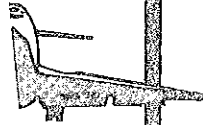


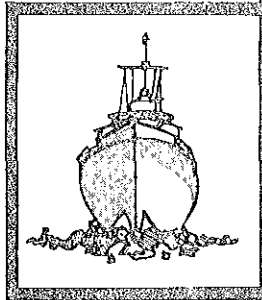
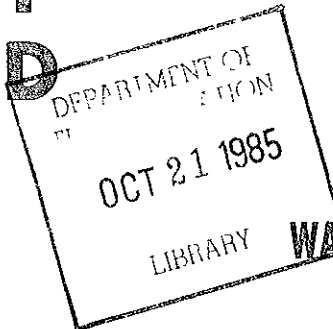
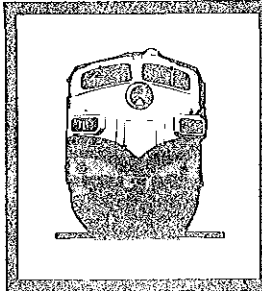
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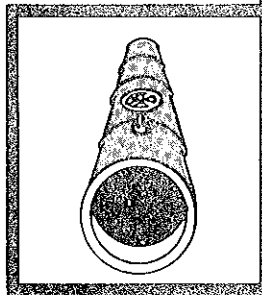
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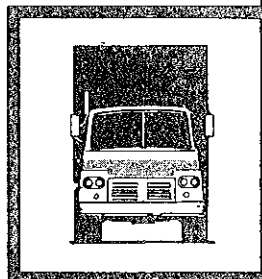
# NATIONAL TRANSPORTATION SAFETY BOARD



## RAILROAD/HIGHWAY ACCIDENT REPORT,



GRADE CROSSING COLLISION OF A  
FLORIDA EAST COAST RAILWAY COMPANY  
FREIGHT TRAIN AND AN  
INDIAN RIVER ACADEMY SCHOOLBUS  
PORT ST. LUCIE, FLORIDA  
SEPTEMBER 27, 1984

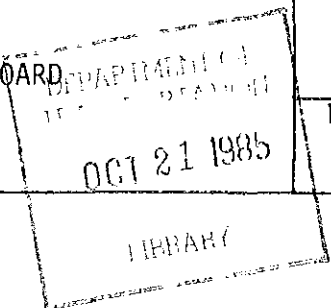


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**NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C. 20594**

**RAILROAD/HIGHWAY ACCIDENT REPORT**

**Adopted: June 12, 1985**

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**GRADE CROSSING COLLISION  
OF A FLORIDA EAST COAST RAILWAY COMPANY FREIGHT TRAIN  
AND AN INDIAN RIVER ACADEMY SCHOOLBUS  
PORT ST. LUCIE, FLORIDA  
SEPTEMBER 27, 1984**

**SYNOPSIS**

About 6:55 a.m., on September 27, 1984, a northbound Florida East Coast Railway Company freight train struck a westbound Indian River Academy schoolbus stalled at a grade crossing on Walton Road in Port St. Lucie, Florida. The grade crossing was a two-lane, asphalt-paved, county road intersecting a single railroad track with automatic flashing signals and gates. The 1968 Bluebird/Chevrolet 66-passenger schoolbus was occupied by the driver and four students. Two of the students fled the stopped schoolbus before impact and were not injured. In the collision, the schoolbus body separated from the chassis, and the three remaining occupants were ejected. The two students were killed, and the busdriver was injured seriously. Neither of the two train crewmembers was injured.

The National Transportation Safety Board determines that the probable cause of this accident was the inadequate standards for certifying nonpublic schoolbus drivers, insufficient training and testing programs, and the limited experience of the schoolbus driver, which led to the intrusion of the schoolbus onto the railroad track when the driver misshifted the transmission. Contributing to the accident was the absence of a stop line on the westbound approach to the grade crossing. Contributing to the severity of the accident was the engineer's delay in applying the train brakes and the locked deadbolt on the rear emergency door of the schoolbus.

**INVESTIGATION**

**The Accident**

At 6:20 a.m. on September 27, 1984, a schoolbus driver and her student son boarded a schoolbus owned and operated by the Indian River Academy at the private school in Fort Pierce, Florida, to begin picking up students along her prescribed morning route. The busdriver had made a routine pretrip inspection of the schoolbus, which did not include examining or unlocking the rear emergency door, which was fitted with a deadbolt lock in addition to the normal latch. Following the first stop to pick up a student, at 6:40 a.m., the busdriver drove the schoolbus across a railroad/highway grade crossing. Just before the second stop on the route, she drove the schoolbus over a second grade crossing. The busdriver stopped to board two students, and the schoolbus passed over the second grade crossing again. Both of these crossings were equipped with active warning devices--a bell, flashing lights, and automatic gates; stop lines were painted on the pavement. The busdriver stopped at each crossing in accordance with State law, which requires a schoolbus to stop at all railroad/highway grade crossings, and proceeded without incident.

About 6:50 a.m., as it proceeded westbound on two-lane Walton Road in Port St. Lucie, Florida, the schoolbus approached a single Florida East Coast Railway Company (FEC) track at grade. It was dawn and cloudy, and the roadway was wet. The crossing was equipped with active warning devices--a bell, flashing lights, and automatic gates; however, there was no stop line painted on the pavement. The busdriver stopped the schoolbus short of the track, opened the front door of the schoolbus, and looked in both directions. The schoolbus stop arm was extended and its attendant lights were flashing. The busdriver said she saw a train, the first she had ever encountered at this crossing, approaching from her left. According to the busdriver and students, the crossing warning devices were not activated and they did not hear the locomotive whistle when the schoolbus first was stopped at the crossing.

Northbound FEC freight train Extra 412 North was approaching the crossing at a reported speed of 38 miles per hour with its locomotive headlight illuminated. The engineer was operating the locomotive unit from the right side. The conductor was seated on the left side opposite the engineer. The engineer said he began sounding the standard whistle signal at the Riverview grade crossing, 2,688 feet south of Walton Road. According to the engineer, the schoolbus was in his view at that moment and the warning devices at the crossing were activated. The whistle post was located 2,620 feet south of the crossing at Walton Road.

The busdriver believed that the front of the schoolbus was too close to the track and attempted to shift the manual transmission into reverse gear in order to back up. One student said he believed the busdriver got the transmission into gear and stalled the engine. Another student said the schoolbus "lurched" forward toward the track. According to the busdriver, the engine stalled and the schoolbus rolled forward. The parking brake was not applied.

The driver of a pickup truck behind the schoolbus stated that the schoolbus was stopped for 4 or 5 seconds as he approached it and that about the time he stopped to its rear and observed the approaching train, the schoolbus "lurched" forward an estimated or 6 or 7 feet and stopped with the front bumper near the east rail. About 2 or 3 seconds later, the schoolbus "jerked" forward for a short distance and stopped for a third time. The front wheels were over the west rail and the schoolbus blocked the track. The pickup driver said the lights of the crossing warning device began flashing while the schoolbus was at its second stop or just as it moved forward to the third stop.

The crossing gate descended onto and came to rest upon the right roofline of the schoolbus 18 feet 9 inches from the front bumper. According to the pickup driver, the gate arm came to rest about the time the schoolbus reached its third stop. The train conductor stated that he saw the schoolbus move forward and appear to veer around the automatic gate arm as it descended. He said also that he was reaching for the emergency brake valve on his side of the locomotive cab when the engineer made an emergency application of the train brakes. After placing the automatic brake valve handle in the emergency position, the engineer immediately released the locomotive brake. Sand from the locomotive sanders was found on the track 628 feet from the center of the crossing. Placement of the automatic brake valve handle in the emergency position provides automatic power cutoff and instantaneous sanding.

After unsuccessful efforts to restart the engine, while the schoolbus was astride the track, the busdriver stood up and ordered the passengers off the schoolbus. Two passengers, a 13-year-old boy and a 15-year-old girl seated in the two front seats, were "pushed" by the busdriver out of the front door. The two fleeing passengers ran to the

northeast and away from the schoolbus. A third passenger, a 12-year-old girl seated in the second seat behind the busdriver, ran to the rear of the schoolbus to awaken the busdriver's 10-year-old son who was asleep on a rear seat. From behind the schoolbus, the pickup driver saw the two children at the rear emergency door for an estimated 10 to 15 seconds, while they appeared to be attempting to open it. The busdriver was still on the schoolbus calling to the two children to get off, and one of them turned and ran toward the front of the schoolbus.

The train struck the left side of the schoolbus approximately 8 feet rearward of the front bumper. The force of the collision separated the schoolbus body from the chassis. Both the body and chassis were rotated clockwise, the right side of the schoolbus body striking the warning device structure. The rear of the schoolbus body and left rear corner of the chassis were struck by the right side of the locomotive in secondary collisions before they came to rest in the northeast quadrant of the intersection. At rest, the schoolbus body lay across the chassis. The body was located 47 feet north of the roadway and 5 1/2 feet east of the track. The chassis was located some 36 feet north of the roadway and 2 feet east of the track. Both components were damaged substantially. The three remaining schoolbus occupants were ejected; the busdriver was injured seriously, and the two students were killed. There was no fire.

The front of the train came to rest 798 feet north of the center of the crossing. The cars of the train remained coupled and in line on the track. The traincrew was not injured. (See figures 1 and 2.)

### Injuries to Persons

	<u>Driver</u>	<u>Passengers</u>	<u>Traincrew</u>	<u>Totals</u>
Fatal	0	2	0	2
Nonfatal	1	0	0	1
None	0	2	2	4
Total	1	4	2	7

### Schoolbus Information and Damage

The schoolbus was a 1968 Bluebird body mounted on a 1968 Chevrolet two-axle chassis. Current Federal Motor Vehicle Safety Standards (FMVSS 221) for schoolbus body construction and voluntary standards for the attachment of schoolbus bodies to chassis frames, as contained in the Vehicle Equipment Safety Commission Standard 13, were not in effect when the schoolbus was built. (See appendix B.) It was equipped with a 350 CID V-8 gasoline engine, a floor-mounted 5-speed manual transmission, and vacuum over hydraulic power brakes. The schoolbus was painted standard chrome yellow. The seating capacity was 66 passengers. It was owned and operated by the Indian River Academy, a private school. (Detailed specifications of the schoolbus are in appendix C.)

A deadbolt lock had been installed on the emergency door of the schoolbus with a key location outside and a handle inside. Postcrash examination revealed that it was locked at the time of the collision. From inside the schoolbus, the lock handle could be reached only by a person in a seated or crouched position near the rear door. The lock handle could be seen only when sitting in the right-rear seat or when standing facing the rear door and looking directly down at the lock handle. There was no placard explaining the location or operation of the lock.

A postcrash mechanical inspection of the schoolbus revealed that the transmission gear shift lever was sheared, the cover was separated from the transmission, and the shift linkage that prevents simultaneous engagement of more than one gear was broken. Since both third and reverse gears were engaged, the gear engaged at the time of the accident could not be determined. The clutch functioned, although the rubber pad was missing from the clutch pedal. The free travel adjustment of the clutch could not be determined because of the crash damage.

The spark plugs, which had been in the engine for 1,571 miles, were observed to be extremely clean. The ignition point gap was adequate. An inspection of the connections of the starter and battery determined that a wire necessary to prevent starter current draw from starving other functions was in place at the time of the accident. No discrepancies that might tend to cause a malfunction were found.

Some of the vacuum lines and hoses were damaged in the accident. The vacuum lines and hoses that could be examined were in good condition with no local deterioration. No defects were found. The carburetor was removed and examined, and no discrepancies that would tend to cause poor starting were found.

The brakes were found to be in very good condition; the brake linings with 1,571 miles showed very little wear. An examination of the parking brake revealed that the brake band was adequate to close tightly around the drum and function properly when the parking brake was applied.

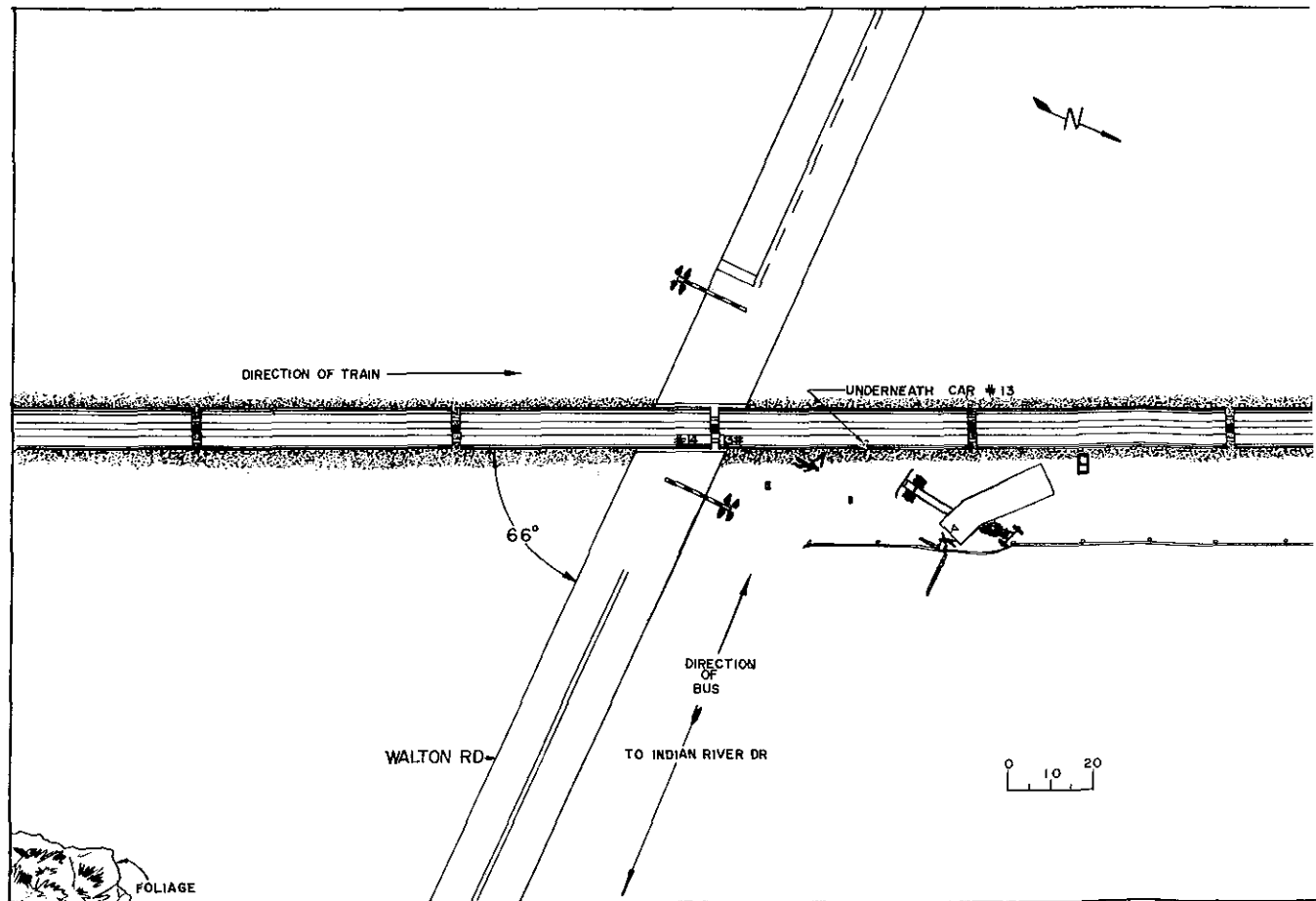
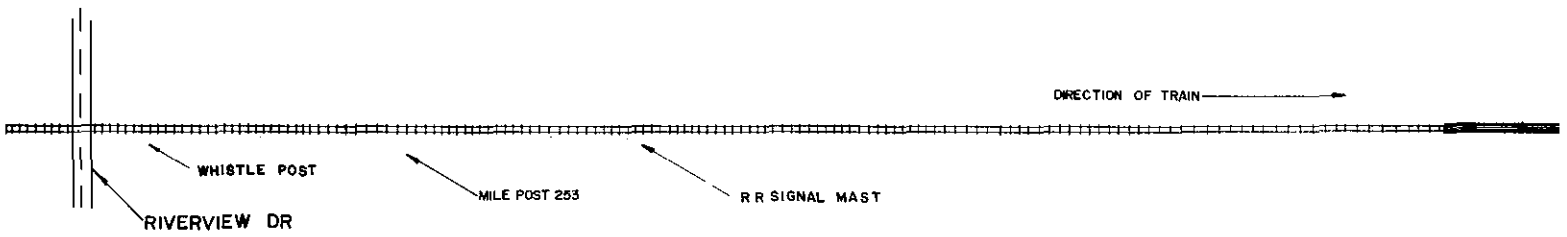
The left-front tire was cut in the crash and deflated. Air pressure in the other tires was adequate. Tread depth of the tires varied, but all were adequate. No preexisting defects were found in the tires.

