



**NATIONAL TRANSPORTATION SAFETY BOARD  
OFFICE OF HIGHWAY SAFETY  
WASHINGTON, D.C.**

**HIGHWAY FACTORS GROUP CHAIRMAN'S  
FACTUAL REPORT**

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**A. CRASH INFORMATION**

Location: 17000 Block 480<sup>th</sup> Street, Oakland, Pottawattamie County, Iowa  
Vehicle 1: 2004 IC, Model 3S530, 65 passenger school bus  
Operator 1: Riverside Community School District  
Date: December 12, 2017  
Time: Approximately 6:52 a.m. CST  
NTSB #: **HWY18MH003**

**B. HIGHWAY FACTORS GROUP**

Steven L. Prouty, P.E., Senior Highway Engineer, Group Chairman  
NTSB Office of Highway Safety  
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John A. Rasmussen, P.E., County Engineer  
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Tony Leick, Deputy Sheriff  
Pottawattamie County Sheriff's Office  
1400 Big Lake Road, Council Bluffs, IA 51501

Katie Pattee, Crime Scene Technician  
Pottawattamie County Sheriff's Office  
1400 Big Lake Road, Council Bluffs, IA 51501

**C. CRASH SUMMARY**

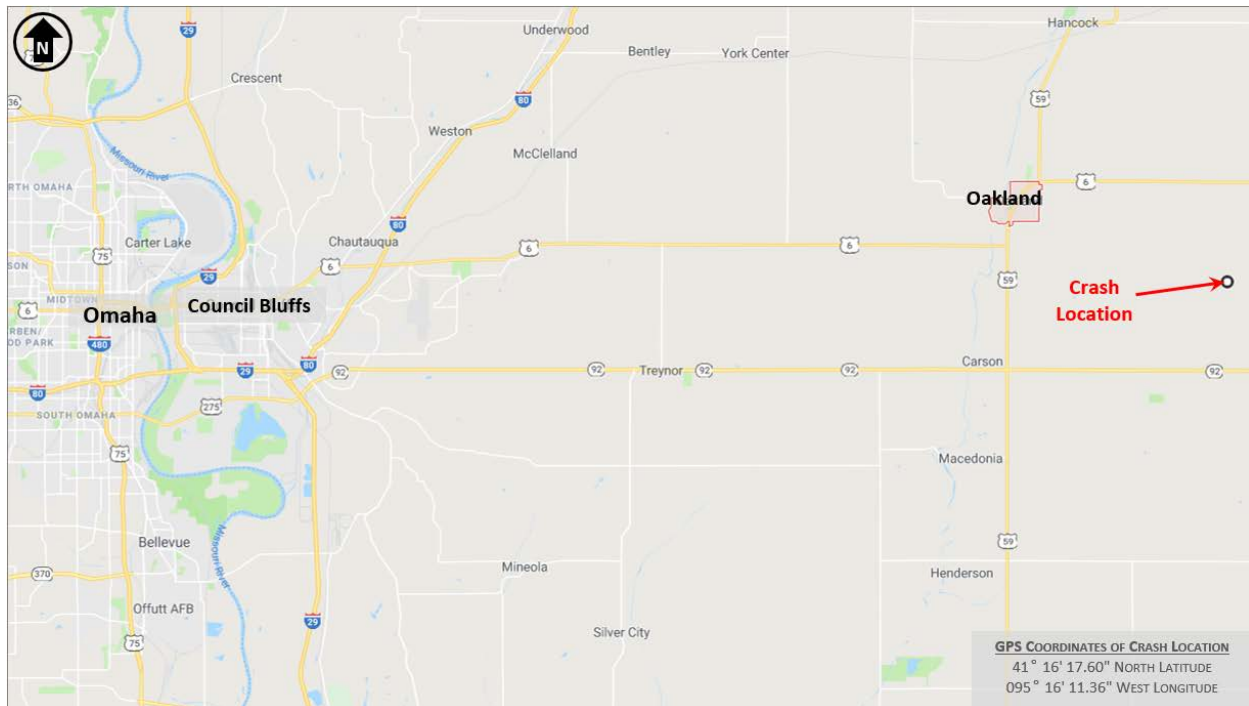
For a summary of the crash, refer to the *Crash Summary Report* in the docket for this investigation.

