# National Transportation Safety Board

## Highway Accident Brief

### Train and Truck Crash on Railroad Right-of-Way and Subsequent Fire

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|---|---|
| **Accident Number:** | HWY15MH006 |
| **Accident Type:** | Train and truck crash on railroad right-of-way and subsequent fire |
| **Location:** | Near intersection of East Fifth Street and South Rice Avenue, Oxnard, California |
| **Date and Time:** | February 24, 2015, 5:44 a.m. Pacific standard time |
| **Vehicle 1:** | Commuter train 102 |
| **Operator:** | Metrolink/Amtrak |
| **Vehicle 2:** | 2005 Ford F450 service truck, with two-axle utility trailer |
| **Operator:** | Harvest Management, LLC |
| **Vehicle 3:** | 1998 Toyota Camry |
| **Fatalities:** | 1 |
| **Injuries:** | 33 |

## Crash Description

On Tuesday, February 24, 2015, in the predawn hours, Metrolink commuter train 102, operated by Amtrak, was en route from Oxnard, in Ventura County, California, to Los Angeles.[1] As the train approached the South Rice Avenue grade crossing about 5:44 a.m., it collided with a 2005 Ford F450 service truck towing a 2000 Wells Cargo two-axle utility trailer.[2] The truck driver had turned right from South Rice Avenue onto the Union Pacific Railroad (UP) track, and the truck became lodged on the track 80 feet west of the grade crossing (figure 1).[3] The train consisted of a cab/coach car in the lead, three coach cars, and a locomotive at the rear.[4] It was occupied by three crew members (an engineer, a student engineer, and a conductor) and 51 passengers.

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[1] On the day of the crash, civil dawn occurred at 6:06 a.m., when the geometric center of the sun was 6 degrees below the horizon. Sunrise occurred at 6:32 a.m.

[2] All times in this brief are Pacific standard time.

[3] Metrolink trains operate on the track through an agreement with the UP.

[4] A cab/coach car is a nonpowered coach car with a compartment from which the engineer can control the train. Cab/coach car 645 led the train, followed by coach cars 206, 211, and 263. Locomotive 870 was located at the rear of the train.

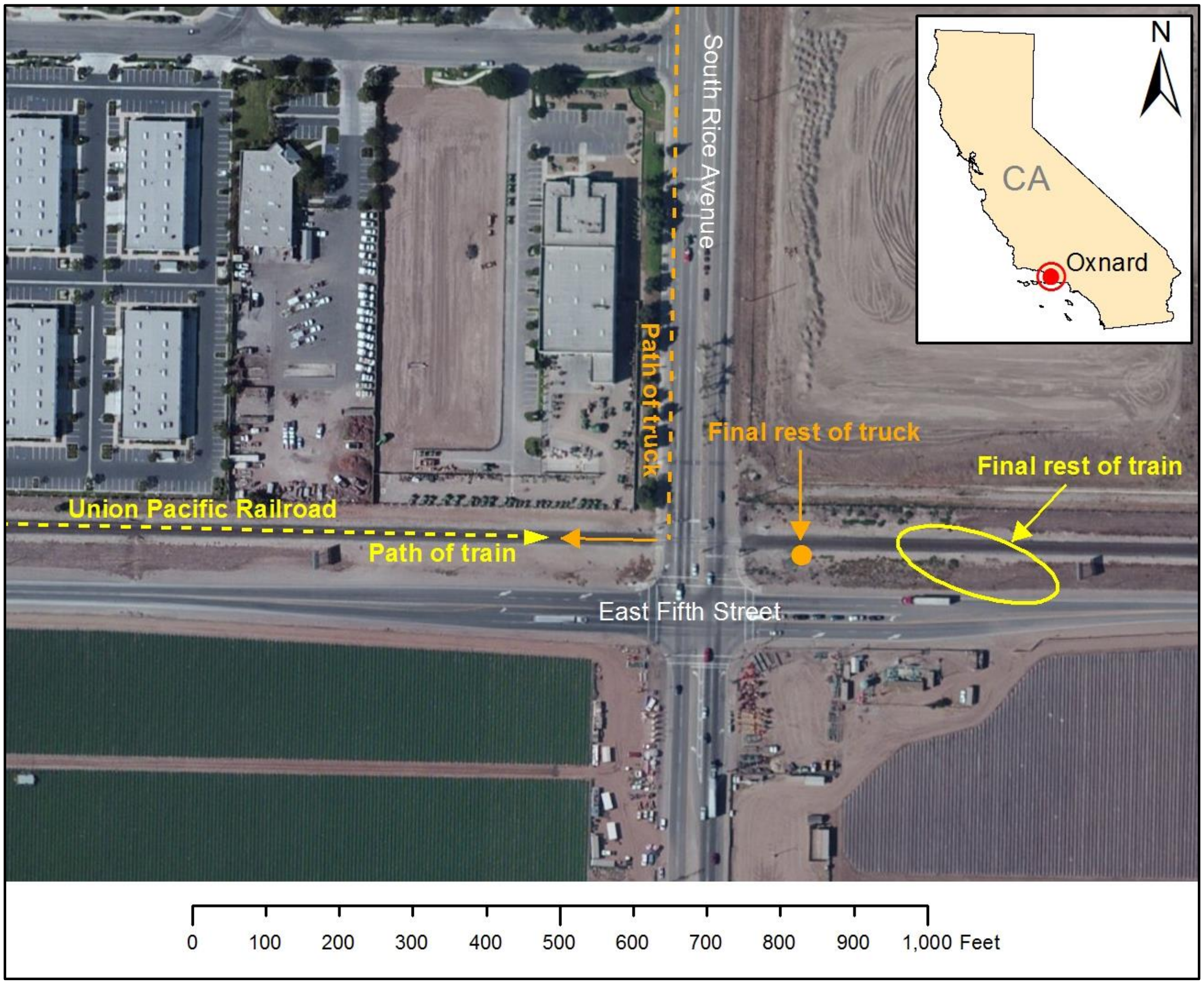


**Figure 1.** Aerial view of crash location showing (a) truck's path onto railroad track 80 feet west of South Rice Avenue; and (b) East Fifth Street, where truck driver had intended to turn. (Source: Google Maps)

After striking the truck and trailer, the train continued through the grade crossing, where all four coach cars subsequently derailed, and three rolled over on their sides (figure 2). The locomotive did not derail. The truck was pushed along the track and came to rest about 130 feet east of the grade crossing on the south side of the track bed (figure 3). The trailer detached from the truck and came to rest on the grade crossing, where it was consumed by a postcrash fire. Debris from the collision caused minor damage to a 1998 Toyota Camry, which was stopped at the grade crossing, facing north, at the time of the crash.