The schoolbus body was separated from the chassis frame at the body mounts. (See figure 3.) The front fenders remained with the body. The engine and transmission remained with the chassis. Damage to the radiator fan was typical of damage that results when the fan is not turning at impact. The transmission gear shift lever, cover, and shift linkage were separated from the transmission assembly.

The greatest deformation on the schoolbus was approximately 8 feet to the rear of the front bumper at the initial point of impact. The left frame rail of the chassis was deformed inward 5 inches. The chassis was buckled, with the front of the left frame rail deformed leftward approximately 15 inches from its original position. The left side of the rear bumper was bent forward. Otherwise, the rear of the chassis/rear bumper was undamaged.

Deformation on the left side of the body at the point of impact measured 4 feet 2 inches inward. The left sidewall was penetrated and the floor was deformed, leaving an opening into the schoolbus. The driver's seat was forced toward the right and into the area of the front door. Several of the seats in the area of the penetration into the body were dislodged, but most of the seats rearward of the area of penetration remained in place.

There was a scrape/cut in the right side of the schoolbus body beginning 15 feet 5 inches from the front bumper and 16 inches above the bottom of the body sidewall. It extended rearward for 33 inches; its greatest width measured approximately 6 inches at the rear of the scrape/cut. From its beginning, the depth of penetration left a scrape; toward the rear, there was deformation.





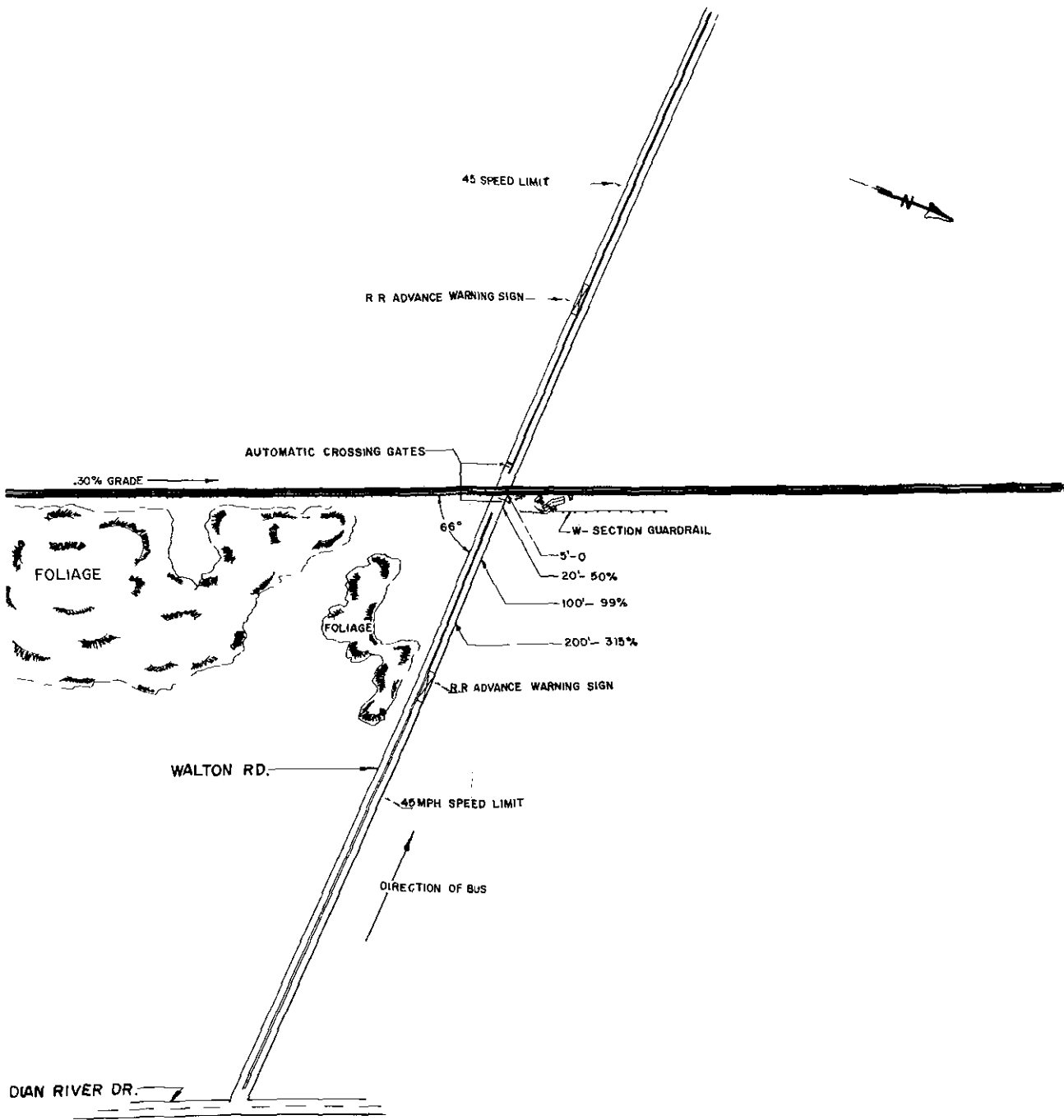
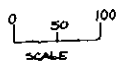


FIGURE 1. -- PLAN VIEW OF ACCIDENT SITE.



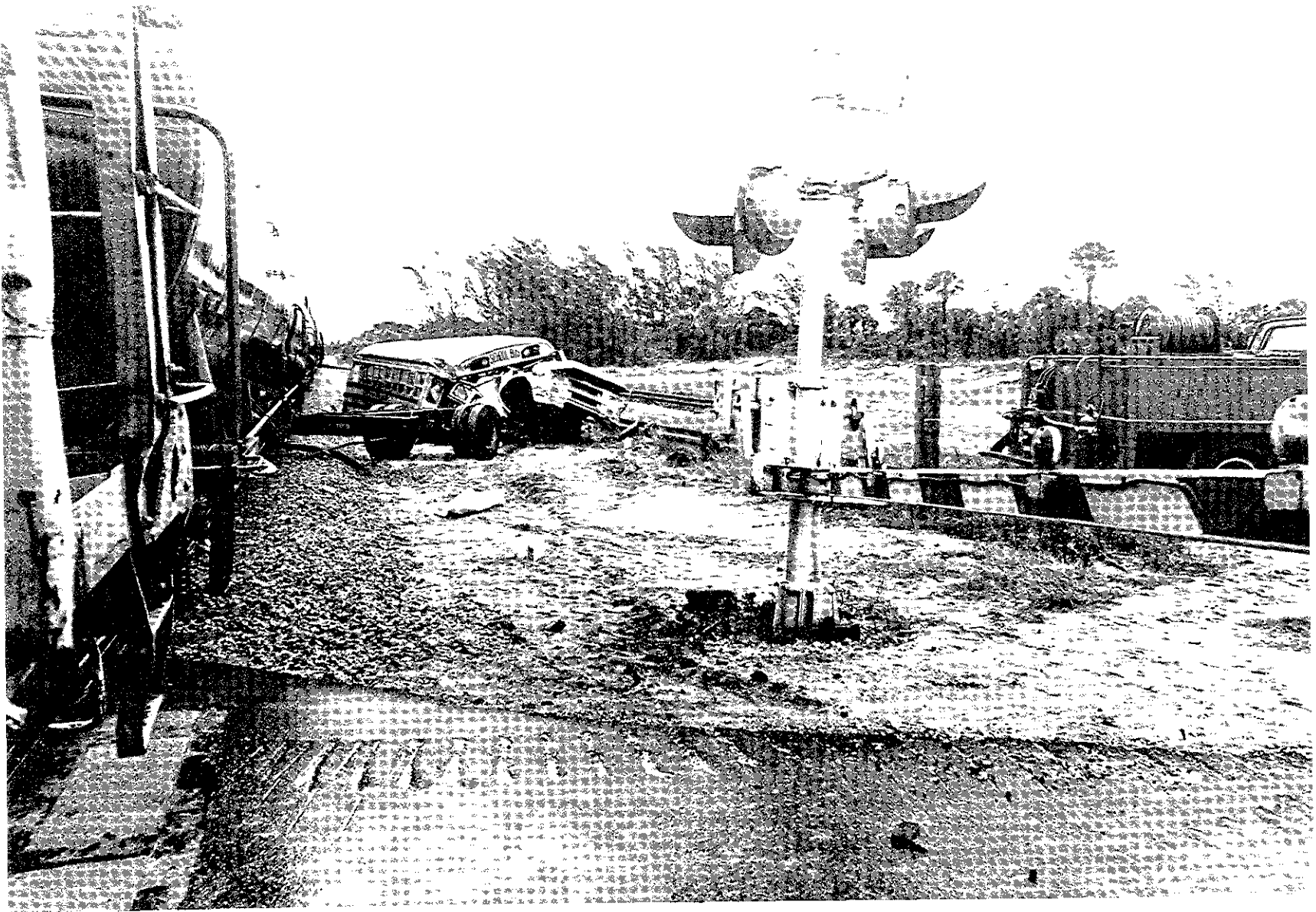


Figure 2.--Schoolbus, train, and warning device at accident site.

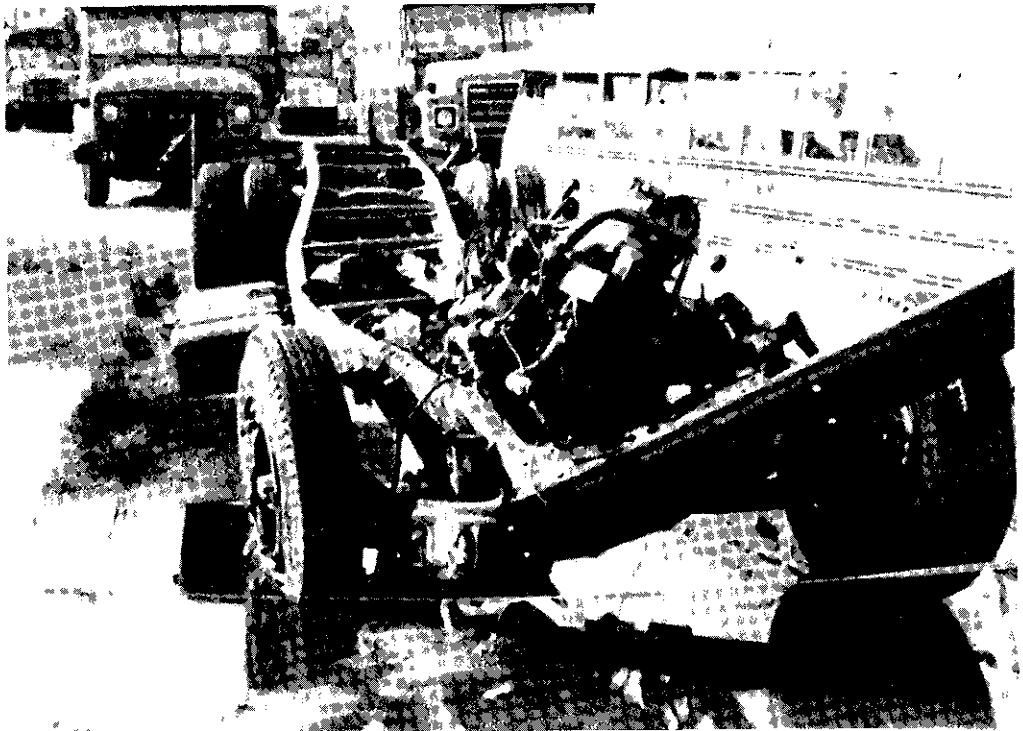


Figure 3.--Crash damage to schoolbus body (above) (note emergency door at lower right), and crash damage to schoolbus chassis (below).

Eighteen feet 9 inches rearward from the front bumper and 1 foot above the right side windows of the schoolbus, a small clearance light assembly was damaged. The lense and bulb were missing, and the remaining portion of the assembly was bent. Transfers of white paint were found at the top front area of the assembly. Forward of the remaining assembly, there was a scrape mark which reached to about 3 inches below the assembly. It extended upward and at about a 45° angle to the roofline of the schoolbus. The outer perimeter of the scrape was irregular, but the extreme measurements were 10 inches horizontally and 13 inches vertically. No other similar scrape marks were found on the right side of the roofline.

