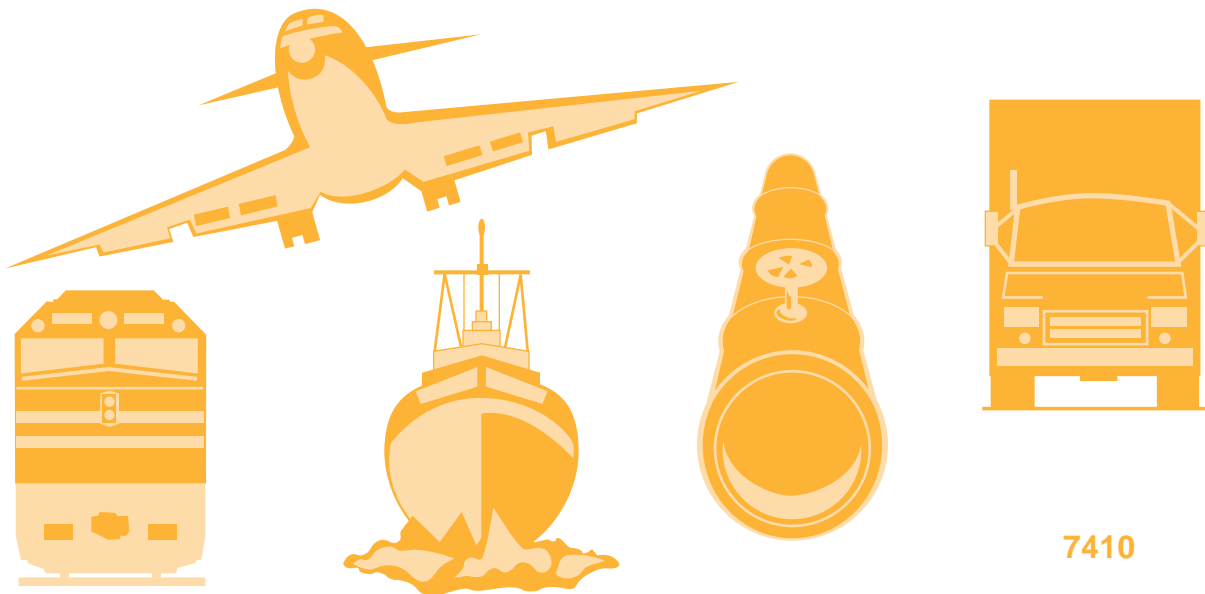


NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

HIGHWAY ACCIDENT REPORT

COLLISION BETWEEN METROLINK TRAIN 901 AND
MERCURY TRANSPORTATION, INC., TRACTOR-COMBINATION
VEHICLE AT HIGHWAY-RAILROAD GRADE CROSSING
IN GLENDALE, CALIFORNIA
ON JANUARY 28, 2000



7410

Highway Accident Report

**Collision Between Metrolink Train 901 and Mercury
Transportation, Inc., Tractor-Combination Vehicle
at Highway-Railroad Grade Crossing
in Glendale, California
January 28, 2000**

**NTSB/HAR-01/02
PB2001-916202
Notation 7410
Adopted November 27, 2001**



**National Transportation Safety Board
490 L'Enfant Plaza, S.W.
Washington, D.C. 20594**

National Transportation Safety Board. 2001. *Collision Between Metrolink Train 901 and Mercury Transportation, Inc., Tractor-Combination Vehicle at Highway-Railroad Grade Crossing in Glendale, California, on January 28, 2000.* Highway Accident Report. NTSB/HAR-01/02. Washington, DC.

Abstract: About 5:56 a.m. on January 28, 2000, in Glendale, California, a tractor-combination vehicle was transporting an oil refinery condenser unit. The vehicle was attempting to traverse a highway-railroad grade crossing when it became lodged on the railroad tracks. A northbound commuter train collided with the vehicle. The engineer, conductor, and four passengers received minor injuries. Total damages were estimated to be over \$2 million.

The major safety issues discussed in this report were the appropriateness of the actions of the truckdriver, pilot car drivers, and police escorts; the weaknesses in the planning, coordination, and execution of this oversize/overweight movement; pilot car driver and truckdriver fatigue; and the lack of low-clearance warning signs.

As a result of this accident investigation, the National Transportation Safety Board issued recommendations to the Federal Highway Administration; Federal Motor Carrier Safety Administration; city of Glendale, California; American Association of State Highway and Transportation Officials; American Association of Motor Vehicle Administrators; Commercial Vehicle Safety Alliance; International Association of Chiefs of Police; National Sheriffs' Association; Specialized Carriers and Rigging Association; California Professional Escort Car Association; Texas Pilot Car Association; and United Safety Car Association.

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Acronyms and Abbreviations

AASHTO -- American Association of State Highway and Transportation Officials

Caltrans -- California Department of Transportation

CDL -- commercial driver's license

CDLIS -- Commercial Driver's License Information System

CFR -- *Code of Federal Regulations*

CHP -- California Highway Patrol

DPS -- Department of Public Safety

FHWA -- Federal Highway Administration

Mercury -- Mercury Transportation, Inc.

WASHTO -- Western Association of State Highway and Transportation Officials

Executive Summary

On January 28, 2000, about 5:56 a.m. in Glendale, California, a tractor-combination vehicle, operated by Mercury Transportation, Inc., was transporting an oil refinery condenser unit. The vehicle missed a turn in its planned route, traversed a highway-railroad grade crossing, turned around, and was attempting to retrace the crossing when it became lodged on the railroad tracks. About 90 seconds later, northbound Metrolink commuter train 901, operated by the Southern California Regional Rail Authority, collided with the vehicle. The engineer, conductor, and four passengers received minor injuries. Total damages were estimated to be over \$2 million.

The National Transportation Safety Board determines that the probable cause of the collision of the Metrolink passenger train with the tractor-combination vehicle was (1) inadequate preparation and route planning for the movement; (2) poor coordination of the movement among the truckdriver, pilot car drivers, police escort, and permitting authorities; and (3) a lack of recognition of the potential hazard caused by the accident vehicle at the grade crossing. Contributing to the accident was the fatigue of the pilot car drivers and the truckdriver.

The following major safety issues were identified in this accident: the appropriateness of the actions of the truckdriver, pilot car drivers, and police escorts; the weaknesses in the planning, coordination, and execution of this oversize/overweight movement; pilot car driver and truckdriver fatigue; and the lack of low-clearance warning signs.

As a result of this accident investigation, the National Transportation Safety Board makes recommendations to the Federal Highway Administration; Federal Motor Carrier Safety Administration; city of Glendale, California; American Association of State Highway and Transportation Officials; American Association of Motor Vehicle Administrators; Commercial Vehicle Safety Alliance; International Association of Chiefs of Police; National Sheriffs' Association; Specialized Carriers and Rigging Association; California Professional Escort Car Association; Texas Pilot Car Association; and United Safety Car Association.

Factual Information

Accident Narrative

On January 28, 2000, about 5:56 a.m. (Pacific standard time) in Glendale, California, a tractor-combination vehicle, operated by Mercury Transportation, Inc., (Mercury) was transporting an oil refinery condenser unit, manufactured by Toromont Process Systems. The vehicle missed a turn in its planned route, traversed a highway-railroad grade crossing, turned around, and was attempting to retrace the crossing when it became lodged on the railroad tracks. About 90 seconds later, westbound Metrolink commuter train 901, operated by the Southern California Regional Rail Authority, collided with the vehicle. (See figure 1.) The Metrolink train had been traveling about 70 mph at the time of the collision. The engineer, conductor, and four passengers received minor injuries.

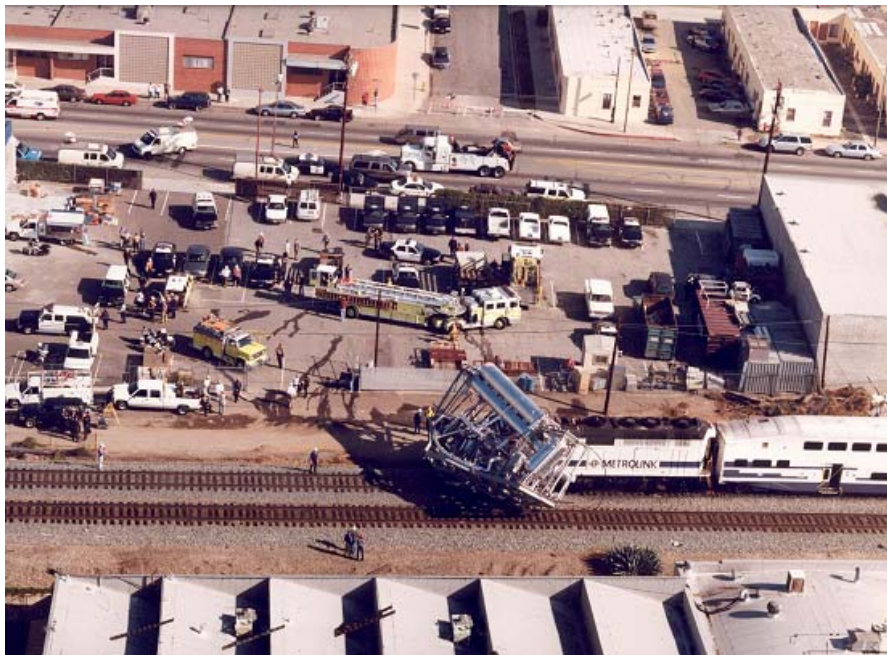


Figure 1. Final rest positions of train and vehicle. (Photograph source: Glendale, California, Police Department.)

The tractor-combination vehicle measured 135 feet long, 15 feet wide, and 18 feet 6 inches high with a ground clearance of approximately 6 inches (see figure 2); the gross vehicle weight was 226,000 pounds.¹ (See appendix B for terms relating to oversize/overweight loads.) The load, valued at \$1.5 million, was being transported from

¹ A typical tractor-semitrailer is made up of a tractor (18 to 20 feet long) and a semitrailer (40 to 53 feet long), both 8 feet wide, which together weigh 80,000 pounds.

Houston, Texas, to El Segundo, California, and possessed specialized moving permits requiring escort vehicles. At the time of the accident, two private pilot vehicles and three California Highway Patrol (CHP) officers were escorting the tractor-combination vehicle. The Metrolink train had been bound from Los Angeles to Burbank, California.



Figure 2. Photograph of the tractor-combination vehicle before the accident. *(Photograph source: Mercury Transportation, Inc.)*

Truck Events Preceding the Accident

The transportation of this oversize/overweight load covered over 2,100 miles through 4 States (see figure 3); involved 5 pilot car companies, 2 permit companies, the permit issuing offices of 4 States, and in California, 12 local jurisdictions; and had been under way for 22 days at the time of the accident. The following description of the trip is segmented by State.

Texas (January 6 to 14, 2000)

According to Toromont Process Systems officials, the load was scheduled to begin moving from Houston on January 6 with a verbal agreement between the company and Mercury that the load was to be delivered as rapidly as possible.

On January 6 about 8:45 a.m., the truckdriver arrived to transport the load. He stated that a tree had to be cut down before the vehicle could exit the Toromont Process Systems facility. The convoy of vehicles consisted of two police units;² two private pilot



Figure 3. Map indicating convoy route from Houston, Texas, to El Segundo, California.

cars (one leading and one trailing) from different companies, Happy's Pilot Car Service and L.P. Flag Car Company; and the transport vehicle. The convoy traveled about 51 miles to Sealy, Texas, where the truckdriver determined that the load was unstable and parked the vehicle. He then notified Townsend Transportation, the owner of the tractor-combination vehicle,³ that the vehicle needed a set of outrigger wheels to make the load more stable. The outrigger wheels were installed, and the Texas segment of the trip resumed on January 10.

The truckdriver indicated that the convoy encountered subsequent problems with delays on seven other occasions in Texas (see figure 4):

Sealy	The load knocked down city hazard warning lights on a sign.
Wallis	The convoy encountered a raised railroad grade crossing that the truck could not traverse. They stopped for 3 hours until they received approved rerouting.

² The truckdriver and pilot car driver indicated that police in Houston and Las Cruces, New Mexico, escorted the load; however, this information was not noted on the permits, and the National Transportation Safety Board was not able to verify which police departments conducted the escorts.

³ Mercury leased the vehicle.

San Antonio	The convoy encountered a bridge with a height clearance lower than the load height and required rerouting.
Castroville	The load struck an overhead telephone line.
Clint	The load struck a traffic light.
El Paso	The convoy encountered overhead street signs with height clearances lower than the load height. A bucket truck had to be used to lift power lines to allow the load to pass through.
Unknown location ⁴	The convoy encountered a right turn that the truck could not negotiate and had to detour around.



Figure 4. Map indicating convoy route through Texas.

New Mexico (January 14 to 24, 2000)

On January 14, the convoy entered New Mexico at Carlsbad, where the Port of Entry officials checked the New Mexico State permit and found that it had expired and had to be renewed.⁵ The renewal required contacting the New Mexico Department of

⁴ The driver was unable to recall the exact location.

Public Safety and Public Utilities to gain approval for another permit. The convoy also had to arrange for a bucket truck to raise power and telephone lines along the trip route. The convoy drove to El Paso, Texas, and waited for the new permit.

On January 21, the convoy resumed the trip, leaving El Paso and entering New Mexico near Las Cruces. The trip through New Mexico was along a southern route, roughly parallel to Interstate Highway 10 through Deming and Lordsburg, New Mexico, into Arizona. In Lordsburg, a pilot car from Billy's Pilot Car Company replaced the pilot car from Happy's Pilot Car Service, and the truckdriver parked the truck at 4:15 p.m. on January 22 until 9:45 a.m. on January 24. According to the truckdriver and pilot car drivers, the trip through New Mexico was uneventful. (See figure 5.)



Figure 5. Map indicating convoy route through New Mexico.

Arizona (January 24 to 27, 2000)

On January 24, the vehicle entered the State on State Route 80 near Douglas, Arizona, and traveled to the Sierra Vista (Arizona) Port of Entry, where it met officials from the Arizona Department of Public Safety (DPS). The Arizona permit specified a DPS

⁵ New Mexico has a fixed Port of Entry system, under which commercial vehicles entering the State, including special moving permitted vehicles, are checked for required licensing, equipment, and fuel tax documents.

escort from Sierra Vista through Nogales and to Tucson, Arizona, but not through the remainder of the State. The trip route took the convoy on Interstate Highway 8 from Sierra Vista to Tucson to Yuma, Arizona, and north on U.S. 95 to Quartzsite, Arizona.

At 1:30 p.m. on January 26, the convoy arrived in Quartzsite, where they encountered DPS officers who told them that a recreational vehicle festival was occurring in Quartzsite and that they would have to be escorted through the city because of the traffic conditions. The DPS officers added that another load was ahead of them and that they would have to wait.⁶ They parked on the shoulder of the two-lane roadway until about 5:00 p.m. when the officers returned. The officers told the truckdriver that they would be unable to escort the load through Quartzsite that day; the load remained parked on the side of the road all night. The truckdriver said he went to a truck stop in Quartzsite to obtain faxed copies of the California permits.

The truckdriver and the rear pilot car driver said they awoke about 7:30 a.m. on January 27. The public safety officers did not come back, and the convoy drove through Quartzsite without them. About 9:00 a.m., the convoy arrived at the California-Arizona border, where the truckdriver acquired the last of the faxed California permits from Mercury at a nearby truck stop. (See figure 6.)



Figure 6. Map indicating convoy route through Arizona.

⁶ The vehicle and load ahead of them required an Arizona DPS escort per the conditions of the permit.

California (January 27 to 28, 2000)

A driver from Dick's Pilot Car Service (the lead pilot car driver) had driven from San Bernardino to Blythe, California, during the night⁷ and met with CHP officers at the California-Arizona border at 6:00 a.m. (Pacific standard time) on January 27.⁸ About 8:00 a.m., they met the truck and the rear pilot car at the Arizona truck scale facility about 1 mile from the border. While the truckdriver obtained the permits, the CHP officers examined the vehicle and load for proper securement and lighting. This check was a walk-around inspection and did not include matters such as brake adjustment, driver's logbook (record-of-duty status), or measurement of the load to ensure compliance with the permit. The CHP officers explained that they used their experience in estimating the dimensions of the load for compliance and did not check the driver's logbook because they believed that he had rested the day before in Quartzsite and had received the required 8 hours of rest before beginning this trip.

The CHP officers had a copy of the California Department of Transportation (Caltrans) permit and the lead pilot car driver had copies of the permits supplied by West Coast Services,⁹ which included *permit applications* for Glendale and Hawthorne, California. The CHP officers examined the permits for routing only. They did not notice that the Glendale paperwork was not a permit but an application only. The Hawthorne paperwork read "Annual on File" in the permit number box, and they believed it to be a valid permit. The lead pilot car driver told investigators that the night before the trip he had created a master list of the designated routes in California by transcribing them from the various permits onto a handwritten sheet of paper.