**Figure 2**. Northward-facing aerial view of train at final rest, showing (a) rear locomotive; (b) three overturned railcars and one derailed but upright railcar, with railcar at far right blocking part of East Fifth Street; and (c) remains of truck circled at left.

**Figure 3**. Remains of truck at final rest, with grade crossing at left.

As a result of the crash, the train engineer died, and 32 passengers and crew members were injured. The truck driver exited his vehicle and ran from the scene prior to the crash; he sustained minor injuries that were unrelated to the crash sequence. The Toyota driver was not injured (table 1).

**Table 1.** Occupant injury summary.

| | Fatal[a] | Serious[a] | Minor | None | Total |
|---|---|---|---|---|---|
| Truck driver | -- | -- | 1 | -- | 1 |
| Train crew | 1 | 1 | 1 | -- | 3 |
| Train passengers | -- | 12 | 18 | 21 | 51 |
| Toyota driver | -- | -- | -- | 1 | 1 |
| **Total** | 1 | 13 | 20 | 22 | 56 |

[a] Although 49 *Code of Federal Regulations (CFR)* Part 830 pertains to the reporting of aircraft accidents and incidents to the NTSB, section 830.2 defines fatal injury as any injury that results in death within 30 days of the accident, and serious injury as any injury that: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date of injury; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, or nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.

## Precrash Events

### *Truck Driver Activities*

The truck driver was interviewed by the Oxnard Police Department shortly after the crash, but he declined an interview with NTSB investigators. His activities prior to the crash were reconstructed using information gathered by the police, interviews with his son and his employer, records from his employer, and cell phone data, as summarized in table 2.

**Table 2.** Truck driver's precrash activities, February 21–24, 2015.

| Time[a] | Event | Source |
|---|---|---|
| **Saturday, February 21** | | |
| 3:57 a.m. | On duty | Employer records |
| 1:09 p.m. | Off duty | Employer records |
| **Sunday, February 22** | | |
| -- | Off duty | Employer records |
| **Monday, February 23** | | |
| 5:51 a.m. | On duty in Somerton, Arizona | Employer records |
| 1:00 p.m. | Begins trip to Oxnard, California | Interview with employer |
| 4:27 | Reports mechanical breakdown in Jacumba, California | Cell phone data |
| 9:00 | Resumes trip in new vehicle | Interview with employer |
| **Tuesday, February 24** | | |
| 1:31 a.m. | Calls son to report having been hit by another vehicle in Los Angeles | Cell phone data and interview with son |
| 1:49–2:07 | Attempts to contact supervisor to report minor crash | Cell phone data and interview with employer |
| 2:19 | Calls 911 to report minor crash in Los Angeles | Cell phone data |
| 5:32 | Turns onto railroad right-of-way in Oxnard | Cell phone data |
| 5:44 a.m. | Crash occurs | 911 call from passerby |

[a] All times are Pacific standard time.

The crash occurred nearly 24 hours after the truck driver reported for duty in Somerton, Arizona—and 16.75 hours after he began the trip to Oxnard. The driver went on duty at 5:51 a.m. on February 23, after having been off duty the day before. According to his employer, he was given paper directions, written in Spanish, from Somerton to Oxnard, and he departed the carrier's base that afternoon at 1:00 p.m. The driver also used an application on his cell phone to navigate to his intended destination in Oxnard.[5] The travel distance was about 350 miles, with an estimated travel time of 6 hours. However, the driver experienced a 4.5-hour delay in Jacumba, California, due to a damaged radiator—which necessitated that he obtain a replacement truck. Additionally,

[5] Data extracted from the driver's cell phone indicated that he used Google Maps to navigate during the trip. Google Maps is a global positioning system (GPS)-based mobile mapping application that provides turn-by-turn directions and information.

his truck was sideswiped by another vehicle in Los Angeles, which further extended his travel time.[6]

In Oxnard, the truck driver traveled south on South Rice Avenue on approach to the intersection with East Fifth Street, which is located just 57 feet beyond the railroad grade crossing (745855H). This protected highway–railroad at-grade crossing is marked by a combination of warning lights, gates, signs, and pavement markings (figure 4). According to the driver, he had intended to turn right at the intersection and to proceed west on East Fifth Street; however, he turned his vehicle too soon and entered the railroad right-of-way. The lights and gates at the grade crossing were not active because no train was approaching at that time.


**Figure 4.** View of southward approach to East Fifth Street from right lane of South Rice Avenue, with grade crossing in foreground, 57 feet from East Fifth Street.

[6] Data downloaded from the driver's cell phone indicated that he first called his supervisor to report the crash at 1:49 a.m. After several unsuccessful attempts, he reached his supervisor at 2:07 a.m. and then called 911 at 2:19 a.m. The California Highway Patrol was unable to locate the police report.

The truck driver continued to travel west on the railroad tracks until his vehicle became stuck after about 80 feet.[7] He attempted to push the truck off the track. He also stated that he tried to call 911 but was in a state of panic and could not do so.[8] At some point prior to the arrival of the train, he exited the truck, leaving the headlights and hazard lights on, and the driver door open. Based on an analysis of GPS data obtained from the driver's cell phone, about 12 minutes elapsed between the time the truck became lodged on the tracks and the collision with the train.