There was accident damage to the rear of the schoolbus body. At floor height, deformation to the rear of the body measured 35.75 inches at the rear left, 40.5 inches at the rear center, and 12.5 inches at the rear right. The left portion of the rear wall was separated from the roof, the interior panels above the emergency door were separated from each other, and the panels were separated from the roof rail. Bluish-colored paint transfers were on the schoolbus body near the roof.

The rear emergency door was separated from the schoolbus body at the line of fasteners which connected the door hinge to the door. The factory-equipped operating lever was found near the vertical (open) position. The main door latch was damaged by direct impact, and the outside lever that operated the latch was broken off.

The deadbolt lock was separated from the rear emergency door in the collision. It was found on the floor of the schoolbus, with the bolt extended. The tumbler portion remained in place in the door. Investigators determined that the lock could be operated with a key from the outside or its handle from the inside.

### Train Information and Damage

A pretrip inspection of the train in the Hialeah Yard revealed air brake problems. After three cars were set out, the train received a satisfactory initial terminal brake test and departed. The train consisted of 18 loaded freight cars and 15 empty freight cars for a total of 2,710 trailing tons. Seven of the empty tank cars had recently carried hazardous materials cargo. None of the cars carried hazardous materials at the time of the accident.

The single locomotive unit of Extra 412 North was a 3,000-horsepower, model GP40-2, diesel-electric unit manufactured by the Electro-Motive Division of General Motors. It was equipped with a dual sealed-beam headlight, an Oscitrol signal light, whistle, bell, and 26-L air brake equipment. The Oscitrol signal light consisted of three vertical, fixed-mounted, sealed-beam lights; two alternately flashing, obliquely mounted clear lights, and one (bottom) red light which activated automatically in conjunction with the application of emergency brakes. The whistle was operated by a manual switch and provided maximum sound upon each application. The bell operated either with the whistle or independently. The locomotive unit had an alertness device, an operable radio, and a speed indicator, but it did not have a speed recorder device.

Damage to the locomotive unit was minor and was limited to the front pilot, right-side handrail, and rear steps. No other cars in the train were damaged. A postcrash inspection of the train revealed no mechanical defects.

### Roadway Information

Walton Road is a 3-mile-long, east-west county road between U.S. Route 1 and Indian River Drive in St. Lucie County, Florida. It crosses a single track of the FEC in a rural-residential area two-tenths of a mile west of Indian River Drive and within the city limits of Port St. Lucie. The road consists of two asphalt-paved, 10-foot-wide lanes bordered by unpaved shoulders on each side. Pavement striping consists of solid white edgelines along both edges of the pavement and a centerline painted to within 28 feet of the track on both approaches. Standard signs and pavement markings for advance warning of a grade crossing were in place on both approaches. A solid white painted stop line was west of the gate and 32 feet west of the track on the pavement of the eastbound approach; however, there was no stop line on the westbound approach. (See figure 4.) The Manual on Uniform Traffic Control Devices (MUTCD) mandated that stop lines be placed in each approach lane on all paved approaches where grade crossing signals or automatic gates are located. The State of Florida conforms with the MUTCD.

On the westbound approach to the track, the grade of the roadway decreases from 3.15 percent at 200 feet, to 0.99 percent at 30 feet, to 0.50 percent at 20 feet, and to zero percent at 5 feet.

The westbound approach to the crossing permitted a line of sight between the train and the schoolbus, according to statements of the traincrew, busdriver, witnesses, and visibility testing. (See figure 5.)

In 1983, Walton Road was resurfaced by a private contractor. On both approaches, the asphalt surface was paved over up to within a few inches of the track. Replacement of pavement markings was included in the contract. The completed work was inspected and approved by St. Lucie County. According to an Assistant County Engineer, he inspected the site following the 1983 project and found a stop line painted on the westbound approach.

In April 1984, the elevation of the track at the Walton Road crossing was raised, and the pavement on either side of the track was resurfaced. A private contractor employed by the FEC resurfaced the pavement 28 feet east and west of the track. The contractor stated that he did not replace any pavement markings. Consequently, the westbound stop line located 18 feet from the track was covered over with new asphalt; it had not been repainted at the time of the accident. Following communications with Safety Board investigators, the stop line was immediately repainted by St. Lucie County.

A license agreement, dated September 21, 1965, between St. Lucie County and the FEC specified that the county was responsible for all roadway maintenance at the crossing. Although the FEC was reimbursed by the county for the costs of the 1984 resurfacing, no county official inspected the site following completion of the work.

There was no record of any traffic accidents at the crossing within the past 5 years. In 1983, the average daily traffic count was 3,360 vehicles westbound and 1,743 eastbound. The posted speed limit on Walton Road was 45 miles per hour.

The only marks on the roadway that could be identified with the accident were a tire mark and scrape. Other marks were present which could not be related to this accident.

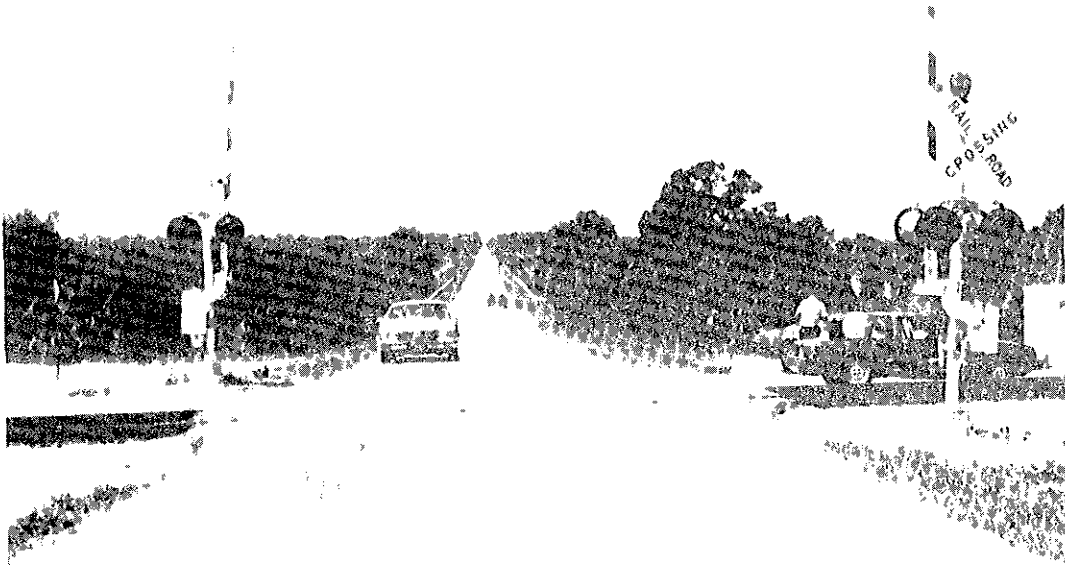


Figure 4.--Westbound approach to Walton Road grade crossing.



Figure 5.--Line of sight to busdriver's left from 20 feet short of the track at accident site.

A W-beam (steel) guardrail runs parallel to the track starting 29 feet north of the roadway and 25 feet east of the east rail. The guardrail was struck by the schoolbus and deformed inward 16 inches over an area measuring 30 feet in length. A wooden utility pole located in the northeast quadrant of the intersection 44 feet north of the roadway and 22 feet east of the track was severed near the ground.

### **Track Information**

The railroad/highway grade crossing at Walton Road is at milepost location 252.559 on the FEC's single-track main line. The grade crossing inventory number is 2723320.

The track structure consists of 132-pound, continuous-welded rail laid on prestressed concrete ties. The track is tangent for more than 1 mile to the south and has a 0.30-percent ascending grade for northbound trains. The angle at which the road and track intersect was measured as 66 degrees in the southeast quadrant.

Two automatic grade crossing warning devices are located within the railroad right-of-way. Each is equipped with flashing lights and a gate. One device is mounted in the northeast quadrant, 10 feet east of the track at the center of the roadway and 7 feet north of the roadway edge. It is equipped with a bell and back-to-back flashers aimed east and west on Walton Road. The other device is mounted in the southwest quadrant, 27 feet 6 inches west of the track at center of roadway and 7 feet south of the roadway edge. It is equipped with back-to-back flashers aimed east and west on Walton Road, but has no bell.

The track on each side of the crossing is equipped with motion-sensitive circuits for the warning devices. When activated, the crossing warning devices provide for a minimum of 20 seconds of warning in advance of the arrival of any train. On the day following the accident, a train traveled north at 38 miles per hour to and through the crossing. The warning devices at Walton Road began to activate when the train was about 1,650 feet south of and 30 seconds from the crossing.

The fiberglass section of the gate arm was 13 feet long with standard 16-inch alternate red-and-white striping on each side; the underside was painted white. A chrome yellow paint transfer found on the underside of the gate arm extended for 64.25 inches beginning at a point measuring 59.25 inches from the outboard end of the gate arm.

### **Personnel Information**

**Schoolbus Driver.**--The schoolbus driver was 28 years old, 5 feet 6 inches tall, and weighed 125 pounds. At the time of the accident, she was wearing contact lenses which corrected her vision to 20/20. She was in good health and had not been under stress or on any special type of diet. Her rest on the night preceding the accident was reported as adequate.

On August 16, 1984, the busdriver applied for employment with the Indian River Academy as a schoolbus driver. On August 20, 1984, she took a medical examination administered by a physician as a prerequisite for State certification as a nonpublic schoolbus driver. The physician took no exception to her health. On August 22, 1984, she took a written test and was issued a chauffeur license by the State of Florida. Her application form for certification was forwarded by the school on the same day to the Florida Highway Patrol (FHP). Although the signature of a school official was required, no school official signed the form. Failure to sign the form was explained later as an oversight. The FHP's Office of Student Transportation (OST) received the application on

August 24, 1984. On September 10, 1984, the OST sent a letter to the applicant advising that the FHP had no record of her chauffeur license. In response on October 3, 1984, the school mailed a copy of the busdriver's chauffeur license to the OST. On October 11, 1984, the OST issued the busdriver a certificate to drive a nonpublic schoolbus. The school received the certificate on October 23, 1984, 26 days after the accident. It is a violation of State law to drive a schoolbus without a certificate. (See appendix B.)

The busdriver had been driving the same schoolbus route with minor modifications since September 4, 1984, the opening day of school. She had no previous experience or training in driving schoolbuses or other types of buses. Neither experience nor schoolbus driver training was required for employment or certification. Before her first trip with students, she drove the schoolbus through the route with a school official aboard. She stated that he "showed her everything she needed to know to drive a schoolbus." There was no training in evacuation procedures or instruction on how to carry out an evacuation exercise with students aboard. She stated that she was not given instruction as to the operation of the rear emergency door and was not aware that the key to its deadbolt lock was on the same ring as the ignition key. She said that after driving the schoolbus a few days, she learned about the operation of the rear emergency door and the deadbolt lock on a morning when she was unable to enter the schoolbus through the front door. Someone opened the emergency door so she could gain entrance to the vehicle.

The busdriver said that she had been experiencing difficulty shifting the schoolbus transmission into reverse gear and that she had advised her supervisor at the school of the problem. The supervisor reported that he found no mechanical defects in the transmission and advised the busdriver that both reverse and low gear were not synchronized. He told her that "double clutching" was sometimes necessary for shifting into reverse or low gear and he expected her ability to shift the transmission would improve with experience. Her previous difficulty also was reported to Safety Board investigators by one of the passengers. Also, it was reported to Safety Board investigators that at one turnaround stop on her route she sometimes used a circular maneuver to avoid backing the schoolbus.

The busdriver's driving record with the State of Florida included a stop sign violation in December 1982 and a traffic accident in February 1984. She received a fine for the stop sign violation and was sent to traffic school as a result of the accident. Neither the violation nor the accident would have disqualified her from receiving a schoolbus driver certificate. The busdriver was not charged with a violation by the FHP nor was her certificate withdrawn as a result of the accident on September 27, 1984.

Traincrew.--After having been off duty for 14 hours 20 minutes, the traincrew reported for duty in Hialeah, Florida, at 9 p.m., on September 26, 1984. Their physical appearance was evaluated by an FEC official; he took no exception. Both crewmembers had passed physical examinations within the past year.

The locomotive engineer was 62 years old. His service with the FEC began on January 16, 1947, as an oiler/packer. He transferred to engine service as a fireman/hostler on January 3, 1952, and was promoted to engineer on March 22, 1965.

The train conductor was 54 years old. His service with the FEC began in September 1951 as a trainman. He qualified as a conductor in 1956.

The engineer and conductor attended rules classes in May and August 1984. Both passed efficiency tests without restrictions in July 1984. The traincrew was very familiar with the Walton Road crossing.



## Method of Operation

**Schoolbus.**--The Indian River Academy was organized and founded as a nonprofit corporation in Ft. Pierce in 1969 and was registered with the Florida State Department of Education as an independent private school. The school is governed by an 11-member Board of Directors and is directed by a headmaster. The school has an enrollment of approximately 420 students in kindergarten through twelfth grade.

Parents are responsible for student transportation to and from the school. However, transportation by schoolbus for an additional fee is provided by the school to about 120 students who live in Ft. Pierce, Lakewood Park, Port St. Lucie, and Jensen Beach. In the school handbook, five general rules of discipline and safety on schoolbuses are listed along with other general rules of the school. One rule applies to silence at grade crossings, and one restricts use of an emergency exit to emergencies.

The school employs a Director of Operations (DOER), whose duties include oversight of the operation and maintenance of the school and the five-schoolbus fleet for pupil transportation. The DOER had been employed by the school since July 13, 1984, in that position. He previously drove a schoolbus, beginning in December 1983 and continuing throughout the school year about 6 months. He was certificated as a schoolbus driver by the FHP on January 27, 1984. At the time of this accident, the DOER served as a relief schoolbus driver.

State of Florida records revealed that, as of November 12, 1984, nine persons held current State-issued certificates as nonpublic schoolbus drivers through applications submitted by the Indian River Academy. Eight of the nine certificated drivers, including the accident busdriver, had not completed a formal course in schoolbus driver training. Six of the nine persons were first certificated by the FHP to drive a nonpublic schoolbus in 1984. The school did not provide a structured preservice or inservice schoolbus driver training program. Schoolbus driver training was limited to individual discussions with the DOER. Screening of applicants and preservice training was similar to that followed in hiring and training the driver of the accident schoolbus. The DOER stated that he made a concerted effort to have daily personal communications with each regular schoolbus driver regarding both driving and maintenance. The DOER himself had no formal schoolbus driver training.