The movement of the convoy began about 8:30 a.m., and the convoy traveled several secondary routes from Blythe to Adelanto, California, through mostly desert area that was sparsely populated. Communication between vehicles was accomplished using CB and car-to-car CHP radios. Near Victorville, California, the convoy drove past a roadway¹⁰ onto which it should have turned. After driving one block, the convoy realized the error and turned around. The convoy arrived in Adelanto about 5:00 p.m., and the CHP officers from Blythe¹¹ departed. (See figure 7.)

The truckdriver went to a truck stop, where he fueled the truck, ate, showered, and contacted the company. He returned to the load about 8:30 p.m. and was rigging the vehicle with lights for the nighttime move when, about 9:00 p.m., three CHP officers from the Inland Division¹² arrived. (Neither the truckdriver nor the pilot car drivers received any sleep during this stop.) The Inland Division CHP officers examined the permits. Again the examination was for routing and not for permit verification. None of the CHP

⁷ The pilot car driver said that he slept at home for 7 to 8 hours before the trip.

⁸ The time to drive from San Bernardino to Blythe is between 3 and 3 ½ hours.

⁹ A private permit company hired by Mercury to obtain the California permits.

¹⁰ The name of the roadway had been changed from Air Base Road, which was the name on the permit, to Air Express Way.

¹¹ The CHP officers from Blythe are referred to as CHP team 1.

¹² The CHP officers from the Inland Division are referred to as CHP team 2.



Figure 7. Map indicating convoy route through California.

officers had copies of the moving permits; however, they indicated that they were familiar with the routes taken by oversized loads in their area. The officer-in-charge said that he relied on the lead pilot car driver to ensure that the convoy stayed on the correct routes.

The truckdriver, who had been driving nearly 10 hours when he arrived at Adelanto, said that he talked with the CHP officer-in-charge about his hours of service; he told the officer-in-charge that he was almost out of hours¹³ and that they could not travel very far. The truckdriver said the officer-in-charge told him, “I guess we will not get very far.” The truckdriver also indicated that his hours of service were not discussed further throughout the remainder of the trip. According to the officer-in-charge and another officer who was standing nearby while the two conversed, the truckdriver’s hours of

¹³ The current hours-of-service rules permit a commercial driver to drive 10 hours before resting 8 hours.

service were not discussed. According to the officer-in-charge, he was unaware of the time the vehicle arrived in Adelanto, and he assumed the truckdriver had received sufficient rest. The CHP officers conducted a walk-around inspection of the vehicle and load, and the convoy departed Adelanto about 9:30 p.m.

From Adelanto, the Caltrans permit routed the convoy southbound on Interstate Highway 15 to westbound Highway 138 to westbound Highway 18. Two weeks earlier the officer-in-charge had escorted another permit load through this area. The earlier permit had routed that load out of Adelanto westbound on Highway 18 to Highway 138 into Los Angeles County. The officer-in-charge indicated that when he read the route approved by Caltrans for the accident load, he thought it strange but relied on the Caltrans approval process. The convoy traveled the designated route and as it made the turn from southbound Interstate Highway 15 onto Highway 138, the bottom of the semitrailer scraped the roadway. On Highway 138, approximately 1/3 mile west of Interstate Highway 15, about 11:00 p.m., it approached a railroad bridge that had inadequate clearance.

The CHP officer-in-charge ordered the vehicle to turn around and return to Adelanto. He went to the CHP Cajon Pass scale facility, about 2 miles away, and phoned the Caltrans 24-hour emergency number for permit routing to obtain a route variance. After business hours, the 24-hour number connects to a pager for an on-call official. The officer-in-charge said that a page response in these circumstances usually came within 5 minutes. He waited about 10 minutes and instructed the CHP scale officers to notify him via radio if the Caltrans official called. (CHP reported that Caltrans returned the page at 2:30 a.m., after the convoy was well within Los Angeles County.) The CHP officer-in-charge then authorized the convoy move from Adelanto west on Highway 18. The route led the convoy west on Highway 18 to Highway 138, to Pearblossom Highway, and to Sierra Highway near Palmdale, California, in Los Angeles County. En route the lead pilot car driver missed a turn around a bridge and another turn down a dirt roadway.

The Los Angeles County permit required a Los Angeles County Department of Public Works escort, which was to meet the vehicle at the county line. The escort expected the vehicle to arrive about 11:30 p.m., but it did not arrive until about 1:30 a.m. on January 28. (While traveling southbound on Sierra Highway, the lead pilot car driver had missed a bypass around a low bridge, and the convoy had to turn around.) The county escort and the CHP discussed the county and Los Angeles city permit curfew of 5:00 a.m., which meant the load would be prohibited from further movement after 5:00 a.m. The county escort said he stayed with the vehicle until about 3:45 a.m. when the convoy arrived at the Los Angeles city limit. According to the CHP officer-in-charge, the convoy reached the Los Angeles city limit about 4:20 a.m. Upon reaching the Los Angeles city limit, the county escort said, "you're clear now"; the CHP officer-in-charge understood this statement to mean that he was clear to continue all the way to El Segundo.¹⁴

The Los Angeles city permit required a city department of public works escort. The city escort indicated that he had anticipated the vehicle to arrive about 1:00 a.m. at the

¹⁴ The CHP officer-in-charge said he was not familiar with the curfews imposed by any jurisdiction.

city limits near the intersection of Sierra Highway and Foothill Boulevard. The city escort said that he waited from 12:00 a.m. to 4:00 a.m., and when the load did not arrive, he went home. A city escort was required as a condition of the city permit, and when the vehicle continued into the city without the escort, it was in violation of the terms and conditions of the permit. The CHP officer-in-charge indicated that he was unaware of this requirement.

The vehicle continued south on several major streets through Los Angeles and entered Burbank traveling east on Glenoaks Boulevard. The Burbank permit did not require a city escort. The vehicle continued east on Glenoaks Boulevard into Glendale. Although West Coast Services had applied for a permit from Glendale, one had not been issued because of missing insurance information from the carrier.

The CHP officer-in-charge said that he was fairly familiar with the route taken until the convoy entered Glendale. He said he was less familiar with these streets and relied on the lead pilot car driver to take the correct route, although he was suspicious of the pilot car driver's abilities since he had made several previous routing errors. The route on the *permit application* to Glendale specified travel east on Glenoaks Boulevard, south on Grandview Avenue, east on San Fernando Road, and south on Fletcher Drive. (See figure 8.) When the lead pilot car reached the intersection of Glenoaks Boulevard and Grandview Avenue, he continued east on Glenoaks Boulevard, failing to make the correct turn. The lead CHP officers notified him that he had missed the turn, and he went to the next intersection and turned around. By this time, the first CHP units and the truck had made the correct turn. The pilot car driver returned and drove ahead of the other vehicles on Grandview Avenue as they approached San Fernando Road.

The pilot car driver had transcribed the route incorrectly on his handwritten sheet and had not recorded the turn from Grandview Avenue onto San Fernando Road. As a result, he told the CHP officers and the truckdriver that they were looking for Fletcher Drive as the next turn.

The CHP officers entered the intersection of San Fernando Road and Grandview Avenue and stopped westbound and eastbound traffic to allow the truck to go safely through the intersection. The lead pilot car driver told the investigating police¹⁵ that he heard the truck making a sound like it had "bottomed out" when it first went over San Fernando Road.

Grandview Avenue continued over a set of two Metrolink railroad tracks at an active highway-railroad grade crossing. The traffic control at the grade crossing consisted of pavement markings, signs, lights, bells, and gates. As the vehicle crossed over the tracks, the CHP officer-in-charge noticed that the vehicle scraped the surface of the grade crossing. He said he believed that this was not an unusual occurrence for a load of this size and ground clearance. The truckdriver said he did not feel the vehicle scrape when it went across the grade crossing. The time was approximately 5:15 a.m.

¹⁵ During a January 28, 2000, interview conducted by the Glendale Police Department.

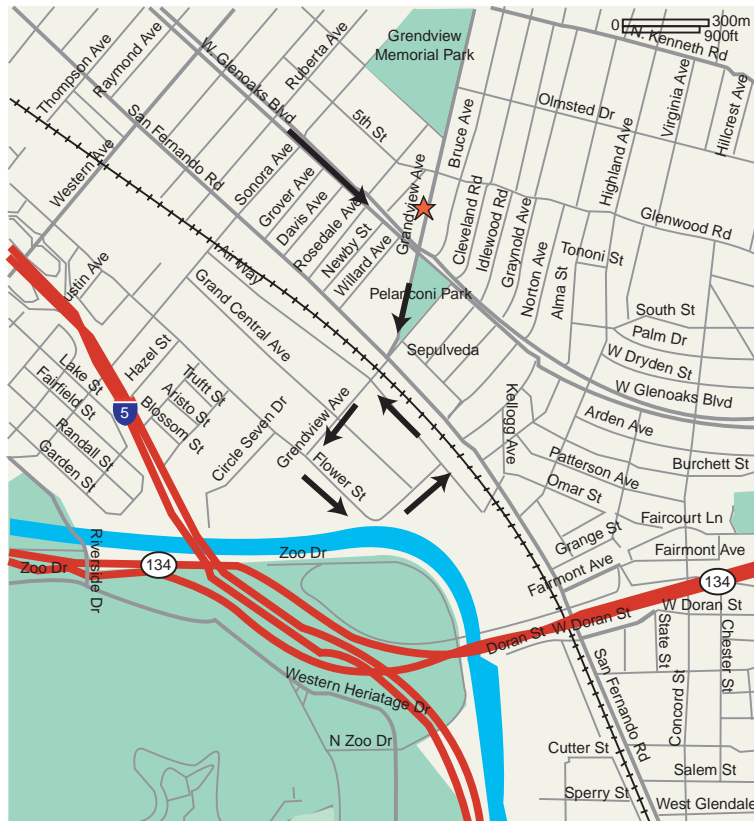


Figure 8. Map indicating convoy route through section of Glendale.

After crossing the railroad tracks, the lead pilot car driver saw that the street came to a dead end 2 blocks from the grade crossing. He stated that he realized then that he had made a mistake and stopped. The three CHP officers, both pilot car drivers, and the truckdriver stopped and exited their vehicles; together they examined a map to determine the best route of egress and return to the permit route. They found that the best route was to go around the block, eastbound on Flower Street (curved to the north), to westbound on Airway Street, and back to Grandview Avenue; the convoy could then turn east on San Fernando Road. After the lead pilot car and one CHP officer drove the route to assess its safety, the convoy returned to northbound Grandview Avenue. (See figure 8.) Upon reaching Grandview Avenue, the convoy encountered an eastbound Metrolink commuter train at the grade crossing and waited for the train to pass. The lead pilot car and two lead CHP escort units then entered the intersection. The lead pilot car turned east on San Fernando Road, while one CHP unit blocked westbound traffic and the other CHP unit blocked eastbound traffic.

The truck began to cross the railroad tracks, and the rear section of the vehicle became lodged on the tracks. At this point, no one except the truckdriver realized the vehicle was stuck. The truckdriver exited the tractor and went to the hydraulic controls on the left side of the vehicle to raise it off the tracks. The rear pilot car driver moved up to the right rear of the vehicle to determine why the truck was not moving. The CHP officer-

in-charge, who was the rear CHP unit at the time, began calling out for the truckdriver to move the truck off the tracks, not realizing the vehicle was lodged on the crossing.

The railroad warning devices started to activate. Witnesses estimated that from the time the vehicle was initially stuck (stopped) on the tracks to the activation of the warning devices was less than 60 seconds. When the warning devices activated, several events happened at once. One CHP officer began to call on the CB radio for the truckdriver to get the truck off the tracks, believing the driver was still in the tractor. She did this several times until she saw the truckdriver running back toward the tractor from somewhere on the left side of the vehicle. The CHP officer-in-charge began to yell for the truckdriver to move the truck off the tracks. The rear pilot car driver began to call for the truckdriver to get the vehicle off the tracks. (See figure 9.)

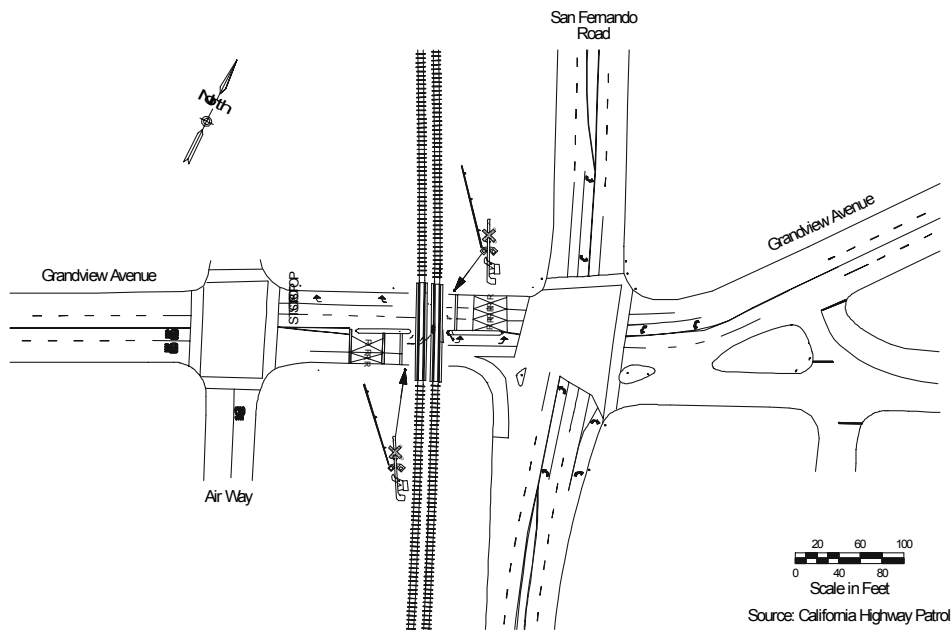


Figure 9. Diagram of accident site.

The truckdriver, seeing the approaching westbound train, ran back to the tractor and began to drive forward. He was able to move the tractor forward a few inches when the train struck the load. Two CHP officers said they saw the truck moving forward before the collision. The truckdriver said he was just starting to move off the tracks when the train hit the vehicle. The impact broke the semitrailer and rear “jeep”¹⁶ off the leading jeep. The train propelled the rear jeep about 101 feet west of the crossing where it came to rest along the south side of the tracks. The train carried the load about 1,100 feet west on

¹⁶ The term *jeep* denotes various configurations of long-frame and short-frame dollies when they are combined to accommodate the weight of a load. A jeep dolly unit is usually positioned at each end of the cargo bed.

the tracks before coming to a stop on the tracks. (See figure 10.) Witnesses estimated the total time from the truck stopping on the tracks to impact was less than 90 seconds.

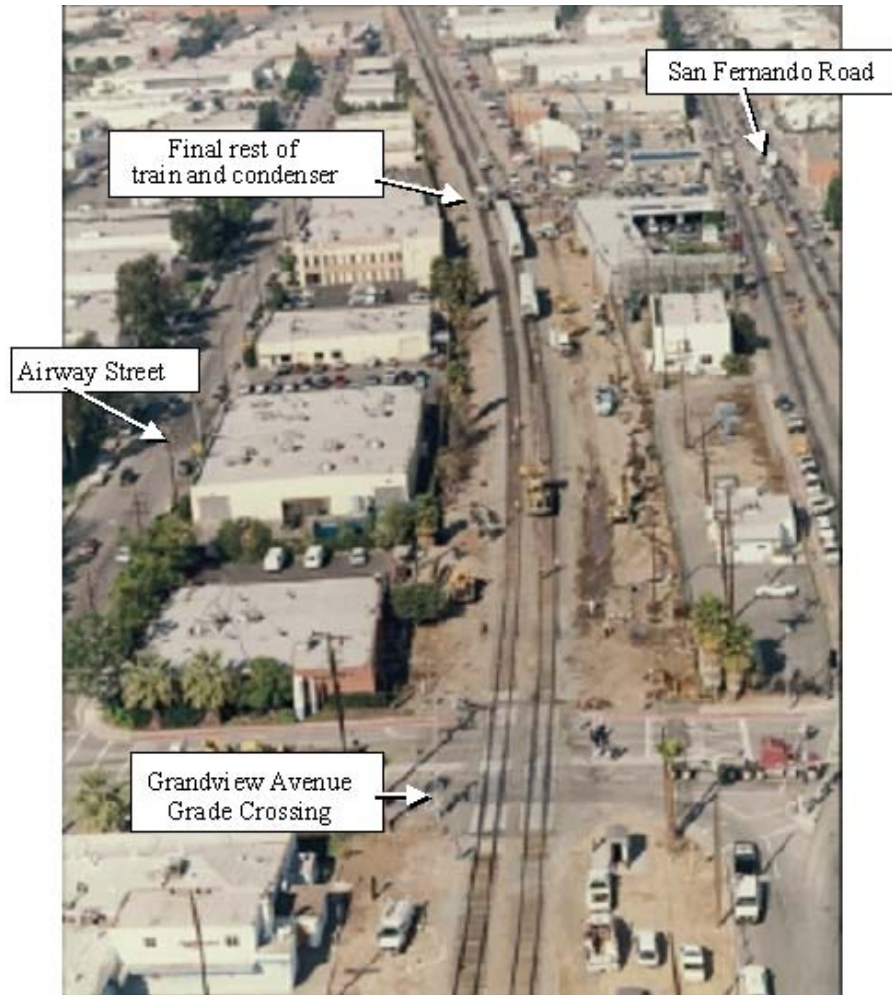


Figure 10. Aerial view of accident site. (Photograph source: Glendale, California, Police Department.)

