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

HWY24MH005

HIGHWAY FACTORS

Group Chair's Factual Report

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A. CRASH INFORMATION

Location: Rushville, Schuyler County, Illinois
Date: March 11, 2024
Time: 11:29 a.m. (CDT)

B. HIGHWAY FACTORS GROUP

Group Chair	Scott Parent National Transportation Safety Board
Group Member	Steve Beran, P.E., S.E. Illinois Department of Transportation

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 highway information that includes the crash location, construction history, average daily traffic volumes, vehicle classification count, traffic crash history, and speed limit. The report concludes with a focus on highway design (roadway geometry), roadside design (clear zone concept, including the drainage channel), and highway markings and signage (including a discussion on centerline rumble strips).

1.0 Highway Information

1.1 Crash Location

The crash site was located near Rushville, Schuyler County, Illinois, on U.S. Route 24 (US-24). The impact occurred within the westbound travel lane, approximately 150 feet east of mile marker 7.00 at the approximate Global Positioning System (GPS) coordinates of latitude: 40.115959° and longitude: -90.583929°. Figure 1 is a map that illustrates the location of the crash site, which was approximately 55 miles northwest of Springfield, Illinois (see Figure 1)

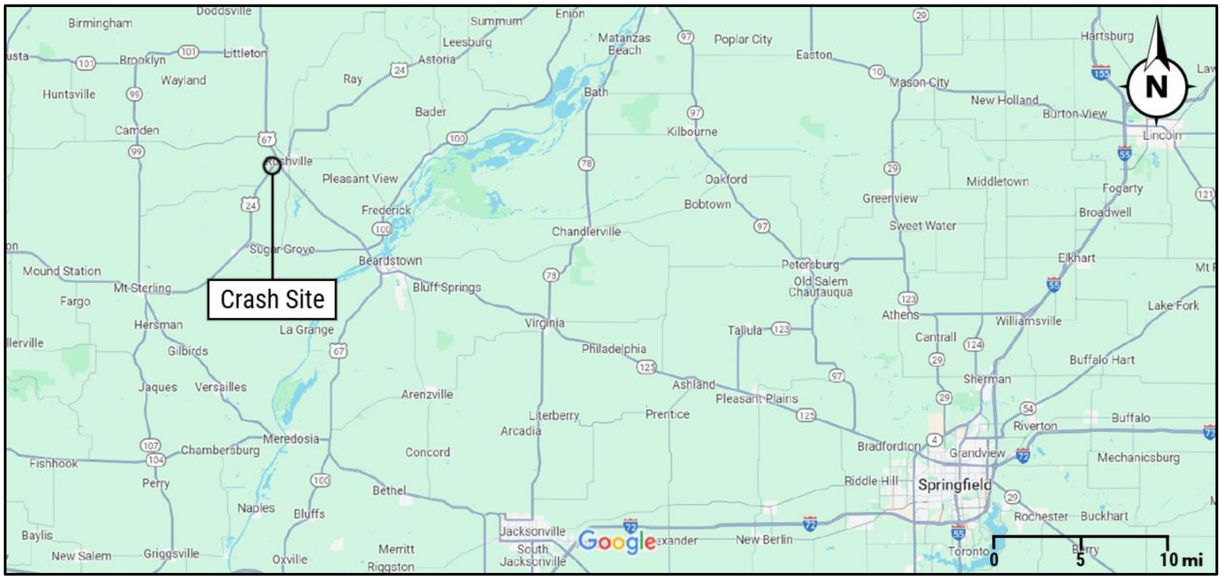

Figure 1. Crash site map [Source: Google Maps revised].

Figure 2 illustrates the crash site from an aerial view looking to the southwest.

