National Transportation Safety Board
Office of Railroad, Pipeline and Hazardous Materials Investigations
Washington, DC 20594

RRD24MR002

SURVIVAL FACTORS- CRASHWORTHINESS INVESTIGATION

Group Chair's Factual Report

January 20, 2024

Table of Contents

A. ACCIDENT

Location: Chicago, Illinois
Date: November 16, 2023
Time: 10:31 a.m. (local time)
Train: CTA Yellow-line Train 593
Vehicle: CTA Rail Borne Snow Removal Vehicle S-500
Injury: 7 CTA employees and 16 train passengers

B. SURIVAL FACTORS GROUP

Group Chair Sheryl Harley
NTSB
Washington, DC

C. SYNOPSIS

On November 16, 2023, at about 10:31 a.m. (local time), a Chicago Transit Authority (CTA) Yellow Line Train No. 593 traveling on the southbound track collided with a Snow Removal Vehicle S-500 in Chicago, Illinois. The collision occurred as the CTA train was traversing through the Howard Yard enroute to the Howard Avenue station. As a result of the collision, the CTA train derailed. Six CTA employees occupied the snow removal vehicle and one of the employees was ejected out of the vehicle during the impact. All the occupants sustained injury. An operator and thirty passengers occupied the CTA train. Post-accident, the operator's cab of the train sustained extensive intrusion damage resulting from the impact with the snow removal vehicle. The operator was initially pinned in the operator's compartment but was able to extricate himself, sustaining serious injury in the process. In addition to the train operator, sixteen passengers were injured, sustaining a variety of injuries that ranged from minor to serious.

D. DETAILS OF THE INVESTIGATION

The Survival Factors-Crashworthiness investigation focused on the circumstances surrounding the accident and involving the occupants of both the snow removal vehicle and the train to determine the cause or mechanism of injury and the severity of the injuries sustained. The investigation examined the timeliness, efficiency, and effectiveness of the emergency response and the training provided to various agency personnel. The report also discusses the protection systems, protocols, and devices available to passengers and responders to assist in the evacuation and the minimization of exposure to hazards by the accident victims and emergency responders.

1.0 The Accident Scene

The accident occurred on the southbound track that runs below Chicago Avenue that leads into the Howard rail yard. From the roadway, the overpass partially obscured the scene and the accident train. Access to the accident scene was gained through the Chicago Avenue rail yard gate. From there, emergency crews had to traverse several train tracks including climbing a steep incline to reach the tracks that loop the yard above the accident scene, before descending the steep grade to the track area, where once again personnel were required to cross over an additional set of tracks before gaining access to the scene. **Figure 1** is a photograph showing the southbound yellow line track, below the Chicago Avenue overpass, sloping upwards and curving as it enters the Howard Yard.

Figure 1 Photograph showing the southbound yellow line track, sloping upward and curving as it enters the Howard Yard. The Chicago Avenue overpass is visible in the foreground. (Source: NTSB)

1.1 The Accident Environment

The Howard yard is a large network of intersecting tracks that service the red, purple, and yellow lines and the maintenance facility. **Figure 2** is a yard map showing the Howard yard and the interwoven networks of tracks. The Yellow Line tracks are highlighted in the yellow box with the train's direction of travel noted by the red

arrow and the location of the accident underneath the Chicago Avenue overpass indicated by the red X.

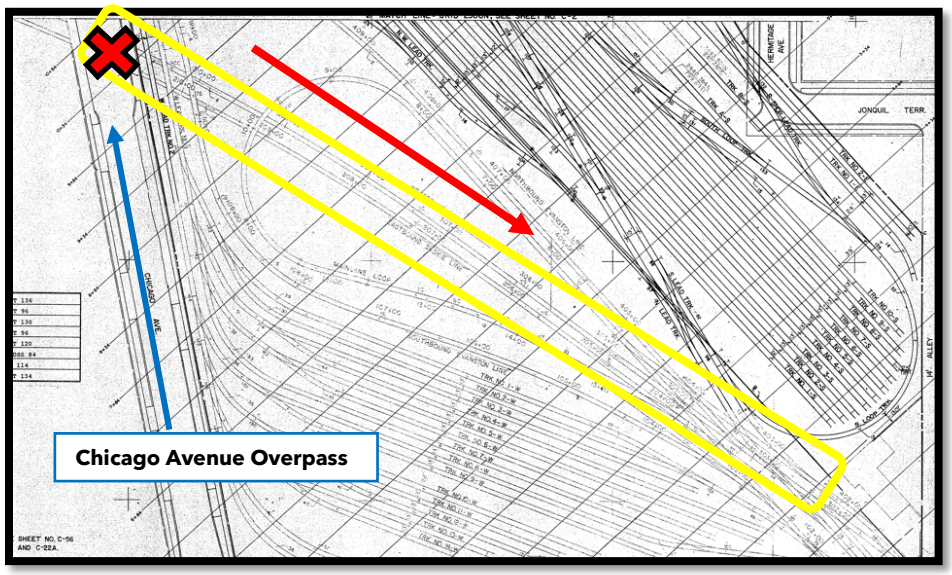

Figure 2 A diagram of the Howard yard showing the interwoven network of tracks and the highlighted yellow line tracks shown in the box. The direction of travel of the accident train is noted by the red arrow and the approximate location of the accident under the Chicago Avenue overpass is indicated by the red X. (Source: CTA)

Figure 3 is a photograph taken from the Howard Avenue CTA station platform looking northward towards the Howard yard. The photograph shows the various train lines tracks that traverse through the rail yard.

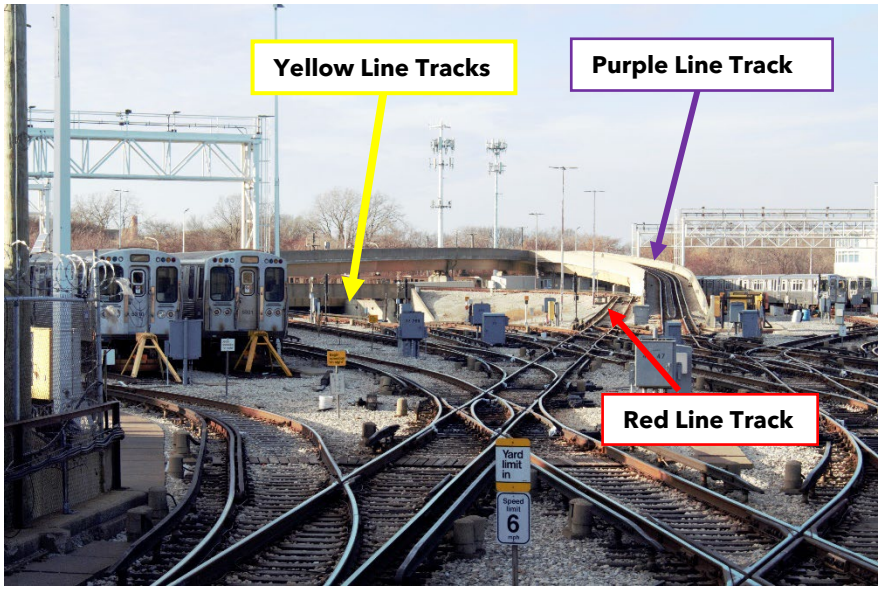

Figure 3 Photograph taken from the Howard Avenue CTA station platform looking northward into the Howard Yard. The Yellow Line, Red Line and Purple Line tracks are highlighted. (Source: NTSB)

On the day of the accident, members of the Chicago Fire Department and the Chicago Police Department negotiated their way through the CTA rail yard and across several train tracks to access the accident scene. Two triage areas were set up for this incident. The forward triage area was set up adjacent to the accident train stopped on the yellow line track. The secondary triage area was set up in the rail yard. To access the secondary triage area, which served as a staging area for the injured awaiting transport, emergency responders had to carry or walk the victims up a steep embankment, cross over the loop track at the top of the hill, and then descend the steep rocky embankment to the main yard area. **Figure 4** Photograph showing the steep uphill grade that the emergency responders had to negotiate to remove the patients from the immediate scene. **Figure 5** is a photograph taken from the site of the secondary triage area, looking up the rocky incline that responders had to traverse during their rescue operations.