### *Train Crew Activities*

The three-person train crew went on duty at 4:25 a.m. on February 24 at the Metrolink facility in Montalvo, California. They prepared the train for departure and moved it to the East Ventura station passenger platform. The train departed East Ventura at 5:25 a.m., and the crew performed a running air brake test on the equipment as they left. The train departed the Oxnard station at 5:39 a.m., with the student engineer at the controls.[9] He observed a "delayed in block" requirement and did not exceed 40 mph until he determined that the next signal was clear.[10] He then accelerated the train in the full throttle position while approaching Rose Avenue. About 0.75 mile after passing Rose Avenue and 0.25 mile before reaching the South Rice Avenue grade crossing, the train passed the whistle board for the crossing, and the student engineer reduced the throttle.[11] As he was doing so, he recognized an obstruction on the track and placed the train into emergency braking. About 8 seconds transpired between activation of the emergency brakes and the collision with the truck.

The train's forward-facing video camera showed the truck straddling the south rail, positioned to the right of center of the track bed, relative to the eastbound movement of the train (figure 5). NTSB investigators performed a postcrash sight-distance test to determine how soon the student engineer could have seen the truck.[12] The test showed that the truck was visible from a distance of more than 0.5 mile; however, at that distance, the headlights of approaching highway vehicles traveling west on East Fifth Street converged with the truck headlights. This masking of

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[7] Although the truck was badly damaged as a result of the collision, no evidence suggested a prior mechanical issue with the vehicle. Based on video evidence showing the orientation of the truck, it appeared to have become lodged on the tracks.

[8] According to the Oxnard 911 dispatch, it frequently receives calls from drivers whose vehicles are within a grade crossing or on the tracks; and it is fully knowledgeable of the procedures to follow in these circumstances, including calling the rail emergency number.

[9] The 31-year-old student engineer was hired by Amtrak on June 15, 2010. He transferred to the engineer training program on January 6, 2014. At the time of the crash, he had completed his training and was only days from becoming a qualified engineer.

[10] The "delayed in block" requirement states that when a train stops at a location where there is no visible signal ahead, the engineer must approach the next signal at a reduced speed in case it has a restrictive indication (49 *CFR* Part 217).

[11] The whistle board is a sign located 0.25 mile in advance of a grade crossing. The sign (on this railroad) displays a "W" to remind the engineer to start the whistle sequence for the upcoming grade crossing.

[12] This observation exercise was conducted on February 28, 2015, at nearly the same time of day and with similar lighting conditions as on February 24. An exemplar train and truck were obtained, and the truck was situated as seen on the train's forward-facing video, with its headlights and flashers activated. Two data points were captured: when the train cab occupants could first see the truck and when they could determine that it was obstructing the track. (During this observation, the cab occupants understood in advance what they were looking for near the crossing.)

the obstruction—and the unexpected condition of having a vehicle on the track in advance of the crossing—might have made it difficult for the student engineer to identify and comprehend the hazard.


**Figure 5.** Still image from train's forward video camera, showing disabled truck straddling south rail, with headlights on and driver door open; utility trailer behind the truck; and South Rice Avenue grade crossing in background, with its gates down and lights active.

## Postcrash Events

The crash occurred within the jurisdiction of the Oxnard Police Department, the Oxnard Fire Department, and the Ventura County Health Care Agency. In addition, several other agencies responded, as follows:

- The Los Angeles County Sheriff's Department, which was under contract to Metrolink for security.
- The Federal Bureau of Investigation Los Angeles field office, which responded but determined that the circumstances were not intentional or related to terrorism.

- The California Highway Patrol, which provided assistance under a mutual aid agreement.
- Several state and federal wildlife-, environment-, and water-affiliated agencies, which sent representatives to oversee wreckage recovery and cleanup efforts.

The Oxnard Fire Department was responsible for incident command (IC) and firefighting efforts, and it was the primary agency conducting rescue and triage for the train passengers. Fire department personnel extinguished the fire engulfing the detached utility trailer. They designated the crash scene a level 3 mass casualty incident (MCI) and established the appropriate command structure.[13] Some passengers had already exited the train when fire department personnel arrived, while others required assistance evacuating. Those passengers on the ground were directed to triage in holding areas as the rescue operations proceeded. MCI protocols were in place and were followed on scene. Of the 51 train passengers, 31 were taken to local hospitals. The three members of the train crew sustained minor-to-serious injuries. Seven days after the crash, the engineer died as a result of his injuries.

After interviewing emergency responders and reviewing on-scene IC notes and postcrash reports, NTSB investigators determined that the emergency response management was consistent with best practices.

## Motor Carrier

The truck driver worked for The Growers Company but was operating a vehicle owned by Harvest Management. These two motor carriers manage a farming operation consisting of 131 trucks and buses, 96 semitrailers, 134 drivers, and 1,400 seasonal employees. Both companies are located in Somerton, Arizona, and share the same ownership, drivers, and equipment. Although Harvest Management has not been subject to a compliance review, The Growers Company received "satisfactory" safety ratings in compliance reviews conducted in 2005 and 2010.[14] At the time of the crash, both carriers had no status alerts in any of the seven behavior analysis and safety improvement categories (BASIC).[15]

NTSB investigators examined the operations of both carriers and found that the policies and procedures in place for their commercial drivers met or exceeded federal requirements.[16] However, the carriers had not realized that, because the gross vehicle weight rating (GVWR) of

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[13] The Ventura County MCI Plan defines a level 3 incident as a suddenly occurring event with 50 or more victims.

[14] Carriers subject to a compliance review receive one of three safety ratings. A "satisfactory" rating indicates that a motor carrier has in place and functioning adequate safety management controls to meet the safety fitness standard prescribed in 49 *CFR* 385.5. A "conditional" rating means that a motor carrier does not have adequate safety management controls in place to ensure compliance with the safety fitness standard, which could result in occurrences listed in section 385.5 (a) through (k). An "unsatisfactory" rating means that a motor carrier does not have adequate safety management controls in place to ensure compliance with the safety fitness standard, which has resulted in occurrences listed in section 385.5 (a) through (k).

[15] The BASICs consist of seven measures the Federal Motor Carrier Safety Administration uses to gauge a carrier's on-the-road safety performance: unsafe driving, hours-of-service compliance, driver fitness, alcohol/controlled substances, vehicle maintenance, hazardous materials compliance, and history of crashes.