## D. DETAILS OF THE HIGHWAY FACTORS INVESTIGATION

This Highway Group Chairman’s Factual Report is based on reports, photographs, documents, and data provided by the Pottawattamie County Secondary Roads Department and the Pottawattamie County Sheriff’s Office, as well as information and photographs gathered on-scene by NTSB investigators. Data was obtained that included a construction history, daily traffic volumes, and crash summaries. Highway data was obtained that included functional classification, highway design, and data from a total station survey conducted by the Pottawattamie County Secondary Roads Department.

### 1. CRASH LOCATION

The crash occurred in a ditch to the east of the roadway, across from the south driveway to 17840 480<sup>th</sup> Street, in Oakland, Pottawattamie County, Iowa. The crash location, shown in **Figure 1**, was located approximately 7.1 miles east-southeast of the downtown area of the City of Oakland, Iowa.<sup>1</sup>



**Figure 1:** Map Showing General Crash Location East-Southeast of the City of Oakland (modified from Google Maps)

### 2. HIGHWAY DESIGN

In the area of the collision, 480<sup>th</sup> Street was functionally classified as a rural minor collector roadway.<sup>2</sup> 480<sup>th</sup> Street was a two-lane gravel roadway that consisted of a northbound travel lane

<sup>1</sup> See *Highway Photograph 1 – Crash Location – Facing Northwest*.

<sup>2</sup> See *Highway Attachment – Iowa DOT Federal Functional Classification Map*.

and southbound travel lane.<sup>3</sup> At the crash location, the northbound and southbound lanes were both approximately 12-feet and 13.5-feet wide respectively. An approximate 2.5-foot wide earthen and gravel shoulder flanked the east side of the gravel roadway. It should be noted that, while present, the earthen and gravel shoulders were difficult to discern from both sides of the roadway, both north and south of the crash location. An approximate 3-foot deep drainage ditch ran parallel to the east edge of the roadway. Two driveways on the west side of the road provided access to a residence at 17840 480<sup>th</sup> Street. The collision occurred in the ditch across from the south driveway. A field driveway was located on the east side of the roadway across from the residence. The crest of a vertical curve was located approximately 166-feet north of the crash location. There was an approximate 8.9% grade both north and south of the vertical curve. The crash location was located on the vertical curve, and northbound traffic had an approximate 4.2% uphill grade at the collision location.<sup>4</sup> The satellite image in **Figure 2** shows the layout of the roadway, residence, and driveways. The crash occurred during the hours of darkness and there was no artificial highway lighting along 480<sup>th</sup> Street in the vicinity of the crash location.

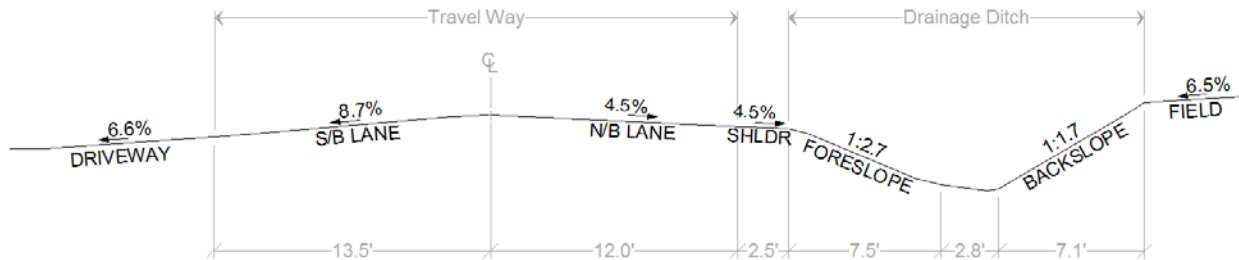


**Figure 2:** Satellite Image of the Crash Location (modified from Google Earth - Image Date: 3/8/2015)

<sup>3</sup> See *Highway Photograph 2 – Roadway at Crash Location – Facing South*.