Train Events Preceding the Accident¹⁷

The train operating crew, consisting of the locomotive engineer and the conductor, went on duty at Taylor Yard in Glendale at 4:25 a.m. They operated the commuter train without passengers to Los Angeles Union Station. Once the train arrived at the station, the crew changed operating ends of the train, loaded passengers, and prepared for departure. At 5:42 a.m., the engineer informed the train dispatcher that train 901 was ready to depart

¹⁷ A Safety Board railroad accident investigator interviewed both the engineer and the conductor on April 3, 2000.

on time; it left the station at 5:43 a.m. During the departure from the station, the engineer performed a running air brake test. The engineer stated that the test did not reveal any problems with the braking system. Further, she stated that the brakes worked properly during the trip from Los Angeles Union Station to Glendale, the first passenger stop.

At the Glendale station, about 10 passengers exited, and no one boarded train 901. Moments after departing the station, train 901 passed an opposing train on the opposite track. Before the Grandview Avenue crossing, the train passed a wayside detector at milepost 7.8 that announced no defect was detected on the train and that the train speed was 76 mph. As the train rounded a slight left-hand curve, the engineer said that the crossing became fully visible and she saw a large object on the tracks. She sounded the train whistle as a warning. As the train approached the crossing, the engineer determined that the train was going to strike the object. About 1,000 feet¹⁸ before the crossing, the engineer applied the emergency brakes on the train.

The engineer said that she “threw herself to the floor” to avoid possible personal injury during the inevitable collision. Once the train had stopped, the engineer radioed an emergency message to southbound commuter Metrolink train 100 on the opposing track. She recalled that she normally passed train 100 daily at this location on the adjacent track. As the trailer was shoved in front of her locomotive, she knew that it was obstructing the adjacent southbound track. She told the train 100 engineer “to stop his train immediately.” The other engineer heard this instruction and stopped his train 50 feet from the obstruction.

Emergency Response

Immediately after the collision, the CHP officer-in-charge radioed his dispatch officer about the accident. One of two Glendale police officers who were in the area and witnessed the collision immediately radioed the Glendale dispatcher about the collision.

The Glendale Fire Department records¹⁹ indicate that a citizen notified the fire department of the accident at 5:57 a.m. The department dispatched 3 fire engines, 2 emergency medical ambulances, 2 pump trucks, 2 other rescue vehicles, and 21 firefighters. At 6:02 a. m., the first fire department vehicle, engine 27B, arrived on scene. Upon arrival, the firefighters advised responding units that the accident site was located 1/4 mile north of where it had been initially reported. Initial radio reports from the scene to the communications center indicated that “the front of the train was wrapped in a large metal structure that did not appear to be a semi [tractor trailer].” (See figure 11.)

¹⁸ Sand was applied when the brakes were placed in emergency; signs of sand were noted on the rail 955 feet before the crossing.

¹⁹ The Glendale Fire Department Field Incident Report No. 00-1149 provided information regarding the emergency response, as well as the hazard assessment, multiagency and emergency medical responses, and establishment of a safe area. The report of the management of the incident by emergency response agencies indicates the response was timely and adequate to meet the emergency situation.



Figure 11. Postcollision view of condenser and train. (Photograph source: Glendale, California, Police Department.)

Engine 27B initially had difficulty reaching the accident site because two chain link fences blocked the access route; these were later cut through by fire department personnel. After making their way to the train, firefighters found several local industry personnel assisting passengers away from the train. During the search of the train and immediate area, truck 21 firefighters found exposed wires from the rail crossing gate, notified Metrolink, and requested the power be turned off; Metrolink responded to the request immediately.

The firefighters found the train engineer still in the locomotive and checked her for injuries. They then asked whether she had “shut down the engine” and notified the railroad of the accident; she replied she had. The engine access door was jammed, and the engineer was extricated from the engine by firefighters from truck 21. Firefighters from engine 27B and truck 26 searched the train cars for injured passengers; about 10 minutes later, they repeated the search to insure that all the injured had been located.

The emergency responders established a triage area for treating the passengers in a parking lot adjacent to the railroad tracks at San Fernando Road. The two ambulances were assigned to transport injured passengers to local medical facilities, and a third rescue vehicle was based at the triage area to care for the injured. No passengers, train crewmembers, or emergency response personnel required medical attention.

By 8:50 a.m., the emergency medical personnel and ambulances were released from the scene. Engine 22 was assigned to remain on scene to provide fire protection

during the wreckage removal and site restoration process. The fire department officially completed its duties at 9:52 p.m.

According to the Glendale Office of Emergency Services coordinator, the California and the Federal Emergency Management Agency guidelines form the basis for Glendale's Emergency Response Plan, which is updated annually. Glendale employs the incident command system for all public safety and utility agencies, and the incident command system specifically addresses mass casualty transportation accidents. In addition, the response plan for "all hazards" provides guidelines for mass casualty incidents. The coordinator indicated that the responding fire and police department personnel used the emergency response plan at the accident scene and that the management of the accident scene was routine for the type of accident occurrence.

Injuries

The two train crewmembers and four passengers received minor injuries. (See table 1.)

Table 1. Injuries.

Injuries	Truckdriver	Train crew	Train passengers	Total
Minor	0	2	4	6
None	1	0	6	7
Total	1	2	10	13

Damages

The collision resulted in severe damage to the locomotive (see figure 12) and minor exterior sheet metal damage to two coaches. The signal mast, lights, bells, and gate on the north side of the crossing were removed in the collision. No significant track damage occurred. The tractor was not damaged. The vehicle separated into three parts, and the oil refinery condenser was destroyed. (See table 2.)



Figure 12. Postcollision view of locomotive. (Photograph source: Glendale, California, Police Department.)

Table 2. Damages.

Equipment	Amount
Locomotive and cars	\$610,000
Signal and crossing warning devices	13,950
Vehicle	150,000 - 200,000
Condenser	1,500,000
Total	\$2,273,950+

Truck Information

The truck consisted of a 1997 Peterbilt tractor and a 1992 Aspen semitrailer configured with a two-axle jeep, a three-axle low-boy semitrailer, and another two-axle jeep. (See figure 13.) The semitrailer was equipped with a hydraulic lift with a 13-horsepower motor. The tractor-combination vehicle was leased from Townsend Transportation in Buda, Texas.

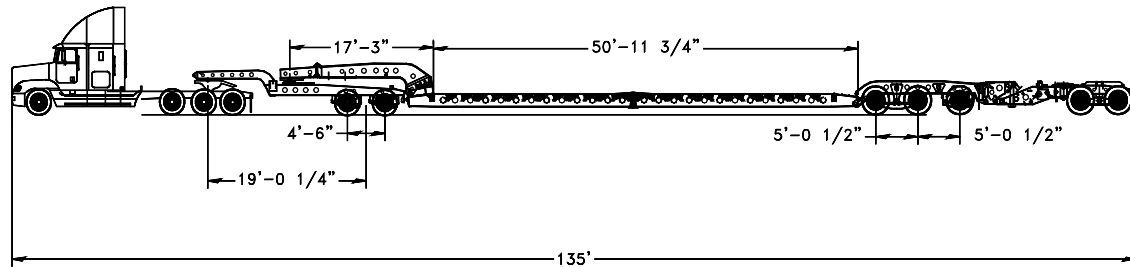


Figure 13. Schematic of truck.

The tractor's most recent Commercial Vehicle Safety Alliance inspection sticker was from the first quarter (January through March) 1997.

Train Information

The Metrolink train 901 consisted of a 1992 3,000 horsepower General Motors, Inc., locomotive 861 (F59PH) and Bombardier Transportation coach cars 160 and 155 and coach/cab car²⁰ 611.

Truckdriver Information

The 30-year-old truckdriver held a valid Class A Texas commercial driver's license (CDL) with endorsements²¹ for double/triple trailers, tank vehicles, and hazardous materials and had no restrictions. His valid medical certificate was to expire May 5, 2001. The motor carrier's driving history records of the driver indicated no traffic violations and one noninjury traffic collision in the previous 5 years. A check of the Commercial Driver's License Information System (CDLIS)²² indicated a traffic violation in November 1986 and a traffic accident in April 1995 involving a commercial vehicle.

According to the truckdriver's driver qualification file, he was employed as a truckdriver in January 1994 by DAD's Trucking in Baytown, Texas. He left DAD's

²⁰ A coach/cab car is a passenger coach equipped with an operating cab at one end. The train can be operated from this car for movement with the car at the front of the train. The power and braking for the car is controlled through wiring and piping running through the train back to the locomotive.

²¹ Under 49 *Code of Federal Regulations* (CFR) 383.93, the endorsements for a CDL include (1) double/triple trailers, (2) passenger vehicles, (3) tank vehicles, or (4) vehicles required to be placarded for hazardous materials.

²² The CDLIS is a computer pointer system that records traffic violations and collisions for people holding CDLs. The CDLIS is operated by the American Association of Motor Vehicle Administrators, which is a State and federally funded organization.

Trucking in April 1994, when the company had insufficient business to employ him. The truckdriver worked for Mercury from May 1994 until November 1996, when he returned to DAD's Trucking until April 1997, after which he was reemployed by Mercury. The truckdriver had been subject to several random drug and alcohol tests while employed by Mercury. All test results were negative.

A review of the truckdriver's logbook for November and December 1999 indicated no violations of the hours-of-service rules. The truckdriver logged off duty on January 4 and 5, 2000, the 2 days before the accident trip began. He reported to work at 8:45 a.m. on January 6 in Houston. The truckdriver's log did not indicate any invalid entries until January 26, when he logged off duty from 1:30 p.m. until 8:00 a.m. on January 27 in Quartzsite. A receipt for a repair on the tractor from Ramsey International (truck dealer and repair service) in Blythe was found in the tractor during the postaccident vehicle inspection. The receipt was stamped with the date "01/26/2000" and the time 10:58 p.m. Ramsey International was contacted to determine the time it would take to complete the repair: based on the labor charge (\$105) and the time necessary to process in and out (assuming the truck was accepted immediately for repair), it would have taken from 2 to 2.5 hours. The distance from Quartzsite to Blythe is about 24 miles or between 20 and 25 minutes' driving time. Calculations based on this information indicate that the truckdriver needed a minimum of 3 to 3.5 hours to accomplish the vehicle repair. Based on the time-out stamp of 10:58 p.m. on the repair receipt, the truckdriver should have logged time for the repair from about 8:00 p.m. to 11:30 p.m. This time was not recorded in the truckdriver's logbook.

According to the Mercury driver's manual,²³ drivers are to log "rest and meal stops as *off duty* since you are on duty just prior to the rest period and are required to properly secure your vehicle prior to your rest period," which is permitted under Federal rules if the company provides written instructions to do so. Under 49 *Code of Federal Regulations* (CFR) 395.2, driving to a repair facility and waiting for the repair work is considered driving and on-duty time and should be recorded as such.

No times were recorded in the truckdriver's logbook after the 8:00 a.m. entry on January 27. The truckdriver should have recorded 10 hours of driving time when he arrived in Adelanto, logged off duty for 4 hours, and recorded an additional 9 hours of driving time from Adelanto to Glendale. At the time of the accident, the driver was at least 9 hours beyond his allotted 10-hour driving time²⁴ and was in violation of the 15-hour rule²⁵ by at least 4 hours, not including the fueling time in Adelanto.

The truckdriver said that he had informed the new CHP escort of his hours-of-service status in Adelanto, but they directed him to drive anyway. He indicated that he believed that CHP was in charge of the trip (determining the correct routes and allowing

²³ Mercury Transportation, Inc., *Driver's Manual*, revised September 27, 1998.

²⁴ Title 49 CFR 395.3 (a)(1).

²⁵ Title 49 CFR 395.3 (a)(2).

him to continue to drive). He said that he had relied on CHP and the lead pilot car driver for directions because he was unfamiliar with the route.

Pilot Car Drivers' Information

The lead pilot car driver at the time of the accident held a valid California Class C driver's license (noncommercial) scheduled to expire on June 5, 2003, with a restriction for wearing corrective lenses. His driving history showed one moving traffic violation in March 1998 for following too closely.

He told a Safety Board investigator²⁶ that he owned Dick's Pilot Car Service and had been in business since 1992. The lead pilot car driver had received Utah pilot car driver certification in 1998. He indicated he was a member of the California Professional Escort Car Association; California does not require pilot car driver certification.

West Coast Services contacted him for this job when the pilot car driver from Doug's Pilot Car Service, who had conducted the route survey, was unable to escort the load. He said that he was unfamiliar with the route. He indicated that he had received the California permits from West Coast Services on January 26, 2000, but did not receive any of the permit attachments, which contained the rules and regulations relating to that load movement. He did not check the permits for validity, but he reviewed them and created a master route list from the routes indicated on the permits. After the collision, he checked his notes and discovered that he had failed to record the turn from Grandview Avenue to San Fernando Road.

He stated that he had been in contact with the truckdriver and the CHP officers via CB radio. He said that he thought the Los Angeles County curfew was 5:00 a.m. and the Los Angeles city curfew was 6:00 a.m. In addition, immediately after the accident, he told the Glendale police that he did not know of any requirement to notify the railroad when about to traverse a grade crossing. His Utah pilot car certification curriculum did not include railroad notification of low-clearance vehicle²⁷ track crossings. California does not require railroad notification.²⁸

The rear pilot car driver from L. P. Flag Car Company held a Commonwealth of Virginia escort vehicle operator certificate scheduled to expire on November 25, 2001. He escorted the vehicle from Houston into California.

²⁶ A Safety Board investigator interviewed the pilot car driver on February 8, 2000.

²⁷ Defined by the *Uniform Vehicle Code* as a vehicle with a vertical body or load clearance of less than ½-inch-per-foot of the distance between any two axles or less than 9 inches, measured above the level surface of the roadway.

²⁸ Some States require notification of the railroad for permitted loads under certain conditions, such as low clearance. The Safety Board will discuss this issue at length in its forthcoming report on the November 17, 2000, Intercession City, Florida, highway-railroad accident investigation.

Motor Carrier Information

Mercury was a for-hire interstate carrier specializing in hauling oversized equipment. The Houston company began operations in 1971 hauling oil field pipes and equipment. In 1982, it expanded to the carrying of oversized loads requiring specialized moving permits. It also hauls small amounts of class 3 (flammable) and class 8 (corrosive) hazardous materials. The owner estimated that about 60 percent of the company business is interstate and 40 percent intrastate commerce.

The company operates 35 tractors, of which 10 are owned by the company and 25 are leased from owner-operators. Truckdrivers are assigned the same tractor daily. The company operates 36 semitrailers of different makes and models: 20 flatbed semitrailers, ranging in length from 42 to 53 feet; 5 double-drop semitrailers; 7 single trailers; and 4 heavy-haul trailers.

All Mercury vehicles are subject to the Federal and State of Texas annual vehicle inspection requirements. Olympic International, Inc., in Houston conducts the annual inspection on the vehicles. This company employs one full-time mechanic, who has 12 years of truck mechanic experience and holds a CDL. All Mercury vehicles are serviced every 10,000 miles, which includes changing the oil and filters and inspecting the brakes and lights.

Before the accident, the motor carrier's most recent safety review by the Federal Motor Carrier Safety Administration took place on April 6, 1982, when the carrier received a satisfactory rating.

Mercury employed 35 full-time truckdrivers, 10 contracted from National Personnel, Inc., of Dallas, Texas, and 25 long-term lease owner-operators. Due to the high cost of purchasing insurance and workman's compensation and operating a full-time personnel office, according to the Mercury owner, the company contracts the truckdrivers. Mercury pays National Personnel, Inc., a fee-for-services company, which, in turn, pays the truckdrivers.

Truckdrivers are interviewed and approved for hiring by Mercury. The Mercury driver's manual includes the following hiring criteria: (1) be 25 years of age or older, (2) have at least 2 years of truck driving experience, (3) have personal transportation, (4) be physically able to handle pipe and other physically demanding loads, (5) live in the greater Houston area, and (6) be able to pass a U.S. Department of Transportation physical examination and drug screen. The hiring criteria do not include having had training in moving oversize/overweight loads.

