 26, 2010	April 10, 2014
Vehicle Crossing	Truck-tractor in combination with 2 empty trailers	Truck-tractor in combination with a 53-foot-long van semitrailer	Truck-tractor in combination with two 28-foot trailers
NTSB Recommendation Number	H-98-12[14] H-98-24[15]	H-11-21[16] H-11-31[17]	No new recommendations to FHWA or AASHTO since NCHRP Research Project was underway
Status of NTSB Recommendation	H-98-12 (Closed – Acceptable Action) H-98-24 (Closed – Superseded)	H-11-21 (Open – Acceptable Response) H-11-31 (Open – Acceptable Response)[18]	

Another more recent median crossover crash investigated by the NTSB occurred in Davis, Oklahoma on September 26, 2014. The new and reiterated recommendations regarding median barriers can be found in the NTSB Board Report at the following link Investigation Report (ntsb.gov).

[14] To the Federal Highway Administration: Review, with the American Association of State Highway and Transportation Officials, the median barrier warrants and revise them as necessary to reflect changes in the factors affecting the probability of cross-median accidents, including changes in the vehicle fleet and the percentage of heavy trucks using the roadways (H-98-12).

[15] To the American Association of State Highway and Transportation Officials: Review, with the Federal Highway Administration, the median barrier warrants and revise them as necessary to reflect changes in the factors affecting the probability of cross-median accidents, including changes in the vehicle fleet and the percentage of heavy trucks using the roadways (H-98-24).

[16] To the Federal Highway Administration: Work with the American Association of State Highway and Transportation Officials to establish warrants and implementation criteria for the selection and installation of Test Level Four and Test Level Five median barriers on the National Highway System (H-11-21).

[17] To the American Association of State Highway and Transportation Officials: Work with the Federal Highway Administration to establish warrants and implementation criteria for the selection and installation of Test Level Four and Test Level Five median barriers on the National Highway System, and publish those warrants and criteria in the Roadside Design Guide (H-11-31).

[18] H-11-31 supersedes NTSB Safety Recommendation H-98-24.

NCHRP Research Report 996 recommended "*the need for a median barrier is determined first, then the test level of the barrier is determined*".[19] To determine the need for a median barrier, NCHRP Research Report 996 recommended plotting the point corresponding to the bi-direction average daily traffic and median width in **Figure 5**. The area where these two lines intersect would indicate whether a barrier is needed and the barrier material most appropriate for the site and traffic conditions. As indicated earlier in the Highway Factors Group Chair's Factual Report, the bi-direction average daily traffic on I-64 was 68,360 vehicles per day and the median width was 36 feet.[20] **Figure 5** illustrates the two dashed red lines intersect in the area where a metal beam or cable barrier should be considered. The strong post blocked-out W-beam guardrail on I-64 in the vicinity of the crash site would be considered a metal beam barrier and conformed to the guidelines for median barrier need determination and material selection set forth in NCHRP Research Report 996.