Figure 4 Photograph looking from the accident scene showing the yellow line tracks and the path taken by the emergency responders to access the scene and used by the responders to evacuate the injured. (Source: NTSB)

Figure 5 Photograph of the rocky terrain the emergency responders traversed to access the accident scene and the route used to remove the victims. (Source: NTSB)

1.2 CTA Equipment Involved in the Accident

This section will discuss the CTA equipment involved in the accident, the post-accident inspection and documentation of damage sustained in the collision, the operators of both the CTA train and the snow removal vehicle and the history of pre and post-accident testing.

1.2.1 CTA Yellow Line Train 593

The CTA Yellow Line Train 593 consisted of two train cars that were coupled together operating as a married pair.[1] The lead car, Car 5599, the odd number car is referred to as the "A" car. The trailing even number car, Car 5600, is referred to as the "B" car and was coupled with its rear forward and the operator's compartment at the farthest end of the car. Measurements were obtained to document the variations between an undamaged 5000 series train car and the post-accident damage to Car 5599. **Table 1** outlines the measurements obtained from both, the undamaged and the accident train cars.

Table 1 5000 Series Train Car Measurements- Damaged and Undamaged Car Profiles.

MEASUREMENT TAKEN	WHERE MEASUREMENTS OBTAINED	MEASUREMENT OBTAINED	ADDITIONAL REMARKS
OPERATORS' COMPARTMENT			
Length of Operator's Compartment	Exemplar Train Car 5383	8 feet 1 ¼ inch in length	
End car door to door separating compartment from passenger compartment	Exemplar Car 5383	3 feet 7 inches- center of end door to center of compartment door.	
S/A	Accident Train Car 5599	1 foot 8 ½ inches from the center of end car door to door frame of compartment	
S/A	S/A	Top of end car door to door frame measured 2 inches.	Post accident, end car door pushed into the compartment space, resting at an angle. Greater intrusion at the top. **See Figure 8**.
PASSENGER COMPARTMENT OF TRAIN CAR			

[1] Married Pair- The designation given to two rail cars that are designed to be coupled together and work on a semi-permanent basis.

Aisle Width	Exemplar 5383	Measurements taken at various points in train car. The aisle width at its narrowest is 2 feet 3 inches, at each car end measured 3 feet 6 ½ inches and measured 4 feet 1 ½ inches in the middle of the car.	The narrowest point was found at the location of the forward-facing seats and the widest was the center of the train car.
7-Seat aisle-facing center row	Exemplar 5383	Measures 10 feet 7 inches in length	All seats have an overall seat pan width of 17 ½ inches
6-Seat aisle-facing row	S/A	Measures 8 feet 9 inches in length	S/A
4-Seat aisle-facing row	S/A	Measures 5 feet 10 inches in length	S/A
PLATFORM DOORS	S/A	Measures 74 ½ inches in width	

1.2.1.1 Train Car 5599

The 5000 series cars were manufactured by the Bombardier company between 2009 and 2015. These train cars are used on the Yellow, Red, Pink, Green and Purple Lines. The train car design includes an operator's compartment in the front of the car with an end car door located to the rear. The car has four platform doors, two on each side and numbered starting behind the operator's position side is Door 1 with Door 2 directly across the aisleway. Door 3 is to the rear of door number 1 and Door 4 is aft of door number 2. The train has a seating capacity of 38 with approximately 30 overhead hand safety straps for standing passengers to help maintain their balance. The train is equipment with sixteen windows but none of the windows are designed to be used as emergency egress. Currently, no regulation exists that requires transit rail car windows to be designated as a means of emergency egress. The "A" or odd number cars are equipped with a "gangplank" and a ladder for the purpose of assisting with the emergency evacuation of passengers. **Figure 6** is a photograph of an exemplar 5000 series car, Car 5383, used to obtain pre-accident measurements. **Figure 7** is a photograph of the accident Train Car 5599 after it was removed from the scene and taken to the Skokie maintenance shop.

Figure 6 Photograph of the front of an exemplar 5000 series train car, Car 5383. (Source: NTSB)

Figure 7 Photograph taken looking at the lead train car, 5599, that struck the snow removal vehicle and shows the resulting collision damage. (Source: NTSB)

Figure 8 Photograph of the end car door of Train Car 5599 that was shoved inward into the operator's compartment space during the collision. The operator's compartment door that swung open and into the passenger compartment following the impact with the snowplow is visible in the foreground. (Source: NTSB)

The post-accident examination of Train Car 5599 revealed that the passenger compartment of the train car did not sustain any reduction in the occupant survivable space. However, the operator's compartment sustained extensive intrusion damage and only minimal occupant survivable space existed post-accident.

1.2.1.2 Train Car 5600

Train Car 5600, the even or "B" Car was coupled to the lead car so that its rear was coupled forward and connected to the rear of the "A" Car. The train car operator's compartment was empty and located at the farthest end of the car. Post-accident examination of the train car found evidence that the two train cars made contact collision and damage occurred to both cars' anti-climbers and end sills. The inspection of the car revealed damage to the two front-facing windows, which were found smashed, adjacent to the end of the train car that was coupled to the lead car. This damage was determined to have been caused by the impact with the occupants of the train car, sitting adjacent to the windows, who were thrown against the glass during the collision. **Figure 9** is a photograph taken from the exterior of Train Car 5600 showing the smashed front window on the right side of the car caused by the impact with a passenger's head who was seated inside of the train car.

Figure 9 Photograph taken from the exterior of Train Car 5600 showing the smashed right front window, highlighted in yellow, caused by the impact with an occupant inside of the train car. (Source: NTSB)

1.2.2 Rail Borne Snow Removal Vehicle S-500

The Snow Removal Vehicle S-500 is a specialized piece of equipment operated by CTA and manufactured by Mitsubishi International Corporation in 1981. The diesel driven; airbrake equipped vehicle has two bi-directional cabs that permit the machine to be operated in the forward direction from either end. End No. 1 is designated as the end that is facing the plow assembly and End No. 2 faces the brush assembly. At the time of the accident, the snow removal vehicle was stopped on the southbound track with End No. 1 on the southernmost end of the track. The accident train collided with the brush assembly at End No. 2 which resulted in the ejection of a worker out of the No. 2 cab and onto the track. **Figure 10** is a photograph showing the interior cab of End No. 2 where the employee was ejected out of because of the collision with the train. **Figure 11** shows the area of impact of the snow removal vehicle with the train, at the brush end, in the background and the frame of the cab windshield at End No. 2, where the ejection occurred.

Figure 10 Photograph of the interior cab of the snow removal vehicle at End No. 2 showing the equipment box that the employee was thrown across before being ejected out of the windshield. (Source: NTSB)

Figure 11 Photograph taken at the Skokie maintenance shop of the Snow Removal Vehicle S-500 with the area of impact with the train, the brush assembly, in the foreground and the windshield of the cab where the employee was ejected, in the background. (Source: NTSB)

Measurements were taken of the interior occupant spaces for both End No. 1 and End No. 2 cabs in the snow removal vehicle. Additional measurement related to the accident and the ejection of the occupant from End No. 2 were also obtained. **Table 2** provides the measurements obtained during the post-accident examination of the snow removal vehicle at the Skokie maintenance shop.