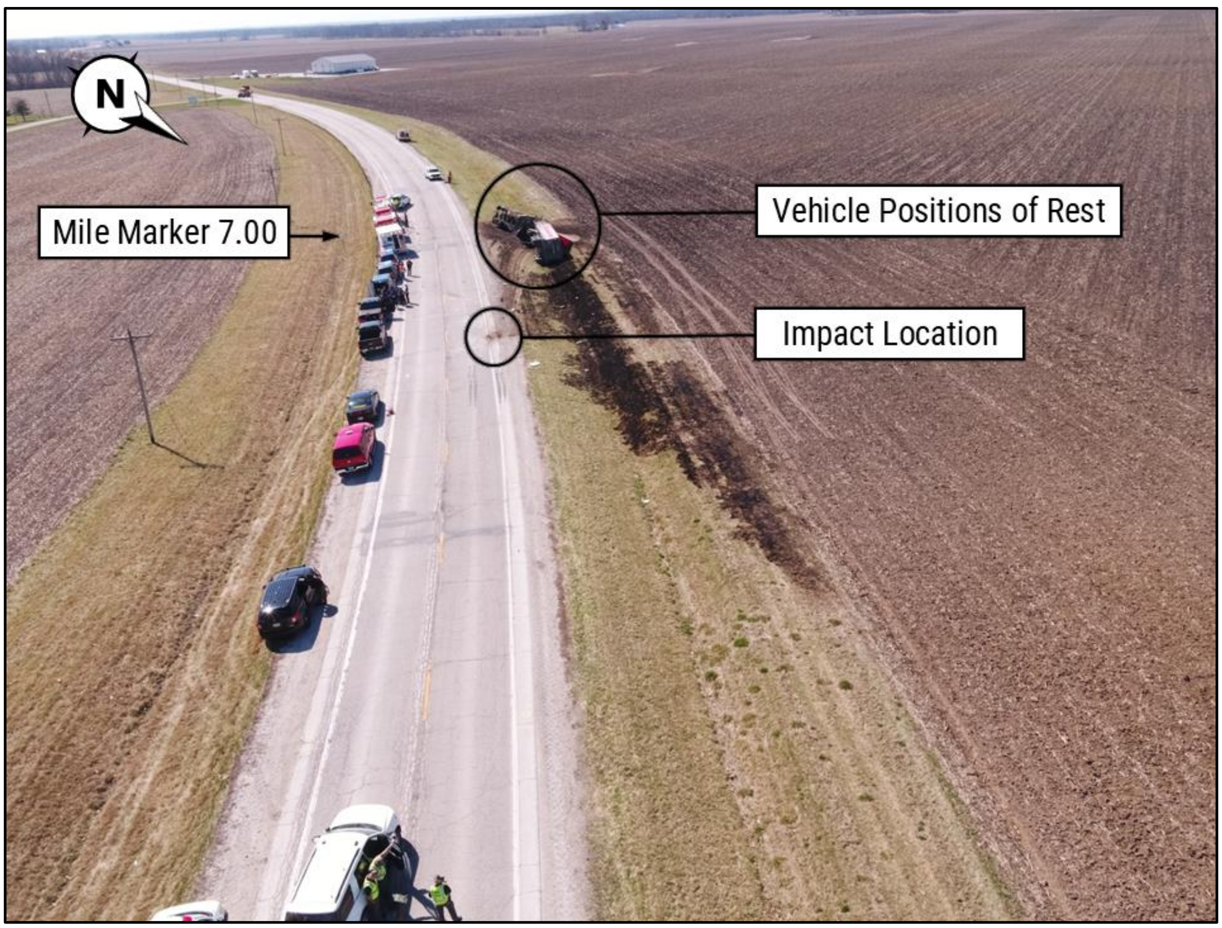

Figure 2. Crash scene from an aerial view looking to the southwest [Source: ISP revised]

1.2 Construction History of US-24

US-24 is a 255-mile-long highway with an east-west alignment that traverses Illinois between the Missouri state line at the Mississippi River in Quincy, Illinois to the west, and the Indiana state line in Sheldon, Illinois to the east.

US-24 at the crash site was originally constructed in 1924 as a rural, two-lane, 18-foot-wide highway. In 1964, the existing roadway typical section was widened to 24 feet with aggregate and earth shoulders. As part of the 1964 improvement, US-24 was realigned near the crash site by shifting the alignment approximately 450 feet to the north and west. In 1992, the route was resurfaced, and a combination of paved and aggregate shoulders were added to the typical section. The latest resurfacing of US-24 at the crash site was completed in 2005. According to IDOT, there are no plans to improve US-24 near the crash site as part of IDOT's Multi-Year Improvement Program (MYP) for fiscal year 2024-2029. However, this section of US-24 is being considered for resurfacing and the addition of 4-foot-wide paved shoulders in fiscal year 2030.

1.3 Functional Design

At the crash site, US-24 is functionally classified as a rural principal arterial roadway. According to the American Association of State Highway and Transportation Officials (AASHTO), a rural principal arterial system consists of a network of routes with the following service characteristics:[1]

- Corridor movement with trip length and density suitable for substantial statewide or interstate travel.
- Movements between all, or virtually all, urban areas with populations over 50,000 and a large majority of those with populations over 25,000.
- Integrated movement without stub connections except where unusual geographic or traffic flow conditions dictate otherwise (e.g., international boundary connections or connections to coastal cities).

1.4 Speed Limit

The speed limit at the crash site was 55 miles per hour. There was a regulatory 55 mile per hour speed limit sign for westbound motorists posted along the north shoulder of US-24, 0.19 mile east of the crash site. There were no regulatory signs within three miles of the crash site for eastbound motorists.

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[1] See *Section 1.4.3.3.1 – Rural Principal Arterial System* in American Association of State Highway and Transportation Officials (AASHTO). 2018. *A Policy on Geometric Design of Highways and Streets.* 7th Edition. Washington, DC: AASHTO, page 1-13.

1.5 Pavement Condition

At the crash site, the pavement had varying degrees of longitudinal, transverse, and alligator cracking (see Figure 3 and Figure 4).[2]

Figure 3. View from the centerline of US-24 facing in an easterly direction.

Figure 4. View from the centerline of US-24 facing in a westerly direction.

[2] Alligator cracking refers to a type of damage on asphalt pavement where a network of interconnected cracks forms, usually caused by repeated traffic loading on a weakened pavement base, significantly impacting its durability and structural integrity.

Performance measures for the National Highway System (NHS) were established by the Federal Highway Administration (FHWA) in 2017 to ensure consistency in how performance is reported by the states. IDOT collects condition data on non-Interstate pavements at least every two years. Results of the most recent NHS pavement condition assessment was conducted in 2022.[3] A summary of the pavement condition index (PCI) near the crash site, between mile marker 6.80 and 7.30 is summarized in

Table 1.[4]

Table 1. *Summary of Pavement Condition Index as Reported by IDOT in 2022*

Mile Marker	State of Acceptable Condition	IRI[a]	Rutting	Cracking	Overall Rating
6.80	Below	Fair	Good	Poor	Fair
6.90	Below	Fair	Good	Poor	Fair
7.00	Below	Fair	Good	Poor	Fair
7.10	Below	Poor	Good	Poor	Poor
7.20	Below	Fair	Good	Poor	Fair
7.23	Below	Fair	Good	Poor	Fair
7.30	Below	Fair	Good	Fair	Fair

Note. [a]International Roughness Index

Rating	Good	Fair	Poor
International Roughness Index (IRI) (inches/mile)	< 95	95–170	> 170
Present serviceability rating (PSR) (only for route with posted speed limit < 40 mph)	≥ 4.0	2.0–4.0	≤ 2.0
Cracking (%)	< 5	CRCP: 5–10 Jointed: 5–15 Asphalt: 5–20	> 10 > 15 > 20
Rutting (inches) (HMA only)	< 0.20	0.20–0.40	> 0.40
Faulting (inches) (PCC only)	< 0.10	0.10–0.15	> 0.15

Figure 5. Pavement performance thresholds criteria [Source: IDOT].

