



National Transportation Safety Board

Highway Accident Brief

School Bus Roadway Departure

Accident Number:	HWY14FH010
Accident Type:	School bus roadway departure
Location:	Nohl Ranch Canyon Road, Anaheim, Orange County, California
Date and Time:	April 24, 2014, about 3:37 p.m. Pacific daylight time
Vehicles:	2012 Blue Bird 78-passenger school bus
Fatalities:	0
Injuries:	10 (5 serious, 5 minor)

Crash Description

About 3:37 p.m. Pacific daylight time on Thursday, April 24, 2014, a 2012 Blue Bird 78-passenger All American school bus, operated by the Orange Unified School District in Anaheim, California, and occupied by a 24-year-old male driver and 11 students, aged 12–14 years old, was returning children home from the El Rancho Charter Middle School. The bus was traveling northbound in the 6500 block of Nohl Ranch Canyon Road in Anaheim. The posted speed limit was 35 mph, but the bus was traveling at a video-estimated speed of 43 mph when it left the roadway.¹ The weather was clear, and the roadway was dry.

According to witnesses, while the school bus was traveling downhill on Nohl Ranch Canyon Road, its speed increased and it traveled out of its lane to the right. The bus left the roadway and overrode the right curb, where it struck and dislodged a concrete light post. The bus continued up an embankment, where its front struck and uprooted a tree. The left side of the bus also scraped along a large tree from approximately the front axle to the rear axle. The bus came to rest at an approximate 30-degree angle on the embankment, leaning onto this same tree, which was in contact with the left side of the bus just aft of the left-side emergency exit door and just forward of the rear wheels. (Figure 1 maps the location of the crash, and figure 2 shows the bus at final rest.)

¹ The video came from the continuous video recording system on the school bus. This system will be discussed later in this brief.

School Bus Roadway Departure

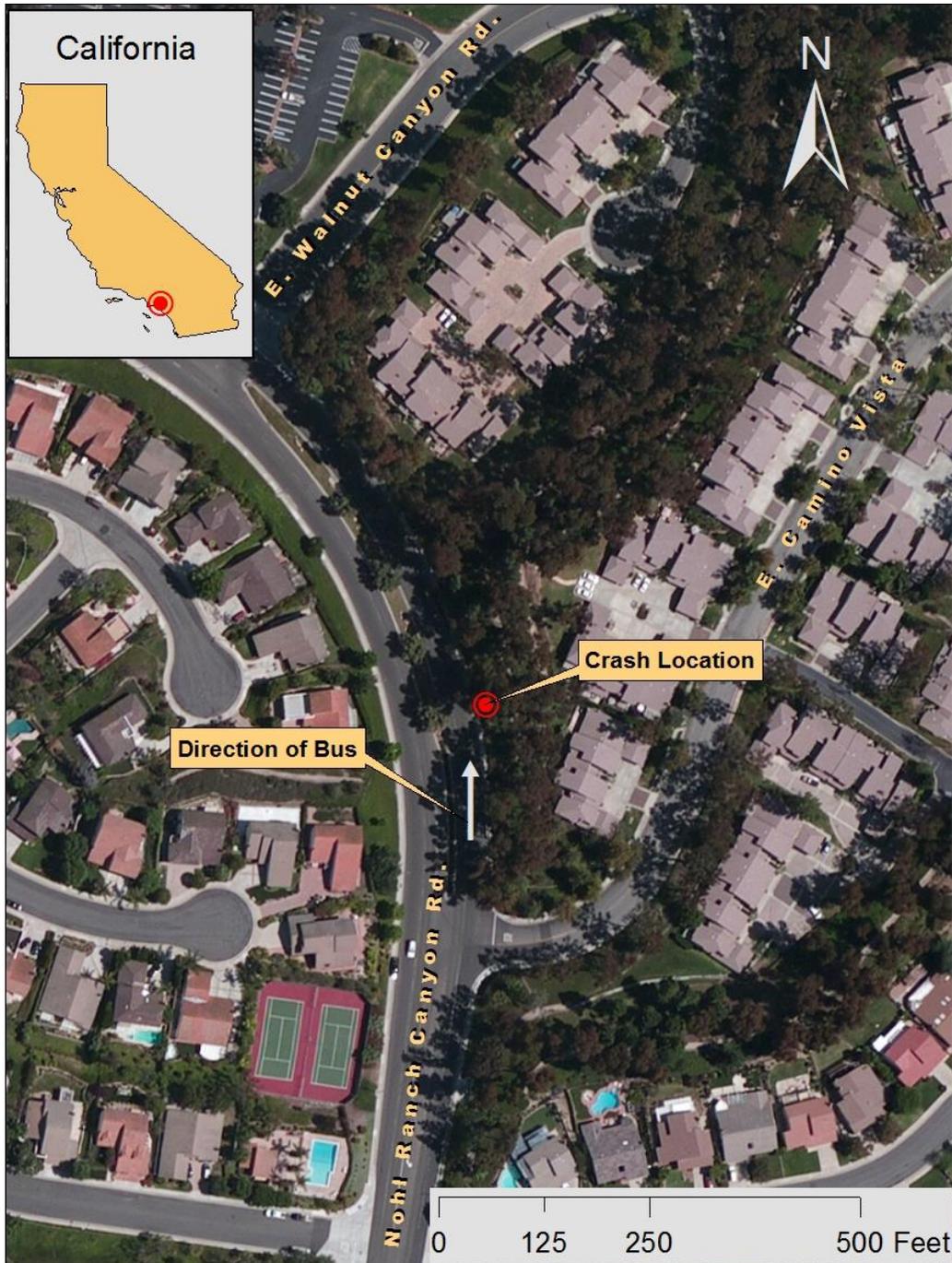


Figure 1. Location of the crash on Nohl Ranch Canyon Road, south of E. Walnut Canyon Road and north of E. Camino Vista, in Anaheim. (Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. May 15, 2014.)

School Bus Roadway Departure



Figure 2. Photograph showing the school bus at final rest (Source: Anaheim Police Department)

As a result of the crash, the driver and four students were seriously injured. Five students sustained minor injuries, and two students were uninjured. The school bus was equipped with lap/shoulder belts at the driver position and at all passenger seating positions. It was also equipped with an onboard continuous video recording system. The restraints and the onboard video system were the primary focuses of this investigation.

