



**NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
WASHINGTON, D.C.**

**VEHICLE FACTORS GROUP CHAIRMAN'S
FACTUAL REPORT**

A. CRASH INFORMATION

Location: 17000 Block 480th St, Oakland, Pottawattamie County, Iowa
Vehicle 1: 2004 IC, Model 3S530, 65 passenger school bus
Operator 1: Riverside Community School District
Date: December 12, 2017
Time: Approximately 06:52 a.m. CST
NTSB #: **HWY18MH003**

B. VEHICLE FACTORS GROUP

Brian Bragonier, Vehicle Factors Investigator, Group Chairman
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C. CRASH SUMMARY

For a summary of the crash, refer to the *Crash Summary Report*, which can be found in the docket for this investigation.

D. DETAILS OF THE VEHICLE FACTORS INVESTIGATION

This document is a collection of factual information obtained during the detailed inspection of the involved vehicle.

The 2004 IC School Bus was inspected between December 13 and 18, 2017 at Arrow Towing, located at 505 South 15th Street, Council Bluffs, Iowa. All major mechanical systems on the school bus were examined, including the steering, braking, and suspension systems. Overall accident damage, along with any damage or anomalies within major vehicle mechanical systems were documented. Some areas of the vehicle could not be reliably documented due to extensive fire damage. Supporting photographs, vehicle specifications, maintenance records, and prior inspection reports were collected.

1. Vehicle Inspection

1.1. Vehicle #1: 2004 IC Model 3S530 School Bus

1.1.1. General Information

VIN¹ : 4DRBRAAP94B970418
Manufacturer: International
Model: IC3S530 School Bus
Manufactured: November 10, 2003
Mileage² : Approximately 162,000
GVWR³ : 29,800 lbs.
GAWR⁴ #1⁵: 10,000 lbs.
GAWR #2: 19,800 lbs.
Engine: Navistar DT466, 215 Horsepower, Diesel, Serial #: 2U1438999
Transmission: Allison, 2000 5-Speed, Automatic
Steering Gear: TRW TAS-55 Ross Power Steering
Brake System: Navistar Diamond Life, Hydraulic Disc w/ABS

1.1.2. Damage Description

The IC school bus sustained severe fire damage affecting all major mechanical systems. Damage specific to many of the vehicle components will be described in greater detail later in the appropriate sections of this document.

For uniform description, “left” will refer to the driver’s side, and “right” will refer to the boarding door side of the school bus. **Figure 1** shows the damage to the right side of the school bus.

¹ Vehicle Identification Number (VIN) with the last six characters redacted.

² According to vehicle maintenance records obtained from the operator.

³ Gross Vehicle Weight Rating (GVWR) is the total maximum weight that a vehicle is designed to carry when loaded, including the weight of the vehicle itself, plus fuel, passengers, and cargo.

⁴ Gross Axle Weight Rating (GAWR), is the maximum distributed weight that a given axle is designed to support.

⁵ For consistency in describing the axles of the school bus, the front (steer) axle will be referred to as Axle #1, and the drive axle as Axle #2.



Figure 1: Damaged Right Side of School Bus

The hood was entirely missing, exposing the engine compartment. All rubber hoses and belts were missing and many aluminum parts had sustained fire damage as well. Plastic parts such as fluid reservoirs and the air cleaner were missing.

The fuel door was opened and the fuel tank was inspected. The fuel cap was in place and no damage was noted to the tank. Approximately 6-inches of fuel remained in the bottom of the tank at the time of inspection.

On the right rear corner of the bus was contact damage. The wrap around steel bumper was slightly deformed rearward and had pulled through several rivets holding it to the body of the bus. There was dirt, debris, and grass embedded in the surface and lodged behind the bumper on a small lip. **Figure 2** shows the damage to the right rear corner of the bus.



Figure 2: Damaged Right Rear Corner of Bus

The rear of the exhaust pipe was displaced upward approximately 3-inches when compared to the exemplar bus. The rearmost exhaust pipe support hanger was also displaced upward approximately 2-inches. There was a split in the exhaust pipe approximately 4-inches long and between 1/16th and 1/8th wide. The turbo charger was disconnected from the exhaust system and shipped to the NTSB Laboratory for analysis.