Of the five schoolbuses owned by the school, four were used regularly on school routes and driven by a regular driver. The other schoolbus was used primarily for temporary replacement and extracurricular activities. All of the schoolbuses were previously owned. The school purchased three of the schoolbuses, including the accident schoolbus, from the St. Lucie County School Board on August 27, 1982. The two other schoolbuses were purchased outside the State of Florida. Three other schoolbuses had deadbolt locks installed on their rear emergency doors in a similar manner. (See figure 6.) School officials stated that the locks were placed on the doors to prevent theft and vandalism. The Director of Pupil Transportation for the St. Lucie County public schools stated that the county had not installed locks on the emergency doors on the county-owned schoolbuses. Further, he stated specifically that the deadbolt lock was not on the accident schoolbus when the Indian River Academy purchased it from St. Lucie County.

A person who drove a schoolbus for the Indian River Academy during two previous school years, both full-time and part-time, stated that the deadbolt locks were installed on the accident schoolbus and at least one other as early as the beginning of the 1982-83



Figure 6.--Deadbolt lock installed on sister schoolbus.

school year, but he did not know who installed the locks. He said that he routinely entered his assigned schoolbus through the rear door by unlocking the deadbolt lock with a key attached to the ignition key ring. He exited the schoolbus through the rear door and locked it from the outside. He also stated that he had never been certificated as a schoolbus driver, nor had he ever been advised that a certificate was required.

Nonpublic schoolbuses in Florida are required to be mechanically inspected by the FHP annually. The accident schoolbus was last inspected on October 26, 1983. The FHP trooper who performed the inspection stated that he did not observe a deadbolt lock installed on the rear emergency door of the schoolbus but that if he had he would not have considered the lock as a rejection item on inspection. According to the OST, deadbolt or similar locks are prohibited on Florida schoolbuses, but it could point to no specific document. The Florida schoolbus inspection manual and the accompanying inspection form do not mention deadbolt locks as an inspection item. Specific prohibition against such devices could not be documented in OST regulations, Florida law, or Federal standards.

Train.--At 1 a.m., on September 27, 1984, Extra 412 North departed Hialeah en route to New Smyrna Beach, Florida. At Villa Rica, Florida, the train set out 18 cars and picked up 2 cars. The train next stopped at West Palm Beach, Florida, where 21 cars and a locomotive were set out. It departed at 4:45 a.m. with a single-unit locomotive, 18 loaded freight cars, and 15 empty freight cars. Shortly after departing Hialeah Yard, the engineer of Extra 412 North verified the accuracy of the speed indicator by using milepost markers.

Train movements in the accident area are governed by the wayside automatic block signals of a centralized traffic control system. The traffic control system is under the direction of a train dispatcher at New Smyrna Beach. The maximum authorized speed limit in the area of the accident site was 65 miles per hour; however, FEC special instructions restrict trains handling hazardous materials to a maximum speed of 50 miles per hour. Extra 412 North was restricted to a speed of 50 miles per hour. There are 21 train movements on the average per day over the Walton Road crossing.

The engineer stated that he did not know the location of the whistle post on the approach to Walton Road. He said that he does not use the whistle post as a reference point for sounding the train whistle upon approaching a crossing at grade. He stated that it was up to his judgment as to where the whistle should be sounded. (See appendix B.)

### **Meteorological Information**

Tropical storm Isidore had moved through the Port St. Lucie area early on September 27, 1984. Although there had been intermittent heavy rains, it was not raining at the time of the accident. The roadway was wet, with standing water. At 6:50 a.m., the humidity was 87 percent, and the temperature was 78 degrees. Witnesses stated that it was dawn at the time of the accident. Civil twilight was at 6:49 a.m., and sunrise occurred at 7:12 a.m. Surface visibility was not obscured.

### **Medical and Pathological Information**

The immediate cause of death for each of the two fatally injured passengers was listed as multiple traumatic injuries. The busdriver's injuries were reported as serious, including a fractured clavicle and facial lacerations. The two passengers who fled the schoolbus before the collision were not injured. Neither of the two train crewmembers was injured.

Analysis of blood and urine samples from the busdriver was negative for alcohol and drugs. Although blood and urine samples were taken from both train crewmembers, the urine was not analyzed because the alcohol and drug screen were found to be negative from the analysis of the blood samples.

### **Survival Aspects**

The two fatally injured passengers were ejected from the schoolbus through the rear door, which was torn off during the crash, and were thrown beneath the moving train. The busdriver was ejected from the schoolbus but did not come in contact with the train or the schoolbus wreckage. The 10-year-old boy was found about 24 feet north of the roadway and 4 feet east of the track. The 12-year-old girl was found about 35 feet north of the roadway and inside the track. The busdriver was found about 47 feet north of the roadway and 22 feet east of the track.

The busdriver's seat was equipped with a lap belt. No occupant restraints were available for passengers. However, none of the three persons in the schoolbus was seated at the time of impact.

### **Tests and Research**

Test data regarding visibility, train brakes, whistle audibility testing, and operational aspects of the active warning devices at the Walton Road grade crossing were recorded. (See figure 7.) In addition to the actual train brake test conducted at the

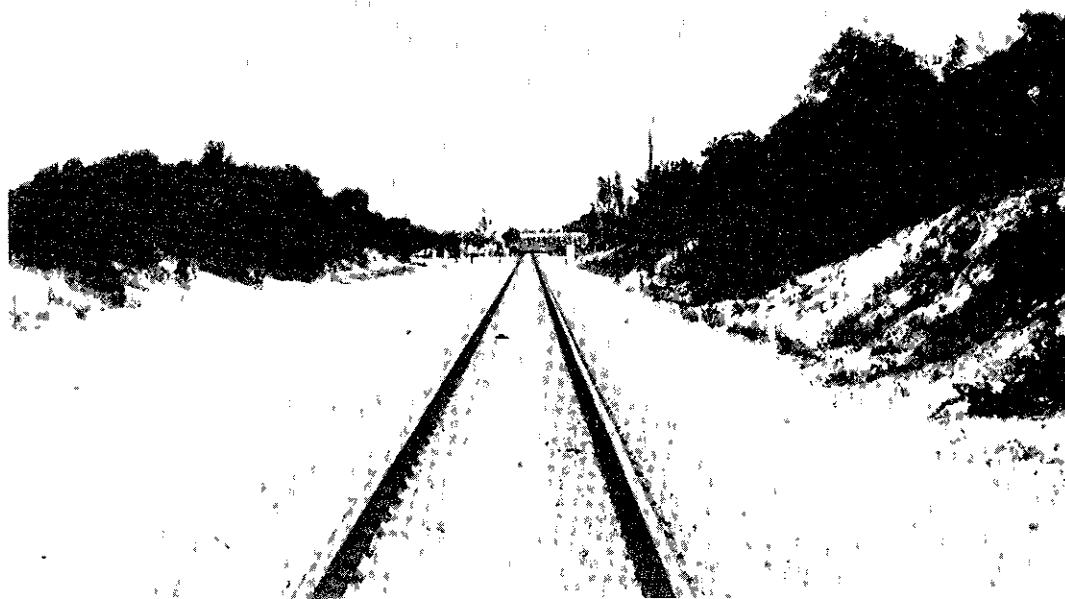
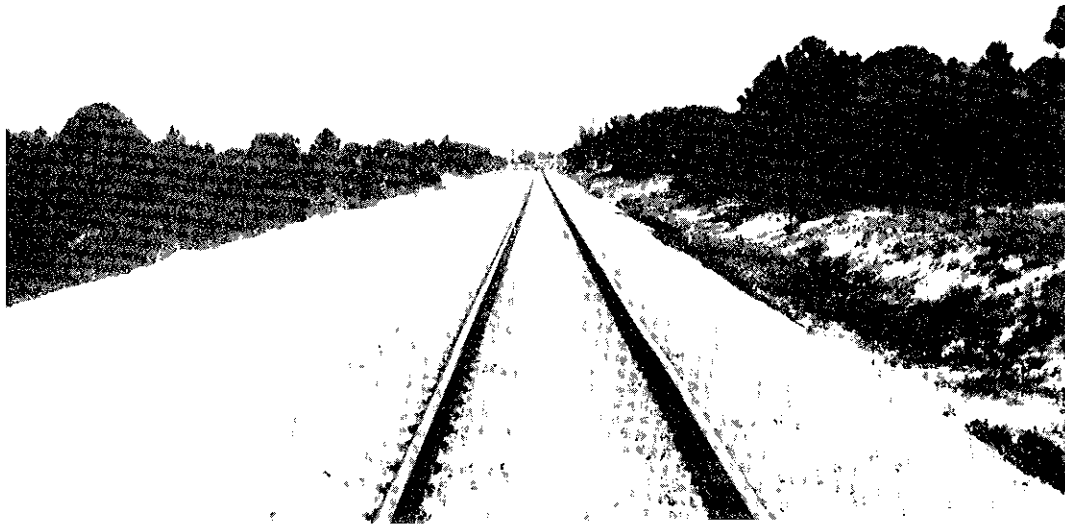


Figure 7.--Northbound approach at 1,732 feet to Walton Road crossing (above), and northbound approach at 732 feet (below).

crossing, a Train Operation Simulation (TOS) was performed. Since the traincrew reported the preaccident speed of the train as 38 miles per hour and sand deposits were found about 628 feet south of the center of the crossing, both values were used in the TOS. The total stopping distance in the TOS was recorded as 1,437 feet, a difference of only 11 feet from the actual stopping distance (1,426 feet) of the accident train. (Test details are in appendix D.)

The deadbolt lock assembly (the lock case and cutout section of the rear door containing the lock cylinder) from the rear door of the schoolbus was examined by a locksmith. (The complete report of the examination is in appendix C). Findings of the examination as excerpted from the locksmith report are listed below:

- (1) The lock took no direct impact.
- (2) The lock was fully operational prior to impact.
- (3) The locking bolt was fully extended to the locked position at the time of impact based on the following observations:
  - (a) The gouges and marks on the inside surface of the bolt were made as a result of impact.
  - (b) The locking bolt acted as a lever to tear the lock case from its mounting screws.
- (4) The locking bolt did not change position, from locked to unlocked, or unlocked to locked, when torn from its mountings.
- (5) The lock case which was mounted with three sheet metal screws would not have separated from its mountings in the unlocked position under twisting motion alone.

### Other Information

Pupil Transportation Safety in Florida.--The total number of schoolbuses transporting pupils to and from nonpublic schools in Florida is not known because the gross classification under which all buses are registered does not separately identify them. However, in Florida, FHP officials stated that during fiscal year 1983 they inspected 5,823 schoolbuses and certificated about 7,200 schoolbus drivers directly associated with nonpublic schools. Florida public school authorities report that 7,800 schoolbuses and 10,000 schoolbus drivers were involved in public school pupil transportation in 1984. These totals do not include one large public school system that uses private contractors for pupil transportation.

Responsibility for pupil transportation safety in public schools in Florida is divided between two State agencies--the Florida Department of Education (FLDOE) and the FHP through its Office of Student Transportation (OST). The FLDOE handles staff assistance to, and oversight of, district public school board pupil transportation systems. The FHP inspects each public and nonpublic schoolbus it identifies and certificates schoolbus drivers employed by public and nonpublic schools.

About 20 FHP troopers throughout the State are assigned inspection of schoolbuses as their primary duty. Vehicles meeting the prescribed standards are issued inspection certificates (stickers) to be displayed on their respective windshield. The FHP enforces the inspection law through on-the-road observation.

The certification of nonpublic schoolbus drivers requires only that it be documented that they are properly licensed, physically fit, and without a substantive traffic record.

Public schoolbus drivers are certificated by the school district in which they are employed. Requirements for certification include the above and additional relevant criteria, i.e., preemployment on-the-road testing and background checks.

Rules, regulations, and statements of policy for the transportation of public school students are promulgated by the State Board of Education, the State Superintendent of Education, and the FLDOE. (See appendix B.) District school boards are responsible to ensure that, "all transportation rules and statements of policy are in harmony with the State Board and are fully observed." A safety compliance and performance audit is conducted annually by the FLDOE of each public school district system in the interest of emphasizing concern for pupil safety and health involving their transportation to and from school.

Nonpublic schools in Florida are required only to meet schoolbus body and mechanical specifications, to make their schoolbuses available for inspection, and to ensure that their schoolbus drivers are certificated by the OST (FHP). No other State rules, regulations, or statements of policy apply by law. Safety audits are performed routinely by the FLDOE on public school pupil transportation systems, but safety audits of nonpublic school systems are not within the purview of any State agency.

Nonpublic schools in Florida manage their own pupil transportation safety programs independently while they may request staff services from the State. The FHP reports frequent requests for schoolbus driver training. Several school districts offer nonpublic schools the opportunity to include their drivers in public schoolbus driver training programs without cost; reportedly, only a few schools have participated. The manager of the St. Lucie School District's pupil transportation system annually invites nonpublic schoolbus drivers to attend the district's 3-day inservice driver training program; the Indian River Academy had never sent any of its drivers to the program. There is no evidence to demonstrate that the Indian River Academy received notice of the training program. The School Transportation Management Section of the FLDOE stated its willingness to assist any nonpublic schools upon request.

In the 1984 session of the Florida legislature, a bill was introduced to amend State statute 316.615, "to revise provisions relating to inspection of schoolbuses and physical requirements of nonpublic schoolbus drivers, to expand inspection provisions and to provide additional qualifications for such drivers . . . ." The bill did not reach the floor of the State Senate during the session. (See appendix E.)

Operation Lifesaver.--Operation Lifesaver is a nationwide, cooperative effort of many organizations, coordinated by the National Safety Council, to increase public awareness of the hazards at railroad/highway grade crossings and to develop proper driver behavioral patterns for safe crossings. Forty-four States, including Florida, participate in this coordinated program, which involves a wide range of State and local governing bodies, civic groups, safety organizations, transportation industry groups operating in the State, labor groups, public information media, and citizens. In locations where this type of program has been implemented, the results have been impressive in terms of reduced accidents, fatalities, and injuries at grade crossings.

There has been Operation Lifesaver activity in Florida for many years on a fragmented basis. However, there is no evidence that nonpublic schools had been involved in the program. In October 1984, the Florida Operation Lifesaver Council was established to serve as an umbrella entity for all the groups and individuals involved in the program.

Although program activities were ongoing and being planned, there was no evidence of educational efforts being aimed directly at nonpublic schoolbus drivers in the State. Such an effort is not uncommon. For example, the Virginia Operation Lifesaver Council has an ongoing program to identify nonpublic schools which operate schoolbuses in that State and to advise them of the availability of Operation Lifesaver presentations and materials.