[16] See Title 49 *CFR*, Subtitle B, Chapter III, Subchapter B, Part 395.

the vehicles driven by their mechanics exceeded 10,001 pounds—and also because the trucks were used for interstate commerce—they were considered commercial vehicles and were subject to the *Federal Motor Carrier Safety Regulations* (FMCSRs; 49 *CFR* 390.5). Consequently, the mechanics were considered commercial drivers and were subject to regulatory requirements in several critical areas of the FMCSRs, most notably maintaining a record of duty and complying with hours-of-service regulations (49 *CFR* Part 395). Since the NTSB examination of their operations, both carriers have taken the appropriate steps to correct this oversight.

## Truck Driver

The truck driver was a 54-year-old male who held a valid Arizona class A commercial driver's license (CDL) with a corrective lenses restriction.[17] The license was issued on September 26, 2013, and expires in April 2018. According to the Commercial Driver's License Information System (CDLIS), the driver had two alcohol-related traffic violations, one in 1997 and the other in 1998—and none thereafter.[18] The National Driver Register had no record of convictions or accidents.[19] According to the motor carrier, the truck driver had occasionally driven truck-tractors but generally drove a vehicle similar to the one involved in the crash and was very familiar with its operating characteristics.

Following the crash, the Oxnard Police Department took the truck driver into custody. A toxicology test was not performed, because the driver did not appear to be under the influence of alcohol or other drugs.[20] NTSB investigators focused on whether the driver's error may have been caused or influenced by health, fatigue, or distraction.

Medical records indicate that the truck driver was taking medication for hypertension; however, NTSB investigators were not able to determine whether he was affected by hypertension at the time of the crash. In an interview with investigators, the driver's son indicated that his father had undergone no significant life events that might have caused him further stress. Additionally, the circumstances of the crash do not suggest that it was the result of an intentional act.

The driver had left his base in Arizona at 1:00 p.m. on February 23, with the expectation of arriving in Oxnard about 7:00 p.m. However, a vehicle breakdown and a minor crash had extended the duration of his trip. As a result, by the time he reached the grade crossing in Oxnard, he had spent 16.75 hours on the road, and he had been on duty for almost 24 hours.[21] Sleep

[17] An Arizona class A driver's license is required to operate a commercial motor vehicle with a GVWR of 26,001 pounds or more, in combination with a trailer with a GVWR of 10,001 pounds or more, or a combination vehicle with a combined GVWR of more than 26,001 pounds. Drivers with a class A license are also eligible to operate large buses and other commercial vehicles with a GVWR under 26,001 pounds.

[18] CDLIS is a nationwide computer system that enables state driver licensing agencies to ensure that each commercial driver has only one driver's license and one complete driver record.

[19] The National Driver Register contains information on US drivers who have had their licenses revoked or suspended, or have been convicted of serious traffic violations.

[20] Although the truck driver held a class A CDL, the accident vehicle had a GVWR under 26,001 pounds and did not require a CDL. Because the driver was not subject to the requirements of a CDL at the time of the crash, the motor carrier did not—and was not required to—conduct a postcrash drug or alcohol test.

[21] Federal regulations, at 49 *CFR* 395.3, restrict commercial drivers to 11 hours of driving and 14 hours on duty per shift to allow adequate time for sleep between duty periods.

deprivation and lack of adequate sleep have been shown to result in decreases in alertness, lapses in attention, driver error, and increased crash risk.[22]

In a postcrash interview with the Oxnard police, the truck driver stated that as he was traveling southbound on South Rice Street, he saw that the traffic signals were green at the East Fifth Street intersection; but instead of turning right at that intersection, he mistakenly turned right onto the railroad tracks. Data extracted from the driver's cell phone indicated that the navigation application was supplying information up to the time of the crash. The crash occurred in the predawn hours, and the driver was unfamiliar with the area and acutely fatigued from being awake for more than 24 hours. It is possible that he relied on the navigation application to find his destination and subsequently misinterpreted the visual and audible cues available to him.[23]

The NTSB concludes that the driver erred in turning west onto the railroad tracks rather than west onto East Fifth Street, 57 feet farther south, due to a combination of acute fatigue and unfamiliarity with the area. At the time of the crash, the navigation application did not include grade crossing data. Therefore, it provided no specific information on the grade crossing located parallel to East Fifth Street. The NTSB concludes that had the driver's navigation application included information on the upcoming grade crossing, he would have been less likely to misinterpret the visual cues and mistakenly turn onto the railroad tracks on his approach to the East Fifth Street intersection.

In June 2015, the Federal Railroad Administration (FRA) announced that Google had agreed to integrate FRA-supplied geographic information system (GIS) data on 250,000 public and private railroad crossings into its mapping and navigation applications, thereby providing drivers and passengers with additional cues when approaching a grade crossing.[24] The FRA indicated that it continues to invite other technology companies to follow suit.[25] As posted on the FRA website, "For drivers and passengers who are driving an unfamiliar route, traveling at night, or who lose situational awareness at any given moment, receiving an additional alert about an upcoming crossing could save lives."

In April 2016, the FRA informed the NTSB that Apple, Garmin, HERE, and TomTom had also agreed to incorporate the grade crossing GIS data into their navigation applications; however, a number of the companies indicated that they were uncertain when they would be able to do so because other projects held higher priority. In June 2016, the FRA informed the NTSB that it was

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[22] (a) J. C. Stutts, J. W. Wilkins, J. S. Osberg, and B. V. Vaughn. 2003. "Driver Risk Factors for Sleep-Related Crashes," *Accident Analysis and Prevention* 35: 321–331; (b) J. S. Durmer and D. F. Dinges. 2005. "Neurocognitive Consequences of Sleep Deprivation," *Seminars in Neurology* 25 (1): 117–129; (c) P. Alhola and P. Polo-Kantola. 2007. "Sleep Deprivation: Impact on Cognitive Performance," *Neuropsychiatric Disease and Treatment* 3 (5): 553–567.

[23] B. Brown and E. Laurier. 2012. "The Normal, Natural Troubles of Driving With GPS," *CHI 2012 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Austin, Texas, May 5-10, 2012*. New York, NY: Association for Computing Machinery.

[24] See "Google, FRA team up for safety; will add rail crossing data to maps," www.transportation.gov/fastlane/fra-google-team-to-incorporate-rail-data-in-maps, accessed May 25, 2016.