School Bus Damage

The front of the bus sustained damage from impacts with a light pole and two trees during the crash sequence. As shown in figure 3, the front end damage occurred predominantly on the right front corner of the bus as a result of the impact with a tree, with intrusion into the loading stairs. The front loading door located on the right side of the bus was inoperable as a result of the crash. The area immediately surrounding the driver's seat was not compromised by this intrusion damage.

School Bus Roadway Departure



Figure 3. Front and left side postcrash views of the bus.

The left side of the bus scraped along a large tree, causing damage from the front axle aft to the rear axle. This tree caused significant intrusion along the left side and roof of the bus, with maximum penetration into the passenger compartment at seat rows 7 through 9. The left-side emergency exit door, at row 8, was partially dislodged from the bus. The left sidewall and roof in the area of rows 7 to 9 were crushed inward, with portions of the roof crushed down to the level of the seatbacks and inward up to half the width of the seats. Figure 4 shows the interior intrusion into rows 8 and 9 with a view looking from the right side interior of the bus toward the left side. The intrusion resulting from the left side of the bus scraping the tree caused multiple seats in rows 6–9 to be displaced inboard to the extent that they blocked the center aisle.

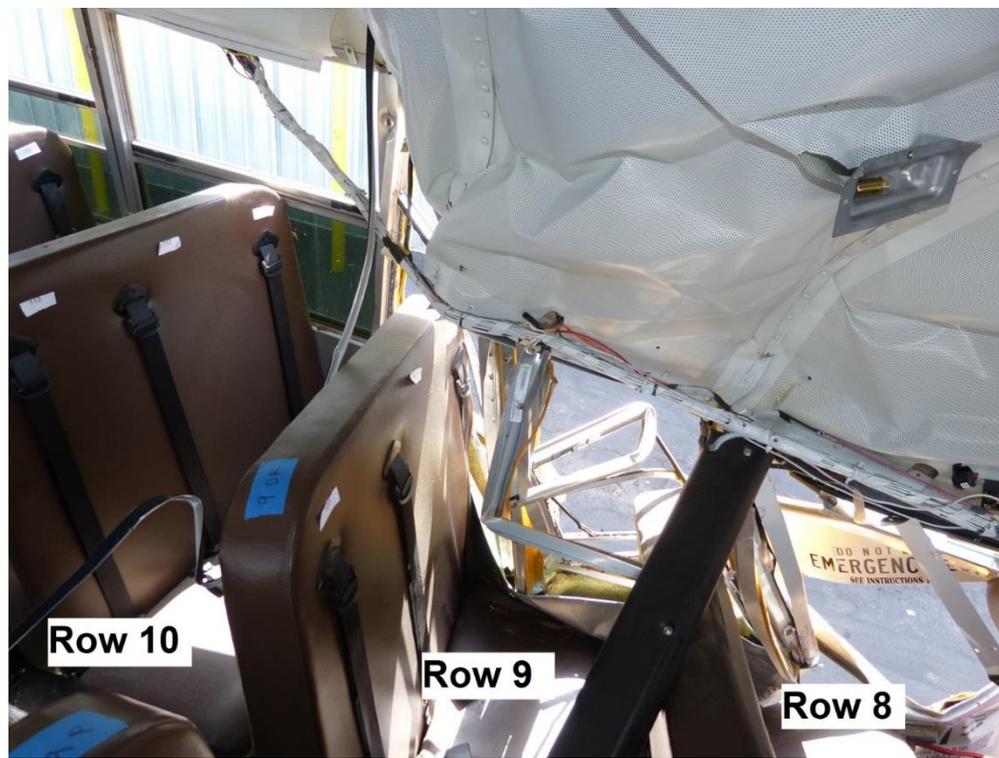


Figure 4. Interior view of the bus showing left side rows 10, 9, and 8.

School Bus Roadway Departure

Injuries

Table 1 summarizes the injuries experienced by the driver and the 11 student passengers. Figure 5 provides a seating diagram and information on the age, gender, and injury severity of the bus occupants. The driver and five students were transported to area hospitals for treatment, and the remaining six students were treated at the scene and released to parents or guardians. The arrows on the figure 5 diagram show areas of impact and areas of intrusion into the school bus.

Table 1. Injury levels for bus driver and student passengers. (Information sourced from medical records and police reports.)

Injury Severity ^a	Bus Driver	Bus Passengers	Total
Serious	1	4	5
Minor	0	5	5
Uninjured	0	2	2
Total	1	11	12

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

The school bus was equipped with lap/shoulder belts at the driver position and at all passenger seating positions. The required form of occupant protection on school buses is compartmentalization, which consists of closely spaced, energy-absorbing seats that deform in a crash to reduce injuries to the occupants.² Several states, including California, require that large school buses be equipped with compartmentalization and passenger seat belt systems.³ California specifically requires that new school buses be equipped with passenger lap/shoulder belts.⁴ The school bus in this crash was equipped with passenger lap/shoulder belts that were installed in a flexible seating arrangement; C.E. White Co. manufactured the seats.⁵

² See Federal Motor Vehicle Safety Standard 222.

³ The states that currently require passenger restraint systems on school buses are California, Florida, Louisiana, New Jersey, New York, and Texas.

⁴ Section 27316 of the *California Vehicle Code* requires that school buses with a seating capacity of 16 or more students manufactured on or after July 1, 2005, be equipped with lap/shoulder belts at all passenger seating positions. Further, the *California Code of Regulations* Title 5 (Education) Section 14105 states that “All passengers in a school bus or in a school pupil activity bus that is equipped with passenger restraint systems in accordance with sections 27316 and 27316.5 of the Vehicle Code, shall use the passenger restraint system.”

⁵ (a) As stated in the final rule on “School Bus Passenger Seating and Crash Protection” concerning flexible seating arrangements on school bus seats, which was published in 2008 by the National Highway Traffic Safety Administration, “Lap/shoulder belts on these bench seats can be adjusted to provide two lap/shoulder belts for two average size high school students or three lap/shoulder belts for three elementary school students.” (b) C.E. White is now HSM Solutions.