Mercury has no *formal* training program; the company provides truckdrivers with an employee safety handbook that was prepared by National Personnel, Inc. Mercury also provides truckdrivers with its driver's manual detailing various driver responsibilities such as customer service, loading vehicles, measuring load and vehicle combinations, required trip and vehicle documentation, and other company policies. Truckdrivers are required to

attend safety training meetings and may receive with their paychecks safety memos that relate the experiences of Mercury truckdrivers and other company issues.

The Mercury owner said that new truckdrivers are assigned to local deliveries with a driver-trainer for evaluation purposes. After completing an unspecified evaluation period, truckdrivers are placed on regular pickup and delivery routes. They are assigned to larger and heavier vehicles as their skill and experience increases. Currently, only two or three truckdrivers are permitted to operate the super loads, which the owner defined as those loads requiring pilot cars per the issuing agency's specialized moving permit.

Train Crew Information

The engineer worked as a clerk for a freight railroad from 1979 to 1986, when she went to work for Amtrak in the clerical department. She transferred to the operating department as an assistant conductor in 1988, was promoted to conductor between 1988 and 1990, and transferred to engine service in 1990. For 2 years, she worked as a fireman/engineer trainee and since 1992 has operated trains as a locomotive engineer.

The conductor worked as a brakeman/conductor for a freight railroad between 1973 and 1990. He has been employed by Amtrak as a conductor since 1991.

Railroad Information

The Southern California Regional Rail Authority is a rail commuter agency established by five counties in the Los Angeles basin: Los Angeles, Ventura, San Bernardino, Riverside, and Orange. It is controlled by a board composed of representatives from each county. The single agency was created to design, develop, and operate a commuter railroad that would service these counties. The Southern California Regional Rail Authority subcontracted railroad functions with Amtrak to provide qualified operating crews to operate the Metrolink commuter trains. This contract contains requirements to supervise these employees, as well as to maintain compliance with Federal regulations.²⁹

The Metrolink train dispatching center in Glendale monitored the train movements. The train dispatcher controlled the territory through signal indications and switch positions known as centralized traffic control. Additional instructions were contained within the timetable, operating rules, general orders, track warrants, and special instructions.

²⁹ Including Engineer Licensing, 49 CFR Part 240; Drug and Alcohol, 49 CFR Part 219; and Accident Reporting, 49 CFR Part 225.

The third edition of the *General Code of Operating Rules*, dated April 10, 1994, comprised the operating rules. Rule modifications or revisions to the *General Code of Operating Rules* were included in the Metrolink timetable, which had two applicable parts: the “System Special Instructions” provided general revisions, and the “Valley Subdivision” contained information specific to trains operating through the territory in which this accident occurred. Permanent track speeds for the trains were designated in the timetable, and temporary speed restrictions were issued in track bulletins³⁰ by the train dispatcher.

Accident Site Information

Roadway

Grandview Avenue is a five-lane, divided urban roadway. A 4-foot-wide concrete median island divides the northbound and southbound traffic lanes. The roadway surface is asphalt concrete. Postaccident inspection of the pavement markings revealed no irregularities, and the markings were in conformance with the *Manual on Uniform Traffic Control Devices*.³¹ The posted speed limit on Grandview Avenue is 25 mph.

Glendale Police Department records indicate that from 1993 through 2000, 12 accidents occurred in the area bounded by Grandview Avenue and San Fernando Road and Grandview Avenue and Airway Street. These accidents resulted in 1 fatality and 10 injuries. The fatality occurred at the grade crossing on Grandview Avenue in 1998 and involved a pedestrian struck by a Metrolink train.

Grade Crossing

The grade crossing is designated as U.S. Department of Transportation 746796L. It consists of two parallel tracks 20 feet apart. The pavement at the grade crossing is concrete. The profile grade from the centerline of the grade crossing to the south edge of San Fernando Road and to the north edge of Airway Street is 3.26 percent and 3.02 percent, respectively.

The last Federal Railroad Administration statistical report on the crossing before the accident was dated February 20, 1997, and indicated the average daily traffic count on Grandview Avenue was 5,900 vehicles, of which 15 percent were trucks. The daily train frequency was approximately 34 trains in both directions on both tracks. The area surrounding the crossing is light industrial.

³⁰ Track bulletins are addressed to trains that operate through the dispatcher’s assigned territories. The track bulletins contain temporary speed restrictions, locations of men and equipment working, and safety hazards that may exist.

³¹ The manual is approved by the Federal Highway Administration as the standard for all streets and highways in accordance with 23 *U.S. Code* sections 109 (b), 109 (d), and 402 (a) and 23 CFR 1204.4.

The grade crossing was built sometime before 1929, when the city of Glendale acquired it from Los Angeles County, and was widened in 1962. At this time the applicable standards were in the American Association of State Highway Officials 1954 *A Policy on Geometric Design of Street and Highways*. The guidelines on railroad grade crossing alignments were 3 percent minimum (desirable) to 6 percent maximum. In 1990, the American Railroad Engineering Association guideline and the American Association of State Highway and Transportation Officials (AASHTO) standard for roadway vertical profiles at highway-railroad grade crossings changed to reflect the following:

Acceptable geometrics necessary to prevent drivers of low-clearance vehicles from becoming caught on the tracks would provide the crossing surface at the same plane as the top of the rails for a distance of 2 ft. outside the rails. The surface of the highway should also not be more than 3 in. higher nor 6 in. lower than the top of the nearest rail at a point 30 ft. from the rail unless track superelevation dictates otherwise.³²

In April 2001, the AASHTO revised its guidelines³³ for roadway vertical profiles at railroad grade crossings, which state:

In some instances, the roadway alignment may not meet acceptable geometrics for a given design speed because of restrictive topography or limitations of right-of-way. To prevent drivers of low-clearance vehicles from becoming caught on the tracks, the crossing surface should be at the same plane as the top of the rails for a distance of 0.6 meter (2 feet) outside the rails. The surface of the highway should also not be more than 75 millimeters (3 inches) higher or lower than the top of nearest rail at a point 9 meters (30 feet) from the rail unless track superelevation makes a different level appropriate.... Vertical curves should be used to traverse from the highway grade to a level plane at the elevation of the rails. Rails that are superelevated, or a roadway approach section that is not level, will necessitate a site-specific analysis for rail clearances.

In addition, section 8B.14 of the 2000 edition of the *Manual on Uniform Traffic Control Devices* includes a new low-ground clearance warning highway-railroad grade crossing sign (W10-5), shown in figure 14, and provides the following guidance for its use:

If the highway profile conditions are sufficiently abrupt to create a hang-up situation for long wheelbase vehicles or for trailers with low ground clearance, the Low-Ground Clearance Highway-Rail Grade Crossing (W10-5) sign should be installed in advance of the highway-rail grade crossing.

Signals

The grade crossing was equipped with a Safetran Systems Corporation grade crossing predictor model 3000D2 with two warning devices. In October 1997, the system was upgraded with grade crossing predictor 3000 "F" level software. Maintenance records

³² *A Policy on Geometric Design of Streets and Highways*, AASHTO, 1990, adopted as a Federal Highway Administration standard in April 1993 at 23 CFR 625.4.

³³ *A Policy on Geometric Design of Highway and Streets*, Fourth Edition, AASHTO, 2001.



W10-5

Figure 14. Low-ground clearance warning highway-railroad grade crossing sign.

indicated that the signal equipment had been inspected once each calendar month as required by regulation.³⁴ The records also indicated that no exceptions were taken to the operation of the crossing warning devices. The event recorder recorded the operation of the devices controlling the gates and lights at the time of the accident and noted no abnormalities.

Track

Both tracks, with an ascending grade of about 1 percent, were maintained to meet or exceed the standards for a class 5 track as described by the Federal Railroad Administration in 49 CFR Part 213. Although class 5 track allows freight trains to operate at 80 mph and passenger trains at 90 mph, other criteria in the signal regulations limited the maximum speed for passenger trains to 79 mph. The accident train speed was calculated from the time recorded by the recording device at the crossing, as passing at an average speed of 77 mph. Metrolink maintenance records indicate that the tracks were inspected twice weekly with at least 1 calendar day interval between inspections as required under 49 CFR 213.

Toxicological Tests

After the collision, the truckdriver voluntarily submitted to a drug and alcohol test administered by the Glendale Police Department. His test results were negative for drugs and alcohol. Under 49 CFR 219.201 (B), the train crew was not required to be tested, and they were not.

³⁴ Title 49 CFR Part 234, "Grade Crossing Signal System Safety."

Tests and Research

Accident Crossing Warning Devices

After the accident, the Safety Board conducted operational tests on the active crossing traffic control devices (signals, bells, lights, and gates) and found no abnormalities.³⁵ The warning devices gave 20 seconds of warning before the train arrived. In addition, the railroad notification telephone number posted on the signal housing in the southwest corner of the crossing was dialed, and the notification party answered immediately.

Other Grade Crossings on Permitted Route

On June 13, 2001, Safety Board investigators drove the permitted route from the California-Arizona border to the accident site. On this route the convoy had traversed seven grade crossings,³⁶ including the accident crossing. Investigators measured the percent grade for the approach and departure lanes at these crossings. (See table 3.)

Table 3. Grade crossing information.

Location and direction of travel	U.S. Department of Transportation no.	Grade percent on approach lane	Grade percent on departure lane
U.S. 95 northbound near Old Parker Road	N/A	+1.3	-0.5
State Route 62 westbound	027 031-C	+0.33	-0.16
Double-track State Route 62 westbound first track second track	027 050-G	+0.58 0.0	0.0 -0.5
San Fernando Road closed crossing (formerly an active crossing with gates)	746 033-A	+0.17	-0.75
Polk Street from San Fernando Road, 12 miles from Grandview Avenue crossing	VY 22.64 903 132-F	+1.04	0.0
Grandview Avenue crossing (accident site), first time across	746 796-L	+3.26	-3.02

³⁵ The operating standards are found at 49 CFR 234.223, "Gate Arm," and 49 CFR 234.22, "Activation of Warning System."

³⁶ Six of these grade crossings were active crossings with signals and gates.

Other Information

Heavy Hauling Industry

In the United States, heavy hauling vehicles, defined as having a gross vehicle weight greater than 80,000 pounds, represent less than 1 percent of the truck fleet.³⁷ According to the U.S. Department of Commerce 1997 Vehicle Inventory and Use Survey, the heavy hauling fleet comprises more than 70,100 vehicles (45,200 tractor single-trailer combinations) that operate over 3.8 billion miles each year. Since 1992, the number of vehicles and miles traveled has increased by 40 and 52 percent, respectively. According to the Specialized Carriers and Rigging Association, 600 of its 1,100 members are in the business of heavy hauling.

Permit Information

Accident Trip. Mercury was required to obtain permits from four States to transport the load from the Toromont Process Systems plant in Houston to the Chevron refinery in El Segundo because the dimensions of the truck exceeded State size and weight limitations. Mercury arranged for the moving permits in Texas and New Mexico and hired Central Arizona Escort Service of Phoenix, Arizona, to obtain the permits in Arizona and West Coast Services of Monrovia, California, to obtain the permits in California. The issuing State agency and special requirements of the obtained permits are shown in table 4. The permits required from the 12 local government entities in California are shown in table 5.

Table 4. Accident trip State permits.

State	Issuing agency	Special requirements	Fee
Texas Permit No. 10649002P	Department of Transportation, Motor Carrier Division in Austin.	Required two pilot cars and a route survey. Mercury had to certify, in writing, that the route was safe. Daylight only.	\$190
New Mexico Permit No. PSFO-3143	Department of Public Safety, Permit Office.	Daylight only.	\$ 15
Arizona Permit No. 001-000126455	Department of Transportation, Maintenance Permits Service in Phoenix and Motor Vehicle Division in Goodyear.	Required Arizona Highway Patrol escort in the Sierra Vista area. Daylight only.	\$100
California Permit No. 665503	Department of Transportation.	Required two pilot cars and a route survey. Required CHP escort on all routes in California.	\$ 16

³⁷ *Economic Benefits of Uniformity in Oversize/Overweight Permitting.* A study conducted for the Specialized Carriers and Rigging Association Foundation by Cambridge Systematics, Inc., Cambridge, Massachusetts, January 2000.

Table 5. Accident trip local government permits in California.

Local government	Permit no.	Restriction	Fee
San Bernardino County	M19651	2:00 a.m. to 5:00 a.m.	\$ 16
Victorville	00-0032		\$ 25
Adelanto	TP 235		\$ 30
Los Angeles County	6107202	Sunrise to sunset. ^a	\$316
Santa Clarita	064676		\$200
Los Angeles	OP.000656	12:00 a.m. to 6:00 a.m.	\$303
Burbank	3404	2:00 a.m. to 6:00 a.m.	\$ 16
Glendale	No permit issued. ^b		
Huntington Park	4430		\$ 15
Compton	00-23		\$ 15
Hawthorne	No permit issued. ^c		
El Segundo	7482		\$ 15

^a Sunset on January 27, 2000, was 5:19 p.m.; sunrise on January 28, 2000, was 6:54 a.m. Source: U.S. Naval Observatory Astronomical Applications Department Web site <<http://aa.usno.navy.mil/data/docs/rs-oneday.html>>.

^b Glendale requires that proof of insurance be on file with the city before issuing a moving permit. In addition, the city requires that a company representative come to the permit section and process the application. According to West Coast Services, proof of insurance was never sent by Mercury to the city, despite several notifications by West Coast Services to Mercury that one was needed. Glendale permit officials stated that proof of insurance was never received from Mercury.

^c Mercury had previously obtained an annual permit for other loads transported in Hawthorne; however, the size limits for the accident load exceeded those recorded on the annual permit. Therefore, the annual permit could not be used for the accident load. As a result, Mercury was required to apply for another permit. West Coast Services submitted a request for a permit; but, Hawthorne does not issue moving permits for loads in excess of 18 feet high and, therefore, did not issue a permit for the accident load.

General Permit Requirements. More than 3 million permits per year, on average, are issued for oversize/overweight loads in the United States.³⁸ California issued 181,000 permits for oversize/overweight loads in 2000.³⁹ The Federal Highway Administration (FHWA) estimated annual super load⁴⁰ movements to be 300 coast-to-coast and 700 to 1,100 regionally.

A permit is a variance, granted by a State, county, or city agency having jurisdiction over a roadway, to a company that transports loads on those highways and

³⁸ Source: FHWA Web site <<http://www.ops.fhwa.dot.gov/freight/>>, February 12, 2001.

³⁹ Source: telephone conversation with the Chief, Office of Truck Services, Division of Traffic Operations, California Department of Transportation, June 27, 2001.

⁴⁰ Definition of super load varies among the States; in California, a vehicle with dimensions greater than 15 feet wide, 17 feet high, and 135 feet long is considered a super load.

roadways where the load or the vehicle exceeds State size or weight limitations or both. National guidance is found in the 1991 AASHTO Subcommittee on Highway Transport's *Guide for Maximum Dimensions and Weights of Motor Vehicles and for the Operation of Nondivisible Load Oversize and Overweight Vehicles*. This document discusses the issuance of truck permits and restrictions and national defense.

Permits can be issued either annually or for multiple or single trips. An annual permit is issued when the vehicle, load dimensions, or weight remain constant, as in the case of a mobile crane or vehicles and transported loads that do not exceed certain limitations. Vehicles or loads in this category receive permits without specified routes but are limited to those roadways designated as truck routes. Multiple- and single-trip permits are issued when a single load or a number of loads require permitting but are only in use for a limited time.

A fee is commonly charged to issue the permit.⁴¹ The fee structure is different in each State, and the cost of a permit varies among jurisdictions. Mercury paid \$15 to \$316 for the permits involved in this accident load. (See tables 4 and 5.)

Part of the permitting process is route selection. Either the company transporting the load or a private permit company selects the route(s) for permitted loads. Routes are selected by determining the size and weight of the vehicle or load, then reviewing highway maps, and finally calling on the company's corporate knowledge of an area. Some State departments of transportation publish maps with bridge weight and clearance limitations; if they do not, the company consults with the State departments of transportation and local departments of public works or road departments.

A number of Web sites provide routing and other permit information. The Texas Department of Transportation Web site⁴² has a list of roadway and time restrictions, escort vehicle requirements, and other permit conditions for several Western States.⁴³ In addition, the Western Association of State Highway and Transportation Officials (WASHTO) publishes the *Guide for Uniform Laws and Regulations Governing Truck Size and Weight Among the WASHTO States*, which provides guidance to companies transporting extralegal⁴⁴ loads among the Western States.

To obtain certain permits, a route survey also may be required to observe potential safety problems along the proposed route, as was the case for the movement of the load involved in this accident. Route surveys, often required for super loads, are conducted by pilot car drivers in passenger vehicles (usually specially equipped pickup trucks) to determine the compatibility of the route with the size or weight of the vehicle and load and to identify potential hazards that should be avoided.⁴⁵ Flexible poles projecting from the

⁴¹ The usual practice is to charge a flat fee for services regardless of the size or weight of the vehicle or load.

⁴² <<http://www.dot.state.tx.us/insdot/orgchart/mcd/permit/AppenC.htm>>.

