

National Transportation Safety Board

Office of Highway Safety

Washington, DC 20594



HWY22MH009

TECHNICAL RECONSTRUCTION

Group Chair's Factual Report

May 24, 2022

A. CRASH

Location: Clarendon Hills, Illinois
Date: May 11th, 2022
Time: 08:16 AM (CDT)

B. TECHNICAL RECONSTRUCTION GROUP

Group Chair Eric Gregson
NTSB, Technical Reconstructionist

C. SUMMARY

Refer to the *Crash Information and Crash Summary Report* in the docket for this investigation.

D. DETAILS OF THE INVESTIGATION

1.0 Introduction

On Wednesday, May 11th, 2022, the NTSB initiated an investigation of a highway-railroad grade crossing (rail crossing) collision that occurred on South Prospect Avenue in Clarendon Hills, Illinois.¹ A 2004 International truck had been traveling north on South Prospect Avenue when it stalled on the tracks.

Prior to the rail crossing South Prospect Avenue intersects with Ann Street. The intersection is controlled by stop signs. The rail crossing warning system was comprised of flashing LED lights, two audible warning bells, two fiberglass automatic gate arms, and a pedestrian warning system. The International had been stopped at the stop sign on South Prospect Avenue for a westbound train. There were two vehicles stopped in front of the International. After the westbound train cleared the rail crossing the warning system deactivated, the gates raised, and traffic began to cross the rail crossing. A vehicle that had been stopped on Ann Street proceeded in front of the International. On the north side of the rail crossing, North Prospect Avenue intersects with Burlington Avenue. Burlington Avenue is controlled by a stop sign.

The International truck stalled while partially blocking track #3. The METRA Train identification number A1242111S consisting of one locomotive and 6

¹ The grade crossing is owned and operated by the Burlington Northern and Santa Fe Railway (BNSF) and is identified by DOT grade crossing inventory #079529S, at BNSF Mile Post 18.32.

passenger rail cars was approaching from the west. As the northbound fiberglass gate arm began to lower it struck the top of the International truck. The train engineer sounded the horn and placed the train into emergency braking. As both units occupied the crossing the right front of the lead cab car struck the front driver's side of the International truck.

The impact propelled the International into a clockwise rotation. The left side and left rear of the International collided with the right side of the first cab car.

NTSB investigators examined and documented the collision site and other roadway and environmental features on May 12th, 2022, one day after the collision. The primary documentation involved photographs and laser scanning of the lead cab car, International truck, and exemplar International truck. This report provides details of observations and information regarding the evidentiary documentation process. Factual reports prepared by other investigative groups should be consulted for additional details.

All photographs were taken in digital format. Laser scanning was accomplished using the FARO Focus 3D scanner that linked multiple scans of the involved cab car, International truck, and an exemplary truck.² Further imagery of the scene was accomplished utilizing a small Unmanned Aircraft System (sUAS) in which the photographs were processed through the Pix4D Mapper software to create a three-dimensional point cloud project for use in the analysis.³ Images of the scene were also captured by the Metra Police Department with their sUAS. Their images were provided to NTSB investigators. Additional processing allowed the data to be exported for the use in various computer aided diagramming software to acquire additional dimensional data and create two-dimensional renderings of the highway environment.

2.0 Vehicle Documentation

2.1 Metra Cab Car

Upon arrival of NTSB investigators, the lead cab car, identified as #8473, was still attached to the other five passenger rail cars and locomotive and was stopped approximately 1,106 feet west of the collision location. The cab car was initially

² The FARO Focus 3D scanner is a high-speed Terrestrial Laser Scanner for 3D measurement and image documentation. The scanner produces dense point cloud scans that can be combined of linked with multiple positions to create a cohesive three-dimensional point cloud rendering an exact measurable copy of the target.

³ Pix4D Mapper is a photogrammetry software package designed to use overlapping photographic images to generate 3D point clouds. Additional outputs from the generated point clouds include 3D models and 2D orthomosaic maps.

examined on May 12th, 2022, the day following the collision. Additional examination and scanning occurred May 14th, 2022, three days after the collision at a secured Metra rail facility in Chicago, IL.

The cab car was identified as a Gallery Type Bi-Level Passenger Car having an overall length of 85 feet, a width of 9.75 feet, a height of 10.83 feet, and a nominal weight of 121,000 pounds. A total of 11 scan stations were established to cover the exterior of the cab car with an additional 3 scan stations to cover the interior of the cab car. Figures 1 and 2 depict the damage to the cab car with photography. Figures 3 and 4 are screen captures of the 3D point cloud.



Figure 1. Photograph of cab car taken during on scene investigation.



Figure 2. Photograph depicting the damage to the right side of the cab car.