<sup>4</sup> The grade of a vertical curve is constantly changing as the roadway transitions from a fixed grade prior to the start of the vertical curve to the crest of the vertical curve. Because the crash was located on a vertical curve, the grade measurement at the crash location was less steep than the reported fixed grade that would have been found south of the vertical curve.

The Pottawattamie county Sheriff’s Office and Council Bluffs Police Department mapped the area of the crash using a 3-dimensional laser scanner, from which a highly accurate 3-D model can be produced. The roadway, driveways, roadway evidence, and surrounding features were also surveyed by a Pottawattamie County Secondary Roads survey crew to further document the area surrounding the crash location.<sup>5</sup> A cross-section of the south driveway, roadway, and drainage ditch is shown in **Figure 3**.



**Figure 3:** Cross-section of Driveway, Roadway, and Drainage Ditch at Crash Location

### 3. CONSTRUCTION, MAINTENANCE, AND PERMIT HISTORY

The roadway that is now known as 480<sup>th</sup> Street was established at 56-feet wide by Petition No. 288, on November 21, 1877, and was recoded on Page 605 of Road Calendar Book B.<sup>6</sup> Since that time, the roadway has not been fully reconstructed, but has been maintained. Construction and design plans related to the roadway’s original construction were not able to be located.

The Pottawattamie County Secondary Roads system consists of approximately 1,500-miles of roadway, with approximately 1,100-miles being unpaved. Current County standards for the new construction of a similar roadway would require a 20-foot wide roadway with 2-foot shoulders.<sup>7</sup> Drainage ditches would require 1V:3H entrance (cross) slopes.<sup>8</sup> For roadways with an average daily traffic (ADT) less than 400, ditch bottoms could be as narrow as 0-feet wide. The depth of the drainage ditches is typically 3-feet lower than the near edge of the roadway, but could vary due to erosion, aggregation, and drainage needs.

A search was conducted for driveway permits at the crash location; none were found. Other permits in the area dated back to the 1950’s.<sup>9</sup> Driveways at the crash location are visible in an aerial photograph from 1950, indicating they were likely built prior to the permitting process.

<sup>5</sup> See *Highway Attachment – Pottawattamie County Secondary Roads Survey Data*, and *Highway Photograph 3 – School Bus at Final Rest Following the Collision and Post-Crash Fire – Facing South*.

<sup>6</sup> See *Highway Attachment – Information and Data Received from Pottawattamie County Secondary Roads Department*.

<sup>7</sup> Ibid.

<sup>8</sup> Roadway sideslopes, ditches, and the slopes of other structures or features alongside the roadway are typically described as a ratio of vertical distance to horizontal distance (V:H). For example, a ditch described as 1V:3H would rise or drop 1 unit of measure (feet, inches, meters, etc.) for each 3 of the same units of measure horizontally.

<sup>9</sup> See *Highway Attachment – Information and Data Received from Pottawattamie County Secondary Roads Department*.

#### 4. AVERAGE DAILY TRAFFIC VOLUMES

Average daily traffic volumes were provided to Pottawattamie County by the Iowa Department of Transportation (DOT) every four years.<sup>10</sup> The ADT values were either counted or calculated. A summary of the ADT volumes on 480<sup>th</sup> Street in the vicinity of the crash is shown in **Table 1**. No vehicle classification data was available; however, Iowa DOT assumes a truck count of 10%.

**Table 1:** Average Daily Traffic Volumes on 480<sup>th</sup> Street

Year	Average Daily Traffic Volume
2004	15
2008	25
2012	25
2016	10

#### 5. TRAFFIC AND FATAL CRASH HISTORY

A summary of the traffic and fatal crash history on any of the roads within an approximate 1.5-mile radius of the nearest intersection to the crash location for the nearly 11-year period between 2007 and 2017, can be found in **Table 2**.<sup>11</sup> Of the four reported crashes during this nearly 11-year period, none of them occurred on 480<sup>th</sup> Street. A map showing the locations of these crashes is shown in **Figure 4**.