⁴³ Arizona, Colorado, Idaho, Montana, New Mexico, Oklahoma, Utah, Texas, and Washington.

⁴⁴ Vehicle or load that is larger or heavier than State size and weight regulations.

top and sides of the survey vehicle are used to determine height and width limitations along the proposed routes.

Once selected, a route is submitted to the jurisdiction in which the load will be traveling for review, approval, and permit issuance. Some jurisdictions require a signed certification that the selected route is suited and safe for the vehicle and load. Each governmental agency is to review the selected route that traverses its jurisdiction for compatibility with roadway geometry, bridge weight tolerances, and construction zones. Agency reviews vary: a smaller jurisdiction may have only one approved route, calling for minimal review; another jurisdiction may conduct a manual review, using printed maps and determining where current roadway work projects are being conducted; and a larger jurisdiction may have a computer database with designated oversize/overweight routes and roadway environment information. Load heights in excess of 15 feet generally require an agency to contact public utility and TV cable companies to ensure the load can clear lights, electrical wires, and phone lines and to determine the presence of work projects. The permit process requires sufficient lead time for an agency to complete its review, which may take as long as several weeks prior to the move. In addition to routing, proof of insurance is sometimes required by the issuing jurisdiction.

A vehicle is required to remain on the approved roadway(s) unless it encounters an obstacle that would prohibit further movement, such as a low-clearance bridge. If alternate routes are necessary, approval must be obtained from the issuing agency before further vehicle movement.⁴⁶ If the movement cannot be accomplished within the permitting dates, the permit expires, the movement must stop, and a new permit or extension must be issued.

Violations of the terms and conditions of the permit, including routing violations, can result in fines. In some States, such as California, the department of motor vehicles and the department of transportation track permit violations. Accumulation of violations can result in the State refusing to issue special moving permits to the violating company.

California Department of Transportation

Permits are processed in the Caltrans Office of Truck Services, which has 56 employees, including managers. In the year 2000, the Office of Truck Services processed 181,000 permits (672 permits daily).

In 1999, after two accidents involving permitted loads (see “Other Accidents” section of this report for further information) and State legislative hearings, Caltrans instituted changes to its permitting process. The Office of Truck Services hired additional permit writers and district truck service managers and is in the process of acquiring an automated permitting system, Transportation Permits Management System, which it

⁴⁵ A general practice is that the person conducting the route survey will be the lead pilot car driver during the movement of the load.

⁴⁶ Exceptions are made for emergent circumstances such as a traffic accident on the route resulting in law enforcement directing the vehicle to take a temporary alternate route or detour. In such cases, the vehicle must return to the approved route as soon as possible.

expects to be on line by October 2002. It began the process of verification of vertical clearances in December 1999 and in July 2000 completed measuring 6,500 State highway bridges. By June 2001, it had updated 94 percent of the bridge clearances in the State route-clearing database. (See appendix C for the Office of Truck Services summary of major improvements.)

As part of its evaluation of the permitting process, the Caltrans Office of Truck Services studied 45 incidents of oversize/overweight loads striking bridge structures that occurred from January 2000 through May 2001. Caltrans found the primary cause of 15 (33 percent) of these incidents was the hauler being off route, the primary cause of 9 (20 percent) of these incidents was the load being higher than permitted, and the primary cause of 6 (13 percent) of these incidents was permit errors.

Permit Companies

In this accident, the process of obtaining permits to transport the oversize/overweight loads involved 4 State and 12 local jurisdictions. Permit companies, such as West Coast Services, the company employed by Mercury to obtain the California permits, provide this service. Some companies also provide computerized routing and mapping services for the transportation of oversize/overweight loads. These companies offer detailed maps of the routes best suited for the load transported, including roadway height and width clearance conditions, bridge weight tolerances, axle weight limits, speed limits, and estimated travel times.

Pilot Car Information

Five pilot car companies were involved in the movement of this oversize load:

- Happy's Pilot Car Service provided one escort vehicle in Texas only.
- L. P. Flag Car Company escorted the vehicle from Houston into California and was the trailing pilot car at the time of the collision.
- Billy's Pilot Car Company provided one escort vehicle with two drivers from the New Mexico-Arizona border to the Arizona-California border. One driver traveled part of the route and was relieved by another driver, who escorted the load to the California border.
- Doug's Pilot Car Service (hired by West Coast Services) conducted the route survey for the California permits but did not escort the load en route.
- Dick's Pilot Car Service (hired by West Coast Services) escorted the vehicle from the Arizona-California border to the accident site.

Pilot Car Industry

According to the Specialized Carriers and Rigging Association's *Oversize/Overweight Permit Manual*, all States require pilot cars for loads of a certain size and have equipment requirements for pilot cars, such as the type of lights, size and color of signs and flags, type of two-way communication between pilot car and transport

vehicle, and height and type of pole.⁴⁷ The requirement parameters vary from State to State.

The pilot car industry estimates that there are between 2,000 and 3,000 pilot car (escort vehicle) operators in the United States.⁴⁸ Three regional professional organizations represent the pilot car industry: the California Professional Escort Car Association, the Texas Pilot Car Association, and the United Safety Car Association (includes Washington, Oregon, and Idaho). These three associations represent about 200 independent pilot car owner/operators. WASHTO publishes a model policy for pilot car drivers and equipment in its *Guide for Uniform Laws and Regulations Governing Truck Size and Weight Among the WASHTO States*. No national standards, policies, or professional organizations exist that cover pilot car driver training, qualification, or equipment issues.

State equipment requirements are not consistent among States, for example:

- One State permits the use of a flashing yellow strobe light; another State has made the use of this type of light illegal.
- One State requires the presence of a single 10-pound BC fire extinguisher; another State requires two 5-pound BC fire extinguishers.⁴⁹
- One State requires that an OVERSIZE sign be on the vehicle bumper; another State has made the use of such a sign illegal because it covers the vehicle license plate.
- Some States require that a pilot car driver possess a handheld STOP and SLOW sign, but prohibit its use for traffic control.

Pilot Car Driver Certification Programs

Nine States (Arizona, Colorado, Florida, Kansas, New Mexico, New York, Oklahoma, Utah, Virginia, and Washington) require pilot car certification.⁵⁰ Arizona and New Mexico do not have certification programs. Pilot car operators domiciled in New Mexico must register with the Public Regulatory Commission. Indiana and North Carolina are considering establishing pilot car driver certification programs.

⁴⁷ *Oversize/Overweight Permit Manual*, Specialized Carriers and Rigging Association, Fairfax, Virginia, September 2000.

⁴⁸ Safety Board investigators interviewed representatives of the pilot car industry at the WASHTO 13th Annual Oversize/Overweight Transportation Symposium, San Antonio, Texas, March 10 and 11, 2000.

⁴⁹ The A, B, and C ratings were established by the Underwriters Laboratories and the National Fire Protection Agency. The letters refer to the type of fire the extinguisher is designed to extinguish:

A = trash, paper, and wood;

B = liquids and grease (petroleum products such as gasoline); and

C = electrical.

⁵⁰ Certification in this context means completion of a course or passing a test or both. Certification programs include courses and test administration.

Drivers who meet the certification requirements are issued a certification card and entered into a registry. (See table 6 for the certification requirements of the existing eight programs.) In those States that have a certification program, no one may operate a pilot car without having first been certified, including pilot car drivers from other States. The States that have a certification program usually grant reciprocity to other State certifications.

Table 6. Requirements of States with pilot car driver certification programs.

State	Requirements	Test administration
Colorado	Test and evidence of completing defensive driving course or valid CDL, certificate of commercial insurance, and 5-year driving record. Colorado honors Virginia, Florida, and Utah certification.	Test administered by Colorado Department of Transportation Transport Permit Office for \$5 fee; certification good for 5 years.
Florida	Completion of 8-hour defensive driving class and 8-hour pilot/escort driving class.	Test administered by University of Florida Transportation Safety Transfer Center.
Kansas	Evidence of completing a National Safety Council-approved defensive driving course or valid CDL.	Not available.
New York	Test of State manual.	Test administered by Department of Motor Vehicles for \$40 fee.
Oklahoma	Completion of 8-hour course on State manual.	Test administered by Oklahoma State University; cost to applicant \$90. State currently in final negotiations with university for record maintenance and access.
Utah	Completion of 8-hour course on escort driver manual and test.	Test administered by Utah Valley Community College; cost to applicant \$120. College maintains records and issues certification cards.
Virginia	Test of State escort driver manual.	Test administered by Virginia Commonwealth University. No cost to in-State applicant; cost to out-of-State applicant \$30. Renewals free.
Washington	Completion of 8-hour course and test based on WASHTO guidelines.	Test administered by Evergreen Safety Council for \$145 fee.

The Colorado, New York, Virginia, and Utah pilot car certification manuals⁵¹ and the WASHTO policy manual⁵² include material on the following topics: vehicle and

⁵¹ *Rules and Regulations of the State of Colorado Department of Transportation Pertaining to Transport Permits for the Movement of Extra-Legal Loads*, amended July 30, 1999; *New York State Certified Escort Manual*; *Virginia Escort Driver's Manual*, "Hauling Permit" section, Department of Transportation, Commonwealth of Virginia; and *Pilot/Escort Driver Training Manual*, Utah Valley State College, Orem, Utah, 1996.

⁵² *Guide for Uniform Laws and Regulations Governing Truck Size & Weight Among the WASHTO States*, adopted by WASHTO Policy Committee July 30, 1997.

personal equipment requirements; pretrip preparation, including route reviews and testing of car-to-car communications; proper use of lights; flagging procedures; traffic flow and control; reducing traffic buildup behind the load; driving on narrow roadways and bridges; passing other vehicles; driving maneuvering and techniques; railroad crossings; legal limitations and responsibilities; reporting traffic accidents; escort vehicle placement; and evaluation of roadway hazards. The training curriculums do not include procedures for conducting a route survey or for notifying railroads of low-clearance vehicle crossings.

The Utah manual cites several advantages of a certification program: uniformity among pilot car vehicles and drivers, safer pilot vehicle operations, consistency in enforcement, accountability, permanent records of pilot car services, trained pilot car drivers for traffic control, reciprocity with other certifying States, better communication between pilot vehicles and transport vehicles, licensing standards for pilot vehicle operators, and reduction of traffic accidents.

Virginia started its certification program in the late 1970s and has certified approximately 6,000 pilot car drivers, of which about 80 percent have been out-of-State. The program began after the Virginia Highway and Transportation Research Council conducted a study on the movement of 14-foot-wide manufactured housing units. The study found that “substandard escort vehicle operations were commonplace . . . especially on two-lane highways.” It also noted:

A wide variation in their [escort] operations was observed. Some of the escorts stayed in constant communications with the load, warning the driver of the load of oncoming traffic and obstructions, and working effectively to enhance safety during lane changes and turns made by the load. These escorts were in the minority, as most of the escorts performed no function other than to display a warning sign. At the other extreme, the driver of an escort vehicle was observed to be so intent on protecting the load that often he would encroach into the opposing traffic lane and force vehicles off the road to ensure the safety of the load.

Pilot Car and Police Escort Responsibilities

In Safety Board interviews with pilot car organization representatives,⁵³ a concern was raised about truckdriver and police reliance on the pilot car driver to ensure that the correct route is followed. In the Glendale accident, the CHP officers escorting the vehicle/load indicated they were not familiar with the routing in the Los Angeles metropolitan area and relied on the lead pilot car driver for directions. The organization representatives stated that the primary purpose of the pilot car operator is not to ensure that the vehicle/load is on the correct route, although being on the correct route is factored into the operation, but to provide advance warning whenever route hazards, such as a bridge with inadequate clearance or a raised grade crossing that the load cannot traverse, are present. This concept is stated in the training material provided by States that have pilot car driver certification programs.

⁵³ WASHTO 13th Annual Oversize/Overweight Transportation Symposium, San Antonio, Texas, March 10 and 11, 2000.

California Highway Patrol

Due to the size of the condenser unit, especially its height, the Caltrans permit office contacted CHP team leader 1 to arrange a CHP escort. CHP team leader 1 contacted Mercury directly and negotiated a contract, dated January 21, 2000, for CHP services. The contract called for two CHP officers from the Blythe office, working overtime on their scheduled days off, to escort the vehicle from the California-Arizona border to Adelanto and for three CHP officers, including CHP team leader 2, from the Inland Division, to escort the vehicle from Adelanto to El Segundo. CHP team leader 1 coordinated his efforts with CHP team leader 2.

Team leader 1 said that he arranged between 35 and 40 escort contracts per year in the Blythe area. Team leader 2 indicated that he arranged between 120 and 150 escort contracts per year in the Inland Division area. According to the team leaders, the number of escorts per vehicle is determined on a case-by-case basis, depending on the size of the load, designated route, anticipated traffic conditions, estimated average speed, and permitted times for movement. Escort officers are drawn from a pool of officers who have signed up for the overtime work. (See appendix D for CHP teams 1 and 2 escort officers' on-duty time for the 3 days before the accident.) The officers involved with the Glendale accident load had previous experience in escorting permit loads.

At the time of the Glendale accident, the CHP had no specific policies or training for escorting oversized and super loads. According to the CHP, the traffic control activities involved in escorting these types of loads are covered in the officer's basic and on-the-job training.

CHP officers told Safety Board investigators⁵⁴ that the general procedure was for the two leading CHP units to go before the load into intersections and other places where traffic control was required and ensure that the vehicle could continue safely, by stopping traffic if necessary. The placement of vehicles in the convoy for the California segment of the trip was (1) the lead pilot car (Dick's Pilot Car Service), (2) two CHP units, (3) the truck with the load, (4) one CHP unit, and (5) the trailing pilot car (L.P. Pilot Car Service).

In its Management Memorandum (96-145), dated September 3, 1996, the CHP published a chart of size, weight, and speeds for vehicles and loads that require Caltrans to notify the CHP. The CHP has guidelines for the movement of oversize loads and vehicles and for determining when and how many CHP escorts are required. The appropriate CHP area permit coordinator is responsible for contracting with the transporting company for any CHP escorts that may be necessary. Included in the Management Memorandum are requirements for the CHP to inspect the vehicle and load before its movement in California. The policy reads as follows:

As a general rule, a NAS [North American Standard] Level 1 inspection⁵⁵ will be required on the transporting vehicle(s) of each load escorted by CHP personnel. An exception to this policy should be vehicle(s) displaying a current Commercial Vehicle Safety Alliance sticker(s). However, all unstickered vehicles within the

⁵⁴ Interviews conducted on February 29, 2000.

combination and any stickered vehicles displaying obvious violations shall be inspected. Inspected vehicle(s) that qualify shall be issued a sticker(s).

The CHP officers in team 1 did not conduct a level 1 inspection of the vehicle or measure the vehicle and load for compliance with the terms and conditions of the permit at the California-Arizona border. The CHP officers in team 2 escorting the load from Adelanto did not review the truckdriver's logbook for hours of service or measure the vehicle and load for compliance.

The CHP Commercial Enforcement Manual 82.6 provides the department's policies and guidelines "to personnel involved in the commercial enforcement program and to serve as a repository for Department interpretations relating to commercial vehicle enforcement."⁵⁶ Chapter 8 of the manual covers size and weight and, under the "Transportation Permits" section, states:

Operation of a vehicle on city or county roadways without a required permit is a violation of size and weight statute limitations. A vehicle shall not be permitted to proceed if it is in violation of the conditions of the permit, is not on the route specified in the permit, and/or the size or weight of the vehicle and/or load exceeds the limitations prescribed on the permit by the amounts indicated below.

The manual also covers the following topics: procedures for contracting for CHP escort services, equipment and placement of pilot cars, and permit documentation. One provision of the manual is that a commercial vehicle enforcement officer may be included in the escort team. The CHP officers involved in the accident indicated that this provision was normal practice and that most of the CHP officers escorting the accident load were in commercial vehicle enforcement.

CHP officers are authorized to direct the vehicle and load to alter the permitted route if the officers have knowledge that the route, or a structure on the route, will not accommodate the vehicle and load. When such circumstances occur, CHP officers are required to notify Caltrans by department report form. CHP team leaders 1 and 2 told Safety Board investigators that "when they are escorting a permit vehicle and load, they are the person-in-charge of the overall safety of the movement."

In March 2001, chapter 8 of the manual was revised, changing the policy concerning escorting variance (oversize/overweight) loads. The policy now obliges the variance load⁵⁷ coordinator to "obtain a copy of the proposed route survey and compare it

⁵⁵ An inspection that includes the examination of the driver's license and medical examiner's certificate and waiver, if applicable; alcohol and drugs; the driver's record-of-duty status, as required, and hours of service; the seat belt; the vehicle inspection report; the brake system; the coupling devices; the exhaust system; the frame fuel system; the turn signals; the brake, tail, and head lamps; the lamps on projecting loads; safe loading; the steering mechanism; the suspension; the tires; the van and open-top trailer bodies; the wheels and rims; the windshield wipers; the emergency exits for buses; and hazardous materials requirements, as applicable. Hazardous materials-required inspection items will be inspected by certified hazardous materials inspectors.