## **ANALYSIS**

### **The Accident**

There was no evidence of mechanical deficiencies of the schoolbus, the train equipment, or the active warning devices that might have contributed to the accident. There was no evidence of medical or physiological conditions that might have affected the performance of the schoolbus driver or the traincrew. Weather and sight distance were not factors.

On approaching the grade crossing, the busdriver routinely stopped the westbound schoolbus short of the track in accordance with State law. A pavement stop line which had been located 18 feet from the track in accordance with MUTCD mandates had been obliterated by a recent resurfacing of the roadway. On noting the approach of the train, the busdriver concluded that the front of the schoolbus was too close to the track and responded by attempting to shift the schoolbus transmission into reverse gear. The acute angle between Walton Road and the track may have adversely influenced her perception of the distance from the front of the stopped schoolbus to the track. Neither witness testimony nor physical evidence was conclusive enough to permit determining the exact location on the roadway where the schoolbus initially stopped. However, it can be reasonably assumed that the busdriver would not have believed that the schoolbus was too close to the track if she had stopped more than 18 feet from the track.

Had the schoolbus not been required by law to stop, it would have cleared the track prior to the arrival of the train. Most States and Federal regulations require vehicles subject to their regulations, including all buses and trucks carrying hazardous materials, to stop before all railroad crossings, even those with gates and flashers that are not activated. The FHWA is currently completing a study entitled "Consequences of Mandatory Stops at Railroad-Highway Crossings." The preliminary findings of this study indicate that "trucks transporting hazardous materials, schoolbuses and passenger buses. . ." should be required to "stop at active crossings with active warning devices only when the devices are activated to warn motorists of an approaching train."

The initial effort of the driver to shift the transmission into reverse gear was unsuccessful. Instead, she engaged a forward gear of the schoolbus transmission, and the schoolbus "lurched" forward. It stopped momentarily with the front bumper near the east rail of the track. Although the driver believed that the schoolbus rolled onto the track, on-site testing with a similar schoolbus revealed that the schoolbus would not roll (out of gear) to the impact position. This fact indicates, as reported by a witness in a following vehicle, that the busdriver again engaged a forward gear and the engine moved the schoolbus onto the track. The schoolbus blocked the track, resting about 6 inches to the right of the center of the roadway with the front bumper approximately 5 feet 5 inches beyond the west rail, when the automatic gate arm came to rest on the right roofline of the schoolbus.

An analysis of time/distance factors of the train movements immediately before impact (see appendix D) shows the following:

- o The TOS-calculated speed of the train before braking was 38 miles per hour.
- o The train traveled the 2,688 feet from the Riverview grade crossing to the Walton Road grade crossing in approximately 49 seconds.
- o The engineer had a clear view of the schoolbus from the Riverview grade crossing.
- o The warning devices at the Walton Road grade crossing activated when the train was a minimum of 1,675 feet from the crossing.
- o The train was a minimum of 1,240 feet from the Walton Road grade crossing when the schoolbus obstructed the track.
- o The schoolbus was visibly blocking the track for a minimum of 11 seconds before the engineer placed the automatic brake valve handle in the emergency position.
- o The automatic brake valve handle of the train was placed in the emergency position at a track location about 628 feet from the Walton Road crossing. The train struck the schoolbus 12 seconds later, at a calculated speed of 33 miles per hour.
- o The stopping distance of the train at 38 miles per hour was 1,426 feet.

Based on witness testimony and physical evidence, the crash sequence occurred as follows:

- o The front of the locomotive struck the left side of the schoolbus approximately 8 feet rearward of the front bumper. It penetrated the schoolbus body and deformed the chassis frame.
- o The schoolbus rotated clockwise, and the body started to disengage from the chassis frame.
- o The underside of the crossing gate arm was marked by the roof of the schoolbus after the initial impact.
- o The right side of the schoolbus body struck the crossing automatic warning device mast.
- o The detached schoolbus body rotated more rapidly than the chassis as both moved clockwise away from engagement with the front of the locomotive. As it was rotating clockwise away from the right front of the locomotive, the rear of the schoolbus body struck the right side of the locomotive and the left section of the rear bumper struck the right side of the locomotive and was deformed inward.

Calculations revealed that if the automatic brake valve handle of the train had been placed in the emergency position 15 seconds earlier at a track location 1,464 feet from



the grade crossing, the train would have stopped before reaching the grade crossing. Additional time/distance calculations are as follows:

<u>Time before actual braking (seconds)</u>	<u>Distance before actual braking (feet)</u>	<u>Calculated speed at impact (mph)</u>
13	724	12
11	613	18
9	501	22
7	390	25
5	276	30
3	167	30
1	56	32
0	0	33

The Train Operation Simulation revealed that the train would have been traveling about 18 miles per hour at impact, 15 miles per hour less than the actual impact speed of 33 miles per hour, had the engineer placed the automatic brake valve handle in the emergency position when the schoolbus stopped astride the track. Although the specific effect of a lower velocity impact on any one of the events described above cannot be documented, a reduced train impact speed would have less likely resulted in the rear emergency door being separated from the schoolbus body. With less rotation of the schoolbus body and/or an impact with the side of the locomotive with the schoolbus body and rear bumper/chassis intact, it is probable that the deformation to the rear of the schoolbus body would have been less severe and the rear emergency door would not have been separated. Without the opening created by the separated door, it is less likely that the two students would have been ejected.

### Operation of the Train

The engineer had a clear view of the schoolbus when he first observed it from the Riverview grade crossing; the schoolbus was stopped short of the track at the Walton Road crossing at that time. Also, he observed the schoolbus move onto the track as the crossing gate descended, and he observed the schoolbus as it stopped astride the track. However, he did not place the automatic brake valve handle in the emergency position until more than 11 seconds later, and after the train had traveled another 612 feet closer to the Walton Road crossing. If the engineer had placed the automatic brake valve handle in the emergency position without hesitation when the schoolbus stopped astride the track, the severity of the accident probably would have been lessened.

The presence of the schoolbus, particularly when it moved forward from its initial stop and to a stopped position with its front bumper near the east rail of the track, should have prompted at least preparatory action by the engineer to slow the train. He had two options available: a service application of the brakes or immediate emergency application of the brakes. A service application of the train brakes would have conditioned the train for an emergency stop with reduced risk of derailment or other lading damage. A service application of the brakes would have slowed the train smoothly and set the brakes for an emergency application if it became necessary. It is reasonable to assume that if the engineer had handled the train in this manner, the velocity of the train at impact would have been reduced substantially.

An approach to a schoolbus on the highway by a motorist usually results in a heightened sense of a need to be prepared to stop. Although there are some adverse effects in braking a train which do not arise when braking a highway vehicle, observing a schoolbus stopped and blocking a track should result in an increased sense of readiness to stop by an engineer. Currently, there is little documented information about the effect of the many varying factors that may influence a train engineer's decisionmaking in such situations. The Safety Board believes that when an engineer sees that a schoolbus is blocking a track and possibly in jeopardy, there is no acceptable alternative to taking whatever action is necessary to stop short of collision. In this accident, the fact that the schoolbus stopped momentarily with the front bumper close to the east rail should have prepared the engineer for evasive action. When the schoolbus stopped, blocking the track, evasive action should have been executed immediately.

### Schoolbus Driver Training

The schoolbus driver had been driving the schoolbus only since September 4, 1984. She had no previous experience or training with schoolbuses or any other type of bus. The Safety Board believes that the busdriver's training in the schoolbus she was operating was inadequate. Training could have reduced or eliminated the difficulty she had experienced before the accident in shifting the transmission gears and in maintaining power in the engine. Behind-the-wheel driver training and instruction in the mechanical systems would have improved the busdriver's ability to distinguish between operator and mechanical problems. Armed with better knowledge, she might have reported operational problems more readily as they arose and probably would have sought assistance from her supervisor. Her lack of understanding as to the cause of her difficulty in operating the schoolbus may have caused her to doubt her ability. With the exception of the brief conversation with her supervisor, she sought no further assistance. She was given no inservice training, and she stated that the difficulty in operating the schoolbus continued.

The time spent by the busdriver in attempting to restart the engine of the schoolbus when it stalled on the track could have been used to evacuate passengers. The busdriver had not been instructed in evacuation procedures, and she was not conditioned to make an immediate response when such a response was essential. Rather, she expended critical seconds by remaining in the driver's seat, time which might have allowed her to evacuate all the passengers. The sight and sound of the oncoming train as it drew nearer compounded the confusion and stress being experienced by the busdriver. An awareness of an impending collision decreased her ability to make even basic judgments--judgments which would have been a matter of reflex for a person with training in evacuation procedures. The busdriver displayed courage in remaining with the schoolbus.

On May 15 1979, as a result of its investigation of an accident in Georgia in 1978, involving a schoolbus-type vehicle operated by a boys club, 1/ the Safety Board issued Safety Recommendation H-79-31 to each State:

Enact legislation to require that the driver of any motor vehicle with a seating capacity of more than 16 passengers, whether so employed or acting voluntarily, shall possess, in addition to a properly classified State drivers license, a certificate authenticating such driver's successful completion of a busdriver training course which conforms to the NHTSA Highway Safety Program Standard No. 17, "Pupil Transportation Safety."

1/ Highway Accident Report--"Overturn of a Ypsilanti, Michigan, Boys Club Bus, I-75, near Tifton, Georgia, April 11, 1978" (NTSB-HAR-79-2).

Only four States, Hawaii, Michigan, New Jersey, and Florida, have furnished the Board any indication of possible action. Hawaii has a requirement for such certification of all schoolbus drivers. Michigan and New Jersey indicated that the issue was being studied. Florida also said that it would study the issue. The Safety Board considers the 1984 proposal to amend Florida State Statute 316.615 to provide additional qualifications of nonpublic schoolbus drivers as responsive to Safety Recommendation H-79-31. Legislation introduced in the Florida legislature in 1985 would upgrade schoolbus driver training for nonpublic schoolbus drivers. The Safety Board has classified Safety Recommendation H-79-31 to Florida as "Open--Acceptable Action." The inadequate training of the schoolbus driver involved in the Port St. Lucie accident demonstrates the continued need for certification of training for all operators of vehicles that may carry many passengers, such as schoolbuses, and the Safety Board reiterates Safety Recommendation H-79-31 to Florida and each State that does not require certification.

Although the schoolbus driver in the Port St. Lucie accident was required by Florida law to possess a chauffeur license, obtaining the license did not require a road test in the size vehicle for which the license was issued. Therefore, she did not have to demonstrate an ability to drive a schoolbus. A road test in the schoolbus might have revealed her reported difficulty in operating the schoolbus transmission in reverse.

On September 24, 1984, as a result of its investigation of an activity bus accident in Texas in 1983, 2/ the Safety Board issued Safety Recommendation H-84-72 to Florida, 20 other States, and the District of Columbia:

Enact appropriate legislation to require all prospective operators of noncommercial buses to demonstrate their driving skills by taking an appropriate written examination and road test in the size vehicle for which the license is to be issued.

Six States and the District of Columbia have replied to the recommendation. Minnesota requires drivers of a vehicle of more than 24,000 pounds to pass a special written test and a driving test in the vehicle. Wisconsin requires schoolbus operators to pass a driving test in a schoolbus. Oregon replied that such a requirement would have a negative impact on volunteer drivers of activity buses. New Mexico has no regulations pertaining to bus operator training and licensing. Ohio and the District of Columbia are studying the issue. Florida replied that it does not require drivers to be tested in the class of vehicle for which they are licensed, but that a bill to implement a Classified Driver Licensing System was introduced in the Florida legislature in 1984. The bill died in committee; a similar bill has not been introduced in the 1985 Florida legislature. The Safety Board has classified Safety Recommendation H-84-72 to Florida as "Open--Acceptable Action." The circumstances of the Port St. Lucie accident demonstrate that the skill of operators of noncommercial buses, such as schoolbuses, should be tested through written examinations geared to the vehicle to be operated and particularly through a road test in an appropriate size vehicle. The Safety Board reiterates Safety Recommendation H-84-72 to Florida and each State that does not have these requirements.

In its report of a schoolbus accident in Miami, Florida, on September 28, 1983, 3/ the Safety Board stated:

2/ Highway Accident Report--"Activity Bus/Tractor-Cargo Tank Semitrailer Collision on State Route 61, near Devers, Texas, December 23, 1983" (NTSB/HAR-84/06).

3/ Highway Accident Report--"Schoolbus Loss of Control Accidents in Miami, Florida, September 28, 1983, and Birmingham, Alabama, April 12, 1984" (NTSB/HAR-85/03).

The Safety Board believes that drivers of privately-owned schoolbuses should be required to be familiar with their vehicles and that they should be as knowledgeable about State and local schoolbus regulations as public schoolbus drivers are required to be. As with vehicle inspection programs, few private bus operations receive financial incentives or have the resources to develop and maintain a driver training program. The training programs for public schoolbus drivers in Florida . . . are open to drivers of privately-owned schoolbuses. However, more needs to be done to encourage statewide participation in the programs by private schoolbus drivers.

As a result of its investigation, the Safety Board issued Safety Recommendation H-85-12 on June 4, 1985, recommending that all States and the District of Columbia:

Develop a model instructional program to be used by local school districts targeted at drivers of privately-owned and privately-operated pupil transportation vehicles that includes a review of all applicable laws, regulations, and policies governing pupil transportation safety, first-aid, and pretrip inspections, and encourage drivers of privately-owned and privately-operated pupil transportation vehicles to participate in the program.

Because of the recency of the recommendation, the Safety Board has not yet received replies from the States.

### **Nonpublic School Pupil Transportation**

A successful and concomitantly a safe pupil transportation system is dependent upon a comprehensive program to exact a high standard of performance from persons within the system--the government agencies, administrators, safety professionals, vehicle maintenance and service personnel, teachers, passengers, parents, the public, and ultimately the schoolbus drivers. Traditionally, States have accepted responsibility for such programs in public schools and have taken the lead in their development and maintenance. That responsibility and leadership, however, has not been extended uniformly to the transportation of pupils by nonpublic schools. In addressing the issue, a 1982 National Highway Traffic Safety Administration technical report stated, ". . . in a number of States, private and parochial schoolbuses are operated under regulations emanating from several State agencies. Problem identification and countermeasure application are compartmentalized and invariably programs are not rigorously evaluated." <sup>4/</sup>

The Safety Board believes that those pupils being transported by schoolbuses to and from nonpublic schools are no less entitled to safe transportation than are those on public schoolbuses. Therefore, the same measure of safety currently mandated for public schools by State regulations and administered by professionals in the State Departments of Education and other State agencies should be extended to nonpublic schools. The bill introduced in the 1984 Florida legislature would have expanded schoolbus inspection requirements and established minimum qualifications for nonpublic schoolbus drivers more rigorous than the minimum requirements now in effect. Enactment of such legislation would be a significant move toward bringing pupils being transported to nonpublic schools under the safety umbrella afforded those being transported to public schools.