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[3] IDOT National Highway System Performance

[4] The pavement condition index is a numerical index between 0 and 100, which is used to indicate the general condition of a pavement section.

1.6 Traffic Crash History

Table 2 summarizes the crash history on US-24 (westbound and eastbound directions) within one mile of the crash site from 2018 to 2024.[5]

Table 2. *Traffic Crash History Within One Mile of the Crash Site*

Year	Fatality	Injury	Property Damage Only	Total
2024	0	0	0	0
2023	0	0	0	0
2022	0	1	9	10
2021	1	1	5	7
2020	0	0	4	4
2019	0	1	3	4
2018	0	0	7	7
Total	1	3	28	32

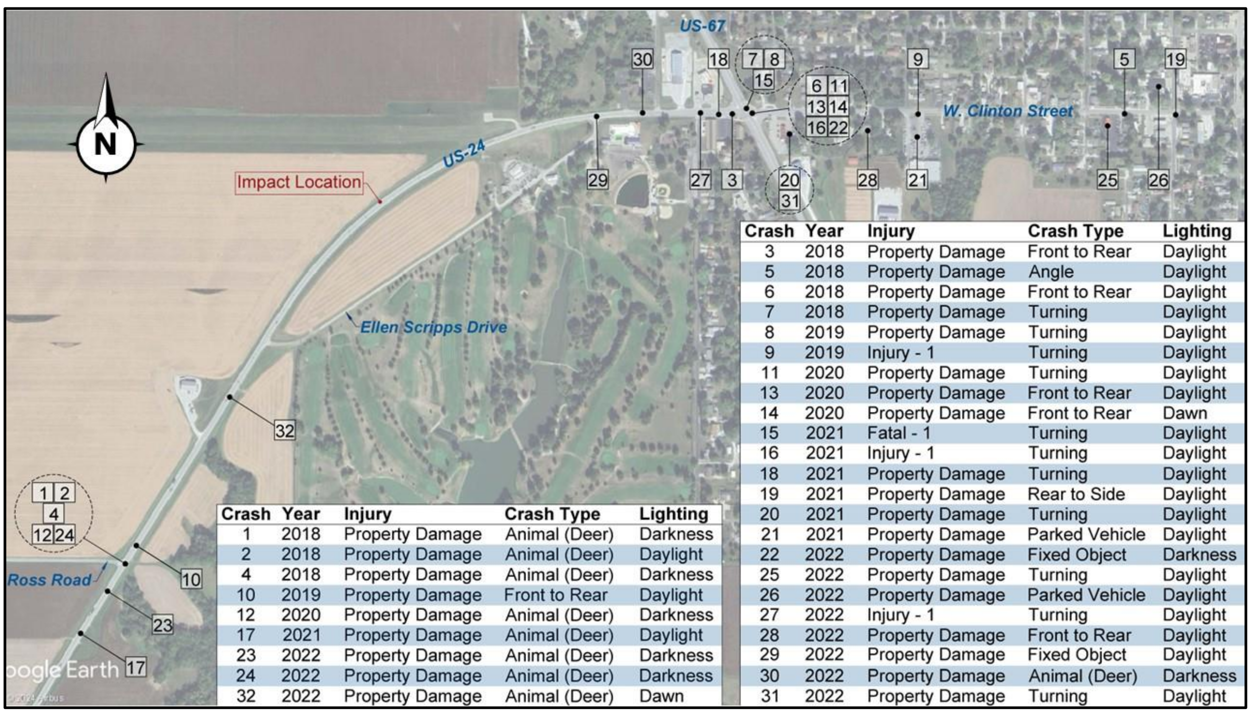

Figure 6. Crashes within one mile of the crash site. Source: Google Earth (revised).

As seen in Figure 6, 28 (88 percent) of the crashes were property damage only, 18 (56 percent) occurred within, or east of the intersection with US-67, and none of the crashes occurred within the horizontal curve where the crash between the school bus and combination vehicle occurred.

[5] See Highway Factors Attachment: IDOT Crash History Report (2018-2024).

1.7 Average Daily Traffic Volume (ADT)

Table 3 summarizes the average daily traffic volume and vehicle classifications on US-24 (westbound and eastbound directions) in the vicinity of the crash site from 2015 to 2023.

Table 3. *ADT Volume and Vehicle Classification on US-24 at the Crash Site*

Data Year	ADT Volume [Vehicles per Day]	Passenger Vehicles	Single Unit Trucks	Multi-Unit Trucks
2023	3,800	3,500 [92.1%]	100 [2.6%]	200 [5.3%]
2021	3,950	3,645 [92.3%]	90 [2.3%]	215 [5.4%]
2019	5,150	4,830 [93.8%]	150 [2.9%]	170 [3.3%]
2017	4,350	4,035 [92.8%]	90 [2.0%]	225 [5.2%]
2015	4,450	4,075 [91.6%]	150 [3.4%]	225 [5.0%]

2.0 Highway Design

On March 13, NTSB investigators mapped the crash site utilizing a small unmanned aircraft system (sUAS).[6] Using the point cloud and orthomosaic map generated from the sUAS mapping, horizontal and vertical alignments were created. Data contained within highway plans provided by the Illinois Department of Transportation (IDOT) were used to assist in the creation of the alignments.[7] The alignment was established along the centerline striping of US-24. Station 1+00 was established as the beginning of the alignment, which was arbitrarily located where the prolongation of the east edge of Ellen Scripps Drive (west) intersects the centerline of US-24. The stations increased in an easterly direction, the direction of travel of the school bus, and ended at Station 21+00, which was located 174.3 feet west of the west prolongation of the entrance to a helipad near the city limit of Rushville.