⁵⁶ Forward to the *California Highway Patrol Commercial Enforcement Manual 82.6*.

⁵⁷ Another term for super load.

with the permits and review all permits for accuracy.” The policy also requires that a safety briefing be conducted with all escort drivers, in which “all parties shall be informed that the CHP is in charge of the escort.” In addition, the policy states:

If a route listed on a permit cannot be traversed or the escort gets off route for any reason, the OIC [officer-in-charge] shall stop the variance load escort at a safe location to park the variance load. The load shall not proceed until an alternate route can be obtained from the appropriate permitting agency.

Other Accidents Involving Permitted Loads

The Safety Board has investigated 6 accidents and is aware of 12 others since March 1999 involving oversize/overweight loads.⁵⁸ (See table 7.) In addition, the Safety Board has investigated four accidents involving a low-clearance vehicle lodged on a railroad crossing, in which the truckdriver was trying to raise the semitrailer with hydraulic lifts, when the vehicle was struck by a train. (See table 8.)

Table 7. Oversize/overweight load accidents.

Date	Location	Description	Injuries and damages
March 16, 1999	Ellisville, Florida	Excavator hit overpass.	\$70,000 to overpass.
June 8, 1999^a	Arbutus, Maryland	Improperly loaded excavator hit pedestrian bridge.	One fatality and three serious injuries. Bridge collapse.
June 1999	Philadelphia, Pennsylvania	Oversize rock screener hit railroad bridge.	One fatality.
September 1999^b	Virginia	On two-lane road, cement truck met two mobile homes escorted by three pilot cars in 1,500-foot-long convoy. Truck lost control and hit passenger car that was following convoy. Rear pilot car of three-vehicle convoy was stopped in right travel lane watching an overheight load travel under bridge when pilot car was struck by another vehicle traveling in right lane.	One fatality. One fatality.
September 28, 1999	Wissahickon, Pennsylvania	Unknown overheight load hit overpass.	Overpass structural damage.
July 16, 1999^c	Los Angeles, California	Overheight vehicle hit freeway bridge. Permit was for 15 feet; permitted route under 14-foot 10-inch bridge.	One fatality.
November 11, 1999	Philadelphia, Pennsylvania	Oversize container hit overpass.	\$1 million to overpass.
December 14, 1999	Cherry Hill, New Jersey	Raised dump truck body hit pedestrian overpass.	Bridge collapse.

⁵⁸ Pilot cars were escorting the loads in five accidents, two of which had police escorts.

Table 7. Oversize/overweight load accidents. (Continued)

February 1, 2000^d	San Diego, California	First of two overheight loads escorted by four pilot cars and four CHP units hit bridge. Convoy was off route; truckdriver did not hear warning from pilot car with height pole.	Concrete support beam damage on overpass substructure.
April 10, 2000	Iowa	Two separate collisions with railroad bridge.	\$100,000 to bridge.
June 8, 2000^e	Lexington, North Carolina	Oversized 14-foot 4-inch combuster on permitted route hit 14-foot 2-inch clearance bridge.	\$75,000 to bridge.
July 17, 2000	Newport, Delaware	Overheight super load hit overpass.	\$229,339 to bridge.
September 28, 2000	Miami, Oklahoma	Steel boat mold hit railroad bridge, was knocked off semitrailer, and landed on passenger car.	One fatality.
November 17, 2000^f	Intercession City, Florida	Truck and semitrailer, carrying 82-ton condenser tube slowly crossing private railroad grade crossing, was struck by Amtrak train. Florida requires permit from railroad before traversing grade crossing. No permit was obtained. Load escorted by three pilot cars. The Florida-certified pilot car driver did not know that railroad was required to be notified before crossing.	\$150,000 to truck and train.
December 23, 2000^g	Sumner, Washington	Truck towing house stopped on tracks to adjust tow dollies when struck by Amtrak train. Washington requires that permit be obtained from railroad to cross tracks. No permit was obtained. (Driver blood alcohol was 0.04 percent.) Load escorted by pilot car and three uniformed, off-duty county police officers.	House destroyed.
July 11, 2001^h	Farmington, Maine	Oversized 14-foot 17-inch load hit 14-foot 2-inch clearance bridge. Truck had no permit required for loads over 13 feet 6 inches.	\$50,000 to overpass.
October 15, 2001ⁱ	Durham, North Carolina	Tractor-semi-trailer transporting crane struck overpass and caused leak in gas pipeline.	\$100,000 to overpass. \$100,000 to pipeline. \$200,000 to truck and crane.

^a NTSB Docket No. HWY-99-FH022.

^b Two oversize load crash case studies, Virginia Crash Investigation Team, Virginia Commonwealth University, Report No. 186, September 1999.

^c California Highway Patrol Collision Report No. 9907-302.

^d California Highway Patrol Collision Report No. unknown.

^e NTSB Docket No. HWY-00-IH040.

^f NTSB Docket No. HWY-01-FH007.

^g NTSB Docket No. HWY-01-IH013.

^h NTSB Docket No. HWY-01-IH031.

ⁱ NTSB Docket No. HWY-02-IH005.

Table 8. Safety Board investigations involving low-clearance vehicles lodged on railroad tracks.

Date and location	Description
August 25, 1983 Rowland, North Carolina	Lowboy with 7-inch clearance. Driver tried to raise semitrailer for 5 to 10 minutes before arrival of train.
November 30, 1983 Citra, Florida	Lowboy with 9 1/2-inch clearance. Driver tried to raise semitrailer for 15 minutes before arrival of train.
November 30, 1993 Intercession City, Florida	Cargo bed with 6- to 8-inch clearance; 184-foot long transport vehicle. Driver trying to raise semitrailer when train arrived.
October 3, 1995 Milford, Connecticut	Vehicle clearance not available. Driver tried to raise semitrailer for 3 to 4 minutes before train arrived.

Accident Statistics

Because most State accident reporting systems do not require permitting information, the frequency of accidents nationwide involving permitted loads cannot be determined. The Maine Department of Transportation (Maine is one of the few States that has a permitted oversize load accident database⁵⁹) reports that from 1995 through 2000, 232 accidents involved permitted vehicles. During that period, 8,257 accidents occurred that involved commercial vehicles.

The Safety Board also examined data from the Trucks Involved in Fatal Accidents Database.⁶⁰ From 1991 to 1997, an estimated 32,593 trucks were involved in fatal accidents. Of those trucks, 2.86 percent weighed between 80,001 and 120,000 pounds and less than 1 percent weighed more than 120,000 pounds; 13 percent and less than 1 percent of the trucks, respectively, were more than 65 feet long and 14 feet wide.

In addition, the Safety Board examined the Federal Railroad Administration Highway-Rail Grade Crossing Accident/Incident Database. In the year 2000, 3,502 highway-rail grade crossing incidents occurred, resulting in 425 fatalities and 1,219 injuries to highway vehicle occupants and railroad employees and passengers.⁶¹ Approximately 24 percent of the highway-railroad grade crossing incidents involved trucks or truck tractors. About 73 percent of the trucks and truck tractors were moving over the crossing at the time of the accident; the other trucks and truck tractors were stalled, stopped, or trapped on the tracks.

⁵⁹ Maine Department of Transportation, Bureau of Planning, Safety Management.

⁶⁰ Maintained by the University of Michigan Transportation Research Institute.

⁶¹ Any impact between a railroad and highway user (both motor vehicles and other users of the crossing as a designated crossing site, including walkways and sidewalks associated with the crossing). Reported on form FRA F 6180.57.

The Highway-Rail Grade Crossing Accident/Incident Database does not contain information on the weight, length, or width of the truck involved in the Glendale accident. The Safety Board examined the 1991 through 1997 data in the Trucks Involved in Fatal Accidents Database to identify the number of oversized trucks involved in fatal highway-railroad grade crossing accidents. Of the trucks involved in accidents at railroad crossings, 5 percent had a gross combination weight of more than 80,000 pounds, about 6 percent were longer than 65 feet, and none were wider than 14 feet.

Analysis

General

Although the oversize/overweight or heavy-haul trucking fleet is growing, it is a small segment of the trucking industry. Vehicles that haul oversize/overweight or permitted loads constitute less than 1 percent of the Nation's trucking fleet. The limited accident data indicate that vehicles hauling permitted loads are not over represented in accident statistics. However, even though accidents involving oversize/overweight vehicles and loads are infrequent, this accident and others investigated by the Safety Board demonstrate that when they occur, such accidents can cause extensive damage to the infrastructure and, particularly at railroad-highway grade crossings, have the potential for catastrophic consequences.

In the following analysis, the Safety Board will exclude those factors that did not cause or contribute to the accident, identify those factors that led to the accident scenario, and determine which factors were contributory. Discussion will focus specifically on the actions of the truckdriver, pilot car drivers, and police escorts and on weaknesses in the planning, coordination, and execution of this oversize/overweight movement. Finally, the analysis will consider measures that can be taken to prevent similar accidents in the future.

Exclusions

The highway-railroad grade crossing pavement markings, signs, signals, and gates operated as they were intended. Postaccident mechanical inspections of the train revealed no defects or deficiencies.

The truckdriver's postaccident toxicological tests were negative for alcohol and drugs.

The Glendale police witnessed the accident and radioed the dispatcher, and the fire department responded within 5 minutes of notification. Although the initial radio dispatch location was 1/4 mile north of the actual accident site and the initial responders had difficulty gaining access to the accident site, these problems did not significantly impact the timeliness or effectiveness of the emergency response.

The Safety Board concludes that neither the design nor the operation of the active railroad grade crossing warning devices nor the mechanical condition of the train contributed to the cause of the accident; the emergency response was adequate and timely.

The Metrolink commuter train 901 engineer applied the brakes when she determined the truck was not moving. Following the collision, the engineer realized that

the truck's trailer was obstructing the adjacent southbound track and radioed an emergency message for the approaching southbound commuter train 100 to stop. The other engineer received the instruction and stopped his train 50 feet from the obstruction. The Safety Board concludes that the alert actions of the train engineer in warning the southbound commuter train engineer of the track obstruction prevented a second collision.

The Accident

Preparation and Planning

The accident scenario began when the oversize/overweight permitted load, escorted by two pilot cars and three CHP escorts, missed a turn from Grandview Avenue onto San Fernando Road. As a result of this mistake, the convoy continued straight on Grandview Avenue and across the grade crossing. The mistake occurred because the lead pilot car driver failed to include the San Fernando Road turn when transcribing route directions onto a notepad. The convoy drivers did not discover the error until they realized that Grandview Avenue ended beyond the crossing.

The lead pilot car driver was contracted to escort the accident load and received the permits 1 day before he met the convoy at the California-Arizona border. He did not have a copy of the route survey, had not previously driven the intended route, and had not met with the CHP, the truckdriver, or the rear pilot car driver prior to the morning of the movement. The lead pilot car driver had been given 1 State and 12 different local California permits, but not their attachments, which contained some rules and regulations relating to the load. From these permits, he had to transcribe route directions to create a master route plan for the move, which he did on his notepad. Although he discussed the route with the truckdriver, CHP escorts, and rear pilot car driver, he did not provide them with a copy of the master route plan.

Because a master route plan had not been prepared in advance, because the driver had not driven the intended route prior to the movement, and because a master route plan had not been provided to the others in the convoy, they missed the opportunity both to identify the transcription error at the onset of the movement and to recognize the error once on Grandview Avenue. The Safety Board concludes that poor preparation and planning for the movement of the oversize/overweight load resulted in the convoy crossing the Grandview Avenue highway-railroad grade crossing instead of turning onto San Fernando Road.

Grade Crossing Hazard Awareness

After the convoy had failed to make the correct turn onto San Fernando Road and the truck had traversed the railroad tracks at the accident site, both the CHP officer-in-charge and the trailing pilot car driver heard the truck bottom out but did not tell the truckdriver. When the convoy drivers realized they were off route after crossing the tracks, they consulted a map to determine how to get back on route, but did not discuss the safety

of going back across the tracks. When attempting to cross the tracks the second time, the convoy had to wait for an eastbound Metrolink train to pass before it could proceed, but no one thought, or apparently knew, to call the railroad to determine the train schedule or to notify the railroad that the load was crossing the tracks.

The truckdriver attempted to raise the semitrailer only after it became lodged on the tracks. Even without becoming “hung up” on the tracks, the truck posed a significant risk at any highway-railroad grade crossing. Regulations at 49 CFR 234.225 require that warning systems at active crossings provide a minimum of 20 seconds’ warning. However, according to Safety Board calculations, after the eastbound Metrolink train passed, the accident truck, because of its size, would have needed more than 26 seconds to completely clear the tracks.

Following the accident, the convoy participants did not indicate that they considered the potential hazards of crossing the tracks with the oversize/overweight accident vehicle, even though it was during the morning commuter train rush. Nor did they consider that the accident vehicle might become stuck on the crossing. Yet the convoy was given two cues about the potential hazard before the accident—the scraping of the truck the first time over the tracks and the passing eastbound Metrolink train. Therefore, the Safety Board concludes that had the truckdriver, pilot car drivers, or police escorts recognized the potential hazard created by the oversize/overweight vehicle crossing the tracks, they could have taken appropriate action and avoided this accident.

Low-Clearance Warning Grade Crossing Sign

According to the 2001 AASHTO guidelines, the roadway surface should not be more than 3 inches higher or lower than the top of the nearest rail at a point 30 feet from the rail. Three inches higher or lower at a point 30 feet from the rail translates to a positive or negative 0.83 percent grade. The approach and departure grades at the Grandview Avenue crossing were 3.26 and -3.02 percent, respectively. (See figure 15.) Therefore, in accordance with the current American Railroad Engineering Association guidelines and the AASHTO guidelines for roadway vertical profiles at highway-railroad grade crossings, the Grandview Avenue grade crossing was a high-profile or humped crossing.

The Safety Board identified the hazards created by the combination of high-profile grade crossing and low-ground clearance vehicles during its investigation of the highway-railroad grade crossing collision near Sycamore, South Carolina, on May 2, 1995.⁶² As a result of its investigation, the Safety Board recommended that the Federal Highway Administration:

H-96-05

Adopt the proposed changes that are published in the notice of proposed amendments to the *Manual on Uniform Traffic Control Devices* regarding warning signs for substandard vertical profiles at railroad grade crossings.

⁶² National Transportation Safety Board, *Highway/Rail Grade Crossing Collision Near Sycamore, South Carolina, May 2, 1995*, Highway Accident Report NTSB/HAR-96/01 (Washington, DC: NTSB, 1996).

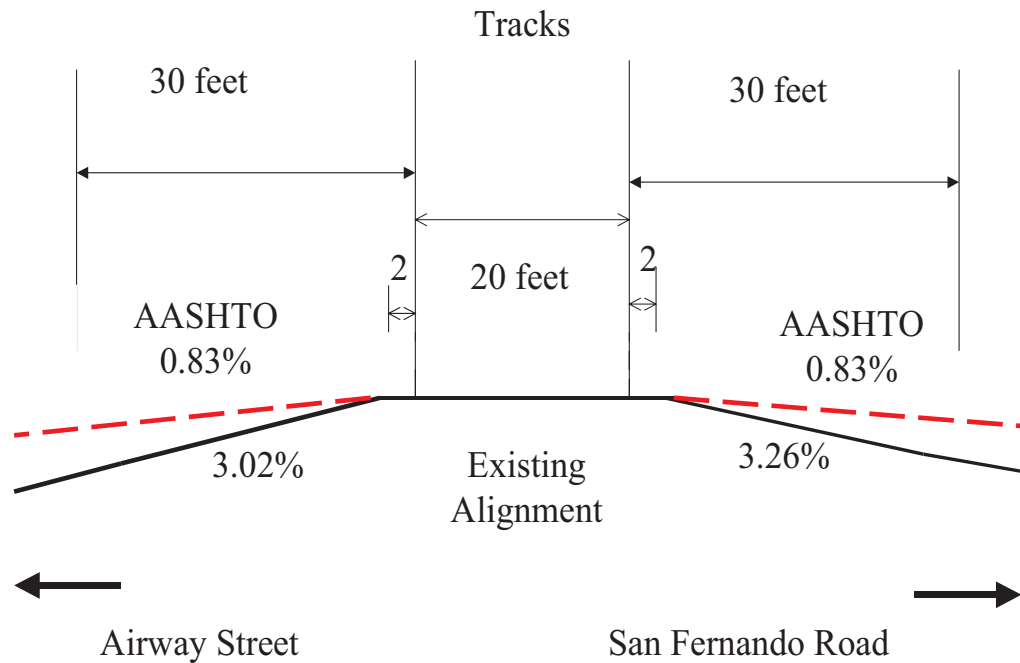


Figure 15. Diagram of Grandview Avenue grade crossing alignment.