[25] The FRA has also reached out to INRIX, MapQuest, Microsoft Corporation, Omnitracs, OpenStreetMap US, Sensys Networks, StreetLight Data, Teletrac, and United Parcel Service of America to integrate grade crossing information into their mapping and navigation applications.

reviewing its grade crossing data for accuracy, and it expects to have them ready for integration into mapping and navigation applications by the end of the year.

Therefore, the NTSB recommends that Google, Apple, Garmin, HERE, TomTom, INRIX, MapQuest, Microsoft Corporation, Omnitracs, OpenStreetMap US, Sensys Networks, StreetLight Data, Teletrac, and United Parcel Service of America incorporate grade crossing-related geographic data, such as those currently being prepared by the FRA, into their navigation applications to provide road users with additional safety cues and to reduce the likelihood of crashes at or near public or private grade crossings. Additionally, the NTSB recommends that the North American Cartographic Information Society use existing newsletters and other routine forms of communication with its members to highlight the importance of creating navigation applications that incorporate grade crossing-related geographic data, such as those currently being prepared by the FRA, to provide road users with additional safety cues and to reduce the likelihood of crashes at or near public or private grade crossings.

## Truck Wreckage

The truck sustained severe collision damage to all areas, and the front of the utility trailer was similarly damaged. The postcrash fire consumed most of the trailer. NTSB investigators were unable to determine if the truck engine was running at the time of the collision; however, a comprehensive examination of the vehicle indicated no mechanical failures that would have prevented the engine from running. Functional checks of the truck's brakes were completed by supplying compressed air directly to each of the hydraulic brake lines. All of the brakes were found to be functional, and any observed damage to the system was consistent with involvement in a collision or postcrash fire. The extent of postcrash damage prevented examination of the vehicle's steering system.

Harvest Management provided maintenance and inspection records for both the truck and the trailer, which documented a variety of regularly scheduled preventative maintenance and as-needed repairs. The documents did not include an annual inspection report on the truck, because the carrier was unaware that the vehicle was subject to the FMCSRs; however, postcrash examination indicated that the truck had been well maintained.

## Train Wreckage

The train wreckage was examined to determine if structural issues may have contributed to the severity of the crash. The train was operating in a cab-car-forward configuration. The lead car was a Hyundai Rotem bilevel passenger cab car, the second was a Bombardier bilevel passenger coach car, and the third and fourth were Hyundai Rotem bilevel passenger coach cars. The locomotive was located at the rear.

The train's pilot assembly failed and detached from the lead cab car during the crash sequence.[26] NTSB investigators examined whether the failed pilot assembly may have contacted the train's wheels. Although the pilot assembly brackets and welds showed signs of impact and

[26] The pilot assembly, colloquially known as the "snowplow" or "cowcatcher," is located at the front of a train to deflect objects on the tracks.

weld failure due to the collision with the truck and trailer, no markings or damage suggested that the pilot assembly itself interfered with the wheels of the train and caused the derailment.

During the crash sequence, three of the derailed passenger railcars separated at their couplers, which apparently resulted from coupler head separations from the respective shank elements. The railcars subsequently rolled over and came to rest on their sidewall surfaces. The coupler of the Bombardier bilevel passenger coach car was sent to the NTSB materials laboratory for further examination. NTSB investigators determined that the coupler exhibited some workmanship issues, including porosity features, improper weld repair of a retained casting pin, a wall thickness just under the minimum allowed, and gate stubs inside the shank. However, stress calculations confirmed that the coupler could have passed a proof test regardless of its workmanship. Furthermore, it could not be determined if the coupler would have failed had the workmanship not been an issue.

The cab car was fitted with a crash energy management (CEM) system designed to dissipate kinetic energy during a collision. A postcrash examination of the cab car determined that the CEM structural elements, collision post elements, and corner post elements did not come into contact with any other structural elements. Therefore, no further evaluation was conducted.

The railcar interiors exhibited no loss of occupant survival space and were not damaged by fire. Many of the passenger injuries were to the head, spine, and upper body. An analysis of seating location and injuries found no correlation between injury severity, the railcar occupied, or the seating position within the railcar. Instead, the primary cause of injury was determined to be the overturning of the railcars and subsequent passenger impacts with hard interior surfaces.

The NTSB recently examined occupant safety during train derailment and rollover crashes in its report on an Amtrak passenger train derailment in Philadelphia, Pennsylvania.[27] In that investigation, the NTSB determined that railroad occupant safety research and regulations should better reflect a broader spectrum of accident types and systematically consider the causes of injury during derailments in which occupants may be thrown or struck by loose objects. The NTSB concluded that the current requirements are not adequate to ensure that occupants are protected in certain types of accidents, though the passenger equipment safety standards in 49 *CFR* Part 238 provide some level of protection.[28] The NTSB made the following two recommendations to the FRA, for which we are currently awaiting a response:

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[27] National Transportation Safety Board. 2016. *Derailment of Amtrak Passenger Train 188, Philadelphia, Pennsylvania, May 12, 2015*, NTSB/RAR-16/02. Washington, DC: NTSB.

[28] Title 49 *CFR* Part 238 contains the current safety requirements for passenger railroad equipment, including standards intended to minimize the effects of collision crash forces by preserving occupant space (structural crashworthiness) and securing interior fittings such as seats (interior crashworthiness). These regulations rely on compartmentalization as the primary passenger protection strategy.

R-16-35

Conduct research to evaluate the causes of passenger injuries in passenger railcar derailments and overturns and evaluate potential methods for mitigating those injuries, such as installing seat belts in railcars and securing potential projectiles.

R-16-36

When the research specified in Safety Recommendation R-16-35 identifies safety improvements, use the findings to develop occupant protection standards for passenger railcars that will mitigate passenger injuries likely to occur during derailments and overturns.

## Railroad and Roadway Infrastructure

### *Railroad*

The UP track structure in the vicinity of the crash consists of a single main track with controlled sidings. South Rice Avenue crosses the track in a geographic north–south direction. The authorized train speed through South Rice Avenue is 79 mph for passenger trains and 60 mph for freight trains.