2.1 Typical Section

The typical section for US-24 in the vicinity of the crash consisted of two travel lanes (one westbound travel lane and one eastbound travel lane) and shoulders bordering each lane. The width of the two travel lanes varied between 22 and 24 feet. The two travel lanes were separated by a 4-inch-wide yellow skip dash. Each dash was approximately 10 feet in length with spacing of 40 feet between each dash. The skip dash was supplemented with raised two-way retroreflective amber pavement markers spaced approximately 80 feet on center.

[6] See the *Technical Reconstruction Group Chairman Report* in the docket.
[7] See Highway Factors Attachment: IDOT US-24 Construction Plans (Contract No. 23536).

The shoulders bordering each travel lane were composed of an asphalt concrete (AC) section adjacent to the white edgeline and aggregate material (Agg.) adjacent to the AC. The shoulders were separated from their respective travel lane by 4-inch-wide solid white edgelines. There were vegetated drainage channels adjacent to the shoulders that ran parallel to the roadway edges.

Figure 7 depicts US-24 from a location approximately 100 feet east of Ellen Scripps Drive (near Station 2+00) looking in an easterly direction.

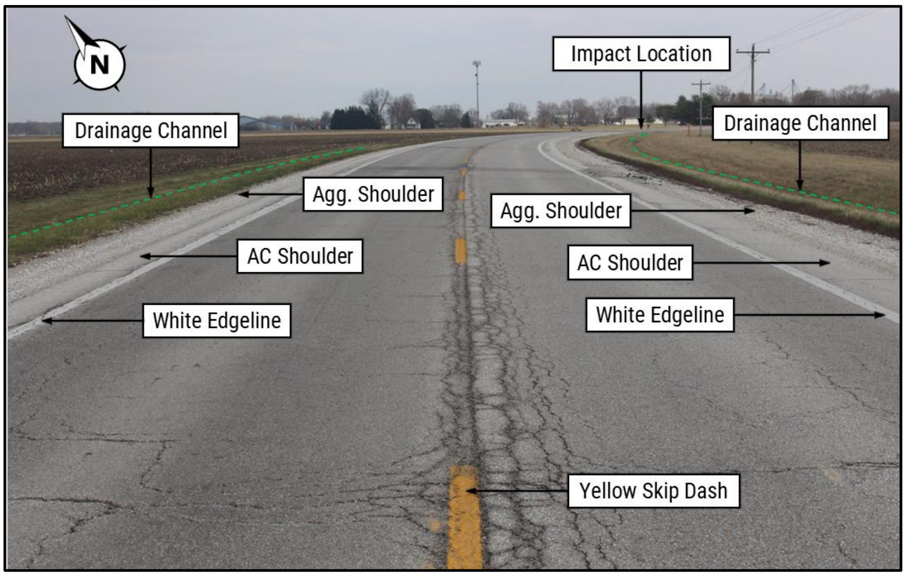

Figure 7. View of US-24 depicting the typical section at the crash site.

Figure 8 illustrates the typical section of US-24 in the area of the crash site. The roadway was superelevated with the high side of the roadway at the edge of the westbound lane, and cross slopes that varied between 0.6 and 4.5 percent.[8] The superelevation between Station 11+00 and Station 15+00, near where the vehicles collided and traveled after impact, the superelevation varied between 4.1 and 4.5 percent. Table 4 shows roadway dimensions at each station.

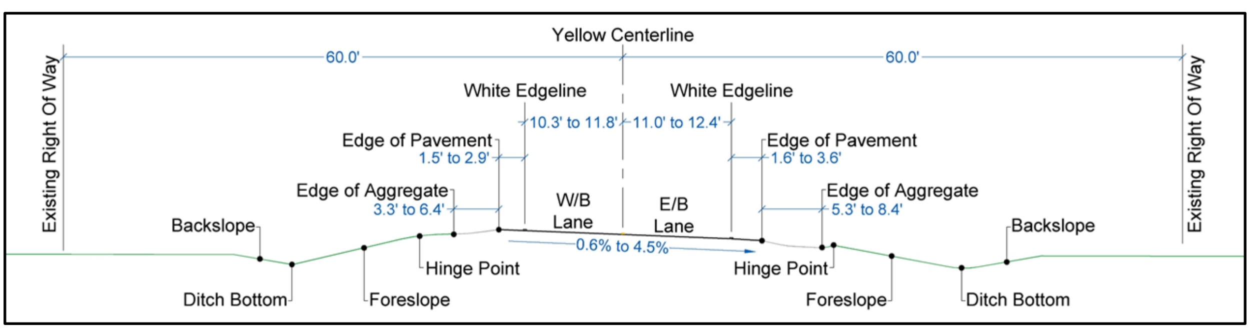

Figure 8. Typical section between Station 1+00 to Station 21+00.

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[8] Superelevation is the banking of a roadway along a horizontal curve so motorists can safely and comfortably maneuver the curve at reasonable speeds.