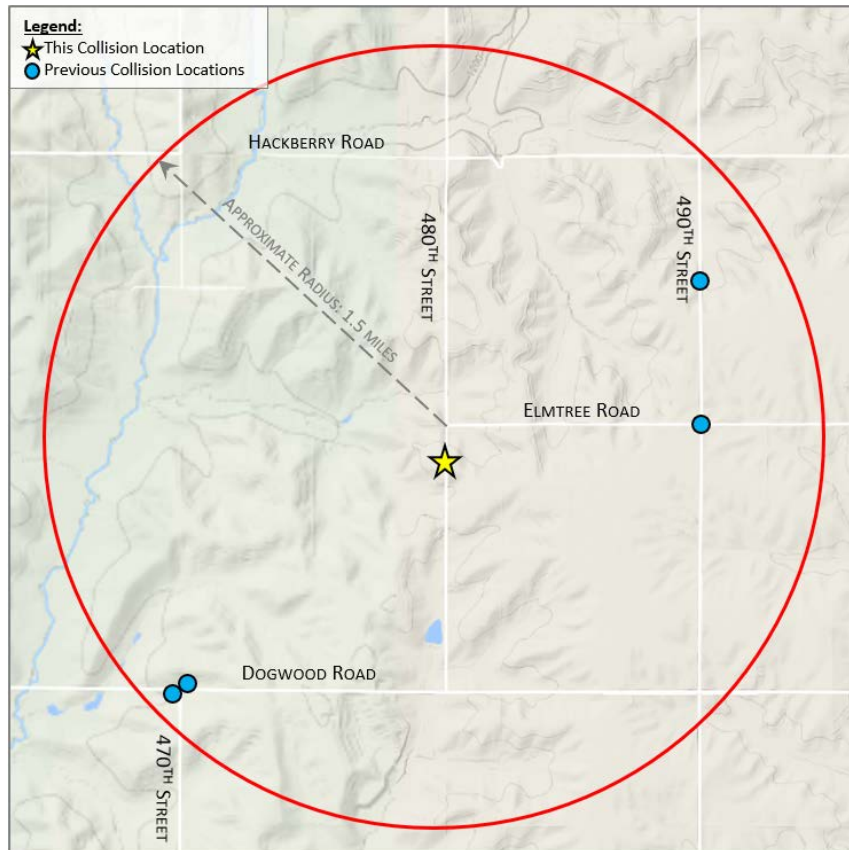
**Table 2:** Traffic and Fatal Crash Summary for Roads Within 1.5 Miles of Crash Location

Year	Fatal	Incapacitating Injury	Non-Incapacitating Injury	Possible Injury	No Injury	Total
2007	0	0	0	0	0	0
2008	0	0	0	0	2	2
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	0	0	0	0	0	0
2012	0	0	0	0	0	0
2013	0	0	0	0	0	0
2014	0	0	0	0	0	0
2015	0	0	0	1	0	1
2016	0	0	1	0	0	1
2017 <sup>A</sup>	0	0	0	0	0	0
Total	0	0	1	1	2	4

<sup>A</sup> Partial Year - Only data that was received and processed prior to December 15, 2017 is included in this table. Therefore, the crash that is the subject of this investigation is not included in this information.

<sup>10</sup> See *Highway Attachment – Iowa DOT Traffic Count Map*, and *Highway Attachment – Information and Data Received from Pottawattamie County Secondary Roads Department*.

<sup>11</sup> See *Highway Attachment – Iowa DOT Crash History*. Note that only partial data was available for 2017.



**Figure 4:** Map of Previous Collision Locations (source: Modified from Google Maps)

## 6. SIGN INVENTORY

No regulatory or warning signs were posted for traffic traveling in either direction on 480<sup>th</sup> Street for several miles, both north and south, of the crash location.