School Bus Roadway Departure

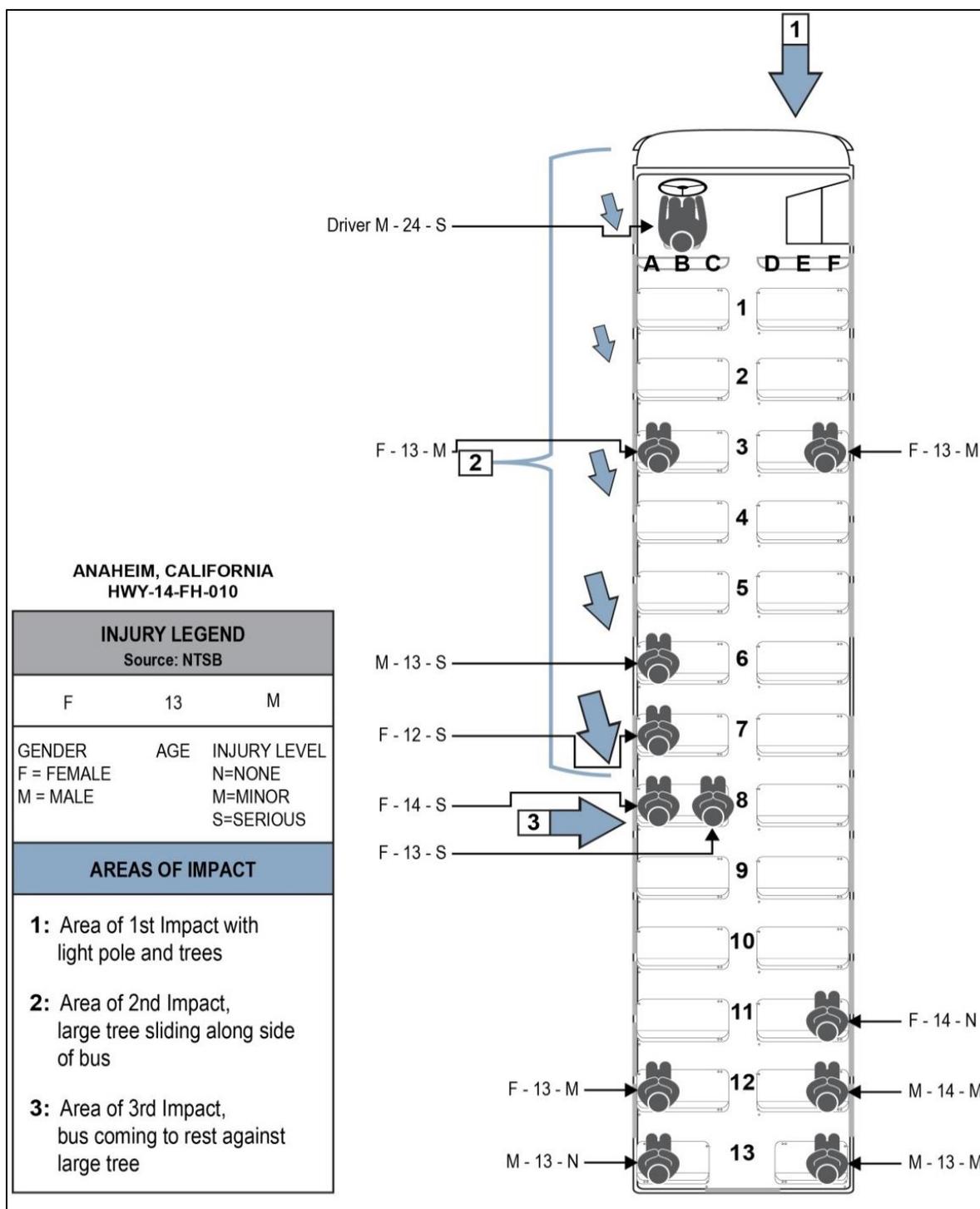


Figure 5. Seating diagram detailing the age, gender, and injury severity of the bus occupants. The arrows show areas of impact and areas of intrusion into the school bus. The arrow designated “1” corresponds to the area of impact with the tree at the front of the bus. The arrows increasing in size down the left side of the bus and designated “2” correspond to the region of increasing intrusion from the left side of the bus scraping a tree. The arrow designated “3” marks the area of maximum intrusion by the tree on the left side.

School Bus Roadway Departure

The school bus was also equipped with an onboard video recording system, manufactured by 24/7 Security. The video recording provided data reflecting the trip, the crash sequence, and the postcrash response. The driver and some students were recorded in the camera views.

Onboard Video Evidence

The three onboard video system cameras had wide angle lenses that captured views of the front loading door; the area of the interior looking aft from the front of the bus, including the driver's region; and the portion of the interior looking downward and aft from row 8. The system also had one audio recording location at the front of the bus. The video system recorded precrash data, the crash sequence, and 34 minutes of postcrash data.⁶

Driver Behavior

The video system provided a clear view of the driver and the driver's actions prior to the crash. Video evidence showed that the driver did not use his cell phone, nor was he distracted by students, before the crash event. The video showed no indications of driver fatigue, such as yawning or head-bobbing.⁷ Moreover, after the crash, none of the students or other witnesses reported that the driver had exhibited any unusual behavior before the final bus stop preceding the crash.

The video evidence also showed that during the trip, the driver did not always wear his lap/shoulder belt and, at one point, the system's audio recorder recorded a student informing the driver that the video recorder would capture his non-use of the seat belt. (After that comment, the driver did fasten his lap/shoulder belt.)

For the last bus stop prior to the crash, the driver was required to exit the bus to stop traffic to enable students to cross the roadway. Upon returning to the bus, the driver exhibited labored breathing and paused multiple times before entering the bus. He paused at the curb and then again at the front loading door for almost 2 minutes while the bus was stopped on the side of the road. After these pauses, one student called out the window to the driver to ask if he felt alright. A few moments later, the driver entered the bus and began driving again, but he neglected to fasten his lap/shoulder belt. The unbelted driver continued to exhibit labored breathing and took multiple drinks of water from a large jug. The video recording showed that less than 1 minute after putting the bus back into motion, the driver slumped over and let go of the steering wheel. The bus then left the roadway to the right. The driver remained unresponsive for the duration of the crash event and for most of the period recorded postcrash. Based on the video evidence, the NTSB concludes that the school bus departed the roadway as a result of the driver's loss of consciousness. The NTSB further concludes that the continuous onboard video recording system provided valuable data concerning the driver's physical state and loss of consciousness prior to the crash sequence.