Table 4. *Widths of US-24 Between Station 1+00 and 21+00*

	Left Shoulder			Travel Lanes			Right Shoulder		
Sta.	**Agg.**	**AC**	**Total**	**West**	**East**	**Total**	**Agg.**	**AC**	**Total**
1+00	5.1'	1.7'	6.8'	11.3'	12.4'	23.7'	10.8'	N/A	10.8'
1+50	6.4'	1.5'	7.9'	11.8'	11.0'	22.8'	3.5'	6.3'	9.8'
2+00	5.2'	1.5'	6.7'	11.7'	11.0'	22.7'	3.5'	6.1'	9.6'
2+50	4.9'	2.2'	7.1'	11.4'	11.3'	22.7'	3.2'	6.7'	9.9'
3+00	5.1'	2.6'	7.7'	11.1'	11.5'	22.6'	3.2'	5.6'	8.8'
3+50	4.7'	2.6'	7.3'	11.2'	11.2'	22.4'	1.6'	8.4'	10.0'
4+00	4.7'	2.4'	7.1'	10.7'	11.7'	22.4'	3.1'	7.3'	10.4'
4+50	4.8'	2.4'	7.2'	10.8'	11.4'	22.2'	3.5'	6.6'	10.1'
5+00	4.5'	2.3'	6.8'	11.0'	11.3'	22.3'	3.6'	6.4'	10.0'
5+50	4.9'	2.5'	7.4'	10.9'	11.2'	22.1'	3.5'	6.3'	9.8'
6+00	4.9'	2.3'	7.2'	10.8'	11.5'	22.3'	3.3'	6.5'	9.8'
6+50	4.5'	2.4'	6.9'	10.9'	11.3'	22.2'	3.6'	6.6'	10.2'
7+00	4.9'	2.6'	7.5'	10.8'	11.5'	22.3'	3.5'	5.8'	9.3'
7+50	4.7'	2.6'	7.3'	11.1'	11.0'	22.1'	3.5'	5.9'	9.4'
8+00	4.8'	2.8'	7.6'	10.5'	11.6'	22.1'	3.3'	6.4'	9.7'
8+50	4.3'	2.6'	6.9'	10.9'	11.1'	22.0'	3.5'	6.2'	9.7'
9+00	5.3'	2.3'	7.6'	10.8'	11.2'	22.0'	3.6'	6.2'	9.8'
9+50	5.3'	2.3'	7.6'	11.1'	11.1'	22.2'	3.5'	6.5'	10.0'
10+00	5.1'	2.4'	7.5'	10.3'	11.9'	22.2'	3.3'	6.0'	9.3'
10+50	4.3'	2.4'	6.7'	10.9'	11.5'	22.4'	3.2'	6.6'	9.8'
11+00	4.9'	2.6'	7.5'	11.0'	11.3'	22.3'	3.3'	7.4'	10.7'
11+50	3.3'	2.6'	5.9'	10.9'	11.3'	22.2'	3.2'	6.6'	9.8'
12+00	4.5'	2.6'	7.1'	10.7'	11.5'	22.2'	3.1'	7.0'	10.1'
12+50	4.2'	2.5'	6.7'	10.8'	11.5'	22.3'	3.2'	6.7'	9.9'
13+00	5.7'	2.6'	8.3'	11.1'	11.1'	22.2'	2.9'	7.4'	10.3'
13+50	4.6'	2.7'	7.3'	10.6'	11.6'	22.2'	3.3'	6.8'	10.1'
14+00	4.2'	2.9'	7.1'	10.7'	11.3'	22.0'	3.3'	6.7'	10.0'
14+50	4.3'	2.5'	6.8'	10.8'	11.2'	22.0'	3.3'	6.6'	9.9'
15+00	5.0'	2.3'	7.3'	11.0'	11.1'	22.1'	3.3'	6.6'	9.9'
15+50	4.8'	2.5'	7.3'	10.6'	11.5'	22.1'	3.1'	6.6'	9.7'
16+00	4.5'	2.8'	7.3'	10.8'	11.3'	22.1'	3.3'	6.2'	9.5'
16+50	4.8'	2.7'	7.5'	11.0'	11.0'	22.0'	3.3'	6.4'	9.7'
17+00	4.9'	2.4'	7.3'	10.9'	11.2'	22.1'	3.2'	6.2'	9.4'
17+50	4.7'	2.6'	7.3'	10.8'	11.4'	22.2'	3.2'	5.8'	9.0'
18+00	4.1'	2.4'	6.5'	11.1'	11.3'	22.4'	3.2'	6.6'	9.8'
18+50	5.5'	2.4'	7.9'	11.1'	11.1'	22.2'	3.5'	6.3'	9.8'
19+00	3.8'	2.4'	6.2'	11.0'	11.2'	22.2'	3.4'	6.0'	9.4'
19+50	3.4'	2.3'	5.7'	10.9'	11.2'	22.1'	3.5'	5.3'	8.8'
20+00	4.9'	2.6'	7.5'	11.1'	11.2'	22.3'	3.2'	6.0'	9.2'
20+50	4.1'	2.7'	6.8'	11.2'	11.1'	22.3'	2.9'	6.3'	9.2'
21+00	4.3'	2.4'	6.7'	11.0'	11.3'	22.3'	2.8'	7.3'	10.1'

2.2 Horizontal and Vertical Alignment

From west to east, the impact occurred approximately 985 feet into a 2,863-foot-long left-to-right horizontal curve with a radius of 2,865 feet. The vertical profile initially had a negative grade between 0.2 and 0.5 percent. At Station 15+00, the grade became positive, varying between 0.2 and 1.0 percent.[9]

3.0 Roadside Design

3.1 Clear Zone

One primary consideration for roadside design along the through traveled way is clear zones. The term "clear zone" is used to designate the unobstructed, traversable area provided beyond the edge of the traveled way for the recovery of errant vehicles.[10] At the crash site, the clear zone (between the white edgeline and existing right of way) varied between approximately 48 and 50 feet.

Figure 9 illustrates that for an ADT between 1,500 and 6,000 and a design speed of 55 miles per hour, consistent with the conditions at the crash site, AASHTO suggests a clear zone between 24 and 30 feet for foreslopes with ratios between 1V:5H and 1V:4H[11].