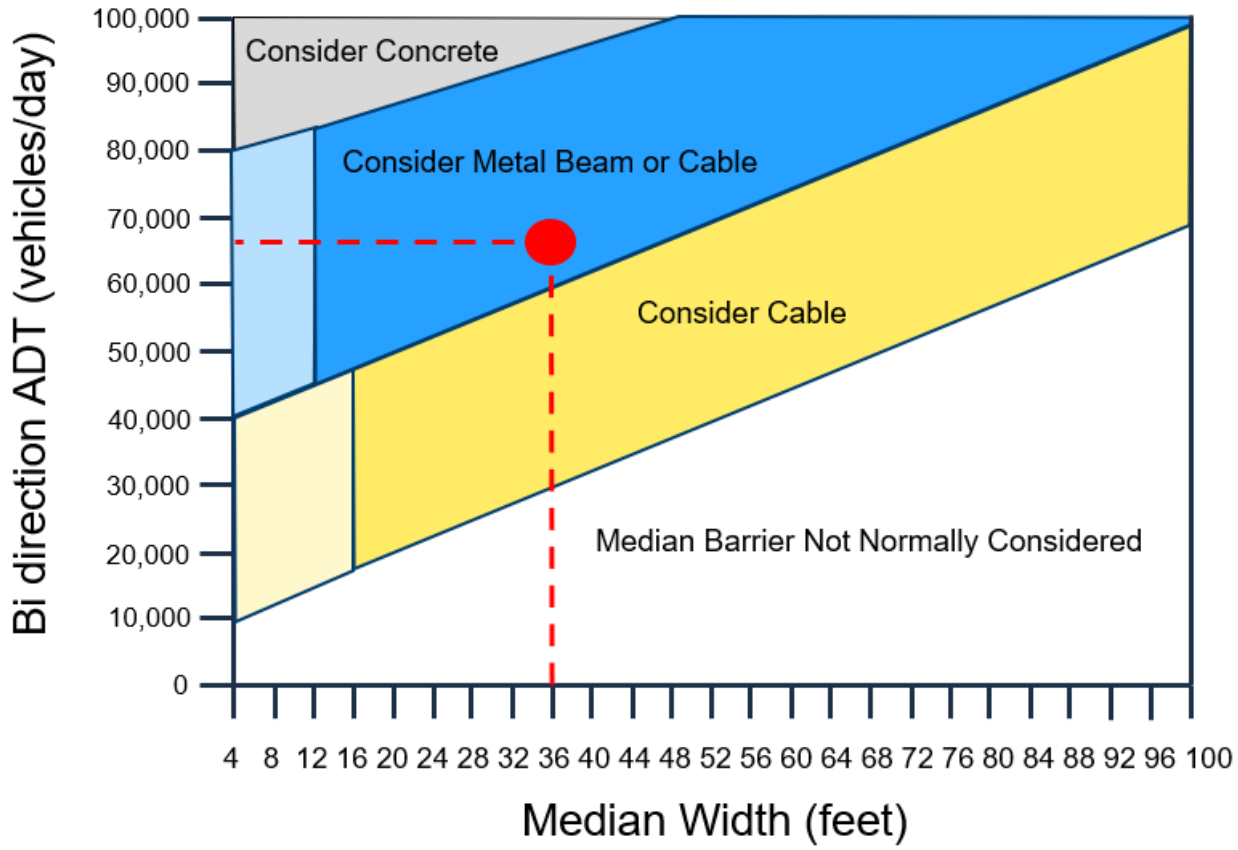

Figure 5 – Guidelines for median barrier need determination and material selection (Source: NCHRP Research Report 996)

[19] *Selection and Placement Guidelines for Test Level 2 through 5 Median Barriers*, NCHRP Research Report 996, Christine E. Carrigan and Malcolm H. Ray; Roadsafe, LLC; 2022, page 43.
[20] Bi-direction average daily traffic in this case means eastbound and westbound directions.

Once the need for a median barrier has been established using **Figure 5**, the appropriate test level can be determined using **Table 4**. **Table 4** is used to select the appropriate median barrier test level as a function of the percentage of trucks in the traffic mix. As indicated earlier in the Highway Factors Group Chair's Factual Report, the percentage of trucks in the traffic mix on I-64 in the eastbound and westbound directions was 6.5 percent. Using **Table 4**, NCHRP Research Report 996 would recommend a Manual for Assessing Safety Hardware (MASH) Test Level 3 (TL-3) barrier or higher as shown in the red text.

Table 4 – Guidelines for selection of longitudinal barrier test level (Source: NCHRP Research Report 996)

MASH Test Level	Traffic Conditions	Crash on I-64
2 or higher	0 percent trucks and posted speed ≤ 45 mph	
3 or higher	0 < percent trucks ≤ 10	6.5 percent trucks
4 or higher	10 < percent trucks ≤ 15	
5 or higher	> 15 percent trucks or a designated truck or hazardous material route	

The strong post blocked-out W-beam guardrail on I-64 in the vicinity of the crash site would be considered a MASH Test Level 3 (TL-3) compliant barrier system and conformed to the guidelines for selection of longitudinal barrier test levels set forth in NCHRP Research Report 996.

Under MASH guidelines, longitudinal barriers may be tested to six test levels.[21] **Table 5** summarizes the six test levels tested under MASH guidelines.

Table 5 - Six test levels tested under MASH guidelines.