Figure 3. Screen capture of 3D point cloud depicting damage incurred during the collision.



Figure 4. Screen capture of 3D point cloud depicting the damage to the right side of the lead cab car. (The appearance of damage to the top of the train is due to lack of information when rendering the 3D point cloud).

Direct impact occurred on the right front and right side of the cab car. The damage to the front extended inboard a distance of 4.8 feet and upward a distance of about 9.0 feet. The right side of the snow plow, sill step, and hand brake equipment all exhibited rearward displacement. The uncoupling rod exhibited impact damage as well as the 480 junction. The right-side end structure cross beam was deformed and displaced rearward. Just above the end structure cross beam was the right-side cab signal. The glass and bulb were shattered, and the bracket was damaged. The right-side mirror was missing, and the bottom support arm was broken and displaced rearward.

On the right side of the cab car were two areas which were consist with impact damage from the International. The first area was approximately 5.9 feet from the front of the cab car and was located between the engineer's side window and the first upper passenger window and was in line with damage identified at the highest point on the front of the cab car. The damage consisted of three scratch marks with two of them containing a black mark. The first upper passenger window had been dislodged and was missing with the rubber seal hanging outside the window frame. Approximately 42.0 feet from the front of the cab car, on the rear vestibule door was apparent contact damage. Scrape marks with white paint transfer was visible on the door and the passenger grab rail was bent. The lower right sidewall had been torn open exposing the interior of the cab car. The breach began approximately 4.0 feet aft of the vestibule doors and extended rearward for about 9.0 feet and expanded vertically for about 1.6 feet. There was a second puncture in the sidewall about 3.3 feet rearward of the large breach. There were scrapes and scratches extending upward from the sidewall breach to the upper passenger window. The lower passenger window was missing along with the rubber seal. The upper passenger window had been pushed inward into the passenger area and the seal was hanging along the lower frame.

2.2 Commercial Motor Vehicle

The involved commercial motor vehicle was identified as a 2004 International 4400 26-foot box truck. The vehicle was left at its position of final rest and secured by law enforcement until the arrival of NTSB investigators. As a result of the collision event the truck had overturned. The truck was photographed at the scene and again after removal to a storage facility. The truck was also scanned while at the storage facility.

Figure 5 is a photograph of the International box truck looking at the damage to the front left side of the cab. Figure 6 is a screen capture of the 3D point cloud depicting the damage to the International. Figure 7 is a screen capture of the 3D point cloud depicting an exemplar International box truck that was scanned on May 14th, 2022 at the company's headquarters.



Figure 5. Photograph depicting the damage to the front and left side of the 2004 International box truck.



Figure 6. Image of the rendered three-dimensional point cloud depicting the damage sustained by the International.

As a result of the impact the front of the truck was displaced laterally towards the passenger (right) side resulting in an offset angle of approximately 8.0° . The driver's side of the cab was collapsed downward and towards the passenger's side and the hood was torn off. The left front tire had separated from the wheel assembly and the left side of the front bumper was bent upward and inward towards the engine compartment. A post-crash fire ensued resulting in the cab of the truck as well as the engine compartment receiving thermal damage. The bed portion also received thermal damage.



Figure 7. Image of the rendered three-dimensional point cloud of an exemplar International box truck with dimensional measurements.

Figure 8 depicts the damage to the rear of the truck where a second impact area was identified. The frame rail was displaced laterally to the right side (passenger side) at an angle of approximately 12.5° . The left rear corner of the deck had been pushed upward and the left side of the rear end protection device was bent inward towards the center of the truck. Also noted was damage to the loading ramp. The left side rail had been torn from the ramp and displaced downward. Along the left rear side of the

bed was approximately 3.0 feet of aluminum from the box portion still bolted on. There were diagonal scratches throughout the length of the aluminum piece.



Figure 8. Photograph of the left rear depicting the area of the second impact.

3.0 Scene Documentation

The scene was documented with photography and by sUAS.⁴ The cab car and truck were captured at the scene with digital photography. The entire grade crossing was subsequently documented with the sUAS after the Metra train and truck were removed from the scene. Figure 9 is an overhead aerial photograph of the truck at its location of final rest.

Figure 10 depicts a screen capture of the orthomosaic image created from the 3D point cloud showing the overall grade crossing. Figure 11 depicts a screen capture of the 3D point cloud showing the grade crossing profile.

⁴ sUAS - "small - unmanned aircraft system" as defined by 14CFR part 107.



Figure 9. Photograph showing overhead view of the International in its position of final rest. Evidence was outlined by law enforcement personnel. (Source: Metra Police Department).

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Figure 10. Orthomosaic image depicting the overhead view of the grade crossing.



Figure 11. Depiction of 3D point cloud showing the grade crossing profile.