⁶ See the Video Study Report in the NTSB public docket for this investigation for additional detail on the onboard video system.

⁷ The driver was wearing sunglasses. As a result, his eyes were not visible in the video.

School Bus Roadway Departure

Seat Belt Use

The video recordings provided information about how the students boarded the bus, the passenger seating positions (within the limitations of the camera views), the stops along the route, and the passengers who got off at each stop. The recordings established the precrash conditions, including showing which students were on the bus at the time of the crash, their seating locations, and the seat belt use status of those who were within the camera's view. Passenger seat belt usage was visible in several of the video recordings, although views of some seating positions were obstructed by the bus's high seatbacks.

For some seating positions, the video captured the students' actions, indicating when the lap/shoulder belts were being used. In some instances, the lap/shoulder belt would be unfastened during the trip when a student moved to a different seat or changed position in the seat. The video recordings from the camera mounted in the middle of the school bus showed that the two students seated in row 8, adjacent to the left-side emergency exit door, were wearing their seat belts at the time of the crash. These two students were the focus of the occupant kinematics study discussed later in this report. Approximately three-fourths of the students visible in the recordings were wearing lap/shoulder belts while the bus was in motion. The NTSB concludes that many, but not all, students were belted while the school bus was in motion.

In 2012, the NTSB investigated a school bus crash in Chesterfield, New Jersey.⁸ The school bus in that crash was equipped with passenger lap-only belts and, because several students were wearing the belts improperly or not at all, the NTSB recommended that the states of California, Florida, Louisiana, New Jersey, New York, and Texas—

Develop (1) a handout for your school districts to distribute annually to students and parents about the importance of the proper use of all types of passenger seat belts on school buses, including the potential harm of not wearing a seat belt or wearing one but not adjusting it properly; and (2) training procedures for schools to follow during the twice yearly emergency drills to show students how to wear their seat belts properly. (H-13-32)

This recommendation is currently classified "Open—Await Response" for the state of California. Because several students and the bus driver were not properly wearing the available lap/shoulder belts while the Anaheim school bus was in motion, the NTSB reiterates Safety Recommendation H-13-32 to the state of California.

Crash Sequence and Vehicle Dynamics

The onboard video recordings documented the driver and passenger kinematics during the crash sequence.⁹ These recordings were used to conduct a video study that estimated the vehicle

⁸ See *School Bus and Truck Collision at Intersection Near Chesterfield, New Jersey, February 16, 2012*, Highway Accident Report NTSB/HAR-13/01 (Washington, DC: National Transportation Safety Board, 2013).

⁹ Intrusion into the passenger compartment toward the end of the crash sequence displaced the camera mounted in the middle of the bus, which made the student passengers in row 8 less visible to the camera.

School Bus Roadway Departure

motion during the crash and provided a basis for creating simulations to study occupant kinematics. The occupant kinematics from the video and the simulation study results are discussed later in this brief.

The dynamics of the vehicle were reconstructed based on the motion of the school bus relative to roadway features, trees, and houses visible on the video facing the front loading door.¹⁰ According to the results of this study of the vehicle motion from the onboard video recordings, and based on the bus's position and the associated time history available from the video, the NTSB determined that the school bus was traveling at an estimated speed of 43 mph when it left the roadway. The posted speed limit was 35 mph. Unfortunately, the video system did not include a forward view from the school bus, which complicated reconstruction of the crash dynamics. It also did not include views for all seating positions in the bus, which could have facilitated efforts to monitor seat belt use and student behavior. As a result, the NTSB concludes that because of the locations of the cameras, the limited number of cameras facing the students (two cameras), and the high seatbacks, many seating positions within the bus were not recorded by the onboard video system nor was visibility provided forward of the school bus.

In 2015, the NTSB published a safety report titled *Commercial Vehicle Onboard Video Systems*.¹¹ The report noted the need to improve the visibility of all passenger seating positions to the cameras when installing onboard video systems. In addition, the report indicated that to understand the motion of the vehicle during a crash and to record any surrounding vehicles, onboard video systems require improved range of coverage forward of the vehicle. The report discussed how video recordings can be used as a tool to enforce rules, such as seat belt use. Not all students were wearing their seat belts at the time of the Anaheim crash; therefore, this crash emphasizes that making all passenger seating positions visible to onboard video systems could enable better enforcement of seat belt use, which would improve passenger safety. Further, if the video system had had greater range of coverage forward of the school bus, investigators would have had a better understanding of the vehicle dynamics as the bus left the roadway and struck the light pole and two trees. In the 2015 safety report, the NTSB made the following Safety Recommendation H-15-2 to the American Trucking Associations, National Association for Pupil Transportation, National School Transportation Association, American Bus Association, United Motorcoach Association, American Public Transportation Association, and National Association of State Directors of Pupil Transportation Services:

Encourage your members to ensure that any onboard video system in their vehicles provides visibility of the driver and of each occupant seating location, visibility forward of the vehicle, optimized frame rate, and low-light recording capability.
(H-15-2)

Safety Recommendation H-15-2 is classified "Open—Await Response" for the American Bus Association, United Motorcoach Association, American Public Transportation Association, and National Association of State Directors of Pupil Transportation Services. The other three

¹⁰ See the Video Study Report in the NTSB public docket for additional information.

¹¹ See *Commercial Vehicle Onboard Video Systems*, Safety Report NTSB/SR-15/01 (Washington, DC: National Transportation Safety Board, 2015).

School Bus Roadway Departure

recipients responded favorably to the recommendation, such that it is classified “Closed–Acceptable Action” for them. Therefore, because this recommendation is still open to one association affiliated with school transportation, and given the deficiencies with the onboard video system identified during the Anaheim school bus investigation, the NTSB reiterates Safety Recommendation H-15-2 to the National Association of State Directors of Pupil Transportation Services.

Postcrash Events

After the bus came to rest, the video cameras continued to record for 34 minutes. The recordings captured the initial actions of the students and the first people to arrive at the scene.