The windshield, all side windows and rear windows were missing. There was no glass left in the school bus. The loading doors were also missing and could not be located. The headlights and side mirrors were missing. The front lens covers for the red stop lights and amber flashing lights were missing as well. On the rear, all lens covers on the left side were missing, and three of the five on the right were missing. The two remaining lens covers were melted and damaged. The bus body above the right and left rear wheel wells was damaged and blackened.

1.1.3. Driver's Controls

Due to the extensive collision and fire damage to the bus, very few driver controls were able to be documented. The steel frame of the driver's seat was securely mounted in place and did not appear to be deformed. The steel hoop that made up the steering wheel core was also located and measured approximately 17 inches in diameter.

1.1.4. Steering and Suspension

The steering system sustained heavy fire damage, which melted the steering column and exposed the upper steering shaft. The steering wheel was melted to the metal core. The adjustable/tilting steering wheel was found to be offset at approximately a 20° angle to the right. The bottom of the steering wheel was 10 1/2" from the floor of the bus, and approximately 3" from the exposed metal located at the front of the driver's seat. The upper steering shaft was connected to the upper splined intermediate shaft by means of a universal joint. This connection remained intact. Both pinch bolts on the upper and lower universal joints of the

intermediate steering shaft were found to be securely connected during the post-crash inspection.

All segments of the steering system appeared to be mechanically undamaged and in place. The line leading from the TRW steering gear to the power steering fluid reservoir was intact until the point it connected to the fluid reservoir, which was missing. The lower portion of the intermediate shaft remained connected to the input shaft of the steering gear, connected by means of another universal joint. Both the left and right tie rods remained connected to the left and right steering knuckles respectively. Rotating the steering gear's input shaft, by means of rotating the steering wheel, produced the appropriate movement of the steering gear and pitman arm; however, the range of rotation of the input shaft was restricted by the weight of the bus and the rims in contact with the ground.

The school bus's steer axle (axle #1) suspension consisted of two double leaf spring packs mounted to the steer axle, and shock absorbers.

The school bus's drive axle (axle #2) suspension consisted of two 13 leaf spring packs and shock absorbers mounted to the solid drive axle. There was no damage noted to the suspension in the area of axle #2.

1.1.5. Brakes

Due to the significant fire damage sustained by the vehicle, a direct functional check of the hydraulic braking system was not able to be performed. The school bus was equipped with hydraulic disc brakes on all wheels.

The master cylinder for the hydraulic braking system was detached from the mounting brackets on the fire wall of the engine compartment. The fluid reservoir was melted away and entirely missing. The foot treadle on the other side of the firewall was in place but hanging freely from its attachment pin.

The dust covers were removed from the rear disc brake rotors, which were inspected and measured. Both rotors were in good condition and within specification regarding thickness. No cracks or warping was noted.

1.1.6. Tires and Wheels

The tire and weight rating placards that should have been mounted on the school bus was destroyed during the post-crash fire. Information obtained from the build records and the exemplar school bus tire and weight rating placard show the suitable tire size on the front axle to be 265/75R22.5 load range "G" inflated to 110psi. The tire size on the rear axle is recommended at 10R22.5 load range "G" inflated to 105psi. The rim size noted on the record is 22.5x7.50 for both front and rear axles. General information about each of the bus's tires as they were at the time of inspection is included in Table 2. Only the left steer axle tire was in good enough condition to obtain manufacturer, size, and tread information from. All other tires were severely fire damaged to the degree only the steel wires from the bead and body plies remained. The few remnants of the tread from these tires were melted to the point that reliable tread depth measurements could not be taken.

The smallest depth measured on the left steer tire is displayed in the table and represents a minimum tread depth value for that tire.