Table 2 Snow Removal Vehicle Post-Accident Measurements

MEASUREMENTS TAKEN END NO. 1	REMARKS	MEASUREMENTS OBTAINED
Overall height of the cab	Measured at center if cab from floor to ceiling	6 feet 1 inch in height
Overall width of the cab		7 feet 9 ½ inches in width
From seat position 3 (see diagram)	The distance from the windshield to the seat back	1 foot 11 inches
Seat at position 3	Distance measured from the seatback to the wall	1 foot
Seat at position 3	Distance measured from seat pan to control box- right side of cab	6 ½ inches
Seat at position 3 to seat at position 5	Measured from seat pan to seat pan	1-foot ¼ inch
Seat at position 5 to windshield		2 feet 1 ¾ inch
Seat at position 5 to back wall	Measured from center of seatback to wall	11 inches
Seat at position 5 to seat at position 6		1 foot 5 inches
Seat at position 6 to cab access door on left side		1 foot 3 ½ inches
Back wall of cab to windshield		5 feet 5 ½ inches
END No. 2		
Height of cab	Floor beneath position 1 buckled upward. Measurement taken from this point floor to ceiling	5 feet 11 inches in height (2-inch discrepancy noted between End No. 1 and End No. 2 involved in the collision)
Overall width of cab	Slight inward bowing of cab was noted	7 feet 8 inches (Again, discrepancy between the involved and non-involved cab ends were noted)
Height of seat at position 1	Measurement taken from the floor to the underside of the seat pan	1 foot 5 inches
Distance from seat at position 1 to windshield	Evidence found that occupant standing at position 1 was thrown across the equipment box and into the windshield before being ejected out of the vehicle.	4 feet

Distance from seat at position 1 and seat at position 2		1 foot 1 inch
Seat at position 1	Measurement obtained from seat to control panel	4 inches
Seat at position 2	Measured from seat to control panel	1 foot 6 inches
Seat at position 2 to control box on the right side of cab (facing forward)		6 ½ inches
EXTERIOR END No. 2		
From the ground to the bottom of the cab windshield		7 feet 7 ½ inches
Cab to brush assembly	Measured below windshield to the closest portion of the brush assembly	5 feet 2 inches
Brush assembly, closest to the cab, to the end, the remote portion of the assembly on the vehicle	The remote portion of the brush assembly was struck by the train	9 feet 1 inch
Cab below windshield (point of ejection) to Wheel 11- final rest position of employee underneath vehicle	Biological material indicated that Wheel 11 contacted the employee and was the instrument that partially severed the employee's hand.	4 feet 10 ½ inches. (Measured on a diagonal based on the directionality of the ejection from the cab.

1.2.3 CTA Equipment Operators

1.2.3.1 Train Operator

The crew of the CTA Yellow Line Train 593 was comprised of the 47-year-old train operator who was employed by CTA in January 2021 as a bus maintenance worker. The train operator transitioned to the rail side of CTA's operation in October of 2021, first in the safety-sensitive position as a track-worker flagger and finally as train operator in August of 2023. During his employment, the train operator was subject to two pre-employment tests, both tests conducted were to detect the presence of drugs only.

Following the collision, CTA representatives were unable to perform the required post-accident testing due to the train operator's admission to the hospital for the injuries he sustained in the accident. The treating medical facility performed a toxicology screening to facilitate their treatment of the train operator. The medical facility's results showed that at the time the train operator was tested, approximately one hour after the accident, his blood alcohol concentration (BAC) was found to be .06. Federal regulations stipulate that rail employees in safety sensitive positions, such as train operators, shall not have a BAC higher than .02. Additional testing

conducted by the NTSB at the agency's FAA Civil Aerospace Medical Institute (CAMI) confirmed the presence of ethanol in the train operator's system at levels higher than allowable by federal regulations. *(For further information, see Medical Officer's Factual Report provided in the docket of this investigation.)*

1.2.3.2 Snow Removal Vehicle Operator

The crew of the snow removal vehicle was comprised of 6 CTA employees from the agency's maintenance department. Two of the employees, which included the vehicle operator, were instructing the other employees on the operation of the snow equipment. At the time of the accident, the vehicle was being operated by one of the two instructors. The operator, a 60-year-old male, was employed by CTA in January 2006 and served as a rail machinist. CTA records show that in January 2006 and August of 2007, the operator underwent pre-employment drug testing. On those occasions, no alcohol test was administered. The records also document that the operator was administered eight random tests that occurred between August of 2006 and July of 2022. Of the eight "randomly" administered tests, on four occasions, he was tested for both drugs and alcohol. The results of all the operator's tests were found to be negative.

On the day of the accident, the operator was acting as one of the training instructors onboard the equipment. Three CTA employees were in the cab on the No. 1 End along with the vehicle operator. The other employee along with another instructor was in the cab on the No. 2 End. Post-accident testing was conducted on the snow removal vehicle operator and both the alcohol and drug test results were negative. Due to the mistaken identification of the vehicle operator on the scene, specimens recovered for testing at the NTSB CAMI lab were obtained from the wrong employee. No specimens were recovered from the actual operator of the snow vehicle.

1.3 Occupant Injuries

The NTSB used CTA's onboard train car cameras, witness statements and evidence gathered at the scene to document the movements of the occupants of each of the vehicles before, during and after the collision event. This information assisted investigators in the determination of the mechanism of injury for the occupants of the involved equipment and the cause of the severity of those injuries.

1.3.1 Occupant Locations in Car 5599

At the time of the collision, there was a total of sixteen occupants riding in train car 5599, this included the train operator and fifteen passengers. **Figure 12** is a

diagram showing the pre-accident location of the occupants of the train car. The occupants highlighted in yellow sustained injuries during the accident.

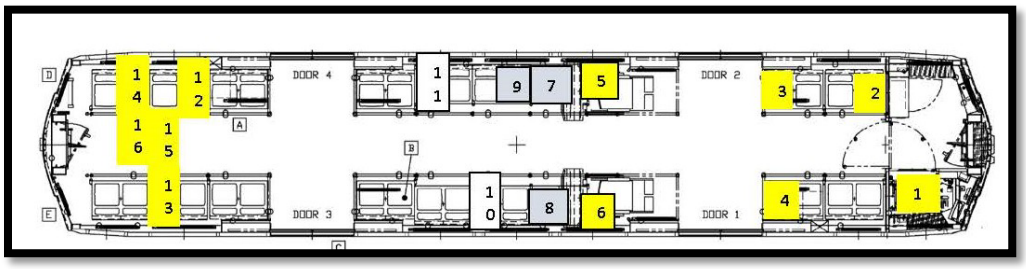

Figure 12 is a diagram showing the pre-accident location of the occupants in Train Car 5599 and those who sustained injury highlighted in yellow.

1.3.2 Occupant Locations in Car 5600

At the time of the accident, there were 15 passengers in the train car. **Figure 13** is a diagram showing the pre-accident location of the occupants within Train Car 5600. Occupants highlighted in yellow sustained injuries in the accident.

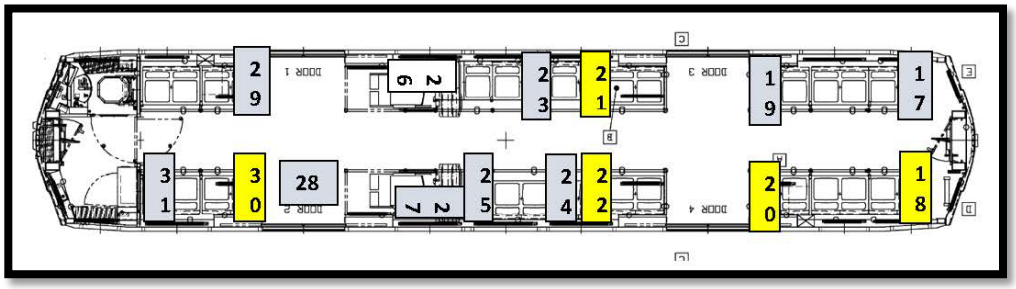

Figure 13 is a diagram showing the pre-accident location of the occupants in Train Car 5600 and those who sustained injury highlighted in yellow.

1.3.3 CTA Train Occupant Injuries

Table 3 details the pre- and post-accident location of the occupants in Train Car 5599. In addition, the table provides the severity of the injuries and the circumstances that caused the resultant injury. It was noted that one of the seriously injured occupants in Car 5599 received additional injuries when the door locking mechanism securing the operator's compartment door in the lead car, failed, allowing the door to swing open, into the passenger compartment striking a passenger in the head. In addition, the open door allowed the passenger to travel a farther distance during the accident and resulted in the passenger coming to final rest partially inside of the operator's compartment of the train. The operator compartment door on Car 5600 also swung open during the accident.