## 7. SPEED LIMIT

The Iowa statutory speed limit is 55 miles per hour (mph) unless otherwise posted.<sup>12</sup> As previously discussed, no regulatory signs, including speed limit signs, were posted on 480<sup>th</sup> Street in advance of the crash location. Therefore, the speed limit on 480<sup>th</sup> Street is 55 mph. No speed studies have been conducted near the collision location.

## E. DOCUMENTATION OF SCENE EVIDENCE

Scene photographs and a scene walk-through video were obtained from the Pottawattamie County Sheriff's Office. 3-D laser scans of the crash location and exemplar school bus were completed on December 14, and December 15, 2017, respectively. These scans were completed

<sup>12</sup> See *Highway Attachment – Information and Data Received from Pottawattamie County Secondary Roads Department*.

as a cooperative effort by the Pottawattamie County Sheriff's Office and the City of Council Bluffs Police Department.

The locations of the school bus's left rear tires were still visible, in the form of two parallel patches of unburned grass, on the east shoulder, near the edge of the drainage ditch. The locations of the school bus's right rear tires were visible in the form of two distinct depressions in the soil near the bottom of the foreslope of the drainage ditch. These depressions were nearly filled with various pieces of debris from the post-crash fire. After using a soft-bristled brush to carefully remove the debris from the depressions, large portions of tire treads were found still lining the bottom of the depressions in the soil, as shown in **Figure 5**.<sup>13</sup> The depression formed by the right inner dually tire was approximately 24-inches long, 9-inches wide, and 2-inches deep. The depression formed by the right outer dually tire was approximately 27-inches long, 9-inches wide, and 2-inches deep.



**Figure 5:** Right Rear Tire Depressions Near the Bottom of the Ditch Foreslope

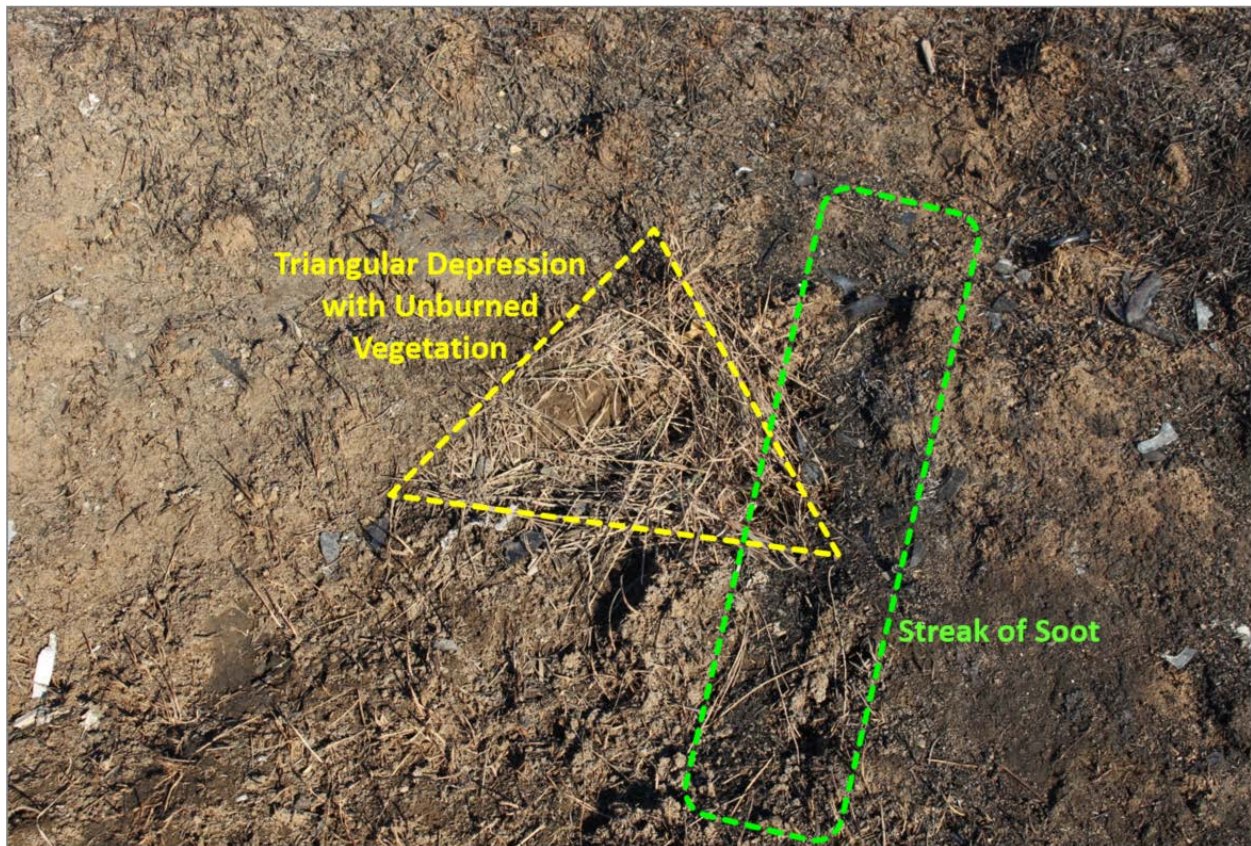
Investigators also located a triangular depression in the backslope of the ditch that contained unburned, dried vegetation.<sup>14</sup> The location of the triangular depression was consistent with the location of the lower right corner of the school bus's bumper following the collision and