A male passerby arrived at the right rear emergency exit within 2 minutes of the bus coming to rest. The video did not clearly show who opened the right rear exit door, and some students stated that the student from seat 13F opened it. The passerby checked on the driver and then assisted the children in leaving the school bus by providing instructions and directing them to the rear exit. Because the front loading door was inaccessible, and the left-side emergency exit door was partially blocked by a tree and an injured student, the students exited through the right rear emergency exit. The recordings showed that, due to the intrusion near row 8, the students seated in front of row 8 had to climb over the seatbacks to reach the right rear emergency exit. All students, except the one in seat 8A, were able to self-evacuate. While the onboard video captured some information about the egress paths inside the bus, because of the limited views of the right rear emergency exit, the video did not capture how the students used this exit or whether they received assistance in evacuating the bus through the exit door. Students’ accounts of their experiences indicated that only the driver and the student in seat 8A were carried off the bus. Due to the tree intrusion at row 8, the student in seat 8A was partially ejected through the damaged left side emergency exit door. This student was removed from the bus through the damaged exit door.

Medical Fitness of Commercial Drivers

Medical History

In postcrash interviews conducted by police officers, the school bus driver said he felt severely dizzy, hot, and short of breath just prior to the crash. The driver reported a history of pulmonary hypertension going back approximately 5 years.¹² Further, the driver reported that he had had a seizure a year prior to this crash and had “blacked out” three times over the last 5 years. He stated that he was being treated for the condition and was taking medication regularly, including on the day of the crash. He indicated that he did not inform the California Department of Motor Vehicles (DMV) or the doctor who performed his commercial driver’s license (CDL) exam about these events because he felt the medical examiner did not need to know, and his primary care doctor and pulmonologist indicated everything was under control.

¹² Pulmonary hypertension is elevated pressure in the blood vessels in the lungs. Typical “blood pressure” is measured in the arm or leg and is optimally around 120/80 mm Hg. In the lung vessels, normal pressures are below 30/15 mm Hg.

School Bus Roadway Departure

Investigators considered whether the driver's loss of consciousness may have resulted from complications associated with his pulmonary hypertension. Although shortness of breath with exertion, dizziness, and fainting may occur as a result of pulmonary hypertension, there are other reasons why an individual could lose consciousness.¹³ Evaluation of the driver's medical history and treatment would have been required to assess whether the loss of consciousness was directly related to his medical condition, but it was evident that the driver had not informed the school district of his condition.¹⁴ The health history section of the DMV Medical Examination Report DL-51, filled out by the driver on September 6, 2013, did not indicate pulmonary hypertension or any other medical conditions. Specifically, the driver checked "no" to all the health history questions, including "illness or injury in the last 5 years," "lung disease," "heart disease," "shortness of breath," "fainting or dizziness," and "loss of or altered consciousness." Although the form asked the driver to list all medications, including over-the-counter medications, this section of the form was left blank. The physician certified the driver for 2 years; the medical certificate was effective from September 6, 2013, to September 6, 2015.

Drivers are required to self-report medical conditions on the medical examination report for commercial driver fitness determination and must sign it to certify, under penalty of perjury, that the supplied information is true and correct. When the driver health history is missing or incomplete, the medical examiner is at a disadvantage when completing the driver's medical examination, particularly if there are no obvious physical exam findings related to a condition, as in this case. The NTSB concludes that the driver did not provide a complete health history, which impeded the medical examiner's ability to fully evaluate the driver's fitness for duty.

Although it is challenging to overcome issues pertaining to honesty on occupational health history forms, the legal consequences of a driver's incomplete reporting can be significant. In the case of this school bus driver, after the crash, he was charged by the state of California with two felonies: (1) child abuse and endangerment, and (2) perjury by declaration. The maximum penalty is 19 years in state prison.¹⁵

Ensuring that safety-critical professionals, such as school bus drivers, are medically fit for duty is important to safe transportation. Although we have no information on how often drivers inaccurately report their health information, they might be reluctant to report their complete health histories to a medical examiner for a number of reasons. This crash highlights the serious safety and legal consequences of providing an inaccurate health history to a medical examiner; greater awareness of the severity of these consequences might encourage other drivers to report their own health information more completely. Therefore, we recommend that the National Association for Pupil Transportation, National Association of State Directors of Pupil Transportation Services, and National School Transportation Association inform school bus drivers of the impact their health may have on the safe transportation of school children, of their responsibility to accurately

¹³ Fainting is caused by low blood pressure; this can occur as a result of many things, such as the effects of medication, dehydration from any cause, heart rhythm disturbances, blood clots, anemia, or bleeding.

¹⁴ Investigators attempted to obtain detailed medical records for the driver but were unable to do so.

¹⁵ A pretrial motion was scheduled for the driver on September 7, 2016.

School Bus Roadway Departure

and completely report their health history and medications, and of the legal consequences of dishonesty on the medical examination report.

Medical Certification

Since May 21, 2014, the Federal Motor Carrier Safety Administration (FMCSA) has required that medical examinations for commercial drivers be completed by a medical examiner listed on the National Registry of Certified Medical Examiners.¹⁶ (See 49 *CFR* 391.42, *Federal Register*, Vol. 77, No. 77, April 20, 2012.) The criteria to become a certified medical examiner include training concerning the FMCSA's physical qualification standards, demonstration of an understanding of those standards, and periodic training and testing to maintain and demonstrate competence.

Many school districts mandate where a school bus driver can obtain a medical certificate for a CDL. In this case, Orange Unified School District employed a contracted medical examiner, and the bus driver obtained his 2-year medical certificate from the medical examiner associated with the school district. When the driver obtained his medical certificate in 2013, the National Registry of Certified Medical Examiners was not in place. California has since implemented a requirement that school bus driver medical exams be performed by individuals on the National Registry.¹⁷ The NTSB's review of the National Registry showed that the medical examiner who certified the school bus driver was listed as a certified medical examiner as of September 12, 2014.

If the driver had revealed his pulmonary hypertension to the medical examiner, including the episodes of fainting and seizure activity, he most likely would not have passed the medical exam and would not have been certified to operate a commercial motor vehicle.¹⁸ The 2014 *FMCSA Medical Examiner Handbook*, which is currently offline and awaiting update, recommended that medical examiners not certify drivers with pulmonary hypertension if they had shortness of breath at rest, dizziness, low blood pressure, or low blood oxygen. However, if the condition and its treatments were disclosed and the condition appeared to be well controlled, under some circumstances a medical examiner might use his or her own clinical judgment and certify a person with pulmonary hypertension.