Table 3 Train Car 5599 Occupant Mechanism and Severity of Injury

OCCUPANT IDENTIFIER	DEMOGRAPHIC INFORMATION	PRE-ACCIDENT POSITION	POST-ACCIDENT POSITION	SEVERITY OF INJURIES	REMARKS
Occupant #1 Train Operator	M/47	Operator's Cab	Pinned by intruding structure to rear compartment wall	Serious	Self-extrication resulted in severe lacerations from sharp metal edges
Occupant #2	M/24	Seat 1, left side, adjacent to forward wall separating passenger compartment from operator's cab	Aisleway floor-lying headfirst inside of operator's compartment	Serious	Struck front window twice with left side of head smashing the glass. Occupant suffered what appeared to be a seizure following the head strikes. Sustained third blow to the head caused by operator's compartment door which springs open. (The same failure of the latching mechanism to secure the operator's compartment was observed in Train Car 5600). **See Figures 13 and 14.**
Occupant #3	F/71	Seat 4, left side adjacent to Door 2	Thrown to her left and collides with Occupant #2.	Minor	Sustained injury to head
Occupant #4	M/20	Seat 4, right side	Thrown to the right across the seat row and into front window.	Serious	Slid across entire length of seat 5 feet 10 inches to strike front window with the back of the head. Later, occupant observed unsteady on his feet, unable to maintain balance.
Occupant #5	M/67	Window seat behind Door 2 on the left side facing forward	Thrown diagonally across train car, collided with Occupant # 6. Final rest position just aft of Door 1		The occupant traveled 6 feet 11 inches before coming to final rest on the train car floor on the right side. Sustained bleeding laceration to forehead and back of head.
Occupant #6	M/45	Window seat behind Door 1 on the right side facing forward	Thrown diagonally across train car, collided with Occupant #5. Final rest on the floor adjacent to Door 2		The occupant traveled 10 feet 1 inch before coming to final rest on the train car floor on the left side. Post-accident, occupant unable to stand unaided. Complaint to injury to right side to arm and leg.
Occupant #7	F/unknown	First aisle facing seat behind Occupant #5		No injury reported	

		on the left side facing forward			
Occupant #8	M/unknown	First aisle facing seat behind Occupant #6 on the right side-facing forward		No injury reported	
Occupant #9	F/	Seated on left side of train car in aisle-facing seat forward of Door 4.		No injury reported	
Occupant #10	F/	Seated on right side of train car, forward of Door 3 in aisle-facing seat row	Passenger was thrown forward and then out of the seat and onto the car floor.		Unknown
Occupant #11	M/unknown	Seated on left side of train car, forward of Door 4 in aisle-facing seat row.		No injury reported	
Occupant #12	F/31	Seated on left side of train. Rear of train car in aisle-facing six seat row. Third seat from door 4.	Thrown to the left and into forward windscreen.	Minor	
Occupant #13	M/65	Sitting in the aisle facing seat, third seat from the back on the right side.	Occupant slide forward and struck the upper right side of head on windscreen.	Serious	The occupant slid a total of 4 feet 10 inches forward to strike windscreen. Bleeding head wound resulted from the impact.
Occupant #14	F/65	Seated on left side of train in next to the last seat of aisle-facing six seat row, rear of train car.	Thrown forward and to the left during collision.	Minor	
Occupant #15	M/1	Child secured in stroller- at the rear of the train car, positioned in the center of aisleway, facing forward	Stroller rolled slightly forward before tipping over. Child landed on his left side but still secured to the stroller seat.	Minor	Occupant 16 was secured to the stroller on the opposite side of the two-child apparatus.

Occupant #16	F/1	Child secured to stroller facing backwards	Stroller tipped over and child landed on her right side but remained secured to the stroller seat.	Minor	Occupant 15 was secured to the opposite side of the stroller.

Figure 14 and 15 Photographs of Train Car 5600 operator's compartment door latching mechanism and the frame catch that sprung open during the accident. (Source: NTSB)

Table 4 details the pre- and post-accident location of the occupants in Train Car 5600. In addition, the table provides the severity of injury and the circumstances that resulted in the injury to the occupant.

Table 4 Train Car 5600 Occupant Mechanism and Severity of Injury

OCCUPANT IDENTIFIER	DEMOGRAPHIC INFORMATION	PRE-ACCIDENT POSITION	POST-ACCIDENT POSITION	SEVERITY OF INJURY	REMARKS
Occupant #17	M/unknown	Seat 1 on the left side facing the aisleway.	Occupant slide forward and left side of head struck forward window.	No injury reported	Appeared occupant's hand holding cellphone struck window and shattered glass.
Occupant #18	M/43	Sitting in first seat right side, facing aisleway.	Struck right side of head against	Minor	Window glass smashed during the accident.

			forward window		
Occupant #19	M/unknown	Sitting on left side on aisle-facing seat just forward of Door 3.	Occupant remained in seat.	No injury reported	
Occupant #20	F/43	Sitting in Seat 6 on the right side facing the aisleway		Minor	
Occupant #21	M/52	Sitting on left side, aft of Door 3 facing the aisleway	Subject thrown to the left side	Minor	
Occupant #22	M/	Sitting aft of Door 4 on right side adjacent to windscreen facing aisleway.	Right side of head collided with windscreen. Obvious signs of discomfort before and after extrication	Minor	
Occupant #23	F/	Sitting on left side in 7-seat row facing aisleway	Occupant remained in seat during the collision	No injury reported	
Occupant #24	M/	Sitting to the left of Occupant 22 on right side facing aisleway	Remained in seat during collision	No injury reported	
Occupant #25	M/	Sitting in last seat in 7-seat row facing aisleway on right side	Remained in seat even after another passenger thrown over seat rail in front of him	No injury reported	
Occupant #26	F/	Sitting on the left side of train car, first set of seats in front of Door 1, facing backwards	Occupant was flung backwards in seat and to the left but remain in the seat.		
Occupant #27	M/unknown	Facing backwards,	Occupant remained in	No injury reported	

		window seat aft of right side 7-seat row. Forward of Door 2.	seat. Occupant 28 flipped over the adjacent seat back in the accident		
Occupant #28	M/	Standing on right side in front of Door 2-holding onto overhead safety strap	Thrown across aisle seat adjacent to Occupant #27 and came to final rest on the train floor	No injury reported	Occupant traveled 4 feet before being thrown over the seat
Occupant #29	F/	Sitting in 4-seat row facing the aisleway just aft of Door 1.	Strikes left side of head against windscreen adjacent to door		
Occupant #30	M/43	Sitting aft of Door 2 and adjacent to windscreen on the right side, facing aisleway.	Occupant's right side of head collided with windscreen. Occupant observed losing consciousness and apparent seizure activity	Serious	Loss of consciousness following accident. Found unresponsive by emergency responders. Did not regain consciousness prior to extrication.
Occupant #31	F/	Sitting on right side in last seat next to the wall that separates the passenger/ operator's compartments		No injury reported	Occupant immediately stands after accident. No apparent sign of injury.

1.3.4 Snow Removal Vehicle Occupant Location

The Snow Removal Vehicle has two operating ends. The cab at the end facing the plow attachment is referred to as End No. 1. The brush end of the vehicle is referred to as End No. 2. On the day of the accident, the vehicle was stopped on the southbound track with the plow at the south end facing the Howard Avenue station. CTA Yellow Line Train 593 collided with the vehicle at the brush end which resulted in

the ejection of one of the employees standing up in the interior of cab End No. 2. **Figure 16** is a diagram of the snow removal vehicle showing the two cabs on each end, interior seating positions, the exterior location of the axles and the location where the ejected employee was found lying underneath the vehicle adjacent to Wheel 11.