On September 5, 1997, the FHWA advised the Safety Board that it had adopted the low-ground clearance warning highway-railroad grade crossing sign (W10-5). This sign, which has been incorporated into the *Manual on Uniform Traffic Control Devices*, is specifically designed to warn drivers of highway profile conditions sufficiently abrupt to create a “hang-up” situation for long wheelbase vehicles or low-ground clearance trailers. Subsequently, on January 2, 1998, the Board classified Safety Recommendation H-96-05 “Closed—Acceptable Action.”

The evidence does not indicate that before the Glendale accident, the truckdriver, pilot car drivers, or police escorts considered or were aware of the potential hazard created by the combination of the accident truck and the crossing profile. Not until after the accident truck was stuck did the truckdriver make any effort to raise the ground clearance of the vehicle, and by then it was too late. The situation that occurred in this accident is exactly what the low-ground clearance warning sign is intended to prevent. Therefore, the Safety Board concludes that had low-ground clearance warning signs been present at the Glendale crossing, the information conveyed by the signs may have alerted the truckdriver, pilot car drivers, or police escorts to the low-clearance hazard and may have prevented the accident.

Although overall traffic volume on Grandview Avenue is comparatively low (5,900 vehicles), a high proportion of that volume (15 percent) is truck traffic.⁶³ The area surrounding the crossing is light industrial, and, therefore, the potential for other low-ground clearance trucks to travel over the Grandview Avenue crossing remains. The

⁶³ Federal Railroad Administration statistical report of February 1997.

Safety Board believes that the city of Glendale should install low-clearance highway-railroad grade crossing signs (W10-5s) at the Grandview Avenue crossing and evaluate other crossings to determine whether the signs are warranted and, if so, install them.

Fatigue

The errors by the pilot car drivers and truckdriver discussed above may have been errors of judgment or flawed decision-making that were possibly caused or aggravated by fatigue. The lead pilot car driver had been driving and on duty for 24, and awake for 27, consecutive hours; the truckdriver and second pilot car driver had been driving and on duty for 19, and awake for 22, consecutive hours. Research has shown that performance becomes impaired with extended periods of sleep loss and can result in slowed reaction times, reduced vigilance, cognitive slowing, and memory problems, among other performance effects. As little as 2 hours of sleep loss on just one night can impair performance and levels of alertness.⁶⁴ Furthermore, this accident occurred at 5:56 a.m. Performance impairments are greatest during the “trough” or low point, generally from 3:00 a.m. to 5:00 a.m., of the circadian rhythm,⁶⁵ and some functions decrease from 12:00 a.m. to 6:00 a.m. Therefore, the Safety Board concludes that the judgment and vigilance of the pilot car drivers and the truckdriver may have been affected by a lack of sleep.

Oversize/Overweight Vehicle Movements

To determine how and why this accident happened, the Safety Board also examined the events preceding the accident. This examination revealed that the same types of problems that culminated in the Glendale collision were prevalent throughout the movement preceding it. Among them were numerous errors, planning and coordination difficulties, and subsequent delays due to actions by various participants in the transportation of this oversized load. The following sections will discuss issues pertaining to the training and guidance provided to the truckdriver, pilot car drivers, and police escorts; the permitting process; and the coordination among these individuals and activities. The 22-day move over 2,100 miles involved 5 pilot car companies, 2 permit companies, the permit issuing offices of 4 States, and, in California, 12 local jurisdictions.

Many of the permit routing errors were detected and corrected without mishap, but they resulted in delays. Delays put the convoy behind schedule and on the last day of the movement, used up the truckdriver’s available on-duty time. Other oversights, which also resulted in delays, could have been foreseen and avoided, starting with the removal of the tree at the Toromont Process Systems yard on the 1st day of the trip.

⁶⁴ D.F. Dinges and N.B. Kribbs, “Performing While Sleepy: Effects of Experimentally Induced Sleepiness,” *Sleep, Sleepiness and Performance* (Chichester: Wiley, 1991).

⁶⁵ Physiological phenomena and consequently individuals’ performance fluctuate in a rhythmic pattern over a 24- to 25-hour period. This early morning period is typically associated with the most seriously impaired performance of most individuals, particularly those who are accustomed to a normal day-awake/night-asleep schedule.

The Texas permit required a route survey, yet the permitted route included a railroad grade crossing that the truck could not go over, a bridge and power lines that it could not go under, and an intersection that it could not negotiate. By the time the truck arrived at the Texas-New Mexico border, the New Mexico permit had expired. No one associated with the movement of this load checked the date on the permit and called ahead to renew it after the various delays in Texas, so the convoy was delayed further.

In California, the first team of CHP officers did not check the permits, the vehicle, or the truckdriver's logbook. In Adelanto, had the second team of CHP officers checked the truckdriver's logbook, they could have determined that he was near the end of his hours of service. The name of a road along the route had been changed, but neither the original route survey nor the Caltrans permit reflected the change. The permit's route had a turn that the truck could not make and had it pass under a railroad bridge without adequate clearance. The lead pilot car driver made an error transcribing the routes from the permits to a handwritten list. He missed four turns in addition to the one that lead the convoy off route and over the railroad grade crossing where the accident occurred.

Truckdriver Training

At the time of the accident, the truckdriver had a double/triple trailers CDL endorsement and may have attended some company safety training meetings. But the evidence does not indicate that he had received any specialized training in transporting oversize/overweight loads, particularly over railroad grade crossings.

During the California segment of this trip, the convoy encountered five active grade crossings that were on the permitted route. The first four were in the desert, had relatively flat profiles, and were traversed in the daylight. The fifth crossing, at Polk Street over the Metrolink tracks, was similar in appearance to the grade crossing where the accident occurred and was traversed at night successfully. Although similar in appearance to the accident crossing, the Polk Street crossing had a relatively flat profile.

When the truckdriver realized he was stuck on the grade crossing at the accident site, he exited the vehicle and attempted to raise the semitrailer but could not do so before the collision. The Safety Board has investigated four other accidents involving low-clearance vehicles hung up on crossings that were impacted by trains as the drivers were trying to raise the semitrailers equipped with hydraulic lifts (see table 8). At least one trailer manufacturer has indicated that there are no mechanical reasons why, when approaching a grade crossing, a trailer could not be lifted and then lowered after traversing the crossing.

Investigators found no indication that the truckdriver evaluated the potential hazards of crossing the tracks at the accident site or over any of the other crossings encountered during the move. Nor did he or anyone else in the convoy notify the railroads of each crossing that they traversed. Furthermore, although the driver believed that he could raise the load sufficiently to clear the Grandview Avenue tracks, he did not consider this strategy until his vehicle became stuck. This situation was also apparent in similar accidents investigated by the Safety Board. Training drivers of low-clearance or

oversize/overweight vehicles should make them aware of the hazards of grade crossings. The Safety Board concludes that had the truckdriver received training that emphasized the hazards of railroad grade crossings for oversize/overweight vehicles, he might have recognized the potential hazard and notified the railroad that he was about to traverse the tracks and may have raised the height of the semitrailer before crossing the tracks.

The Safety Board has previously addressed the issue of training truckdrivers on the hazards of low-clearance vehicles on hump crossings. As a result of the May 2, 1995, Amtrak train collision with a tractor-low-bed semitrailer combination on a high-vertical-profile (hump) crossing in Sycamore, South Carolina, the Safety Board recommended that the American Trucking Associations, Inc.:

H-96-08

Advise your membership of the circumstances of this accident and during in-service training for all drivers, highlight the potential hazards associated with moving low-bed trailers over hump grade crossings. Include specific instructions for notifying authorities when emergencies or hazardous conditions exist at grade crossings.

The American Trucking Associations, Inc., indicated in its response that information regarding the accident has been published in its weekly newspaper *Transport Topics* and that it developed the video *Physics 101*, which highlights general training on grade crossing safety and specifically training on the hazards of low-bed vehicles over grade crossings. The Safety Board classified Safety Recommendation H-96-08 "Closed–Acceptable Action" on September 6, 1996.

Also as a result of the Sycamore accident, the Safety Board recommended that the American Association of Motor Vehicle Administrators:

H-96-06

Revise the *Commercial Driver's License Manual* to include specific information on hump crossings and ensure that truckdrivers are tested on their knowledge of grade crossing safety, with special emphasis on hump crossings.

In March 1996, the American Association of Motor Vehicle Administrators indicated that the recommendation had been referred to its Test Maintenance Subcommittee and would be placed on the agenda for the next meeting. In May 1996, the Safety Board asked for progress reports on the subcommittee's efforts to meet the intent of the recommendation. In February 1998, the Safety Board inquired about the status of the subcommittee's actions and, having received no response from the American Association of Motor Vehicle Administrators, in July 1998, classified Safety Recommendation H-96-06 "Closed–Unacceptable Action–No Response Received."

In addition, the Safety Board has addressed the issue of operators of low-clearance vehicles notifying the railroad before crossing the grade crossing. On November 30, 1993, a 184-foot-long vehicle loaded with an 82-ton turbine was stopped on a private crossing near Intercession City, Florida, while the crew was raising the height of the cargo deck, when an Amtrak train carrying 89 passengers struck the side of the cargo deck and the turbine.⁶⁶ Six people sustained serious injuries and 53 people suffered minor injuries. As a result of the investigation of this accident, the Safety Board recommended that AASHTO:

H-95-07

Inform your members of the facts and circumstances of the Intercession City, Florida, accident and urge that they require operators of low-clearance, overdimension/overweight vehicles to provide railroads with advance notification of travel over grade crossings. Further, recommend that these members revise their permit document to state that compliance with this notification requirement is a condition of permitting.

On April 30, 1996, after learning that AASHTO distributed copies of the accident report to its members urging them to review their permit procedures and take corrective action, as necessary, the Safety Board classified Safety Recommendation H-95-07 “Closed—Acceptable Action.”

Also, as a result of the November 30, 1993, Intercession City accident investigation, the Safety Board recommended that the Association of American Railroads:

R-95-24

Inform your members of the facts and circumstances of the Intercession City, Florida, accident and recommend that they review their procedures for coordinating the transit of over-dimensional, low-clearance highway vehicles across their right-of-way.

On October 2, 1995, the Association of American Railroads informed the Safety Board that it had informed its membership of the accident and asked that they review their procedures for coordinating the transit of over-dimensional, low-clearance vehicles across their right-of-way. On January 23, 1996, the Safety Board classified Safety Recommendation R-95-24 “Closed—Acceptable Action.”

Although the Safety Board has previously addressed the issue of low-clearance vehicles at high-profile grade crossings, the movement of oversize/overweight vehicles over grade crossings presents a unique problem within the trucking industry. Because of the sheer size of these vehicles, they pose a hazard at any grade crossing, and this accident, as well as others investigated by the Safety Board, demonstrates that truckdrivers operating oversize/overweight vehicles may be unaware of the hazard. Therefore, the

⁶⁶ National Transportation Safety Board, *Collision of Amtrak Train No. 88 with Roundtree Transport and Rigging, Inc., Vehicle on CSX Transportation, Inc., Railroad Near Intercession City, Florida, November 30, 1993*, Highway Accident Report NTSB/HAR-95/01 (Washington, DC: NTSB, 1995).

Safety Board believes that the Specialized Carriers and Rigging Association should notify its members of the circumstances of the Glendale, California, accident and during in-service training for heavy-haul drivers, (1) highlight the potential hazards associated with moving low-clearance trailers over grade crossings and (2) emphasize the need to notify the railroads before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing.

Pilot Car Driver Training

At the time of the accident, the lead pilot car driver had 8 years of experience and was certified in Utah. However, the Utah pilot car certification curriculum does not include railroad notification for crossing tracks. In this accident, the truckdriver and the CHP officers depended on the lead pilot car driver for guidance through California, particularly metropolitan Los Angeles.

Knowledge of the problems of low-clearance vehicles at railroad grade crossings and how to evaluate the safety of each crossing would be valuable for pilot car drivers, as well as for truckdrivers. The Safety Board concludes that had the pilot car drivers received training that emphasized the hazards of railroad grade crossings for oversize/overweight vehicles, the pilot car drivers might have recognized the potential hazard and notified the railroad that the accident vehicle was about to traverse the tracks.

In the November 17, 2000, Intercession City, Florida, accident, the Florida-certified pilot car driver who was involved did not know of the Florida requirement for railroad notification; the Florida pilot car driver certification curriculum did not include course information for railroad notification.

Pilot car drivers are not subject to hours-of-service rules. In the Glendale accident, the lead pilot car driver's day started 5 hours before the trip began. He had driven from San Bernardino to meet the load and waited with the CHP officers in Adelanto for the load to arrive. Most often a pilot car driver adheres to the schedule of the truckdriver, who is subject to hours-of-service rules. However, since pilot car drivers are not subject to the hours-of-service rules, truckdrivers will often park the truck, and then the pilot car will take them to eat or on short errands, as the rear pilot car driver did at several stops on the accident trip. As this accident demonstrates, pilot car drivers can also be subject to the effects of lack of sleep and need to be aware of the deleterious effects of fatigue.

All States require pilot cars for certain size loads; the Safety Board is aware of only eight States that provide oversight in the form of certification of the pilot car drivers (see table 6). Currently, the certification process ranges from reading a manual to classroom instruction, and then passing a test. The existing manuals indicate that pilot car driver responsibilities include ensuring that oversized/overweight loads are transported safely through designated routes. This responsibility requires skill and knowledge. However, in 42 States, pilot car drivers are not required to have any specific training, pass any skills tests, or demonstrate their knowledge regarding the movement of oversize/overweight vehicles. Furthermore, pilot car drivers are not required to have CDLs.

Pilot cars and escort vehicles help protect the traveling public, the infrastructure, and the oversized load itself. Pilot car drivers perform a safety-sensitive function and are an integral component of many oversize/overweight vehicle movements; consequently, it is important that they be trained and qualified. Yet, only eight States have methods or oversight procedures in place to ensure that pilot car drivers are trained or qualified. As this accident demonstrates, an untrained, inexperienced, or fatigued pilot car driver can create hazardous situations during the movement of an oversized load.

The Safety Board considers pilot car driver training critical to ensuring that oversize/overweight loads are transported safely. Such training should include instruction in the effects of fatigue on performance, the need to assess the dangers of railroad crossings, the requirement in some States to notify the railroads, route surveys, and the maneuvering limitations of heavy-haul vehicles.

The Office of Freight Management and Operations in the FHWA provides limited Federal oversight on the transportation of oversize/overweight loads. Three pilot car associations represent the pilot car industry. The heavy hauling, or oversize/overweight load, industry is represented by the Specialized Carriers and Rigging Association. The licensing organizations within the States are represented by the American Association of Motor Vehicle Administrators, which currently administers the CDL program. The American Association of Motor Vehicle Administrators, through its committees, has the structure in place to administer uniform testing processes. Therefore, the Safety Board believes that the FHWA should develop a model pilot car driver training program in cooperation and consultation with the Federal Motor Carrier Safety Administration, AASHTO, American Association of Motor Vehicle Administrators, Commercial Vehicle Safety Alliance, Specialized Carriers and Rigging Association, California Professional Escort Car Association, Texas Pilot Car Association, and United Safety Car Association. The training program should address, at a minimum, issues such as (1) how to conduct route surveys; (2) the maneuvering limitations of heavy-haul vehicles; (3) the effects of fatigue on performance; (4) the need to assess the dangers at railroad crossings, particularly for low-clearance vehicles; and (5) the need and requirements to notify the railroads before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing.

Police Escort Training

At the time of the accident, the CHP had policies in place governing the movement of oversize/overweight vehicles but did not provide specific training for officers escorting these vehicles. The policies addressed topics such as the condition of the oversize/overweight vehicle, the truckdriver's duty status, placement of pilot cars, and permit documentation. Although the CHP policy was to do so, neither of the CHP teams involved in this accident examined the truckdriver's logbooks. The first team said they assumed the truckdriver had gotten enough rest during the previous night near the Arizona border before the California segment of the convoy movement began. Although the truckdriver said that he told the second CHP team in Adelanto "he was near the end of his available hours of service," they deny that hours of service were discussed. If the second CHP team had examined the truckdriver's logbooks, they could have known his duty

status and could have stopped the move at a safe place before the truckdriver was out of available hours and fatigued due to lack of sleep.

In addition, at the beginning of both segments of the move in California, the CHP officers performed a cursory examination of the permits to check the routes. However, the CHP officers did not examine all permits, including the local permits, to determine their validity, the special conditions including the department of public works escorts and local curfews, and the routes. Had they examined the local permits, they would have realized that the truck should not have entered the city of Los Angeles without the department of public works escort and that the convoy only had permit applications for Glendale and Hawthorne. Therefore, the Safety Board concludes that the CHP officers missed the opportunity to identify and prevent the subsequent fatigued condition of the truckdriver and the two pilot car drivers and the opportunity to identify inconsistencies between the proposed movement and the permits.