¹⁶ The NTSB's Safety Recommendation H-01-17 calls on the FMCSA to develop a comprehensive medical oversight program for interstate commercial drivers that contains the following program element: Individuals performing medical examinations for drivers are qualified to do so and are educated about occupational issues for drivers. In part as a result of the implementation of the National Registry of Certified Medical Examiners, this recommendation is classified "Open—Acceptable Response."

¹⁷ (a) As has been noted, since May 21, 2014, all interstate commercial drivers must have their medical examination performed by a certified medical examiner listed on the National Registry of Certified Medical Examiners. (b) For information on California's medical examination report requirements for commercial drivers, see https://www.dmv.ca.gov/portal/dmv/?1dmy&urle=wcm:path:/dmv_content_en/dmv/pubs/cdl_hm/sec1, accessed October 10, 2016.

¹⁸ If the school bus is operated by the state, the California Highway Patrol is responsible for school bus licensing and inspections. The FMCSA can enact civil penalties against a school bus driver, but only after performing a compliance review of the school district. The civil actions include (1) imminent hazard and (2) a notice of claim against the driver. The FMCSA did not become involved in this investigation.

School Bus Roadway Departure

The NTSB has previously recommended, in its Safety Recommendation H-01-20, a comprehensive medical oversight program for interstate commercial drivers that provides guidance and additional information to medical examiners to improve their certification decisions.¹⁹ As noted above, the FMCSA created a *Medical Examiner Handbook* that contained such guidance; however, that information is no longer available from the FMCSA. The link on the FMCSA webpage providing access to the handbook has been replaced with a message that states, “This document is in the process of being updated. A revised version will be published shortly.”²⁰ This message has been in place for almost 2 years. Disease-specific guidance about certification could be particularly useful to certified medical examiners in cases of uncommon medical conditions, such as pulmonary hypertension. Therefore, the NTSB reiterates Safety Recommendation H-01-20 to the FMCSA.

Occupant Kinematics and Injuries

Driver’s Motion and Injuries

The onboard video system captured the driver’s motions resulting from the crash.²¹ The recording showed that during the first part of the crash, the unbelted driver was thrown forward and upward as the bus left the roadway and struck the light pole. As the bus struck the light pole and trees, debris partially blocked the camera’s view of the driver, but he was visible falling back down to his seat, with his head and shoulders leaning against the driver side window and upper window frame. Postcrash, the driver’s left shoulder and head rotated out of the driver side window, which was open before the crash. The California Highway Patrol police report indicated that the driver suffered lacerations to the face and a fractured left clavicle. These injuries are classified as serious, and they most likely would have been mitigated if the driver had been wearing the available lap/shoulder restraint. Therefore, the NTSB concludes that the driver’s injuries most likely would have been reduced if he had been wearing the available lap/shoulder belt at the time of the crash.

Student Injuries

Eleven students were on the school bus. Of these, four students were seriously injured, all of whom were seated on the left side near the middle of the bus, in seats 6A, 7A, 8A, and 8C. The student in seat 8A suffered the most serious injuries, which included three cervical fractures with spinal cord injury, skull and mandible fractures, and an open toe fracture.²² In addition, all the seriously injured students suffered fractures on the left sides of their bodies, including a left arm fracture (student in seat 6A), left clavicle fractures (students in seats 7A and 8C), and a left foot

¹⁹ Safety Recommendation H-01-20 calls on the FMCSA to develop a comprehensive medical oversight program for interstate commercial drivers that contains the following program element: Individuals performing examinations have specific guidance and a readily identifiable source of information for questions on such examinations. This recommendation is classified “Open—Acceptable Response.”

²⁰ See <https://www.fmcsa.dot.gov/regulations/medical/fmcsa-medical-examiner-handbook>, accessed September 19, 2016.

²¹ The events visible in the camera views are documented in the Video Factual Report, available in the NTSB public docket for this crash.

²² The cervical fractures were at the C5 to C7 vertebra.

School Bus Roadway Departure

fracture (student in seat 8A). Other injuries to these four students included lacerations and contusions on their left sides.

Five other students sustained minor injuries. The student in seat 3A suffered a laceration to the right hand, mild whiplash, and a lumbar strain. The student in seat 12A suffered a mild contusion to the scalp. The remaining three students sustained minor contusions or abrasions as noted in the police report. Two students were uninjured.

Occupant Kinematics Study

Because of the position of the camera at the middle of the bus and the students' seat locations in row 8, the two students adjacent to the left-side emergency exit door were clearly visible in the video recording. These students were a 14-year-old female in seat 8A (at the window) and a 13-year-old female in seat 8C (on the aisle). Both were properly wearing their lap/shoulder belts at the time of the crash; they were the focus of the occupant kinematics study.

At the start of the crash sequence, the onboard video recorders showed that the students in seats 8A and 8C were in upright, forward-facing, seated positions. As the bus left the roadway and struck the light pole, both students began to flail forward and to the right, but the shoulder harnesses reduced their forward movement such that their heads did not contact the seatback in front of them. As the bus continued up the sloped embankment, these students remained upright within their seating compartments with their shoulder belts properly positioned over their shoulders. The lap/shoulder belts appeared to restrain their natural motions toward the left emergency exit door. As the bus struck the tree at the front right corner and the left side of the bus began to scrape against the larger tree, both students again flailed forward and finally toward the left, with the lap/shoulder belts again limiting their forward and lateral movement. During these portions of the crash sequence, the two students' shoulder harnesses were visibly engaged with their upper torsos. Due to the intrusion into seat rows 7 through 9, the left-side emergency exit door was partially dislodged. The student in seat 8A shifted to the left, which was partially outside the camera's view in the vicinity of the left emergency exit door, but she remained restrained by her lap/shoulder belt.