South Prospect Road intersected with the grade crossing at a 73° angle and was oriented in a north-south direction with the rail line running northeast to southwest.

In its position of final rest, the truck had rotated approximately 110° clockwise relative to its original direction of travel. The truck came to rest on a sidewalk and partially in a parking lot that was southeast of the grade crossing. The front of the truck was approximately 33 feet south of track #3 and 96 feet east of South Prospect Road. The truck had overturned onto its left side.

The onset of roadway evidence consisted of tire friction marks created by the left and right side rear dual tires as well as the left and right front tires. The rear marks initiated about 24 feet south of track #3 and 15.3 and 11.6 feet west of the eastern edge of the roadway for the left and right-side tires respectively. The left front mark began about 1.2 feet north of the southern rail of track #3 and was in line with the rear left mark. The right front mark began on the southern rail of track #3 and was in line with the rear right mark. Figure 12 is a screen capture of the 3D point cloud depicting the tire friction marks. The marks were highlighted with orange spray paint by law enforcement.



Figure 12. Screen capture of 3D point cloud depicted the location of the tire friction marks.

The front marks displayed a clockwise arced path of travel. The beginning of the rear marks showed a clockwise arced path of travel which transitioned too straight. The marks change directions clockwise approximately 27° relative to the

trucks original heading. Southeast of the tire friction marks was a black smear mark, scrapes, and fluids that led to the final rest of the truck.

As a result of the collision there was damage to highway infrastructure. Approximately 6 feet north of the overhead warning signals was a steel pole that supported the vehicle gate arm. East of the vehicle gate arm about 11 feet was another steel pole that supported the pedestrian gate arm. Both support poles and gates were broken from the concrete pedestals coming to rest approximately 44.7 feet east of the eastern roadway edge and about 40.3 feet south of track #3. The support poles for both the vehicle and pedestrian gate arms were attached to concrete pedestals utilizing breakaway devices designed to reduce impact severity.

A light pole which was aligned with the sidewalk located approximately 76 feet east of the overhead warning signals was struck by the truck as it traveled to its final rest. The light pole pulled down an overhead wire that paralleled the sidewalk.

At impact, approximately 3.0 feet of the front of the truck overlapped the train right of way. Figure 13 is a screen capture of the 3D point cloud depicting the position of the truck and train at impact. The truck was an exemplar truck that had been scanned at the company's headquarters. The train was the collision cab car. Location of the truck was based on the tire friction marks identified at the scene.