The grade crossing signal system consists of four gates with fiberglass and aluminum gate arms. Each gate arm is equipped with three lights. When the grade crossing signal system is activated, the first two lights flash alternately; and the third light, or tip light, is constantly lit. The two center roadway gates are mounted on a mast, and each mast has two 12-inch light-emitting diode (LED) flashers. Two cantilever signal masts with four flashers each are mounted above the street, and four flashers are mounted on the mast near the crossing gates. In total, 20 12-inch flashers are located at the crossing. Blue retroreflective signs mounted on the two cantilever signal masts provide a telephone number and the grade crossing number in the event of an emergency. This information is also posted on a retroreflective sign located on the side of the railroad signal bungalow on the east side of South Rice Avenue (figure 6).[29] All three of these signs are positioned to be visible to motorists within the grade crossing.

[29] The Emergency Notification System (ENS) was established to assist the public in reporting unsafe situations at grade crossings, such as malfunctioning warning signals or vehicles stalled on the tracks. An ENS sign is required to be clearly posted at each grade crossing. Each sign must identify the unique crossing number and include a toll-free telephone number that routes to a 24-hour call center, or—for smaller railroads—to an automated answering system or third-party telephone service. All railroads were required to establish an ENS by July 2015.


**Figure 6.** Signal bungalow near South Rice Avenue grade crossing, and one of two blue signs mounted on the cantilever signal masts, showing emergency telephone and grade crossing numbers.

NTSB investigators examined both the train and the track and found no issues that would have caused or contributed to the crash. No abnormalities were found with the track or track structure, and the grade crossing signals functioned properly.

### *Roadway*

South Rice Avenue in the vicinity of the grade crossing consists of four southbound lanes and two northbound lanes, separated by an 8-foot-wide raised median. The southbound lanes include one right-turn lane, two through lanes, and one left-turn lane; the northbound lanes include two through lanes. A raised concrete curb separates the travel lanes from a concrete sidewalk located on the outside edges of the roadway. The total width of the six-lane cross section south of the grade crossing is 102 feet. The posted speed limit for South Rice Avenue north of East Fifth Street is 50 mph.

According to a 2008 Oxnard traffic study, 32,000 vehicles per day travel on South Rice Avenue north of East Fifth Street, of which 7.6 percent are commercial vehicles.[30] Based on the result of this study, the authors recommended that the city:

> Continue to pursue grade separation at Rice Avenue at the Union Pacific rail corridor immediately north of Fifth Street. . . . Train traffic operating in the rail corridor creates traffic congestion at the Rice Avenue/Fifth Street intersection, and

[30] Southern California Association of Governments. 2008. *Cities of Port Hueneme/Oxnard Truck Traffic Study: Final Report*. Los Angeles, California.

eliminating this conflict would improve traffic safety and traffic operations for trucks traveling on Rice Avenue.

From August 2010 to January 2015, 21 crashes occurred at the East Fifth Street–South Rice Avenue intersection, of which six were located near the grade crossing. One crash involved a train striking a vehicle that had turned right onto the tracks from South Rice Avenue.[31] Another crash involved a passenger vehicle traveling on South Rice Avenue that failed to stop at the railroad crossing and collided with an Amtrak train.[32]

Figure 7 shows the layout of the grade crossing on South Rice Avenue just north of the intersection. Figure 8 shows the approach to the intersection from South Rice Avenue. The distance from the nearest rail to the nearest point of the intersection is about 57 feet. On the southbound approach to the grade crossing, parallel white stop lines are located 11 feet from the automatic gate arm; on the northbound approach, parallel white stop lines are located 5 feet from the gate arm. Thirty-foot-high LED street lights are located on each quadrant of the intersection. The street lights were tested on February 26, 2015, and found to be in full working order and performing as designed.

[31] This 2010 crash was similar to the February 24, 2015, crash in that a passenger car traveling south on South Rice Avenue turned right onto the railroad tracks. The driver's statements indicated that she realized she was driving on the tracks and began to back up. A Metrolink passenger train traveling in the westbound direction struck the passenger car in the rear at a low speed. None of the passengers or the crew members on board were reported to have been injured. The driver of the passenger car was transported to the hospital for a laceration near her left eye.

[32] This 2014 crash resulted in two fatalities, the driver and a passenger. None of the train passengers were injured.