After the accident, the CHP made changes to its policy involving the movement of oversize/overweight loads (variance or superloads). The CHP now requires its officers to: (1) compare the route survey and permitted routes, (2) hold safety briefings to discuss routing and special conditions of the permits before the move begins, and (3) park the load if it becomes off route. The Safety Board supports these actions. Nonetheless, as in the case of the truckdriver and pilot car drivers, the Safety Board concludes that had the CHP officers received training that emphasized the hazards of railroad grade crossings for oversize/overweight vehicles, the officers may have recognized the potential hazard and notified the railroad that the accident vehicle was about to traverse the tracks.

The Safety Board believes that the Commercial Vehicle Safety Alliance, the International Association of Chiefs of Police, and the National Sheriffs' Association should notify their members of the circumstances of the Glendale, California, accident and encourage them to train their officers to make sure (1) that documentation regarding permits is reviewed and verified; (2) that safety briefings to discuss routings and special conditions, including the hazards associated with moving oversize/overweight vehicles over grade crossings, are conducted; (3) that provisions for handling off-route loads are in place; and (4) that necessary notification to the railroads is made before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing.

Permitting Process

The movement of this load from Houston to El Segundo required 4 State and 12 local government permits. Obtaining a permit to move an oversize/overweight load through the various State and local jurisdictions in the United States can be a very complex operation. The permit errors made in the Glendale accident illustrate several weaknesses in the process that led to difficulties during the movement.

The Texas permit required a route survey, yet the permitted route included a railroad grade crossing that the truck could not traverse, a bridge and power lines that it could not go under, and an intersection that it could not negotiate. A permitting process grounded in safety should preclude such occurrences.

Doug's Pilot Car Service conducted a route survey for West Coast Services that was submitted to Caltrans with the permit application. Caltrans issued the permit, entirely within its prerogative, with a route that deviated from the route survey. The Caltrans permit route had a turn that the truck could not make and took the convoy under a railroad bridge the load could not clear. Detouring around the bridge resulted in a delay of several hours.

Coordination

As discussed previously, the movement of this oversize/overweight vehicle from Houston to Los Angeles was plagued by errors, delays, and a general lack of coordination among the participants. The permits obtained did not correspond to the actual route taken, and the discrepancies caused delays. Moreover, the truckdriver, pilot car drivers, and police escorts did not share information among themselves and also exhibited a lack of safety awareness regarding the movement of oversize/overweight vehicles over grade crossings. Planning for this movement appeared to be haphazard and uncoordinated as well. For example, the convoy had not even left the plant in Houston before it encountered its first predictable obstacle, a tree that had to be cut down.

During the movement of an oversize/overweight load, the truckdriver, pilot car drivers, motor carrier, permitting officials, and police escorts must communicate effectively to coordinate their efforts. In this accident, several missed opportunities for communication occurred, as well as several occasions of miscommunication:

1. In Adelanto, when the Inland Division CHP officers met with the truckdriver, a discussion of hours of service should have taken place. The truckdriver said he informed the CHP officers that he was almost out of available hours (he had driven 8 ½ hours). The CHP officers said that the conversation did not occur.
2. When the truckdriver reached the 10th hour, he should have informed the CHP officers that he was beyond his available hours to drive.
3. When the Los Angeles County Department of Public Works employee said, "you're clear now," the CHP officer-in-charge thought that the convoy was clear all the way to El Segundo, when in fact the county department of public works employee had meant the convoy was clear of the county and his jurisdiction.
4. The Los Angeles City Department of Public Works escort was not informed that the convoy was 4 to 5 hours late, and it left after waiting from 12:00 a.m. until 4:00 a.m.
5. When the convoy participants realized that they were off the permitted route and stopped to determine how to get back on route, the lead pilot car driver and the CHP officer-in-charge did not tell the truckdriver that his load had bottomed out.

The poor communication may have resulted for several reasons. One such reason is the interaction of private citizens and uniformed police. Private citizens tend to defer to the authority of police. The truckdriver's reticence in making sure the CHP officers were aware of his duty status is an example. The truckdriver evidently deferred to the authority of the CHP officers and failed to effectively communicate his hours-of-service status before abdicating responsibility to the CHP officers. The perceived authority of the CHP officers and the associated "power imbalance" appears to have led the truckdriver to proceed in violation of his hours of service, erroneously believing that was the CHP officers' intention.

This accident and the movement that preceded the accident demonstrate how fragmented the permitting and route planning process can be and how poor communication among the participants can lead to catastrophe. Although the States, through their permitting process, have some requirements for oversize/overweight vehicle movements, and permitting guidance is available through AASHTO, no overall guidance is available concerning how this type of movement should be made.

The Safety Board concludes that had the movement of the accident vehicle been coordinated more effectively, many of the errors, delays, and failures of communication that led to the accident could have been avoided. Therefore, the Safety Board believes that the FHWA should develop model oversize/overweight vehicle movement guidelines in cooperation and consultation with the Federal Motor Carrier Safety Administration, AASHTO, the American Association of Motor Vehicle Administrators, the Commercial Vehicle Safety Alliance, the Specialized Carriers and Rigging Association, the California Professional Escort Car Association, the Texas Pilot Car Association, and the United Safety Car Association. The guidelines should address, at a minimum, issues such as (1) when pilot cars and police escorts are required; (2) the training, testing, and certification of pilot car operators, police officers, and truckdrivers in the movement of oversize/overweight loads; (3) the use of height poles and traffic controls; (4) how to conduct route surveys; (5) the maneuvering limitations of heavy-haul vehicles; (6) the effects of fatigue on performance; (7) the need to assess the dangers at railroad crossings, particularly for low-clearance vehicles; and (8) the need and requirements to notify the railroads before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing.

The Safety Board considers that the States should adopt the model oversize/overweight vehicle movement guidelines, once developed, and require that oversize/overweight vehicle movements conform to the guidelines. Therefore, the Safety Board believes that the FHWA and AASHTO should encourage the States to adopt the model oversize/overweight vehicle movement guidelines, once developed, and to require that oversize/overweight vehicle movements conform to the guidelines.

Conclusions

Findings

1. Neither the design nor the operation of the active railroad grade crossing warning devices nor the mechanical condition of the train contributed to the cause of the accident; the emergency response was adequate and timely.
2. The alert actions of the train engineer in warning the southbound commuter train engineer of the track obstruction prevented a second collision.
3. Poor preparation and planning for the movement of the oversize/overweight load resulted in the convoy crossing the Grandview Avenue highway-railroad grade crossing instead of turning onto San Fernando Road.
4. Had the truckdriver, pilot car drivers, or police escorts recognized the potential hazard created by the oversize/overweight vehicle crossing the tracks, they could have taken appropriate action and avoided this accident.
5. Had low-ground clearance warning signs been present at the Glendale crossing, the information conveyed by the signs may have alerted the truckdriver, pilot car drivers, or police escorts to the low-clearance hazard and may have prevented the accident.
6. The judgment and vigilance of the pilot car drivers and the truckdriver may have been affected by a lack of sleep.
7. Had the truckdriver received training that emphasized the hazards of railroad grade crossings for oversize/overweight vehicles, he might have recognized the potential hazard and notified the railroad that he was about to traverse the tracks and may have raised the height of the semitrailer before crossing the tracks.
8. Had the pilot car drivers received training that emphasized the hazards of railroad grade crossings for oversize/overweight vehicles, the pilot car drivers might have recognized the potential hazard and notified the railroad that the accident vehicle was about to traverse the tracks.
9. The California Highway Patrol officers missed the opportunity to identify and prevent the subsequent fatigued condition of the truckdriver and the two pilot car drivers and the opportunity to identify inconsistencies between the proposed movement and the permits.

10. Had the California Highway Patrol officers received training that emphasized the hazards of railroad grade crossings for oversize/overweight vehicles, the officers may have recognized the potential hazard and notified the railroad that the accident vehicle was about to traverse the tracks.
11. Had the movement of the accident vehicle been coordinated more effectively, many of the errors, delays, and failures of communication that led to the accident could have been avoided.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the collision of the Metrolink passenger train with the tractor-combination vehicle was (1) inadequate preparation and route planning for the movement; (2) poor coordination of the movement among the truckdriver, pilot car drivers, police escort, and permitting authorities; and (3) a lack of recognition of the potential hazard caused by the accident vehicle at the grade crossing. Contributing to the accident was the fatigue of the pilot car drivers and the truckdriver.

Recommendations

As a result of this accident, the National Transportation Safety Board makes the following safety recommendations:

To the Federal Highway Administration, in cooperation and consultation with the Federal Motor Carrier Safety Administration, the American Association of State Highway and Transportation Officials, the American Association of Motor Vehicle Administrators, the Commercial Vehicle Safety Alliance, the Specialized Carriers and Rigging Association, the California Professional Escort Car Association, the Texas Pilot Car Association, and the United Safety Car Association:

Develop a model pilot car driver training program. The training program should address, at a minimum, issues such as (1) how to conduct route surveys; (2) the maneuvering limitations of heavy-haul vehicles; (3) the effects of fatigue on performance; (4) the need to assess the dangers at railroad crossings, particularly for low-clearance vehicles; and (5) the need and requirements to notify the railroads before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing. (H-01-30)

Develop model oversize/overweight vehicle movement guidelines. The guidelines should address, at a minimum, issues such as (1) when pilot cars and police escorts are required; (2) the training, testing, and certification of pilot car operators, police officers, and truckdrivers in the movement of oversize/overweight loads; (3) the use of height poles and traffic controls; (4) how to conduct route surveys; (5) the maneuvering limitations of heavy-haul vehicles; (6) the effects of fatigue on performance; (7) the need to assess the dangers at railroad crossings, particularly for low-clearance vehicles; and (8) the need and requirements to notify the railroads before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing. (H-01-31)

To the Federal Motor Carrier Safety Administration, the American Association of State Highway and Transportation Officials, the American Association of Motor Vehicle Administrators, the Commercial Vehicle Safety Alliance, the Specialized Carriers and Rigging Association, the California Professional Escort Car Association, the Texas Pilot Car Association, and the United Safety Car Association:

Work with the Federal Highway Administration to develop a model pilot car driver training program. The training program should address, at a minimum, issues such as (1) how to conduct route surveys; (2) the maneuvering limitations of heavy-haul vehicles; (3) the effects of fatigue on performance; (4) the need to assess the dangers at railroad crossings,

particularly for low-clearance vehicles; and (5) the need and requirements to notify the railroads before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing. (H-01-32)

Work with the Federal Highway Administration to develop model oversize/overweight vehicle movement guidelines. The guidelines should address, at a minimum, issues such as (1) when pilot cars and police escorts are required; (2) the training, testing, and certification of pilot car operators, police officers, and truckdrivers in the movement of oversize/overweight loads; (3) the use of height poles and traffic controls; (4) how to conduct route surveys; (5) the maneuvering limitations of heavy-haul vehicles; (6) the effects of fatigue on performance; (7) the need to assess the dangers at railroad crossings, particularly for low-clearance vehicles; and (8) the need and requirements to notify the railroads before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing. (H-01-33)

To the Federal Highway Administration and the American Association of State Highway and Transportation Officials:

Encourage the States to adopt the model oversize/overweight vehicle movement guidelines, as addressed in Safety Recommendations H-01-31 and -33, and once developed, to require that oversize/overweight vehicle movements conform to the guidelines. (H-01-34)

To the City of Glendale, California:

Install low-clearance highway-railroad grade crossing signs (W10-5s) at the Grandview Avenue crossing and evaluate other crossings to determine whether the signs are warranted and, if so, install them. (H-01-35)

To the Commercial Vehicle Safety Alliance, the International Association of Chiefs of Police, and the National Sheriffs' Association:

Notify your members of the circumstances of the Glendale, California, accident and encourage them to train their officers to make sure (1) that documentation regarding permits is reviewed and verified; (2) that safety briefings to discuss routings and special conditions, including the hazards associated with moving oversize/overweight vehicles over grade crossings, are conducted; (3) that provisions for handling off-route loads are in place; and (4) that necessary notification to the railroads is made before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing. (H-01-36)

To the Specialized Carriers and Rigging Association:

Notify your members of the circumstances of the Glendale, California, accident and during in-service training for heavy-haul drivers, (1) highlight the potential hazards associated with moving low-clearance trailers over grade crossings and (2) emphasize the need to notify the railroads before an oversize/overweight vehicle is escorted across a highway-railroad grade crossing. (H-01-37)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Chairman

CAROL J. CARMODY
Vice Chairman

JOHN A. HAMMERSCHMIDT
Member

JOHN J. GOGLIA
Member

GEORGE W. BLACK, JR.
Member

Adopted: November 27, 2001

Appendix A

Investigation

The National Transportation Safety Board was notified of the Glendale, California, accident about 11:00 a.m. on January 29, 2000. An investigative team was dispatched with members from the Gardena, California, office. Groups were established to investigate the highway and railroad factors and the motor carrier operations.

No parties were designated; no public hearing was held; no depositions were taken.

Appendix B

Terms Relating to Oversize/Overweight Loads

Tractor-semitrailer	Typically made up of tractor (18 to 20 feet long) and semitrailer (40 to 53 feet long), both 8 feet wide, and together weighing not more than 80,000 pounds.
Heavy haul	Has gross vehicle weight greater than 80,000 pounds.
Extralegal	Vehicle or load that is larger or heavier than State size or weight regulations.
Super load	Definition varies among the States; in California, vehicle with dimensions greater than 15 feet wide, 17 feet high, and 135 feet long.
Variance load	Another term for super load.
Low clearance	Vehicle with vertical body or load clearance of less than ½-inch-per-foot of distance between any two axles or less than 9 inches, measured above level surface of roadway. ^a
Permit	Variance from oversize/overweight load restrictions issued by State and local authorities.

a. Source: *Uniform Vehicle Code*.

Appendix C

California Department of Transportation Office of Truck Services Summary of Major Improvements

Staffing

- September 1999 - January 2000 — Hired 15 additional permit writers to double check all overheight (>14 feet) permits.
- September 1999 — Began formal training of new and current staff.
- October 1999 — Hired consultants to document, modify, enhance, and maintain Transportation Permits Routing Database and provide computer and network support.
- October 1999 — Established Transportation Permits Steering Committee made up of Caltrans' upper management to direct efforts on improvements.
- December 1999 - January 2000 — Hired two additional managers for regional Transportation Permits Offices.
- July 2000 — Procured services of consultant for oversight/quality assurance of automated permitting system (Transportation Permits Management System).
- December 2000 — Hired full-time project manager to lead procurement and implementation of automated transportation permits system.
- March 2001 — Developed plans to explore options for recruitment, retention, and upward mobility of transportation permits staff.
- May 2001 — Completed hiring of 10 District Truck Services managers for 12 Caltrans districts, who are main link between various functional units in Caltrans, CHP, trucking industry, and regional Transportation Permits Offices (two of which are in Sacramento and San Bernardino).
- Ongoing — Employing formal and on-job training with specific emphasis on safety.

Processes

- November - December 1999 — Began process of verification of vertical clearances.
- July 2000 — Completed measurements of 6,500 State highway bridges; updated Caltrans Route-Clearing Database with this information.

- February - May 2000 — Joint Legislative Audit Committee approved audit of transportation permits program. Published final report on May 31, 2000. Caltrans adopted recommendations.
- June 2000 — Issued policies on communication between various functions within Caltrans and transportation permits program. Established within these policies new and revised procedures on reporting of temporary and permanent changes to highway system impacting routing of extralegal loads/vehicles.
- June 2001 — Input 94 percent of bridge measurements into Caltrans Route-Clearing Database.
- Ongoing — Issuing weekly notification of State highway changes to permit holders/customers.

Tools

- July - August 2000 — Procured fax services to notify permit holders of changes to State highway system affecting routing of extralegal loads.
- August - September 1999 — Made several safety enhancements to current routing system database.
- September 1999 — Transferred responsibilities of modifications and improvements to and maintenance of routing database from regional Transportation Permits Offices to Caltrans IT [information technology] function, including preparation of user guide and software documentation of all transportation permit databases and reference systems.
- September 2001 — Began work on Transportation Permits Management System.
- October 2002 — Transportation Permits Management System in production.

Appendix D

California Highway Patrol Teams 1 and 2 Escort Officers' On-Duty Time for the 3 Days Prior to the Accident

Officer	Commercial training	January 25	January 26	January 27/28
#1 -- Team 1	Basic academy, commercial level 1	0500 - 1430	0500 - 1430	0530 - 2100*
#2 -- Team 1	Basic academy	2130 - 0600	2130 - 0600	0530 - 2100*
#3 -- Team 2 officer-in-charge	Basic academy, commercial level 1	0700 - 1530	0700 - 1530	0700 - 1530 2000 - 0600*
#4 -- Team 2	Basic academy, commercial level 1	2200 - 0630	2200 - 0630	2000 - 0600*
#5 -- Team 2	Basic academy	0700 - 1530	0700 - 1530	0700 - 1530 2030 - 0600*
*Overtime hours worked escorting load				

Source: California Highway Patrol on October 19, 2001.