<sup>13</sup> See *Highway Photograph 4 – Right Rear Tire Depressions Near the Bottom of Ditch Foreslope*.

<sup>14</sup> See *Highway Photograph 5 – Triangular Depression in Soil of Ditch Backslope – Facing Southeast*.

post-crash fire.<sup>15</sup> A streak of what appeared to be soot deposits was located approximately 18-inches inward of the outer edge of the corner depression, and slightly below the bottom of the corner depression as shown in **Figure 6**.<sup>16</sup> The streak of suspected soot was approximately 22-inches long, and 5-inches wide. Investigators obtained a sample of the material and forwarded it to the NTSB Materials Laboratory for analysis.

The items of roadway evidence were photographed, and their locations documented by a Pottawattamie County Secondary Roads survey crew. The survey crew also documented the “as-built” layout of roadway in the area of the collision, as well as the outer boundaries of the area burned by the post-crash bus and grass fires.



**Figure 6:** Triangular Depression and Soot Deposits Located on Backslope of Ditch

<sup>15</sup> See *Highway Photograph 6 – Right Rear Corner of School Bus at Final Rest Against the Ditch Backslope Following the Collision and Post-Crash Fire.*

<sup>16</sup> See *Highway Photograph 7 – Area of Suspected Soot Deposits on Ditch Backslope.*

## **F. DOCKET MATERIAL**

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

### LIST OF ATTACHMENTS

- Highway Attachment - Iowa DOT Federal Functional Classification Map
- Highway Attachment - Pottawattamie County Secondary Roads Survey Data
- Highway Attachment - Information and Data Received from Pottawattamie County Secondary Roads Department
- Highway Attachment - Iowa DOT Traffic County Map
- Highway Attachment - Iowa DOT Crash History

### LIST OF PHOTOGRAPHS

- Highway Photograph 1 - Crash Location – Facing Northwest
- Highway Photograph 2 - Roadway at Crash Location – Facing South
- Highway Photograph 3 - School Bus at Final Rest Following the Collision and Post-Crash Fire – Facing South
- Highway Photograph 4 - Right Rear Tire Depressions Near the Bottom of Ditch Foreslope
- Highway Photograph 5 - Triangular Depression in Soil of Ditch Backslope – Facing Southeast
- Highway Photograph 6 - Right Rear Corner of School Bus at Final Rest Against the Ditch Backslope Following the Collision and Post-Crash Fire
- Highway Photograph 7 - Area of Suspected Soot Deposits on Ditch Backslope

END OF REPORT

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