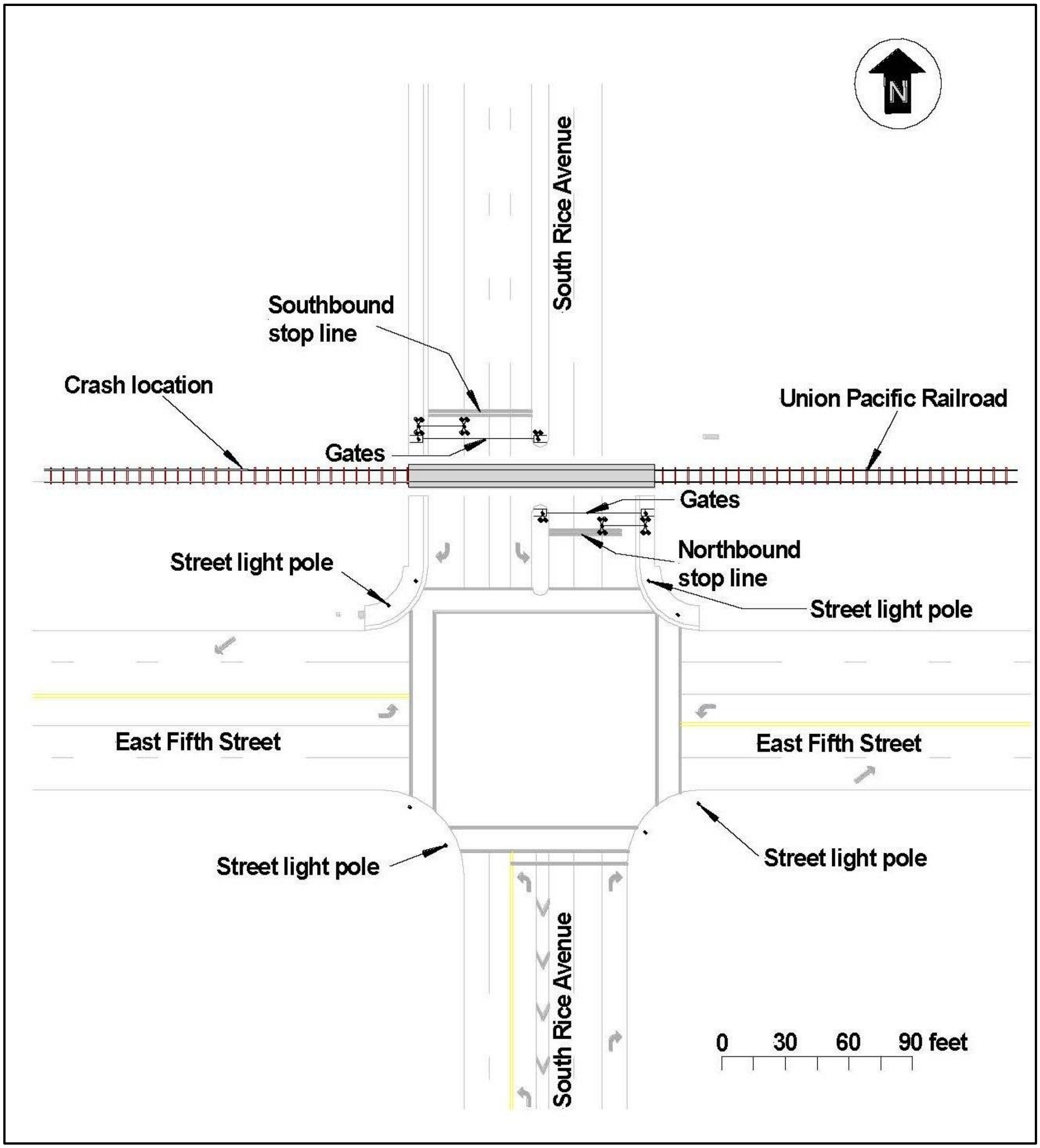


**Figure 7.** Crash scene diagram of grade crossing and East Fifth Street–South Rice Avenue intersection.

**Figure 8.** View of southbound approach to East Fifth Street intersection from right lane of South Rice Avenue.

In addition to the grade crossing warning devices and markings shown in figure 7, grade crossing pavement marking symbols are located in the southbound and northbound through lanes of South Rice Avenue on approach to the grade crossing. The center of the southbound pavement marking symbols is located 463 feet from the nearest rail, and the center of the northbound pavement marking symbols is located 400 feet from the East Fifth Street–South Rice Avenue intersection.

Figure 9 depicts the following signage on the southbound approach to the grade crossing:

- Grade crossing advance warning symbol located 355 feet from the nearest rail.
- "RIGHT LANE MUST TURN RIGHT" sign located 208 feet from the nearest rail.
- No parking sign located 105 feet from the nearest rail.
- "DO NOT STOP ON TRACKS" sign located 18 feet from the nearest rail.