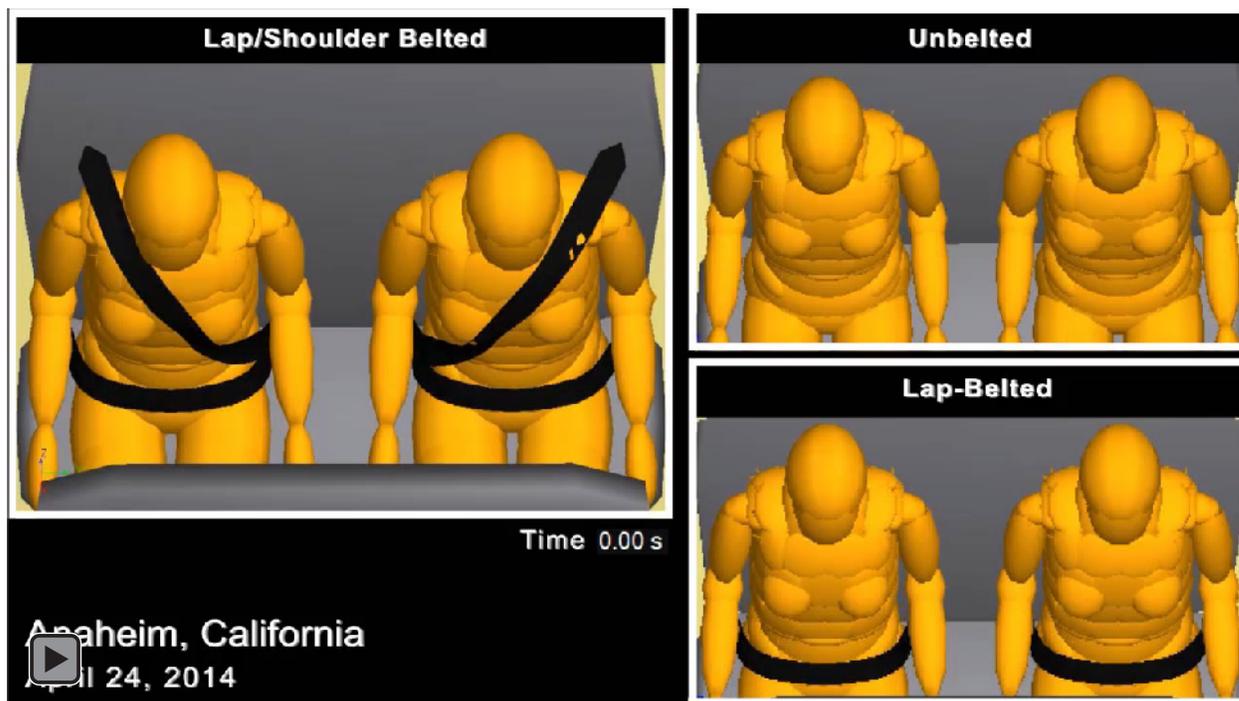
Occupant Simulations

Because of the injuries sustained by the students in row 8 and the general vulnerability of students in the regions of intrusion, simulations were conducted to better understand the restraining action of the passenger lap/shoulder belts based on a reconstruction of the crash dynamics.²³ The simulations were used to understand where the row 8 students might have been at the time of the intrusion into their seat row if they had been belted with lap-only seat belts or if they had been unbelted. These results were then compared to simulations with lap/shoulder-belted occupants.

²³ Only limited accuracy was attainable for simulating the timing, the damage to the vehicle structure, and the interactions of the occupants with the intruding structure.

School Bus Roadway Departure

Generally, the simulations predicted the lowest injury levels for the lap/shoulder-belted occupants. (See link to video simulations below.)



Results for unbelted occupants. The simulations predicted that both unbelted occupants would have been thrown toward the area of tree intrusion, and they most likely would have been either partially or fully ejected as a result of being in that region at that time.

Results for lap-belted occupants. Although in the simulations the entire bodies of the lap-belted occupants were not thrown toward the area of tree intrusion, their upper bodies still flailed in that direction. As a result of their positions, both lap-belted occupants would have been vulnerable to upper body injury due to the tree intrusion.

Results for lap/shoulder-belted occupants. The simulations indicated that lap/shoulder-belted occupants would have been generally retained within their seating compartment. Their upper body flailing was still directed to the left, but the magnitude of the movement was greatly reduced. The simulations showed that lap/shoulder-belted occupants had the best retention in the seats with the lowest potential for occupant-to-occupant contacts and occupant-to-interior contacts, which are common in severe lateral impacts involving unbelted school bus occupants. The simulations also indicated that while restrained with a lap/shoulder belt, the occupant seated nearest the area of intrusion (seat 8A) maintained a more upright position than that person would have maintained if restrained only by a lap belt.

The simulations show that their injuries would probably have been greater if the occupants of row 8 had not been restrained by the lap/shoulder belts. Therefore, the NTSB concludes that the properly worn lap/shoulder belts of the two occupants of the row 8 seats most likely reduced their injuries related to upper body flailing, which are commonly seen when occupants are restrained

School Bus Roadway Departure

only by lap belts. Further, the NTSB concludes that the properly worn lap/shoulder belts reduced passenger motion toward the intruding tree, which probably reduced the severity of the injuries sustained, especially for the student in seat 8C.

In its 2013 Chesterfield report, the NTSB issued Safety Recommendation H-13-36 to the National Association for Pupil Transportation, National Association of State Directors of Pupil Transportation Services, and National School Transportation Association:²⁴

Provide your members with educational materials on lap and shoulder belts providing the highest level of protection for school bus passengers, and advise states or school districts to consider this added safety benefit when purchasing seat belt-equipped school buses. (H-13-36)

Safety Recommendation H-13-36 is classified “Open—Acceptable Alternate Response” for the National Association for Pupil Transportation and the National School Transportation Association. It is classified “Open—Acceptable Response” for the National Association of State Directors of Pupil Transportation Services. Based on the evidence of the benefits provided by the properly worn lap/shoulder belts in this crash, the NTSB reiterates Safety Recommendation H-13-36 to all three recipients.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the Anaheim, California, crash was the driver’s loss of consciousness, resulting in his loss of control of the school bus, which departed the roadway and collided with a light pole and trees. Reducing the severity of passenger injuries in the area of maximum intrusion was the proper use of the available lap/shoulder belts by the student passengers seated in this area.

New Recommendation

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

To the National Association for Pupil Transportation, National Association of State Directors of Pupil Transportation Services, and National School Transportation Association:

Inform school bus drivers of the impact their health may have on the safe transportation of school children, of their responsibility to accurately and completely report their health history and medications, and of the legal consequences of dishonesty on the medical examination report. (H-16-7)

²⁴NTSB/HAR-13/01.