Design Speed (mph)	Design ADT	Foreslopes			Backslopes		
		1V:6H or flatter	1V:5H to 1V:4H	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Figure 9. Suggested clear-zone distances [source: AASHTO].

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[9] See Highway Factors Attachment: NTSB Horizontal and Vertical Alignments.

[10] See *Section 3.1 – The Clear-Zone Concept* in American Association of State Highway and Transportation Officials (AASHTO). 2011. *Roadside Design Guide*. 4th Edition. Washington, DC: AASHTO, pages 3-1 and 3-2.

[11] 1V:4H means 1-foot vertical distance for every 4-feet horizontal distance.

3.2 Drainage Channel

Within the clear zone, there were vegetated drainage channels north and south of the traveled way that paralleled the roadway. The primary function of drainage channels is to collect surface runoff from the roadway and areas that drain to the right-of-way and convey the accumulated runoff to acceptable outlet points. Although important in collecting surface runoff, drainage channels should be designed, built, and maintained with consideration given to their effect on the roadside environment.

Three regions of the roadside are important to reducing the potential for loss of control for vehicles that run off the road; the top of the slope (hinge point), the foreslope, and the toe of the slope (intersection of the foreslope with level ground or with a backslope, forming a ditch).[12]

After impact, the combination vehicle and school bus traveled in a westerly direction, entered the drainage channel north of the westbound traffic lane, and came to rest within the same drainage channel. Figure 10 illustrates the typical cross section of the drainage channel north of the traveled way, the channel traversed by the vehicles after impact and as they traveled to their respective positions of rest.

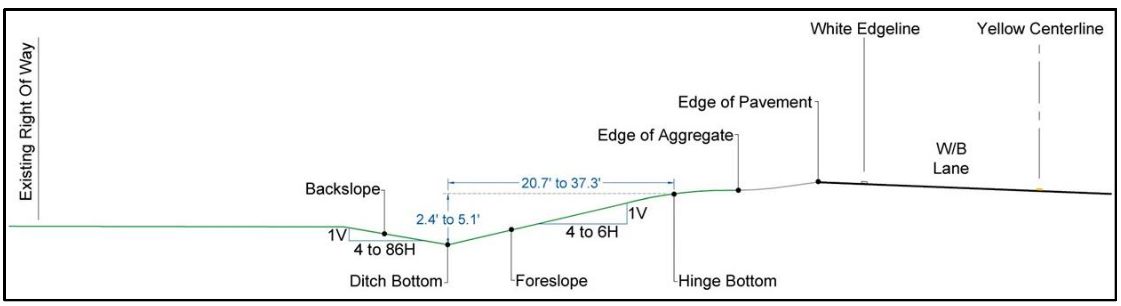

Figure 10. Typical section of the drainage channel (Station 1+00 to Station 21+00).

The hinge point contributes to loss of steering control because vehicles tend to become airborne in crossing this point. The toe of the slope is often within the roadside clear zone and therefore, the probability that an out-of-control vehicle will reach the ditch is high.

[12] See *Section 4.8.4 – Side Slopes* in American Association of State Highway and Transportation Officials (AASHTO). 2018. *A Policy on Geometric Design of Highways and Streets*. 7th Edition. Washington, DC: AASHTO, page 4-28.

Foreslopes parallel to the flow of traffic may be identified as recoverable, non-recoverable, or critical. AASHTO characterizes each of these slopes as follows:[13]

> Recoverable – recoverable foreslopes are 1V:4H or flatter. Motorists who encroach on recoverable slopes generally can stop their vehicles or slow them enough to return to the roadway safely.
>
> Non-recoverable – non-recoverable foreslopes are generally between 1V:4H and 1V:3H. These foreslopes are traversable, but most vehicles will not be able to stop or return to the roadway easily and vehicles typically can be expected to reach the bottom.
>
> Critical – critical foreslopes are steeper than 1V:3H. These foreslopes create a higher propensity for vehicles to overturn.

Drainage channel cross sections that are considered preferable are not obstacles and need not be constructed at or beyond the suggested clear-zone distance for a specific roadway.[14] Any vehicle leaving the roadway may be funneled along the drainage channel bottom or encroach to some extent on the backslope, thus making an impact more likely.[15]

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[13] See *Section 3.2.1 – Foreslopes* in American Association of State Highway and Transportation Officials (AASHTO). 2011. *Roadside Design Guide*. 4th Edition. Washington, DC: AASHTO, pages 3-4 and 3-5.
[14] See *Section 3.3.5 – Clear-Zone Applications for Drainage Channels and Backslopes* in American Association of State Highway and Transportation Officials (AASHTO). 2011. *Roadside Design Guide*. 4th Edition. Washington, DC: AASHTO, page 3-12.
[15] Ibid.

Figure 11 depicts preferred foreslopes and backslopes for basic channel configurations. Cross sections shown in the shaded region are considered to have traversable cross sections, while cross sections outside the shaded region are considered less desirable and their use should be limited where high-angle encroachments can be expected.[16]