		Test Conditions		
Test Level	**MASH Test Vehicle**	**Vehicle Weight (pounds)**	**Speed (mph)**	**Angle (degrees)**
1	Passenger Car Pickup Truck	2,420 5,000	31 31	25 25
2	Passenger Car Pickup Truck	2,420 5,000	44 44	25 25
3	Passenger Car Pickup Truck	2,420 5,000	62 62	25 25
4	Passenger Car Pickup Truck Single-Unit Truck	2,420 5,000 22,000	62 62 56	25 25 15
5	Passenger Car Pickup Truck Tractor-Van Trailer	2,420 5,000 79,300	62 62 50	25 25 15
6	Passenger Car Pickup Truck Tractor-Tank Trailer	2,420 5,000 79,300	62 62 50	25 25 15

The strong post blocked-out W-beam guardrail on I-64 in the vicinity of the crash site conformed to the MASH Test Level 3 (TL-3) barrier. A TL-3 barrier is capable of redirecting passenger cars weighing 2,420 pounds and pickup trucks weighing 5,000 pounds at speeds of 62 mph and impact angles of 25 degrees.

H. PAVEMENT FRICTION TESTS

The NTSB requested VDOT conduct locked-wheel friction testing on I-64 in the vicinity of the crash. Testing was conducted on January 26, 2023, and February 7, 2023, in the eastbound right lane from mile marker 240 to 241. Testing and data processing was performed in accordance with *Virginia Test Method – 122 (VTM-122) Friction Testing Section 5.2 Special Request Testing*.[22] This test method utilizes a measurement representing the steady-state friction force on a locked test wheel as it is dragged over a wetted pavement surface under constant load and at a constant speed while its major plane is parallel to its direction of motion and perpendicular to the

[21] *Manual for Assessing Safety Hardware*, American Association of State Highway and Transportation Officials (AASHTO), 2nd Edition, 2016, pages 5 and 6.
[22] See Highway Factors Attachment – Virginia Test Method (VTM) 122 Friction Testing Section 5.2 Special Request Testing.

pavement. The NTSB Meteorology Specialist's Factual Report indicated the weather conditions during the time preceding the crash as follows:

> *"No significant echoes[23] were depicted in the vicinity of the accident site at the time of the accident. However, a review of the radar imagery for the hours prior to the accident depicted a large area of echoes associated with rain showers prevailing over the region and ending around 1900 EST* [7:00 p.m. EST] *on December 15, 2022."*

The time of the crash was approximately 1:36 a.m. EST on December 16, 2022. The Virginia Department of Motor Vehicles Police Crash Report described the roadway surface condition as wet at the time of the crash.

Test spacing was 0.1 miles and three test speeds, 40 mph, 50 mph, and 60 mph, were used to collect the data. The standard smooth tire was used in accordance with VTM-122. Additionally, as requested by the NTSB, a ribbed tire was also used to collect friction data. Since VDOT's friction test method (VTM-122) is based on the smooth tire, there is no established protocol for testing or analyzing data generated with a ribbed tire. However, raw friction data was collected with a ribbed tire using the same locked-wheel friction tester.

Table 6 summarizes the pavement friction data collected using the smooth tire for both days of testing, January 26, 2023, and February 7, 2023, and the ribbed tire for the February 7, 2023, testing. Additionally, *Highway Factors Attachment – Virginia Department of Transportation (VDOT) pavement friction testing conducted on January 26, 2023, and February 7, 2023*, provides a full summary of the data collected including a graphical representation of the smooth tire friction and ribbed tire friction results.[24]

Per VDOT's friction test method (VTM-122), no further review and/or any corrective action was needed since no value fell below 20 for the smooth tire.

[23] Echoes of 20 dBZ and greater are typically associated with precipitation reaching the surface. Very light drizzle and mist may not be indicated unless the clouds are at least 8,000 feet thick to allow enough droplets to form.

[24] See Highway Factors Attachment – Virginia Department of Transportation (VDOT) pavement friction testing conducted on January 26, 2023, and February 7, 2023.

Table 6 - Pavement friction data collected using the smooth tire for both days of testing, January 26, 2023, and February 7, 2023, and the ribbed tire for the February 7, 2023, testing.