<sup>4/</sup> "Effectiveness and Efficiencies in Pupil Transportation Safety," National Highway Traffic Safety Administration, DOT HS-806-134, March 1982.

## Survival Aspects

The deadbolt lock was installed on the rear emergency door of the schoolbus for security reasons. It was placed in a location that permitted it to be easily unlocked from the outside. From inside the schoolbus, the lock could be reached only by a person in a seated or crouched position near the rear door. The lock could be seen only when sitting in the right rear seat or when standing facing the rear door and looking directly down at the lock. Not only was the lock essentially hidden from unaware passengers, there was no placard or other warning visible to advise of its presence and manner of operation.

It could not be determined if the students who tried to escape through the rear emergency door knew of the existence of the deadbolt lock. The evidence suggests that they were not aware of the deadbolt lock until after they attempted unsuccessfully to open the emergency door with the handle installed by the body manufacturer. The two passengers were observed at the door for a length of time that would have been adequate to open the handle, unlock the deadbolt lock, open the door, and exit the schoolbus safely before the collision. Since the emergency door handle was found in the open position after the door was separated from the schoolbus body, it is probable that the two passengers opened the door handle before the collision. The locksmith's examination confirmed that the deadbolt lock was engaged (locked) when the rear door was struck by the locomotive. If the Indian River Academy had provided busdrivers and passengers in its schoolbuses with some minimal instruction in evacuation techniques, all of the schoolbus occupants might have been aware of the deadbolt lock and its operation.

A specific prohibition on deadbolts or similar locks on rear emergency doors of schoolbuses could not be documented in either Florida law or Federal standards. There is no evidence to indicate that the Florida Office of Student Transportation's stated intent to prohibit such locks, or to regulate their use, was communicated to the FHP troopers responsible for the inspection of schoolbuses. Specifically, the trooper who last inspected the accident schoolbus in October 1983 stated that he did not observe a deadbolt lock on the rear emergency door, and that if he had he would not have considered the lock as a rejection item on inspection. Neither the Florida Schoolbus Inspection Manual nor the accompanying inspection form mentioned such locks as an item for inspection.

The Safety Board surveyed directors of pupil transportation in all States and the District of Columbia regarding their policies on the installation of supplemental locks on schoolbus emergency exits. (See appendix F.) The survey found that 11 States have no regulation on supplemental emergency exit door locks, that 11 States plus the District of Columbia prohibit any such installation, and that the other 28 States allow the installation of these supplemental locks, but impose restrictions on their installation or use. Fifteen of these 28 States require a mechanical device, such as an ignition interlock or audiovisual alarm to minimize the possibility that the schoolbus will be operated with the emergency exits locked. Thirteen of the 28 States do not have restrictions on the type of supplemental lock or latch or on its installation, but do require the device to be in the open or unlocked position whenever the schoolbus is in operation.

The survey also revealed that of the 39 States plus the District of Columbia that prohibit installation of such locks or place limitations on their installation or use, only 23 States apply these regulations to schoolbuses operated by private schools. Thus, in 16 States plus the District of Columbia, students riding in nonpublic schoolbuses are not provided the regulatory protection against emergency exit doors being locked that is provided to students riding in public schoolbuses.

The installation or use of supplemental locks on emergency exits of schoolbuses, as the accident at Port St. Lucie demonstrated, can result in tragic consequences. The best measure for preventing a repeat of the Port St. Lucie tragedy would be to prohibit the installation of supplemental locks on emergency exits. However, the Board recognizes that many schools and school districts are confronted with problems such as vandalism and theft which might necessitate the use of a security lock. The use of these locks can be made considerably safer by requiring that all supplemental security locks installed on schoolbus exits be equipped with an ignition interlock system or an audiovisual alarm located in the driver's compartment. At an absolute minimum, States should require that any security lock system be kept open whenever a schoolbus is in operation.

The accident impact caused the schoolbus body to separate from the chassis frame at the body mounts. As in two earlier investigations of schoolbus accidents involving body separation from the chassis, 5/ the Safety Board concludes that the energy expended in forcing the schoolbus body from the chassis mounts and off the chassis served to dissipate crash energy which otherwise would have been absorbed by the schoolbus body and would have reduced the occupant's survivable space. This circumstance might have been a factor in the survival of the busdriver and might have been a factor in the survival of the students if they had not been ejected through the rear door.

### Operation Lifesaver

To achieve a high level of safety at railroad/highway grade crossings, all school transportation officials and drivers must be educated about the hazards commonly found at grade crossings and methods available to deal safely with these hazards. Nonpublic schools must be identified and brought into the mainstream of the safety community. The Safety Board believes that State Operation Lifesaver Councils, with their broad-based memberships and constituencies, can best accomplish this task.

## CONCLUSIONS

### Findings

1. Weather, visibility, and sight distance were not factors in this accident.
2. No evidence of mechanical defects which would have contributed to the accident was found in the schoolbus, train equipment, or active warning devices.
3. The schoolbus driver had no experience or training as a schoolbus driver or in any other bus-type vehicle before her employment with the Indian River Academy. None was required by the school or by the laws of the State of Florida.
4. At the time of the accident, the schoolbus driver was not certificated to drive a nonpublic schoolbus as required by Florida law.

5/ Highway Accident Reports--"Collision of G&D Auto Sales, Inc. Towtruck Towing Automobile, Branch Motor Express Company Tractor-Semitrailer, Town of Rehoboth Schoolbus, Rehoboth, Massachusetts, January 10, 1984" (NTSB/HAR-84/05); "Collision of Isle of Wight County, Virginia, Schoolbus with Chesapeake and Ohio Railway Company Freight Train, State Route 615, Near Carrsville, Virginia, April 12, 1984" (NTSB/HAR-85/02).

5. Since Florida does not require a road test, the schoolbus driver obtained a Florida chauffeur license by written examination only.
6. The driver initially stopped the schoolbus at the Walton Road crossing as required by Florida law.
7. Had the schoolbus not been required by law to stop at the railroad crossing, it would have cleared the track before the train entered the crossing.
8. A private contractor had paved over the stop line on the east side of the crossing, and it had not been repainted.
9. The schoolbus driver believed that her original stop position was too close to the track, and she attempted to move the schoolbus backwards.
10. The busdriver unintentionally engaged a forward gear in the transmission, and the schoolbus moved from the initial stop to a second stop by engine momentum.
11. The schoolbus did not roll to the impact position while out of gear.
12. The crossing gate arm activated normally at the approach of this train and came to rest on the right side roofline of the schoolbus 23 seconds before the collision.
13. There was ample time before the collision for all occupants to have evacuated the stopped schoolbus.
14. The two fatally injured passengers were at the rear emergency door long enough to have escaped from the schoolbus before the collision had the door not been locked by a deadbolt lock.
15. The train impact speed would have been a maximum of 18 miles per hour rather than 33 miles per hour if an emergency application of the train brakes had been made 11 seconds earlier when the engineer should have seen that the schoolbus was on the track.
16. An impact speed of 18 miles per hour would have reduced significantly the severity of the accident crossing.
17. The separation of the schoolbus body from the frame increased the severity of the injuries.

### Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the inadequate standards for certifying nonpublic schoolbus driver insufficient training and testing programs, and the limited experience of the schoolbus driver, which led to the intrusion of the schoolbus onto the railroad track when the driver misshifted the transmission. Contributing to the accident was the absence of a stop line on the westbound approach to the grade crossing. Contributing to the severity of the accident was the engineer's delay in applying the train brakes and the locked deadbolt of the rear emergency door of the schoolbus.

## RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendations:

--to the Florida East Coast Railway Company:

Use the results of the investigation of the accident in Port St. Lucie, Florida, on September 27, 1984, as a part of the railroad/highway grade crossing safety training given to enginecrews. (Class II, Priority Action) (R-85-74)

--to the National Safety Council:

Encourage Operation Lifesaver Councils in each State to identify nonpublic schools which transport students to and from schools, and include these schools in their programs. (Class II, Priority Action) (H-85-16)

--to the States of Arkansas, Colorado, Idaho, Kentucky, Louisiana, New Hampshire, New Mexico, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Washington, Wisconsin, and the District of Columbia:

Prohibit the operation of nonpublic schoolbuses while deadbolt or similar supplemental locks on emergency doors are engaged. (Class II, Priority Action) (H-85-17)

--to the States of Alabama, Alaska, Arizona, California, Florida, Georgia, Mississippi, Nebraska, South Dakota, West Virginia, and Wyoming:

Prohibit the operation of public and nonpublic schoolbuses while deadbolt or similar supplemental locks on emergency doors are engaged. (Class II, Priority Action) (H-85-18)

In addition to these recommendations, the Safety Board reiterates the following Safety Recommendations issued to the State of Florida and other States:

### H-79-31

Enact legislation to require that the driver of any motor vehicle with a seating capacity of more than 16 passengers, whether so employed or acting voluntarily, shall possess, in addition to a properly classified State drivers license, a certificate authenticating such driver's successful completion of a busdriver training course which conforms to the NHTSA Highway Safety Program Standard No. 17, "Pupil Transportation Safety." (Issued May 15, 1979)

### H-84-72

Enact appropriate legislation to require all prospective operators of noncommercial buses to demonstrate their driving skills by taking an appropriate written examination and road test in the size vehicle for which the license is to be issued. (Issued September 24, 1984)



H-85-12

Develop a model instructional program to be used by local school districts targeted at drivers of privately-owned and privately-operated pupil transportation vehicles that includes a review of all applicable laws, regulations, and policies governing pupil transportation safety, first-aid, and pretrip inspections, and encourage drivers of privately-owned and privately-operated pupil transportation vehicles to participate in the program. (Issued June 4, 1985)

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ G. H. PATRICK BURSLEY  
Member

June 12, 1985

**APPENDIXES**  
**APPENDIX A**  
**INVESTIGATION**

**Investigation**

The National Transportation Safety Board was notified of this accident at 8 a.m., on September 27, 1984, by the Florida Highway Patrol. Investigators were dispatched from the Board's Atlanta Field Office and Washington, D.C., Headquarters. Parties to the investigation were the Florida Highway Patrol, the Florida East Coast Railway Company, the Indian River Academy, and the Federal Railroad Administration.

**APPENDIX B**  
**EXCERPTS FROM**  
**APPLICABLE LAWS, RULES, REGULATIONS AND STANDARDS**

**Florida Statutes**

**316.159 Certain vehicles to stop at all railroad grade crossings.—**

(1) The driver of any motor vehicle carrying passengers for hire, excluding taxicabs, of any school bus carrying any school child, or of any vehicle carrying explosive substances or flammable liquids as a cargo or part of a cargo, before crossing at grade any track or tracks of a railroad, shall stop such vehicle within 50 feet but not less than 15 feet from the nearest rail of the railroad and, while so stopped, shall listen and look in both directions along the track for any approaching train, and for signals indicating the approach of a train, except as hereinafter provided, and shall not proceed until he can do so safely. After stopping as required herein and upon proceeding when it is safe to do so, the driver of any such vehicle shall cross only in a gear of the vehicle so that there will be no necessity for changing gears while traversing the crossing, and the driver shall not shift gears while crossing the track or tracks.

(2) No stop need be made at any such crossing where a police officer, a traffic control signal, or a sign directs traffic to proceed. However, any school bus carrying any school child shall be required to stop unless directed to proceed by a police officer.

*History.—s. 1, ch. 71-135; s. 1, ch. 78 52.*

234.02 Safety and health of pupils  
Maximum regard for safety and adequate protection of health shall be primary requirements which shall be observed by school boards in routing buses, appointing drivers, and providing operating equipment in accordance with all requirements of law and regulations of the state board.

**316.615 Inspection of school buses; physical requirements of drivers.—**

(1)(a) All motor vehicles, other than private passenger automobiles and school buses with a seating capacity of less than 24 pupils, which are used primarily for the transportation of pupils to school, but which are not operated by or under the purview of the state or a political subdivision thereof or under a franchise issued by a municipality or the Public Service Commission, shall comply with the requirements for school buses of chapter 234.

(b) For the purposes of this section the term "school" includes all public and private nursery, pre-elementary, elementary, secondary, and college level schools.

(2)(a) Every bus with a seating capacity of less than 24 pupils shall be equipped with the following:

1. Nonleaking exhaust system;
2. First-aid kit;
3. Fire extinguisher;
4. Unbroken safety glass on all windows;
5. Inside rear view mirror capable of giving the driver a clear view of motor vehicles approaching from the rear; and
6. Seats securely anchored.

(b) Such vehicles shall be covered by liability insurance to protect pupils being transported.

(c) Such vehicles shall transport no more passengers than they are equipped to seat.

(3)(a) No person shall operate or cause to be operated a motor vehicle covered by subsection (1) unless the operator has met the physical examination requirements established by law and by rule adopted by the State Board of Education.

(b) Every school bus driver shall pass an annual physical examination and have posted in the bus a certificate to drive same.

(4) All school buses and all motor vehicles covered by subsection (1) shall be inspected annually by the department and, when found satisfactory for safe operation, shall display on the vehicle a current certificate of inspection.

(5) The department shall promulgate such rules and regulations as are necessary to effect the purposes of this section.

*History.—s. 1, ch. 71-135; s. 1 ch. 76-31; s. 20, ch. 83-215*

*Note.—Former s. 316 288.*

*cf.—s. 234 091 School bus driver; qualifications.*

Florida Highway Patrol Schoolbus Inspection Manual

EMERGENCY DOOR

EMERGENCY DOOR

1. EMERGENCY DOOR ON ALL CONVENTIONAL AND FORWARD CONTROL BUSES SHALL BE LOCATED AT CENTER OF REAR OF BUS AND HAVE MINIMUM HORIZONTAL OPENING OF 24 INCHES AND VERTICAL OPENING OF 48 INCHES. EMERGENCY DOOR SHALL BE HINGED ON RIGHT-HAND SIDE USING HINGE(S) WITH A BRASS OR RUST RESISTANT ROD. DOOR STOP SHALL PERMIT DOOR TO OPEN AT LEAST 150° BUT SHALL PROTECT BODY LIGHTS FROM DAMAGE BY THE OPENED DOOR. INSIDE OF DOOR HEADER SHALL BE PADDED WITH ENERGY ABSORBING MATERIAL A MINIMUM OF THREE (3) INCHES WIDE.
2. THE EMERGENCY DOOR SHALL BE SO DESIGNED TO BE OPENED FROM INSIDE AND OUTSIDE OF BUS AND SHALL HAVE A FASTENING DEVICE WHICH MAY BE QUICKLY RELEASED BUT DESIGNED FOR PROTECTION AGAINST ACCIDENTAL RELEASE. CONTROL FROM DRIVER'S SEAT SHALL NOT BE PERMITTED. OUTSIDE CONTROL SHALL CONSIST OF NONDETACHABLE OPENING DEVICE DESIGNED TO PREVENT HITCHING TO BUT TO PERMIT OPENING WHEN NECESSARY.