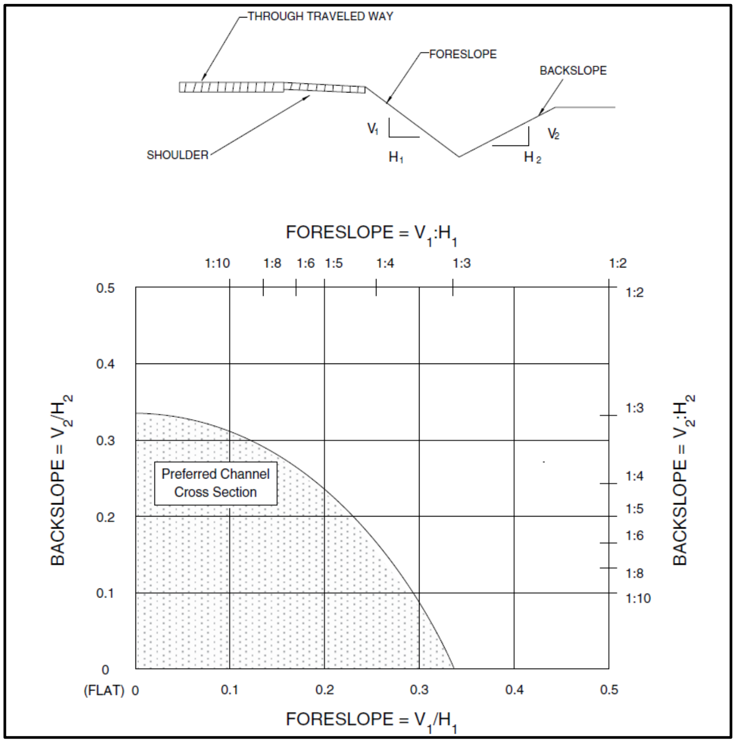

Figure 11. Preferred basic channel configurations [source: AASHTO].

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[16] See *Section 3.2.4 – Drainage Channels* in American Association of State Highway and Transportation Officials. 2011. *Roadside Design Guide*. 4th Edition. Washington, DC: AASHTO, page 3-9.

Using the point cloud, cross sections of the drainage channel were created every 50 feet between Station 11+00 and Station 15+00, near where the vehicles traversed the drainage channel.

Table 5 summarizes measurements of the foreslope and backslope ratios, channel width, and depth of the drainage channel at each station between Station 11+00 and 15+00. The channel width was measured between the hinge point and the top of the backslope. The channel depth was measured between the hinge point and bottom of the channel.

Table 5. *Dimensions of the Drainage Channel*

Station	Foreslope Ratio [V_1:H_1]	Backslope Ratio [V_2:H_2]	Channel Width	Depth
11+00	1:5	1:6	24.4'	3.5'
11+50	1:4	1:6	24.4'	3.5'
12+00	1:5	1:5	24.1'	3.2'
12+50	1:4	1:5	23.4'	3.2'
13+00	1:4	1:5	23.6'	3.3'
13+50	1:5	1:4	21.6'	2.8'
14+00	1:5	1:4	24.2'	2.6'
14+50	1:5	1:4	23.0'	2.7'
15+00	1:5	1:4	22.5'	2.9'

The measured foreslope and backslope ratios were plotted on AASHTO's preferred foreslopes and backslopes chart depicted in Figure 11.

Figure 12 illustrates that all cross sections of the drainage channel were within AASHTO's preferred channel cross section and therefore, need not be constructed at or beyond the suggested clear-zone distance.

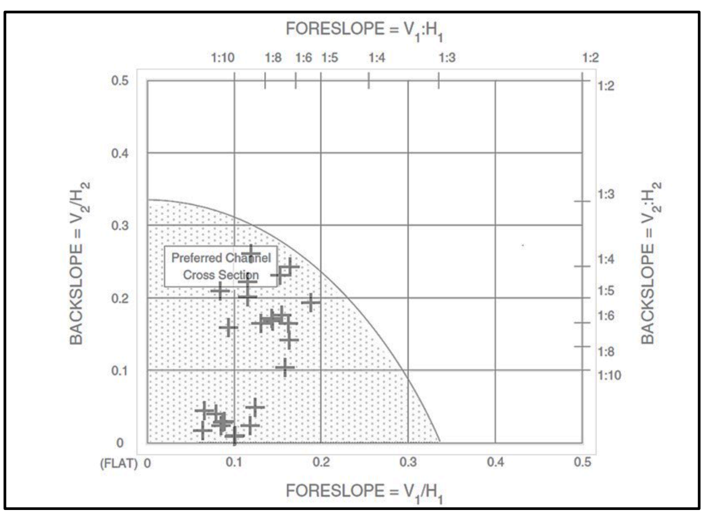

Figure 12. Preferred basic channel configurations [source: AASHTO revised].

4.0 Centerline Rumble Strips

Rumble strips are a safety countermeasure intended to alert drivers when they leave the roadway across the edgeline or centerline through the generation of noise and vibration.[17] Centerline rumble strips (CLRS) are used on undivided highways to reduce head-on, opposite-direction sideswipe crashes and roadway departure crashes to the left.

Currently, there are two main types of rumble strips used on rural, non-freeway facilities, milled and raised. Milled rumble strips, which are most prevalent, are milled into the roadway surface using a rotary milling machine (Figure 13).

Figure 13.Example of milled CLRS and shoulder rumble strips. Source: FHWA

A total of 46 State departments, including the Federal Lands Highway Division Safety Team, have CLRS design standards.[18] Departments that have implemented successful rumble strip standards include California Department of Transportation (Caltrans), Hawaii Department of Transportation (HDOT), Louisiana Department of Transportation and Development (LaDOTD), Montana Department of Transportation (MDT), and Virginia Department of Transportation (VDOT).[19] Most departments implement CLRSs based on crash history and/or systematically; many departments with a systematic approach note that installations are required for new construction, rehabilitation, or overlay projects.[20] According to IDOT officials, IDOT does not have a policy for the installation of CLRSs; however, there is an ongoing study that "should lead to policy at some point in the future."[21]

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[17] Federal Highway Administration (FHWA). 2017. *State of the Practice for Shoulder and Center Line Rumble Strip Implementation on Non-Freeway Facilities*. Technical Report FHWA-HRT-17-026. Washington, DC., page 5
[18] Ibid., page 57
[19] Ibid., page 42.
[20] Ibid., page 46.
[21] See Highway Factors Attachment: Email from IDOT Regarding Centerline Rumble Strips.