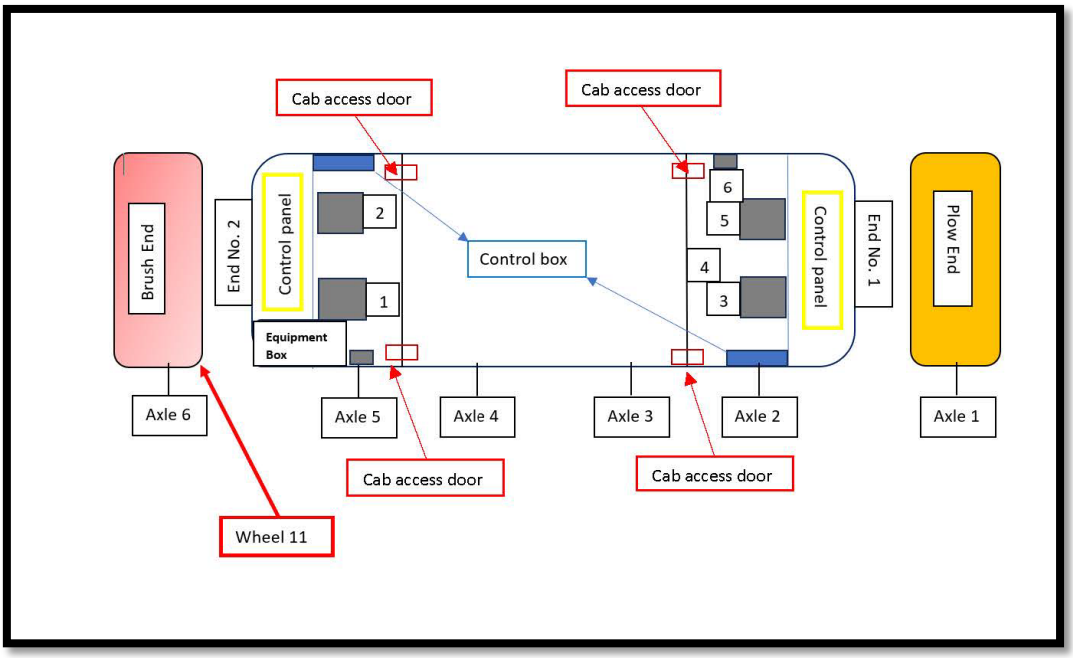

Figure 16 is a diagram of the snow removal vehicle showing the interior design and exterior axles and the location of the final rest position underneath the vehicle adjacent to Wheel 11of the ejected occupant.

After the examination of the snow removal vehicle, to include obtaining measurements of the interior space, it was determined that the damage sustained by the vehicle during the collision with the train did not compromise the survivable space available to the vehicle's occupants.

1.3.5 Snow Removal Vehicle Occupant Injuries

Table 5 shows the pre- and post-accident position of the occupants in the snow removal vehicle as well as the severity of the injuries they sustained and the circumstances that may have attributed to the occupant sustaining the injury.

Table 5 Snow Removal Vehicle Occupant Injuries

OCCUPANT IDENTIFIER-POSITION	DEMOGRAPHIC INFORMATION	PRE-ACCIDENT POSITION	POST-ACCIDENT POSITION	SEVERITY OF INJURY	REMARKS

Occupant #1 (EJECTION) Machinist	M/60	Occupant got out of seat and turned to get away from the approaching train. At the time of impact, Occupant #1 was standing near position 1 with his back to the equipment box and windshield.	Occupant ejected out the windshield and landed on the tracks where his right hand was run over by Wheel 11	Serious	Examination of the interior revealed that the occupant was thrown backwards across the equipment box and ejected out of the windshield
Occupant #2 Rail Instructor I	M/42	Seated at position 2		Minor	
Occupant #3 VEHICLE OPERATOR Machinist	M/60	Seated at controls-position 3		Minor	
Occupant #4 Rail Instructor III	M/56	Standing-position 4		Minor	
Occupant #5 Machinist	M/43	Seated at position 5		Minor	
Occupant #6 Machinist	M/56	Seated at position 6		Minor	

2.0 The Emergency Response

The City of Chicago is approximately 235 square miles and has a population of nearly 3 million people. The two rail systems that service the city are the Chicago Transit Authority (CTA) which provides inner city rail services and METRA, the commuter rail that services the outer suburbs.

The primary emergency response, for the city of Chicago, is provided by the Chicago Fire Department and the Chicago Police Department. The emergency and non-emergency communications for the city is provided by the Office of Emergency Management and Communications (OEMC). The Chicago Transit Authority's communications is managed by the agency's Control Center Operations (CCO).

2.1 CTA Control Center Operations (CCO)

The CTA Control Center Operations is the main communications center for the entire CTA system. The CTA CCO operates 24 hours/ 7 days a week and is tasked with monitoring the service, power, and safety for the CTA system in real-time. The CCO provides non-emergency and emergency communications between the various operators in the system and the civilian authorities. CTA CCO provides the initial

contact and real-time status updates to the civilian emergency 911 communications center (OEMC). CCO personnel are trained to provide the required information to the 911 call center, so that the accurate response type is reported to facilitate the dispatch of the appropriate equipment and number of emergency personnel to the scene expeditiously. Within the CTA CCO, an executive, managers, or supervisors oversee the daily operation of the dispatchers. When an emergency occurs, the Accountable Executive is responsible for the management of the Authority with department heads continuing to provide direction to their employees.

2.2 City of Chicago Office of Emergency Management and Communications (OEMC)

The City of Chicago Office of Emergency Management and Communications manages the city's 9-1-1 dispatch center, handling both emergency and non-emergency calls for service. The OEMC provides interoperability and coordinates the on-scene communications and activities of the various city departments, to include the City of Chicago Fire Department and the Chicago Police Department. Communications for the Chicago Fire Department incorporates both fire suppression and Emergency Medical Services on one radio frequency. OEMC also dispatches the Chicago Police Department, but that agency operates on a separate radio frequency.

2.3 Chicago Fire Department (CFD)

The Chicago Fire Department provides both fire suppression and Emergency Medical Response to the residents of the city of Chicago. The Chicago Fire Department is the second largest municipal fire department in the country, second only to the New York City Fire Department. The department handles approximately 800,000 calls for service annually. The Chicago Fire Department is divided into 6 districts that are comprised of 24 battalions staffing approximately 91 fire stations with 95 Engines, 61 Trucks/Tower Ladders, 76 Ambulances, 3 Squads and several special response vehicles.

2.3.1 Chicago Fire Department Organization

Due to the size of the Chicago Fire Department, the agency does not require its employees to be cross-trained for both fire-suppression and EMS services. Though the department has many employees that are both firefighter/EMT, or firefighter/Paramedic trained, most of the department is not. The operational responsibilities of the CFD's EMS side of the house includes setting up first aid stations or triage areas and remaining out of harm's way with the fire suppression side of the house being responsible for the initial rescue, providing the initial first aid to the victim and then turning that victim over to awaiting EMS personnel. In addition to the two entities having different operational mandates, the type of protective equipment and the training opportunities are also different. EMS personnel are not

issued fire department turnout gear, though they are provided helmets for head protection. In addition, it was found that fire suppression personnel are provided ample training related to rail emergencies which include the ability to identify and mitigate potential hazards such as the third rail or with the railroad equipment. EMS personnel are not afforded the same opportunity and many of the personnel on the scene of the accident had no training related to emergency operations in a rail yard, adjacent to accident equipment or the hazards associated with the track.

2.3.2 Chicago Fire Department Emergency Response

On the day of the accident, The Chicago Fire Department's EMS response included the initiation of an EMS Plan 3 for the Mass Casualty Incident (MCI). The initial response started at EMS Plan 1 which provides 5 Advanced Life Support (ALS) ambulances, EMS chiefs and associated fire suppression support. As the EMS Plan goes up in scale, from 1 to 3, the number of EMS units increases by 5, for each step, as well as adding additional EMS supervisors and supporting fire suppression units to the response. The Chicago Fire Department fire suppression response included 4 Engine companies, 2 Truck companies, 1 Tower Ladder, 1 Squad, 1 Battalion Chief and multiple fire suppression chiefs and command staff.

During the initial response, members of the CFD determined that the location of the incident provided by dispatch was incorrect. The Incident Commander ordered the various units to split up, sending units to various access points for CTA's property to find the correct location. Subsequently, the correct access point for the incident was determined to be the Chicago Avenue gate, which is in the incorporated city of Evanston.

Fire suppression personnel entered the train cars, providing the initial triage, first aid, and extrication of the occupants within the train cars and provided the initial first aid and extrication of the employee that was ejected out of the snow removal vehicle. EMS personnel set up two triage stations. The forward triage station, located at the track level and adjacent to the accident equipment, served as the initial point of contact for medical personnel, to sort the victims by the severity of their injuries. The removal of the victims from the scene was performed by the coordinated efforts of the Chicago Fire Department, the Chicago Police Department and CTA personnel. A secondary triage area was set up away from the accident scene which allowed a more definitive examination of the victims' injuries for the determination of the transport priority and patient disposition.