School Bus Roadway Departure

Reiterated Recommendations

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

To the Federal Motor Carrier Safety Administration:

Develop a comprehensive medical oversight program for interstate commercial drivers that contains the following program element: Individuals performing examinations have specific guidance and a readily identifiable source of information for questions on such examinations. (H-01-20)

To the state of California:

Develop (1) a handout for your school districts to distribute annually to students and parents about the importance of the proper use of all types of passenger seat belts on school buses, including the potential harm of not wearing a seat belt or wearing one but not adjusting it properly; and (2) training procedures for schools to follow during the twice yearly emergency drills to show students how to wear their seat belts properly. (H-13-32)

To the National Association of State Directors of Pupil Transportation Services:

Encourage your members to ensure that any onboard video system in their vehicles provides visibility of the driver and of each occupant seating location, visibility forward of the vehicle, optimized frame rate, and low-light recording capability. (H-15-2)

To the National Association for Pupil Transportation, National Association of State Directors of Pupil Transportation Services, and National School Transportation Association:

Provide your members with educational materials on lap and shoulder belts providing the highest level of protection for school bus passengers, and advise states or school districts to consider this added safety benefit when purchasing seat belt-equipped school buses. (H-13-36)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

CHRISTOPHER A. HART
Chairman

ROBERT L. SUMWALT
Member

T. BELLA DINH-ZARR
Vice Chairman

Adopted: October 11, 2016

School Bus Roadway Departure

For more details about this crash, visit <http://dms.nts.gov/pubdms/> and search for NTSB accident ID HWY14FH010.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person.” 49 *Code of Federal Regulations*, Section 831.4. Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. 49 *United States Code*, Section 1154(b).

Member Weener filed the following statement on October 7, 2016.



I cannot endorse an incomplete report that does not adequately address even the most basic question, the probable cause of this crash. For the reasons detailed below, I do not concur with the body of the report, the statement of probable cause or the majority of the recommendations.

This report comes from an investigation of a school bus crash in which multiple children were seriously injured. In my opinion, there can be no greater cause for an exhaustive and comprehensive investigation. In this report, however, multiple significant issues have been overlooked and are left unaddressed.

- Did this driver suffer from a condition which potentially impaired his ability to safely operate a motor vehicle of any kind?
- Did the driver knowingly conceal such a condition from his employer?
- Was one or more physicians aware of this condition?
- Were these physicians subject to California laws requiring the reporting of certain medical conditions?
- Was the driver diagnosed with a condition that should have been reported under California law to the state driver licensing authority?
- If so, was the condition reported as required?
- If not, why not?
- Are California medical practitioners provided with sufficient guidance from the State of California to apprise them of mandatory reporting requirements?
- Are stronger mandatory reporting laws a good way to prevent medically impaired drivers from causing this type of crash in the future?

The answers to these critical questions are most likely contained within the driver's pre-crash and post-crash medical records. We make clear in our report that the State of California has been able to gather sufficient information to answer these questions to its satisfaction and mount a prosecution against the driver based on his alleged concealment of this type of condition. Moreover, the significant media coverage of this crash includes reports of pending civil litigation based on similar factual allegations. Yet, we failed to gather enough information to satisfy staff as to the cause of the events captured on the onboard camera.

This Board has made determinations of medical probable cause with much less evidence than is available for pursuit here. Yet, we decline to do so in this case, and make no serious attempt to access the abundance of documents and records that apparently exist and are ostensibly the bases of various court matters. It is unclear to me why the subpoena authority of the National Transportation Safety Board does not match that of the State of California's criminal or civil litigants. I have not in any previous investigation seen reluctance on the part of a subpoenaed party cited as cause for abandoning a line of inquiry, nor do I now believe such resistance to be

any sort of justification. There is no explanation as to why this accident investigation is cause for establishing this sort of precedent.

I am heartened by the fact that students on this bus used their seatbelts and agree with staff's excellent investigation of those seatbelts' effectiveness. I also agree with our recommendations regarding seatbelts and inward facing cameras. However, for the foregoing reasons, and because I believe them to be wholly unsupported by the facts of this case, I must also disagree with the following recommendations:

To the National Association for Pupil Transportation, National Association of State Directors of Pupil Transportation Services, and National School Transportation Association:

Inform school bus drivers of the impact their health may have on the safe transportation of school children, of their responsibility to accurately and completely report their health history and medications, and of the legal consequences of dishonesty on the medical examination report. (H-16-7)

I am not certain what is intended by "legal consequences of dishonesty." Clearly, an employer cannot be required to provide legal advice. More importantly, there is absolutely no reason to think even the sternest admonition might compel a young person faced with the loss of employment to reliably self-report. This issue is not unique to commercial motor vehicles. We have seen the same sort of issues in every mode of transportation. We must think outside-the-box to determine ways in which those with relevant information and fewer disincentives, such as treating physicians, can share important information with licensing authorities.

To the Federal Motor Carrier Safety Administration:

Develop a comprehensive medical oversight program for interstate commercial drivers that contains the following program element: Individuals performing examinations have specific guidance and a readily identifiable source of information for questions on such examinations. (H-01-20)

The report does not support this recommendation. I cannot see a connection between this recommendation and the known facts in this crash. There are certain medical conditions that even medical examiners with a plethora of guidance cannot detect without honest communication from a patient. The medical examination form for commercial drivers asked numerous questions that would identify the type of condition this driver is suspected of having. In fact, the basis of the criminal charges against him seems to be an allegation that the driver's answers or failure to answer those very specific questions. There is no question that treating physicians often have more information than do medical examiners, and a recommendation to those medical practitioners would be more logical and, potentially, produce better results.

I remain disappointed in this report. Although certain technical elements are very strong, it does not succeed in the primary mission of the NTSB. We investigate the causes of accidents to make recommendations so that same types of accidents do not happen again. Medical fitness for duty is on our 2016 Most Wanted List for a good reason. Basic medical fitness is the foundation for

the safe operation of every type of personal and commercial vehicle. We have not used these tragic circumstances to learn all we can to make informed recommendations likely to actually prevent crashes. By failing to properly address the probable cause and contributing factors in this investigation, this Board fails not only the children and community affected by this crash but also those likely to be affected by those in the future.