EMERGENCY DOOR SHALL BE EQUIPPED WITH SLIDE BAR, CAM-OPERATED LOCK, HAVING A MINIMUM STROKE OF ONE (1) INCH. EMERGENCY DOOR LOCK SHALL BE EQUIPPED WITH SUITABLE ELECTRIC PLUNGER TYPE SWITCH CONNECTED WITH BUZZERS AS REQUIRED BY FEDERAL STANDARDS. SWITCH SHALL BE CONCEALED IN BUS BODY. SWITCH SHALL BE SO INSTALLED THAT PLUNGER CONTACTS FARTHEST EDGE OF SLIDE BAR IN SUCH A MANNER THAT ANY MOVEMENT OF SLIDE BAR WILL IMMEDIATELY CLOSE CIRCUIT SWITCH AND ACTIVATE BUZZER.

DOOR LOCK SHALL BE EQUIPPED WITH INTERIOR HANDLE THAT EXTENDS APPROXIMATELY TO CENTER OF EMERGENCY DOOR. IT SHALL LIFT UP TO RELEASE LOCK.

EMERGENCY DOOR CONTROLS, LABELING AND WARNING DEVICE SHALL MEET REQUIREMENTS OF F.M.V.S.S. 217.

EXIT DOOREXIT SYSTEMS      INSPECT FOR

1. SERVICE DOOR MUST HAVE EASY RELEASE, CONTROLLED BY THE DRIVER, BUT SHOULD NOT PERMIT ACCIDENTAL OPENING. PANELS MUST HAVE APPROVED SAFETY GLASS AND VERTICAL EDGES SHALL HAVE FLEXIBLE MATERIAL TO PROTECT CHILDREN'S FINGERS.
2. EMERGENCY DOOR SHOULD BE FREE OF OBSTRUCTIONS AND CAN BE EASILY OPENED INSIDE AND OUT. THE INSIDE HANDLE SHOULD HAVE A PROTECTIVE COVER TO PREVENT ACCIDENTAL RELEASE.
3. ALL BUSES PURCHASED AFTER JANUARY 1, 1967, MUST HAVE A WARNING BUZZER IN OPERATION ON THE EMERGENCY DOOR OR WINDOW.
4. ALL EMERGENCY DOORS AND WINDOWS MUST HAVE THE WORDS "EMERGENCY DOOR", "EMERGENCY EXIT", OR "EMERGENCY WINDOW" ON THE INSIDE AND OUTSIDE OF THE VEHICLE AT LEAST 2" ABOVE THE WINDOW OR DOOR. THE INSIDE RELEASE SHOULD HAVE CLEAR CONCISE OPERATING INSTRUCTIONS. EMERGENCY DOOR OR WINDOW SIGNS MAY BE PLACED AT THE TOP OF THE EMERGENCY WINDOW OR DOOR.

Florida School Bus Specifications

EMERGENCY DOOR

1. Emergency door on all conventional and forward control buses shall be located at center of rear of bus and have minimum horizontal opening of 24 inches and vertical opening of 48 inches. Emergency door shall be hinged on right-hand side using hinge(s) with a brass or rust resistant rod. Door stop shall permit door to open at least 150 degrees but shall protect body lights from damage by the opened door. Inside of door header shall be padded with energy absorbing material a minimum of three (3) inches wide.
2. The emergency door shall be designed to be opened from inside and outside of bus and shall have a fastening device which may be quickly released but designed for protection against accidental release. Control from driver's seat shall not be permitted. Outside control shall consist of nondetachable opening device designed to prevent hitching to but to permit opening when necessary.

Emergency door shall be equipped with slide bar, cam-operated lock, having a minimum stroke of one (1) inch. Emergency door lock shall be equipped with suitable electric plunger type switch connected with buzzers as required by Federal Standards. Switch shall be enclosed in metal case, and wires leading from switch shall be concealed in bus body. Switch shall be so installed that plunger contacts farthest edge of slide bar in such a manner that any movement of slide bar will immediately close circuit switch and activate buzzer.

Door lock shall be equipped with interior handle that extends approximately to center of emergency door. It shall lift up to release lock.

Emergency door controls, labeling and warning device shall meet requirements of F.M.V.S.S. 217.

**Federal Highway Safety Program Standard No. 17****"Pupil Transportation Safety."**

- (1) Scope. This standard establishes minimum requirements for a State highway safety program for pupil transportation safety including the identification, operation, and maintenance of school buses; training of personnel; and administration.
- (2) Requirements. Each State, in cooperation with its school districts and its political subdivisions, shall have a comprehensive pupil transportation safety program to assure that school vehicles are operated and maintained so as to achieve the highest possible level of safety.
- (3) Administration
  1. There shall be a single State agency having primary administrative responsibility for pupil transportation, and employing at least one full-time professional to carry out its responsibilities for pupil transportation.
  2. The responsible State agency shall develop an operating system for collecting and reporting information needed to improve the safety of school vehicle operation, in accordance with Safety Program Standard No. 10, "Traffic Records."

**Motor Vehicle Safety Standard No. 217**

§5.2.3.2 The engine starting system of a school bus shall not operate if any emergency door is locked from either inside or outside the bus. For purposes of this requirement, "locked" means that the release mechanism cannot be activated by a person at the door without a special device such as a key or special information such as a combination.

**Vehicle Equipment Safety Commission (Regulation VESC-6\*****8 Emergency Exit**

- 8.5 In the event that door locks are used on the emergency or service doors, an audio-visual alarm shall indicate to the driver when any door is in the locked position.

**15 Mounting**

- 15.1 The chassis frame, bus body on chassis type buses shall extend to the rear edge of the rear body cross member. The body shall be attached to the chassis frame in such a manner as to minimize shifting of the body from the chassis under severe impact. Alternation in the length of the frame may be made only behind the rear hangers of the rear springs and/or forward of the front hangers of the front springs and shall not be for the purpose of extending the wheel base. Said alterations may be made only if designed and guaranteed either by the original chassis manufacturer or by the company installing the school bus body.
- 15.2 For body on chassis type buses, insulating material used at body to frame contact points shall be so attached that it will remain in position under any anticipated maintenance or bus operating conditions.

\*Although voluntary standards remain, the VESC no longer exists.

Federal Railroad Administration Regulation

§ 229.117 Speed indicators.

(a) After December 31, 1980, each locomotive used as a controlling locomotive at speeds in excess of 20 miles per hour shall be equipped with a speed indicator which is—

(1) Accurate within ±3 miles per hour of actual speed at speeds of 10 to 30 miles per hour and accurate within ±5 miles per hour at speeds above 30 miles per hour, and

(2) Clearly readable from the engineer's normal position under all light conditions.

(b) Each speed indicator required shall be tested as soon as possible after departure by means of speed test sections or equivalent procedures

Florida East Coast Railway Company Operating Rule

14 ENGINE WHISTLE SIGNALS

Note — the signals prescribed are illustrated by "o" for short sounds; "—" for longer sounds. The sound of the whistle should be distinct, with intensity and duration proportionate to the distance signal is to be conveyed.

SOUND	INDICATION
(1) — — o —	Approaching public crossings at grade The signal to be repeated or the last sound prolonged until crossing is passed.

31 The whistle must be sounded where required by rule or law.

1016 They must sound whistle signals accurately and in accordance with the rules

108 In case of doubt or uncertainty the safe course must be taken.

Railroad Highway Grade Crossing Handbook

Stop line should be placed 8 feet from gate, if present.



**APPENDIX C**  
**SCHOOLBUS DATA**

**Schoolbus Specifications**

The schoolbus was a 66-passenger-capacity, Bluebird body mounted on a 1968 Chevrolet two-axle chassis. It was equipped with:

- Engine:** 350-CID V-8 gasoline engine; serial number V0123TJC. The rebuilt engine, including spark plugs and spark plug wires, had been installed in June 1984. Records indicated that the schoolbus had been driven 1,571 miles since the rebuilt engine was installed.
- Carburetor:** Rochester two-barrel; serial number 7029124-0216-1. The source of the carburetor is unknown; however, it was rebuilt and installed on the engine. A new choke control also was installed.
- Brakes:** Vacuum over hydraulic power with two storage tanks. New front and rear brakeshoes had been installed on May 30, 1984. Records indicated that the schoolbus had been driven 1,571 miles since the brake linings were installed.
- Transmission:** Manual 5-speed Chevrolet.
- Steering:** Manually operated.
- Chassis:** Two-axle truck-type with overall length of 34.4 feet and wheel base of 21.1 feet.
- Body:** The schoolbus body had been attached to the chassis frame by clips which clamped the underside of the body to the upper flange of the frame rail, a type of construction still found on schoolbuses buses of current manufacture. The body had 22 passenger seats, each of which measured 38 inches wide. The aisle width was 13 inches. There was an 8-inch gap between the rearmost seatbacks and the inside rear wall of the schoolbus. The rear emergency door was 32 inches wide and hinged on the right side. It had a customary factory-installed latch with an interior handle. There was an instruction label for operation of the door on the inside wall of the schoolbus as required. A Yale #2 Rim Deadlock (deadbolt) lock installed with the key location outside and the handle inside had been installed on the door 3 1/2 inches from the bottom. No operating instructions for the lock could be found. The lock was not readily visible from inside the schoolbus, and there was no placard pointing out its presence.

### Locksmith Report

The Yale #2 Rim Deadlock (deadbolt) lock case showed no apparent damage that would keep it from working properly. The lock was operational and worked smoothly when it was tested on October 9, 1984, by a locksmith.

The Rim cylinder showed no damage from impact and worked freely when tested. The tail piece showed some distortion and had some corrosion on it. The distortion was not the result of impact, but a sign that the lock either turned hard or was not aligned properly with the Rim cylinder or that the locking mechanism was not out of sequence with the lock cylinder.

The back plate of the Rim cylinder showed some distortion from the bends on the door panel section and the mounting screw holes which had been pulled out approximately 1/8 inch indicating that the lock case was separated from its mounting by impact. The lock was mounted with three #8 sheet metal screws approximately 1 1/4 to 1 1/2 inches long.

The locking mechanism was in working condition and had no broken or missing parts. The locking bolt showed a gouge on the inside surface from about 3/4 inch from the end of the bolt running to the tip of the bolt. Also, there were two marks at about 3/4 inch from the tip of the bolt. The marks were in line and were about where the locking bolt would contact the strike box or plate when extended to the locked position. There were few wear marks on the locking bolt indicating that the lock bolt was not in contact with the strike box under normal conditions (before impact) and was working freely.

The lock has an arrow indicator stamped into the lock back plate and a notch in the tail piece cam to set properly the lock in sequence. The arrow and notch must be in alignment for the lock to work properly, allowing the lock cylinder to revolve completely so the key will come out in the locked and unlocked position. When these two timing marks are not in alignment, the lock will not work properly. The key cannot be removed in the fully unlocked position, and the lock will not open properly or at all from the inside. If the lock were installed in this condition, the bolt would be extended partly when the key is removed and the inside handle would be in a midway position. The bolt then would not be in the locked or unlocked position and could move freely on impact.

The lock was designed to deadlock, that is, go to the locked position and hold under any pressure on the lock or bolt. The bolt is connected to a cam arm which forms a blocking device when locked or unlocked and will not free-float once into the position.

## APPENDIX D

### TESTS AND RESEARCH

#### Train Stopping Distance

A few hours following the accident, Extra 412 North was backed south to Rio, about 4 miles south of the crossing. The engineer accelerated the train north in an effort to reach a speed of 38 miles per hour. Since the speed indicator had been damaged in the accident, the attained speed was estimated by time and milepost comparisons as 32 miles per hour. Due to the ascending grade, the train was traveling at the estimated 32 miles per hour on the approach to Walton Road when the brakes were placed in emergency. It was determined from sand deposits that the brakes were applied about 628 feet from the center of the crossing; total stopping distance from a speed of 32 miles per hour was measured at 1,264 feet.

#### Inspection of Train Brakes and Whistle

A posterash test of the brakes of the locomotive and all the cars of Extra 412 North was conducted. It was determined that 100 percent of the brakes were operative and the piston travel was within Federal standards. The locomotive whistle was tested, and it exceeded Federal standards.

#### Schoolbus Location at Time of the Accident

The right side roofline of a sister schoolbus was marked similarly to the damage found on the right side roofline of the accident schoolbus 18 feet 9 inches from the front bumper. The automatic gate arm in the northeast quadrant of the intersection was marked to correspond to the chrome yellow paint transfers and scrape found on the gate arm installed at the time of the accident. The schoolbus was positioned in the westbound traffic lane of Walton Road, maneuvered perpendicular and parallel to a partially descended gate arm. When the schoolbus was positioned so that the outboard mark on the gate arm corresponded to the upper edge of the marked area on the schoolbus, the schoolbus was positioned 6 inches to the right (north) and parallel to the center of Walton Road with the front bumper 8 feet 2 inches west of the center of the intersection.

#### Visibility

A sister schoolbus was positioned on Walton Road heading west. At selected distances on the westbound approach, photographs were taken of the driver's view from the schoolbus to the south along the track. At selected distances along the track approaching the Walton Road crossing from the south, photographs were taken of the sister schoolbus positioned heading west 6 inches to the right (north) and parallel to the center of Walton Road with the front bumper 8 feet 2 inches west of the center of the crossing.

**Schoolbus at the Crossing**

A test was conducted with a sister schoolbus to determine the time required to roll (with a dead engine and transmission in neutral) from a selected distance westward on Walton Road to the position of the accident schoolbus at impact.

<u>Distance</u> <u>(feet)</u>	<u>Time</u> <u>(seconds)</u>
90	16
60	16.8
50	16.9
40	17.5
30	19.5
20	(schoolbus did not roll to impact position.)
10	(schoolbus did not roll to impact position.)