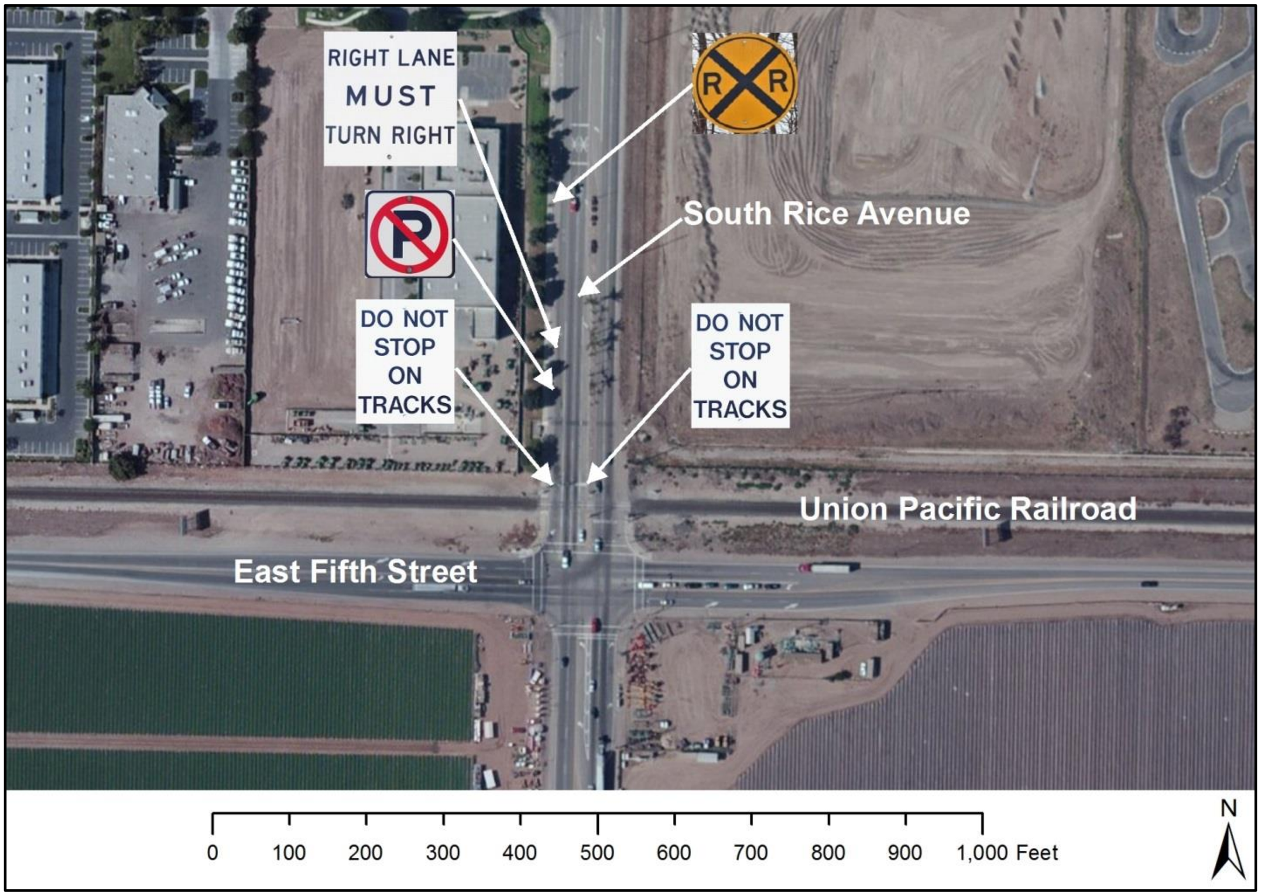


**Figure 9.** Signage in vicinity of southbound approach to grade crossing.

The city of Oxnard is planning to grade separate South Rice Avenue over the UP track and East Fifth Street. The grade separation will address the significant traffic delays that occur on South Rice Avenue and provide free flow movement of vehicles over the track and intersection. Figure 10 depicts the proposed conceptual grade separation. The environmental study phase is currently underway, with completion expected by March 2017. The city plans to select a construction contractor in 2019 and to complete the project in 2021.

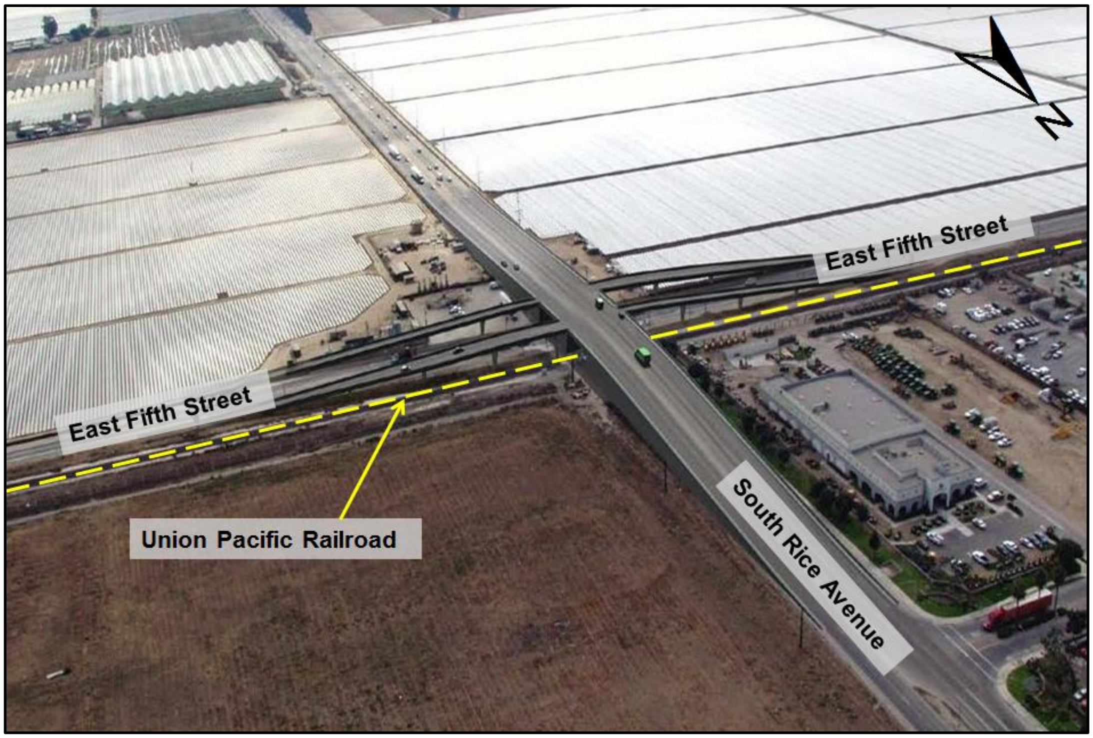


**Figure 10.** Conceptual representation of future grade separation of South Rice Avenue over UP track and East Fifth Street.

In the interim, the city of Oxnard and the UP have worked together to make short-term improvements to the grade crossing, as noted below:

- Extending the roadway's 4-inch-wide solid white edge lines to the edge of the track.
- Mounting white tubular markers with yellow reflective bands 13 feet from the track center on either side of the track.[33]

These improvements were completed on August 12, 2015, and are highlighted in figure 11.

[33] The short-term improvements were selected based on initiatives taken by other municipalities to mitigate the occurrence of railroad right-of-way crashes. For example, after two train–car accidents in 2008—which involved drivers whose navigation devices guided them onto the tracks in Mount Kisco, New York—the New York State Department of Transportation extended the highway markings across the grade crossing and installed tubular markers to prevent vehicles from inadvertently turning onto the tracks. In March 2016, the Federal Highway Administration published an official interpretation of the use of tubular markers at grade crossings.


**Figure 11.** Interim improvements at grade crossing: 4-inch-wide solid white edge line and two white tubular markers installed postcrash.

## Probable Cause

The National Transportation Safety Board determines that the probable cause of the Oxnard, California, crash was the truck driver mistakenly turning onto the railroad right-of-way due to acute fatigue and unfamiliarity with the area.

For additional details, visit dms.ntsb.gov/pubdms/ and search for NTSB accident ID HWY15MH006.

## Recommendations

As a result of its investigation, the National Transportation Safety Board makes the following new safety recommendations:

**To Google, Apple, Garmin Ltd., HERE, TomTom NV, INRIX, MapQuest, Microsoft Corporation, Omnitracs LLC, OpenStreetMap US, Sensys Networks, StreetLight Data, Inc., Teletrac, Inc., and United Parcel Service of America, Inc.:**

> Incorporate grade crossing-related geographic data, such as those currently being prepared by the Federal Railroad Administration, into your navigation applications to provide road users with additional safety cues and to reduce the likelihood of crashes at or near public or private grade crossings. (H-16-15)

**To the North American Cartographic Information Society:**

> Use existing newsletters and other routine forms of communication with your members to highlight the importance of creating navigation applications that incorporate grade crossing-related geographic data, such as those currently being prepared by the Federal Railroad Administration, to provide road users with additional safety cues and to reduce the likelihood of crashes at or near public or private grade crossings. (H-16-16)

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**Adopted: November 15, 2016**