Date	Reference Post	Speed Average	SN[25] Raw	SN40S Speed Corrected[26]	SN40S Speed and Monthly Corrected[27]
Smooth Tire – 40 mph test speed					
1/26/2023	240 - 241	39.4 – 40.1	39.0 – 50.7	39.0 – 50.5	35.3 – 46.8
2/7/2023	240 - 241	39.1 – 39.7	37.0 – 49.5	36.8 – 49.3	33.1 – 45.6
Smooth Tire – 50 mph test speed					
1/26/2023	240 - 241	49.2 – 49.7	36.7 – 42.4	41.3 – 46.9	37.6 – 43.2
2/7/2023	240 - 241	49.2 – 49.7	37.4 – 40.8	41.9 – 45.3	38.2 – 41.6
Smooth Tire – 60 mph test speed					
1/26/2023	240 - 241	59.9 – 60.4	30.6 – 38.9	40.4 – 48.6	36.7 – 44.9
2/7/2023	240 - 241	58.9 – 59.5	34.4 – 38.4	43.8 – 47.4	40.1 – 43.7
Ribbed Tire – 40 mph test speed					
2/7/2023	240 - 241	39.3 – 40.0	41.8 – 48.2	N/A	N/A
Ribbed Tire – 50 mph test speed					
2/7/2023	240 - 241	49.2 – 49.6	40.3 – 42.8	N/A	N/A
Ribbed Tire – 60 mph test speed					
2/7/2023	240 - 241	59.9 – 60.4	37.2 – 40.9	N/A	N/A

APPENDIX A

The following attachments and photographs are included in the docket for this investigation:

LIST OF ATTACHMENTS

Highway Factors Attachment – Typical section on I-64 in the vicinity of the crash

Highway Factors Attachment – Cross sections on I-64 in the vicinity of the crash

Highway Factors Attachment – Horizontal alignment on I-64 in the vicinity of the crash

Highway Factors Attachment – Vertical alignment on I-64 in the vicinity of the crash

[25] Skid Number (SN) is determined from the resulting force or torque and is reported as SN. The SN is determined from the force required to slide the locked test tire at a stated speed, divided by the effective wheel load (coefficient of friction), and multiplied by 100.
[26] Skid number adjusted to and reported at 40 mph for smooth tire without monthly correction.
[27] Skid number adjusted to and reported at 40 mph for smooth tire with monthly correction.

Highway Factors Attachment – Signage and marking plans on I-64 in the vicinity of the crash

Highway Factors Attachment – Virginia Department of Transportation (VDOT) rumble strip detail plan sheet

Highway Factors Attachment – Virginia Test Method (VTM) 122 Friction Testing Section 5.2 Special Request Testing

Highway Factors Attachment – Virginia Department of Transportation (VDOT) pavement friction testing conducted on January 26, 2023, and February 7, 2023

LIST OF PHOTOGRAPHS

Highway Factors Photo 1 – View of strong post blocked-out W-beam guardrail that contained the Freightliner combination vehicle within the median standing in the leftmost travel lane in the westbound direction looking to the northwest (Source: Virginia State Police)

Highway Factors Photo 2 – View of strong post blocked-out W-beam guardrail that contained the Freightliner combination vehicle within the median standing in the paved shoulder adjacent to the leftmost travel lane in the westbound direction looking to the northwest (Source: Virginia State Police)

Highway Factors Photo 3 – View of strong post blocked-out W-beam guardrail that contained the Freightliner combination vehicle within the median standing in the leftmost travel lane in the westbound direction looking to the southeast (Source: Virginia State Police)

Highway Factors Photo 4 – View of strong post blocked-out W-beam guardrail that contained the Freightliner combination vehicle within the median standing in the paved shoulder adjacent to the leftmost travel lane in the westbound direction looking to the southeast (Source: Virginia State Police)

Highway Factors Photo 5 – View of tire marks left in the median by the Freightliner combination vehicle standing in the paved shoulder adjacent to the leftmost travel lane in the westbound direction looking to the northwest

Highway Factors Photo 6 – View of tire marks left in the median by the Freightliner combination vehicle standing in the paved shoulder adjacent to the leftmost travel lane in the eastbound direction looking to the southeast

Highway Factors Photo 7 – View of median separating the eastbound travel lanes from the westbound travel lanes looking to the southeast

Highway Factors Photo 8 – View of deformed W 6 x 9 steel I-beam posts standing in the paved shoulder adjacent to the leftmost travel lane in the eastbound direction looking to the southeast

Highway Factors Photo 9 – Close up view of deformed W 6 x 9 steel I-beam posts standing in the paved shoulder adjacent to the leftmost travel lane in the eastbound direction looking to the southeast

Submitted by:

Dan Walsh, P.E., Chair
Senior Highway Factors Investigator
NTSB