**Movement of Schoolbus with Starter**

A sister schoolbus was positioned in the westbound Walton Road approach to the crossing with the coil wire disconnected. The starter was engaged with the transmission in low gear. The schoolbus moved forward very slowly, too slow for this type of movement to be a factor in this accident.

**Operational Aspects of the Grade Crossing Active Warning Devices**

- (1) An FEC freight train was operated north at 38 miles per hour through the accident area on the day following the accident. The warning devices activated at Walton Road when the train reached a point 1,651 feet from the crossing; the bell and lights were on 30 seconds before the train reached the crossing, and the gate arms were in the horizontal position 23 seconds before the train reached the crossing.
- (2) The active warning devices located at Walton Road were tested for time. The devices were activated by a railroad signal department employee. Three tests were conducted. The times below are averages:
  - (a) Bell to gate movement downward -- 3.13 seconds.
  - (b) Bell to gate angle on schoolbus (33 degrees to ground) -- 7.23 seconds.
  - (c) Bell to gate down (rest position) -- 9.56 seconds.
- (3) A second FEC freight train was operated at 38 miles per hour through the Walton Road crossing a couple of weeks following the accident, with the following results:
  - (a) Bell to gate in horizontal position --9.8 seconds.
  - (b) Bell to train at intersection --31 seconds.

### **Train Operation Simulation**

The Federal Railroad Administration (FRA) conducted a computer simulation using the Train Operation Simulation (TOS). The TOS is a computer program developed by the Association of American Railroads to simulate the operation of a freight train on a track structure over varying terrain. The computer program accepts as input track grade and curve characteristics, consist data including locomotive and car characteristics, and a series of operating commands following the actions that a locomotive engineer performed in handling a train at an accident or incident (usually a derailment). TOS-calculated performance parameters included speed, stopping distances, elapsed time and distance, drawbar forces generated between all vehicles of a train and quasi-static L/V ratios at each vehicle. The L/V ratios are a measure of the lateral force being imparted to the track structure and are direct indicators of possible wheel climb, wheel lift, or rail rollover.

Relevant track geometry data obtained in January 1983 by the FRA in an automated track inspection vehicle operation conducted were utilized. Parameters of car data were obtained from the Universal Machine Language Equipment Register (UMLER). The Florida East Coast Railway Company supplied the train consist and tonnage. The train was operated in the simulation according to the scenario supplied by the engineer in postaccident interviews.

APPENDIX E  
PROPOSED 1984 FLORIDA LEGISLATION

Florida Senate - 1984

By Senator Jenne-

1                                   A bill to be entitled  
2                   An act relating to transportation of school  
3                   children; amending s. 234.02, F.S., relating to  
4                   safety and health of pupils, to provide for  
5                   adoption by the State Board of Education of a  
6                   state plan providing for examination,  
7                   maintenance, and repair of transportation  
8                   equipment used in connection with the public  
9                   school system; amending s. 234 051, F.S.,  
10                  relating to public school buses, to redefine  
11                  the term "school bus" and to modify standards  
12                  for leased vehicles; amending s. 234 091, F.S.,  
13                  relating to general qualifications of public  
14                  school bus drivers, to clarify such provisions  
15                  and provide age and training requirements;  
16                  amending s 316.003, F.S., redefining the term  
17                  "school bus" for purposes of the Florida  
18                  Uniform Traffic Control Law; amending s.  
19                  316 615, F.S., revising provisions relating to  
20                  inspection of school buses and physical  
21                  requirements of nonpublic school bus drivers to  
22                  expand inspection provisions and to provide  
23                  additional qualifications for such drivers;  
24                  providing an effective date.  
25  
26   Be It Enacted by the Legislature of the State of Florida:  
27  
28                  Section 1. Subsection (1) of section 234.02, Florida  
29   Statutes, is amended to read:  
30                  234 02   Safety and health of pupils.--Maximum regard  
31   for safety and adequate protection of health shall be primary

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1 requirements which shall be observed by school boards in  
 2 routing buses, appointing drivers, and providing and operating  
 3 equipment, in accordance with all requirements of law and  
 4 regulations of the state board.

5       (1) The State Board of Education shall adopt a state  
 6 plan that provides for adequate examination, maintenance, and  
 7 repair of transportation equipment, including not less than  
 8 two complete safety inspections of such equipment each year.  
 9 In addition, while the vehicle is in operation, examination of  
 10 the mechanical condition of each school bus shall be made by a  
 11 capable mechanic once every 30 days. Each school board shall  
 12 designate and adopt a specific plan for adequate examination,  
 13 maintenance, and repair of transportation equipment.  
 14 Examination of the mechanical condition of each school bus  
 15 shall be made by a capable mechanic at least once each month  
 16 that the bus is in operation.

17       Section 2. Section 234.051, Florida Statutes, is  
 18 amended to read:

19       234.051 School buses.--School buses shall be defined  
 20 and meet specifications as follows:

21       (1) DEFINITION.--For the purpose of the school code, a  
 22 "school bus" is defined as a motor vehicle which is designed  
 23 for carrying ten or more passengers, is used for  
 24 transportation of public school children to or from school or  
 25 in connection with school activities regularly used for the  
 26 transportation of pupils of the public schools to and from  
 27 school or to and from school activities, and is owned,  
 28 operated, rented, or leased by any school board, excepting any  
 29 bus operating as a common carrier and

30       (a) Motor vehicles of the type commonly called  
 31 pleasure cars and carrying eight pupils or less; and

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1           (b) Motor vehicles subject to and meeting all  
2 requirements of the Public Service Commission and operated by  
3 carriers operating under the jurisdiction of the Public  
4 Service Commission, but not used exclusively for the  
5 transportation of public school pupils.

6           (2) GENERAL STANDARDS SPECIFICATIONS.--Each school bus  
7 shall meet the national minimum standards for school buses as  
8 set by the National Highway Traffic Safety Administration and  
9 all applicable Federal Motor Vehicle Safety Standards with a  
10 total seating space of more than 10 linear feet which is  
11 rented, leased, purchased, or contracted for purchase, and  
12 each school bus with a total seating space of more than 10  
13 linear feet shall meet the specifications as prescribed by  
14 regulations of the state board.

15           (3) STANDARDS FOR LEASED VEHICLES.--A motor vehicle  
16 owned and operated by a county or municipal transit authority  
17 which is leased by the school board of the local school  
18 district for transportation of public school students shall  
19 meet such standards as shall be established by the State Board  
20 of Education for the purpose of implementing this act. A  
21 school bus authorized by a school board to carry passengers  
22 other than school pupils shall have the words "School Bus" and  
23 any other signs and insignia which mark or designate it as a  
24 school bus covered, removed, or otherwise concealed while said  
25 passengers are being transported.

26           Section 3. Section 234.091, Florida Statutes, is  
27 amended to read:

28           234.091 General qualifications.--

29           (1) Each school bus driver shall:

30           (a) Be 18 years of age;

31           (b) Be of good moral character;



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- 1           (c) Have of good vision and hearing,  
 2           (d) Be able-bodied, free from communicable disease,  
 3 mentally alert, and sufficiently strong physically to handle  
 4 the bus with ease and to make emergency repairs, and he shall  
 5 possess such other qualifications as are prescribed by the  
 6 state board; and he shall
- 7           (e) Hold a valid chauffeur's license issued by the  
 8 Department of Highway Safety and Motor Vehicles,
- 9           (f) Complete a school bus driver training program  
 10 conducted by the Department of Education, based upon the  
 11 curriculum guide developed by the National Highway Traffic  
 12 Safety Administration for the training of school bus drivers;  
 13 and
- 14           (g) Possess such other qualifications as are  
 15 prescribed by the state board.
- 16           (2) No person shall operate, or cause to be operated,  
 17 in this state a school bus, as defined in s. 234.051(1),  
 18 unless the operator has been issued a school bus driver's  
 19 license by the Department of Education upon its determination  
 20 that such person possesses the qualifications for public  
 21 school bus drivers prescribed in subsection (1) and has a good  
 22 driving record. Every school bus driver shall have such  
 23 license posted in the school bus whenever the bus is being  
 24 operated by him. In order to remain licensed, every school  
 25 bus driver shall pass an annual physical examination and shall  
 26 submit evidence of same to the district superintendent of  
 27 schools. Any school bus driver whose chauffeur's license is  
 28 suspended or revoked shall automatically have his school bus  
 29 driver's license recalled by the department. Any school bus  
 30 driver who has had his license so recalled may have it  
 31

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1 reinstated upon satisfactorily meeting the department's  
2 requirements for reinstatement.

3 Section 4. Subsection (46) of section 316.003, Florida  
4 Statutes, is amended to read:

5 316.003 Definitions.--The following words and phrases,  
6 when used in this chapter, shall have the meanings  
7 respectively ascribed to them in this section, except where  
8 the context otherwise requires:

9 (46) SCHOOL BUS.--Any motor vehicle which is designed  
10 for carrying ten or more passengers and is used for  
11 transportation of school children to or from school or in  
12 connection with school activities. The term does not include  
13 buses operated by common carriers in the transportation of  
14 school children. The term "school," as used herein, includes  
15 all public and private nursery schools, day care centers, and  
16 other pre-elementary-level schools, as well as all elementary  
17 and secondary schools. that complies with the color and  
18 identification requirements of chapter 234 and is used to  
19 transport children to or from school or in connection with  
20 school activities, but not including buses operated by common  
21 carriers in urban transportation of school children.

22 Section 5. Section 316.615, Florida Statutes, is  
23 amended to read:

24 {Substantial rewording of section. See  
25 s. 316.615, F.S., for present text.}

26 316 615 Requirements for school buses; inspection;  
27 qualifications of nonpublic school bus drivers; rules --

28 (1) All school buses, as defined in s. 316.003(46),  
29 shall be painted "school bus chrome" and shall comply with all  
30 vehicle specifications as required by rule of the department.

31 All school buses shall meet the national minimum standards for

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1 school buses and all applicable federal motor vehicle safety  
2 standards.

3 (2) Every school bus shall be inspected semiannually  
4 by the Division of Florida Highway Patrol of the department,  
5 and, when found to be in satisfactory condition for safe  
6 operation, a current certificate of inspection shall be  
7 displayed on such vehicle. In addition to such semiannual  
8 inspections, each owner or lessee of a school bus shall  
9 provide a mechanical inspection once every 30 days while the  
10 vehicle is in operation, which inspection record shall be  
11 carried in the school bus.

12 (3) No person shall operate, or cause to be operated,  
13 in this state any school bus not regulated under the  
14 provisions of chapter 234 unless the operator thereof has been  
15 issued a school bus driver's certificate by the department  
16 upon its determination that such person possesses the  
17 qualifications for public school bus drivers prescribed in s.  
18 234.091(1)(a)-(e), has a good driving record, has completed a  
19 school bus driver training program conducted by the Florida  
20 Highway Patrol, based upon the curriculum guide developed by  
21 the National Highway Traffic Safety Administration and the  
22 Department of Highway Safety and Motor Vehicles, and possesses  
23 such other qualifications as may be prescribed by the  
24 department. Every such school bus driver shall have his  
25 certificate posted in the school bus whenever the bus is being  
26 operated by him. In order to remain certified, every such  
27 school bus driver shall pass an annual physical examination  
28 and shall submit evidence of same to the department. Any such  
29 school bus driver whose chauffeur's license is suspended or  
30 revoked shall automatically have his school bus driver's  
31 certificate recalled by the department. Any school bus driver

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1 who has had his certificate so recalled may have it reinstated  
 2 upon satisfactorily meeting the department's requirements for  
 3 reinstatement.

4 (4) The department shall promulgate such rules as are  
 5 necessary to effectuate the purposes of this section.

6 Section 6. This act shall take effect July 1, 1984,  
 7 except that section 5 of this act shall take effect January 1,  
 8 1985.

9  
 10 \*\*\*\*\*

11  
 12 HOUSE SUMMARY

13 With respect to transportation of school children to  
 14 public and private schools (including public and private  
 15 nursery schools, day care centers, and other pre-  
 16 elementary schools):

17 (1) Requires the State Board of Education to adopt a  
 18 state plan for examination, maintenance, and repair of  
 19 public school transportation equipment, including semiannual  
 20 safety inspections and monthly mechanical inspections.  
 21 (Under present laws, individual school boards are  
 22 responsible for such activities )

23 (2) For purposes of the school code, redefines "school  
 24 bus" as "a motor vehicle which is designed for carrying 10  
 25 or more passengers, is used for transportation of public  
 26 school children to or from school or in connection with  
 27 school activities, and is owned, operated, rented, or leased  
 28 by any school board, excepting any bus operating as a common  
 29 carrier and not used exclusively for the transportation of  
 30 public school pupils." Similarly redefines the term under  
 31 the Florida Uniform Traffic Control Law.

(3) Requires public school buses to meet national  
 standards and modifies standards for leased vehicles to  
 conform

(4) Clarifies qualifications for public school bus  
 drivers and adds age and training requirements. Requires  
 public school bus drivers to be licensed by the Department  
 of Education and provides requirements for licensure.  
 Provides for recall and reinstatement of licensure.  
 Provides similar requirements for nonpublic school bus  
 drivers.

(5) Modifies requirements for all school buses for  
 purposes of the Florida Uniform Traffic Control Law to  
 provide for meeting of national standards and to provide for  
 semiannual safety inspections and monthly mechanical  
 inspections.

**APPENDIX F**  
**STATE SURVEY RESULTS**  
**CONCERNING LOCKS**  
**ON SCHOOLBUS EMERGENCY DOORS**

INTERLOCK OR  
AUDIOVISUAL

Colorado\*  
Connecticut  
Idaho\*  
Illinois  
Indiana  
Louisiana\*  
Massachusetts  
Minnesota  
Missouri  
New Jersey  
New York  
North Dakota  
Ohio  
Virginia\*  
Wisconsin\*

15 total  
10 private

PROHIBITED

Delaware  
District of Columbia\*  
Iowa  
Kentucky\*  
Maryland  
Michigan  
Montana  
Nevada  
North Carolina\*  
Rhode Island  
South Carolina\*  
Tennessee\*

12 total  
7 private

NO RESTRICTIONS

Alabama  
Alaska  
Arizona  
California  
Florida  
Georgia  
Mississippi  
Nebraska  
South Dakota  
West Virginia  
Wyoming

11 total

ALLOWED BUT MUST  
BE KEPT OPEN

Arkansas\*  
Hawaii  
Kansas  
Maine  
New Hampshire\*  
New Mexico\*  
Oklahoma\*  
Oregon  
Pennsylvania\*  
Texas\*  
Utah  
Vermont  
Washington\*

13 total  
6 private

\* Private schools not covered by state requirements (17 total)