According to FHWA, installation of continuous milled centerline rumble strips, including in passing zones, should be considered:[22]

- System-wide on undivided rural roads with posted or statutory speed limits of 50 miles per hour or greater where the lane plus shoulder width beyond the rumble strip will be at least 14 feet (i.e. systemic safety projects).
- Along rural and urban two-lane road corridors where significant opposing direction crashes that involve any form of motorist inattention have been identified (i.e. location-specific corridor safety improvements).
- During any highway project with a history of head-on and opposing direction sideswipe collisions, or where center line rumble strips were overlaid during the paving process (e.g. reconstruction or resurfacing projects).

US-24 at the crash site was an undivided rural road with a posted speed limit of 55 miles per hour. The westbound lane width plus total shoulder width beyond the centerline varied between 16 and 20 feet (asphalt concrete and aggregate shoulder) and 12 and 15 feet (asphalt concrete shoulder only). The eastbound lane width plus total shoulder width beyond the centerline varied between 20 and 23 feet (asphalt concrete and aggregate shoulder) and 13 and 16 feet (asphalt concrete shoulder only).

During the five years prior to this crash, there were a total of 32 crashes within one mile of the crash site. Of the 32 crashes, 18 occurred within, or east of the intersection with US-67, locations that were not representative of the roadway characteristics at the crash site. Of the nine crashes that occurred in a location consistent with the characteristics of the crash site, all but one involved a vehicle colliding with a deer. There were no reported crashes that occurred within the horizontal curve where this crash occurred and there were no crashes that involved a vehicle crossing the centerline.

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[22] Federal Highway Administration (FHWA). 2011. *Technical Advisory – Centerline Rumble Strips*. Washington, DC., page 6

5.0 Signage Prior to the Crash Site

The highway signs on US-24, in the vicinity of the crash site were documented and are depicted in Figure 14.

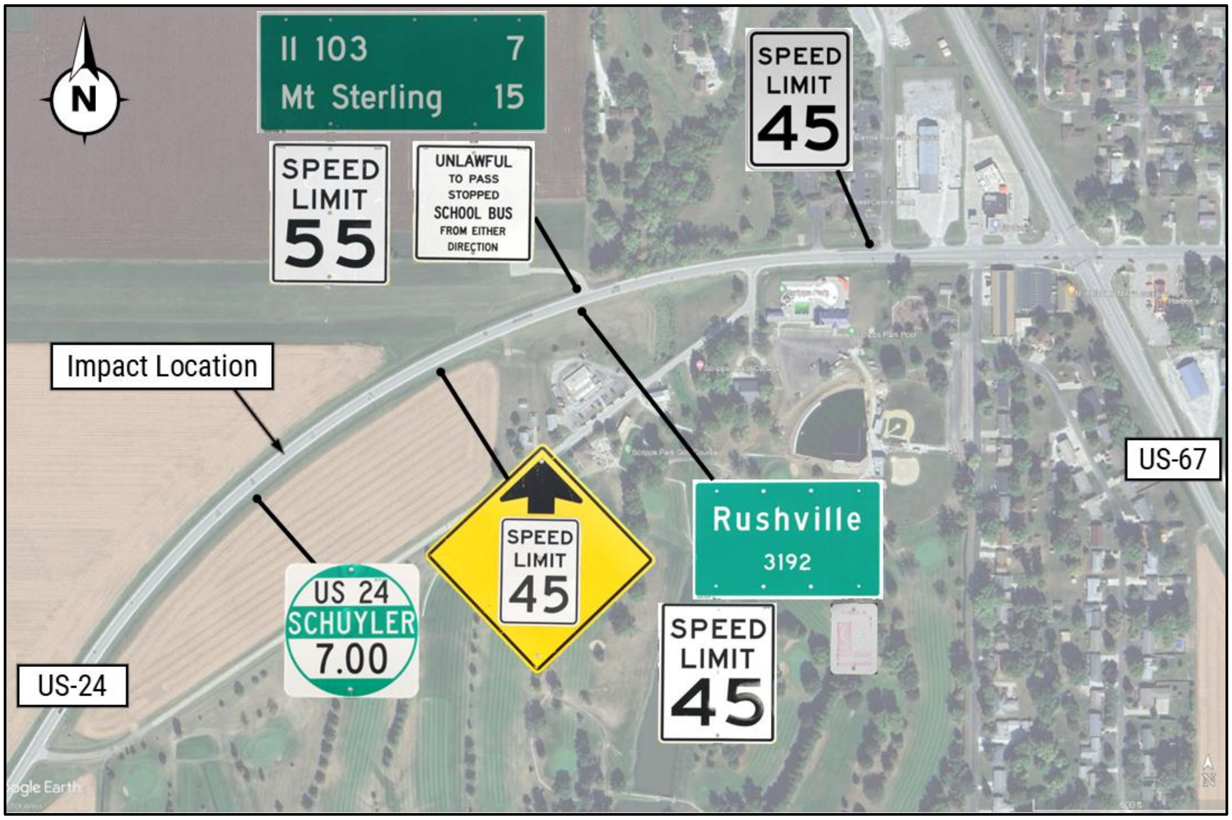

Figure 14. Signs on US-24 near the crash site [Source: Google Earth revised].

E. LIST OF ATTACHMENTS

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

Highway Factors Attachment: IDOT Crash History Report

Highway Factors Attachment: IDOT US-24 Construction Plans (Contract No. 23536)

Highway Factors Attachment: NTSB Horizontal and Vertical Alignments

Highway Factors Attachment: Email from IDOT Regarding Centerline Rumble Strips

Submitted by:

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Highway Factors Investigator