2.4 Medical Facilities

Trauma Centers across the United States are identified by their distinct levels of classifications and their ability to provide resources in the event of a man-made or natural disaster where medical services are required. Trauma Centers are given

different classification levels based on those services that can be provided to the victims. The highest trauma level classification for a Trauma Center is Level 1. The lowest designation is Level 5. Level 1 Trauma Centers provide the highest level of trauma care and incorporate a comprehensive quality assessment of the care provided.

During the incident, the victims were transported to five medical facilities. The EMS personnel, after triaging the victims, determine the appropriate facility to transport the patient based on the level of care needed by that patient and the level of care the medical facility could provide. **Table 6** lists the five receiving medical facilities, their trauma level designation, distance from the accident scene and the number of patients received by each facility.

Table 6 Receiving Medical Facilities, trauma level classification, distance from the scene and the number of patients received.

MEDICAL FACILITY	TRAUMA LEVEL CLASSIFICATION	DISTANCE FROM THE SCENE	NUMBER OF PATIENTS RECEIVED
Ascension St. Francis Hospital	Level 1 Trauma Center	1.5 miles	5
Weiss Memorial Hospital	Level 1 Trauma Center	7 miles	6
Swedish Covenant Hospital	Level 2 Trauma Center	4 miles	5
Advocate Illinois Masonic Medical Center	Level 1 Trauma Center	7 miles	3
Ascension St. Joseph's Hospital	Critical-care Hospital	7 miles	4

2.5 Event Timeline and Emergency Response

Table 7 provides the combined timeline of the accident and the emergency response based on documents provided by CTA's Control Center Operations and the Chicago Fire Department Office of Emergency Management and Communications.

Table 7 Event Timeline and the Emergency Response

TIME	ACTIVITY	REMARKS
CTA CONTROL CENTER OPERATIONS		
10:32 a.m.	Control radios crew of snow removal equipment to ascertain location (clear of right away)	Transmission from equipment inaudible to Control

10:33 a.m.	Howard Tower notifies Control of collision	"Train made contact" with K994 (radio designation of snow removal equipment)
10:34 a.m.	Control receives call from passenger onboard Yellow Line train	Also speaks to 9-1-1 operator.
10:35 a.m.	Additional CTA employees arrives on the scene of the accident	Control advises personnel on the scene that CFP and CPD are enroute
10:39 a.m.	CTA employees on the scene advise Control that CFD is arriving on the scene	
10:40 a.m.	CTA employee inquiries about the removal of power in the yard	10:41 a.m. Confirmed that power had been cut, yellow line and within the yard
10:42 a.m.	Control assigns Incident Command to "568"	Also reconfirms that power is shut off in the yard
10:45 a.m.	Control makes system wide announcement over the radio	3rd confirmation that the power is shut off.
10:46 a.m.	CTA employee announces that he is walking CFD into the yard and to the accident scene	
10:47 a.m.	Employee advises Control that CFD Battalion 9 is requested secondary hold on power	Power removed from yellow line, all four Howard tracks, and a portion of the purple, elevated southbound through the yard
11:26 a.m.	CTA notified that CPD has taken over control of the scene	CPD initiates their own investigation.
OFFICE OF EMERGENCY MANAGEMENT AND COMMUNICATIONS		
10:35:18	Call received reporting a train collision with another train.	Caller was a passenger on board the train. The initial location was given as 7519 N Paulina Street, the address to the Howard Avenue station. Later, location was updated to 7716-7799 N. Haskins Avenue, which is the address to the yard but on the side farthest away from the scene
10:36:03	Initial dispatch of units to the scene	EMS Plan 1 in effect
10:42:51	Incident Commander, BC 9, arrives on the scene	Request verification that the power for the tracks is off. Confirmation received at 10:42:55
10:47:55	BC 9- Upgraded Mass Casualty Incident to EMS Plan 2	
10:48:56	BC 9 requests and receives a confirmed secondary power hold	

11:00:05	Mass Casualty Incident upgraded to EMS Plan 3	
11:15:40	First patient transported from the scene	Last victims left the scene at 12:14:00

In all, the Chicago Fire Department dispatched eleven command officers, seventeen ambulances and over fifteen pieces of apparatus to the scene. The time required to transport all the victims from the scene and to the medical facilities was approximately 1 hour and 38 minutes after the accident was called into the City of Chicago emergency communications center.

3.0 Emergency Responder Training

Interviews with CFD fire suppression personnel found that the crew regularly avail themselves of training opportunities with CTA regarding operations on their trains, buses, and in CTA facilities, such as their rail yards. Fire suppression personnel receive their first initial training during their time in the fire academy and the training continues into the field. In addition to the training received by the firefighters, the fire department is provided with the necessary tools to permit personnel to operate safely on the train tracks and within the train cars. The fire department personnel, on this accident, were found to be knowledgeable and confident in their ability to manage the incident on CTA property.

Interviews with the Chicago Fire Department EMS personnel found that none of the EMS personnel were provided with the same level of training afford to the fire suppression personnel on the scene. One fire department chief officer explained that the operational limits placed on EMS personnel by the department may account for the disparity on the availability of training. Operationally, EMS personnel are limited to staging on the scene and awaiting fire suppression personnel to deliver victims to them. They are not permitted to enter hazardous environments such as the train cars involved in the accidents. CFD does not provide any Personal Protective Equipment (PPE) such as fire department “turn out” gear to EMS personnel. EMS personnel are only issued helmets. As a result, prior to the accident, it was the belief of the CFD that no training was required to be provided to EMS personnel regarding rescue operations involving trains. However, on this accident, EMS personnel were required to set up a forward triage area that was adjacent to the accident equipment and the tracks. The on-scene operation required these untrained individuals to traverse several tracks and though the power had been verified to be shut off, none of the personnel could identify which of the rails was the third rail.

The CFD fire suppression personnel noted that they had never seen, nor had they received any training on the snow removal vehicle. CFD personnel advised that

after the injured crew had been transported from the scene, no one on the scene knew how to shut down the vehicle. During the initial rescue operation, firefighters used helmets to chock the wheel of the vehicle and had to conduct operations such as the extraction of the ejected employee from underneath the vehicle while the vehicle was still running. Firefighters found that CTA employees at the Howard yard did not have the expertise or know how to shut down the snow removal vehicle. Eventually, an employee from the Skokie maintenance shop arrived on the scene and was able to shut off the vehicle. (NTSB investigators later determined that the snow removal vehicle did not have a conventional emergency shut off).

3.1 Emergency Responder After-Action Activities

At the conclusion of the emergency operations, the Incident Commander conducted a 5–10-minute briefing with all the emergency responders who were on the scene to discuss the various aspects of the incident's emergency response. These on-scene post-incident briefings are the only time that all the participants at the incident can come together, discuss, and critique the operation.

An after-action briefing is held within days of the incident. However, due to varying shifts between the fire suppression and EMS personnel, these briefings rarely bring all the actors together to dissect and review the response operation. Each division, fire suppression and EMS, hold their own "after-action" briefing, though representative from the various other divisions are welcome to attend as well as representatives from CTA, the City of Evanston, and the Chicago Police Department. The Deputy Commissioner of Operations as well as other chiefs have commented that a review of the training opportunities provided to EMS personnel and the need to provide additional training, such as operations involving the handling rail emergencies is currently being discussed within the department with an expectation that training opportunities will be provided to both fire suppression and EMS personnel to enhance safety.