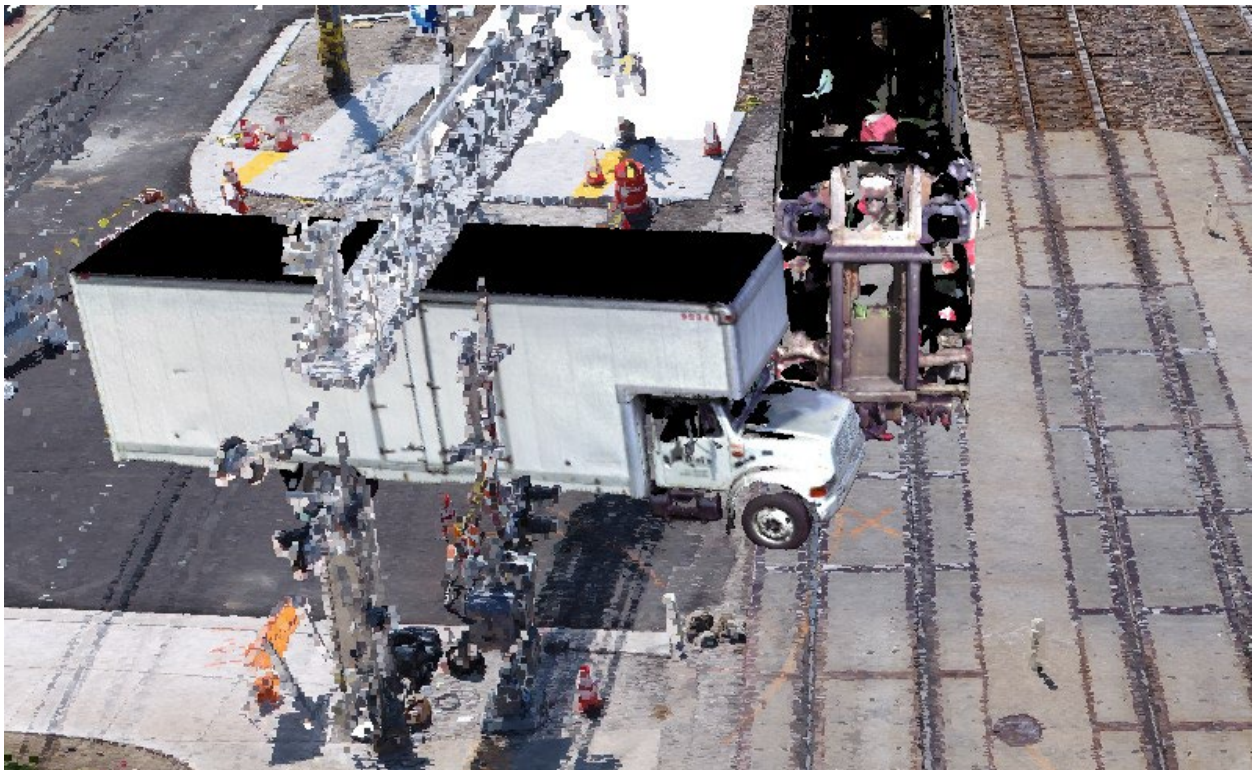
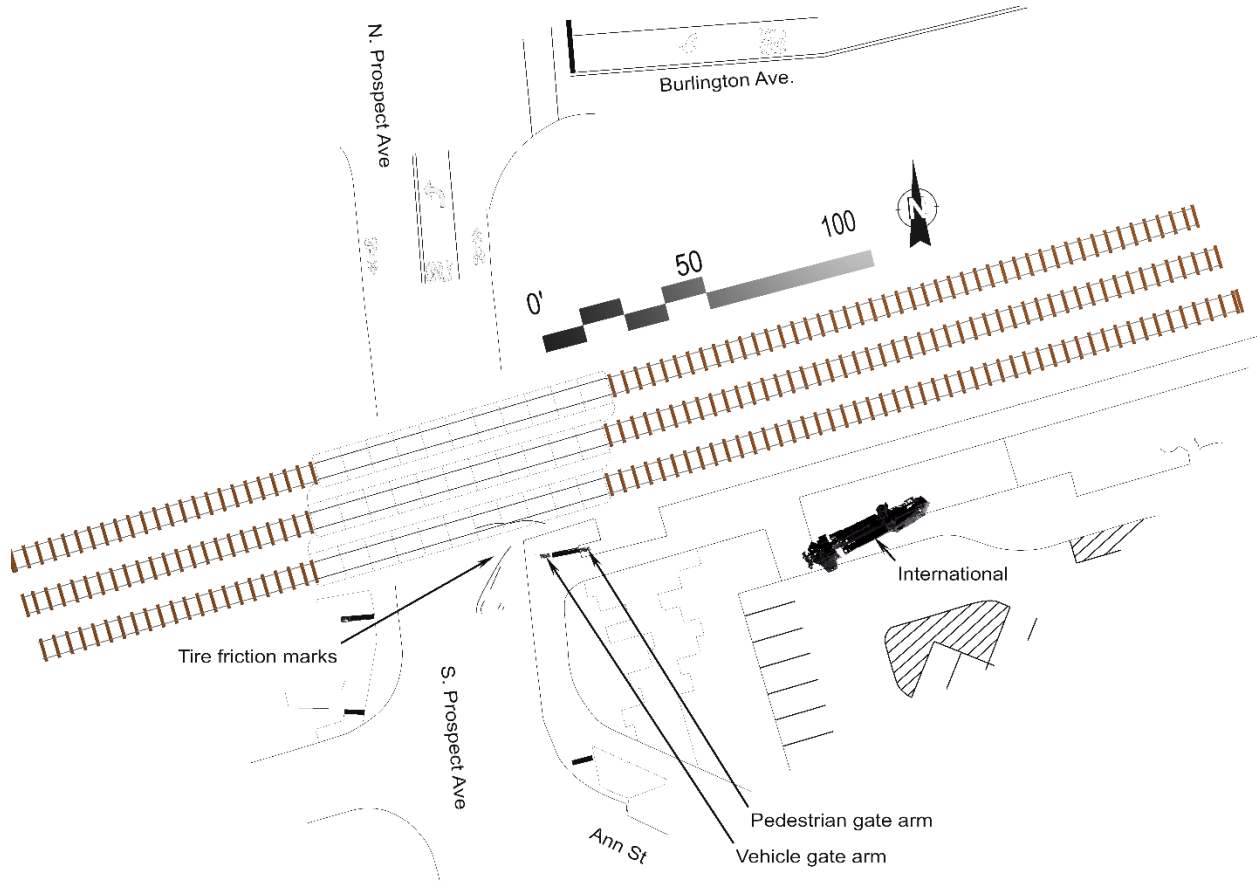


Figure 13. Screen capture depicting location of truck when impacted by the Metra train.

APPENDIX A

Scale diagram of the collision scene and post impact location of the International truck.



Submitted by:

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