4.0 CTA Safety Management System (SMS)

CTA has adopted an Agency Safety Plan- Safety Management System (SMS) for Rail Operations that uses a risk-based approach to achieve its safety objectives. These objectives enumerated in the plan include the institutionalization of an organization-wide SMS, adherence to operational and maintenance procedures, identify, analyze, evaluate, eliminate, or mitigate potential consequences through preventive measures and conduct safety performance monitoring to determine trends and monitor the effectiveness of its policies and procedures. CTA's safety management policy states that all levels of management and all employees are accountable to deliver the highest level of safety performance. Incorporated into the agency's SMS plan is the Emergency Preparedness and Response Plan (EPP) that identifies the emergency

response objectives, defines roles and responsibilities of CTA employees, and stipulates the required coordination with federal, state, and local officials during an emergency. The EPP also establishes the CTA's chain of command to provide the highest level of readiness to minimize injury, loss of life and property damage.[2]

4.1 CTA Employee Emergency Training

CTA Standard Operating Procedures (SOPs) stipulate that all operational and managerial employees must adhere to the Incident Command System (ICS) when responding to an emergency event. The required ICS training is provided either by FEMA online or by CTA Training and Workforce Development Department. CTA conducts drills and exercises to ensure that plans and procedures meet the requirements of both internal and external agencies. These exercises or drills can be a tabletop, functional or full-scale event to help prepare CTA and local responders for incidents on the property or equipment. The training prepares both CTA and emergency responders to deal with emergency situations that may require the immediate extrication of passengers from a train, using specially designed equipment, such as temporary walkways and ladders provided on scene to expedite passenger evacuation.

Following a significant event or exercise, the CTA Safety Department will conduct an After-Action Review (AAR) with all the participants to evaluate the effectiveness of safety plans and protocols. All safety plans implemented by CTA are required to be maintained for a minimum of three years after conception and must be made available to the Federal Transit Administration or any other Federal agency upon request.[3]

On the day of the accident the CTA fire marshal, per CTA protocol, responded to the scene and began triaging the victims of the accident. The fire marshal, per ICS protocol, reported to the incident commander and provided critical information regarding the accident and the status of the victims on the scene.

4.2 Rail Passenger Protection and Safety Features

The interior structure of the 5000 series train cars has several safety features for the occupants of the car. These safety features include overhead handhold for occupants standing while the train is in motion, a windscreen comprised of a stainless-steel partition, a tempered glass top and a vertical stanchion designed to protect occupants from the wind when the side doors are open and an in-car intercom system that permits the passengers to speak directly with the train operator

[2] See Survival Factors-Crashworthiness Attachment- CTA Agency Safety Plan- Safety Management System for Rail, pages 30-32

[3] See Survival Factors-Crashworthiness Attachment- CTA Agency Safety Plan-Safety Management System for Rail, pages 33 and 34.

in the event of an emergency. The intercom system is easily located by looking for the blue light that is illuminated above the call button.

4.2.1 Emergency lighting

The CTA 5000 series cars are equipped with an emergency lighting system that is comprised of four ceiling fixtures over the side doors that provide lighting for passenger egress from the train car and the right-side intercom locator light, identifiable by a partial blue lens. These light fixtures operate on battery power if the low voltage power supply (LVPS) is interrupted.

The interior cameras for both train cars showed that immediately following the accident, the interior lighting in both train cars was operational. Approximately 10 minutes after the collision, the main car lights shut off, but those fixtures designed to provide emergency lighting remained on and provided interior illumination.

4.2.2 Emergency Signage

49 Code of Federal Regulation 238.125 outlines the requirement for "Markings and Instructions for Emergency Egress and Rescue Access" for passenger rail cars. The regulation requires that the signage be posted in each passenger car and provide emergency instructions such as providing information about exit path and potential hazards to the occupants.

The post-accident inspection of the train cars showed that each car provided the required emergency signage and that it was prominently displayed in several locations within each train car. **Figure 17** is a photograph of the emergency signage found in Car 5600.

Figure 17 Photograph of the emergency signage displayed in train Car 5600. (Source: NTSB)

4.2.3 Emergency Evacuation Devices- Ladders and Gangplanks

CTA designates the odd number cars as the "A" car of the married pair. In each of the "A" cars, an emergency evacuation ladder and a "gangplank" is available to assist with the emergency evacuation of occupants from the train car. A gangplank is used to move passengers from one train to another by providing a temporary walkway without exposing the individual to the hazards associated with the third rail. **Figure 18** is a photograph of the stowed emergency evacuation ladder in an exemplar "A" car.

Figure 18 Photograph showing the emergency evacuation ladder in the stowed position on an exemplar "A" car. (Source: NTSB)

During the emergency evacuation of the occupants of the train, emergency responders and CTA employees used both the emergency evacuation ladder located in train Car 5599 and ladders provided by the Chicago Fire Department.

4.3 CTA After-Accident Activity

The Chicago Fire Department held various after-action debriefing and critiques to discuss the emergency response to the incident which included identifying what went right, what went wrong and what needed to be improved to enhance future emergency response and increase public safety. These critiques were attended by representatives from CTA. In addition, the NTSB held a post-accident discussion with representatives from CTA to discuss various findings in the investigation. The topics discussed included communications, the emergency response, crashworthiness of the operator's compartment door securement system and CTA's fitness for duty and medical oversight. At the request of the NTSB, the transit agency agreed to review the findings and provide a response. However, CTA has not provided an official response regarding the transit agency's plans going forward to address the various safety issues.

4.4 Federal Transit Administration Safety Oversight

4.4.1 FTA Safety Management System Oversight

Under 49 Code of Federal regulation (CFR) Part 673, the Federal Transit Authority (FTA) requires certain operators of public transportation systems that receive federal funding to implement a Safety Management System (SMS). The four key components of the SMS include written safety objectives, employee safety reporting program, communications of the Safety Management Plan (SMP) throughout the agency and the establishment of authorities, accountabilities, and responsibilities. CTA has an established Safety Management program which conforms to FTA's regulatory requirements.

4.4.2 FTA Drug and Alcohol Testing Program

Under 49 Code of Federal Regulation (CFR) Part 655, the Federal Transit Administration (FTA) provides guidance to transit agencies regarding the establishment of programs designed to help prevent accidents, injuries, and fatalities from the misuse of alcohol and or drugs by employees who perform safety-sensitive functions. The rule outlines the various components of the testing process to include who is required to be tested, the reason for the testing, protocols related to the collection process, consequences of a positive test, education, reporting and record retention. For each calendar year, the FTA provides transit agencies with the minimum number of random drug and alcohol testing that should be performed by each agency that year. The transit agencies are required to prepare and submit annually a summary of the agency's alcohol and drug testing program to include the number of tests conducted and the results. The report is submitted to the FTA's Office of Safety and Security. The U.S. Department of Transportation Drug and Alcohol Testing Management Information System (DAMIS) maintains a database of the annual reports generated by regulated transit agencies. DAMIS requires that each report shall include at a minimum, the number of FTA covered employees by category, the number tested, the reason for the test; pre-employment, post-accident, random, etc., and include specific information pertaining to the positive test result such as type of drug, blood alcohol concentration, and the number of employees that refuse to submit to testing. A review of the records compiled by the U.S. Department of Transportation showed that CTA's drug and alcohol testing program meets the requirements set forth by FTA.[4]

[4] For more information regarding the U.S. DOT DAMIS go to: Drug & Alcohol Program | FTA (dot.gov).

5.0 Interviews

5.1 Emergency Responders

The emergency response to the accident included CTA employees trained in mass casualty triage protocols, members of the Chicago Fire Department and the Chicago Police Department.

5.1.1 CFD EMS Personnel

Interviews were conducted with medical personnel and EMS command officers that responded to the scene. Below is an excerpt of the interviews with these individuals.

- The CFD EMS Plan 1 (mass casualty incident) was initiated shortly after the initial dispatch.
- Upon arrival, crews entered the yard but initially did not know where to go. No one from CTA was at the entrance to guide some of the responders into the accident site.
- Arriving CFD personnel were advised that the power to the third rail had been cut.
- Triage areas were set up, one at the "top of the hill" and one forward triage area down adjacent to the tracks.
- The number of emergency personnel involved in the rescue effort was increased as a more accurate accounting of the number of victims involved increased. The EMS Plan 3 was quickly established. Each level increases the EMS response by 5 ALS ambulances, additional chiefs, and fires suppression apparatus.
- On the scene, CFD personnel received assistance from CPD and the CTA Fire Safety Marshal who performed the initial triage and reported to responding CFD personnel upon their arrival on scene.
- Due to the terrain, the emergency responders had to use specialized equipment such as scoop stretchers, stokes baskets and skeds to remove the victims from the scene. In addition to CFD personnel, CPD and CTA employees were used to assist with transferring the victims from the track level, up the steep terrain, to the triage and transport area.
- Approximately one week after the incident, an After-Action briefing was conducted and included members from the CPD and the CTA Fire Safety Marshal.
- None of the EMS personnel had received training regarding operations on train tracks or within train cars. None of the personnel were able to identify which was the third rail. The Deputy Fire Commissioner for Operations advised that due to operational parameters (at the time of the incident), training provided to EMS personnel did not include operations conducted

in a hazardous environment such as working near live tracks or on train cars involved in an accident.

5.1.2 CFD Fire Suppression Personnel

- The initial dispatch received by units indicated that the incident involved a CTA train and an automobile. However, crews immediately questioned the incident location due to the improbability that a train and an automobile could come together at the given address. Battalion Chief 9 ordered the units to "split" meaning that the various responding units went to different locations that provided either access to the rail yard or an entrance to the CTA rail stations. Eventually the correct access to the scene was located within the incorporated city of Evanston on Chicago Avenue. Many of the responding units made their way into the yard without assistance from CTA employees.
- Responding units were advised that power to the third rail had been cut. Battalion Chief 9 requested a secondary hold and deployed three companies to "Chain out" which provided a lock-out/tag-out of the power to the third rail to prevent the accidental re-energizing of the track. The operation involved removing the power from all tracks adjacent to the scene. This also resulted in two train being "trapped" within the city of Evanston. Command personnel from the City of Evanston Fire and Police Departments responded to the scene at the Howard rail yard and coordinated with the CFD Incident Commander.
- The CFD fire suppression personnel receive ample training regarding handling emergencies adjacent to the tracks and involving train cars. CFD units carry a variety of tools to assist with these operations on the rails and utilized these tools to perform the "chain out" operations, and to chock and stabilize the accident train's wheels.
- The first fire suppression on the scene, down on the track bed, found the CTA employee underneath the snowplow. After applying a tourniquet to control the bleeding from the employee's hand, the employee was extricated from underneath the equipment. This CTA employee along with the operator of the train, who were deemed the most severely injured, were the first to be transported from the scene.
- Per CFD training and protocols, fire suppression units automatically deployed stokes baskets, ladders, pike poles and Wigi-testers (instrument used to test power to the third rail). One of the most difficult parts of the operation was carrying victims from the track level up the hill to awaiting ambulances. This resulted in the development of a relay or "bucket brigade" type process to maximize effort but minimize the strain on personnel.
- The fire suppression personnel advised that the only problem they encountered on the scene was with the "snowplow." None of the personnel

had ever seen that piece of equipment before and never received any training on it. As a result, during the rescue operation, the "snowplow" was left running because no one knew how to turn it off. In addition, the CTA personnel at the Howard rail yard could not turn it off. The fire department had to wait for personnel from the Skokie yard to arrive to shut down the equipment.
- A post-incident briefing was held with emergency responders on the scene. Days later, an After-action briefing was conducted with representatives from the various divisions and agencies. It was noted that After-action briefing with fire suppression and EMS personnel could not be held at the same time due to scheduling conflicts.

5.2 Train Passenger Interviews

The NTSB reached out to the passengers on board the accident train to discuss the events that led up to the accident and the post-accident response by CTA and emergency responders. A summary of the interviews is provided below.

- The interviewed passengers all agreed that the accident between the train and the snow removal vehicle was unexpected and occurred without warning. The passengers were unprepared for the impact and resulted in passengers colliding with interior structures within the train car which caused a variety of injuries.
- The passengers were unable to recall whether the emergency lighting in the train cars was operational but noted that due to the brightness of the day, it provided adequate illumination within the train car. The passengers remained onboard the train until the arrival of CTA employees and the emergency responders to assist with the evacuation from the train.
- The passenger advised that emergency responders were on the scene quickly and orchestrated the movement of passengers through the train and to the evacuation locations where ladders had been erected to assist the passengers down from the train.
- Upon exiting the train, passenger advised that their information was collected before the passengers were escorted by emergency responders from the area. The emergency responders had to assist the passengers up a steep embankment before they arrived at another collection point where the passengers were sorted by the severity of their injuries and transported from the scene. The most severely injured passengers were transported to the hospital immediately.
- None of the passengers recalled interacting with the train operator. Though several passengers did observe the individual hurt immediately following the accident. None of the passengers recalled seeing the crew of the snow removal vehicle.

(See the complete transcribed Train Passenger Interviews in the docket of this investigation.)

6.0 Fitness for Duty, Medical Oversight Research and Previous NTSB Investigations

Over the years, the NTSB has conducted numerous investigations into fitness for duty, medical oversight and impairment involving all modes of transportation. In several investigations, the NTSB outlined the disparity between the various transportation industries and the federal agencies responsible for their oversight. Since 1999, the NTSB has called on the Federal Railroad Administration to develop and implement a more robust medical standard, fitness for duty testing and oversight. In August of 2019 in Carey, Ohio, two CSX trains collided after the train engineer in the westbound train failed to respond to the signal indicating the requirement for him to slow and stop his train prior to a designated control point. The NTSB determined that the train engineer was under the influence of an intoxicating liquor at the time of the accident and made recommendations to the Department of Transportation to implement enhancements to railroad drug and alcohol testing protocols.

Per FTA regulation, every transit agency as part of their Agency Safety Plan, must establish a drug and alcohol testing program to ensure the safety objectives of the agency and the safety of the public it serves. The minimum drug and alcohol testing rate, for employees in safety sensitive positions, is determined by the FTA. The decision on how the transit agency accomplishes the required annual testing is left up to the individual agencies. This potentially creates a situation where the testing of the employees and the type of test (alcohol, drugs, or both) administered is based on the need to avoid the disruption of service rather than the focus on safety.

In June of 2022, the FTA published the FTA Standards Development Program: Medical Fitness for Duty and Fatigue Risk Management Research report.[5] The research was conducted by the Center for Urban Transportation Research of the University of Tampa, Florida and was sponsored by the FTA. The report examined the medical fitness standards across all the transportation modes and made comparisons between the various agencies within the U.S. Department of Transportation and other countries. In addition, the researchers examined ten transit agencies and their policies related to medical fitness and medical reporting. Researchers found that the Federal Aviation Administration had a more robust medical fitness for duty standards and provided more guidance to its industry than any other transportation office within the U.S. DOT. Federal Motor Carrier Safety Administration (FMCSA) was

[5] https://www.transit.dot.gov/research-innovation/fta-standards-development-program-medical-fitness-duty-and-fatigue-risk

determined to be second within the U.S. Department of Transportation when it comes to requirements for fitness for duty, medical oversight, and industry guidance. The Federal Railroad Administration and the Federal Transit Administration were found to provide little guidance or regulation regarding medical fitness for duty or the requirements regarding medical oversight for employees in safety sensitive positions within the rail industry.

In the U.S., many transit agencies conduct both rail and bus operations. Transit agencies that provide both services are confronted by two different regulatory standards, one governing the commercial vehicle operation overseen by FMCSA and the other, the transit rail operation, under the guidance of the Federal Transit Administration. Though employees are performing the same safety-sensitive job, specifically the safe transportation of the transiting public, the medical fitness and oversight requirements are very different. For commercial bus drivers, medical fitness and oversight standards are outlined by the regulatory agency and provided to certified medical examiner, registered with the federal government, and deemed qualified to perform medical fitness testing on industry employees. A medical standards handbook, advisory notifications, bulletins, etc. are provided to these certified medical examiners by FMCSA. Fitness and medical oversight standards include the requirement to obtain a complete medical history, that must be reviewed by the attending medical practitioner at the time of the employee's physical examination is conducted, and the requirement to retain the medical "long" form by the employer for review and/or presentation to the appropriate authority upon request is just a small part of FMCSA's requirement for compliance with medical fitness and oversight standards. These requirements, however, don't exist in the transit rail industry.

Submitted by:

Sheryl Harley
Survival Factors- Crashworthiness Group Chairman