Axle 1	Left	Right
Make	Firestone	N/A ¹
Model	551	N/A ¹
Size	11R22.5 144/142	N/A ¹
Load Rating	L	N/A ¹
Pressure	Deflated	Deflated
Tread Depth	¹⁰ / ₃₂ inches	N/A ¹
DOT #	N/A ¹	N/A ¹

Axle 2	Left		Right	
	Outside	Inside	Inside	Outside
Make	N/A ¹	N/A ¹	N/A ¹	N/A ¹
Model	N/A ¹	N/A ¹	N/A ¹	N/A ¹
Size	N/A ¹	N/A ¹	N/A ¹	N/A ¹
Load Rating	N/A ¹	N/A ¹	N/A ¹	N/A ¹
Pressure	Deflated	Deflated	Deflated	Deflated
Tread Depth	14/32	N/A ¹	N/A ¹	13/32
DOT #	N/A ¹	N/A ¹	N/A ¹	N/A ¹

¹ Information not available due to fire/heat damage to the tire.

All of the rims were inspected for cracks, welds, and elongated lug nut holes. No non-collision related defects were found on any of the rims. The tire and rim damage observed during the inspection included the following:

- Axle 1 Left
 - No damage to rim, fire/heat damage to tire
 - Tread available for tread depth measurements
- Axle 1 Right
 - No damage to rim, tire destroyed by fire
- Axle 2 Left Outboard and Inboard Tires
 - No damage to rim, tires destroyed by fire, small amount of tread remained
- Axle 2 Right Outboard and Inboard Tires

- No damage to rim, tires destroyed by fire

1.1.7. Transmission

The school bus was equipped with an Allison 2000, 5 speed automatic transmission, and a Navistar DT466, 215 Horsepower engine. The gear shift selector lever was no longer mounted to the dash of the bus, which was destroyed in the fire, but it was intact. There was fire damage to the gear selector face plate obscuring the markings. Measurements were taken of the location of the shift lever within the face plate, which were then compared to measurements obtained on the exemplar bus. These measurements indicate a transmission position of “D” or drive.

1.1.8. Electrical

Due to the extent of the fire damage, the school bus’s entire electrical system was compromised. It was not possible to check the function or integrity of the electrical system.

On the exterior of the bus, below the driver’s seat was a fuse compartment behind a door which opened outward. This compartment was opened and inspected. All wiring and fuses contained within were extremely damaged by the fire.

The battery box, also located on the exterior of the bus, below the fuse compartment, was inspected and no damage was noted to the two batteries within the box. The cables were loose where they attached to the battery terminals, but they were still connected. The insulation covering the battery cables was intact and not melted. The charge on both batteries was 11.65 volts at the time of inspection. The battery hold down was tight against the batteries.

1.1.9. Event Data

The Navistar engine was controlled by an Engine Control Unit (ECU) that controlled engine timing and fuel injection, based on various engine and sensor inputs. This module is also capable of diagnostics associated with engine and/or sensor faults, which may then illuminate warnings on the dash, as well as record vehicle speed, engine speed, and other various parameters during triggered events. The ECU appeared to be destroyed by fire and partially dislodged from its mounting location on the left side of the engine.

1.1.10. Maintenance and Inspection History

Maintenance and inspection records were obtained from the owner of the bus, Riverside Community School District. Additional inspection records were received from the School Transportation Office of the Iowa Department of Education.

The involved school bus was given an annual inspection at the Riverside Community School District Bus Barn on December 6, 2017 by an inspector from the Iowa Department of

Education. This inspector found a total of ten violations on the bus. There were three out of service (OOS) violations noted and seven 30-day violations documented.⁶

Per State of Iowa Department of Education Regulations, out of service violations must be repaired before the vehicle can be used again. The OOS violations noted were:

- Right front red signal was nonfunctional
- Battery hold down was loose
- Rear exit vandal lock warning signal was not audible at driver location

The state inspector documented on the inspection summary that the battery hold down was repaired before he left the day of the inspection. The other two violations were repaired later that same day based upon school district maintenance records. The post-crash inspection performed by NTSB Investigators in the presence of the state inspector confirmed that the exit vandal lock had been remedied to an acceptable state by removing the locking mechanism.

The regulations give school district 30 days to repair 30-day violations. During this time the bus can continue to be used to transport students. The 30-day violations documented on the inspection summary were:

- Roof vent hatch warning signal malfunction – no warning signal in front
- No registration slip available on bus
- Inoperable emergency exit warning signal at driver location (right)
- Inoperable emergency exit warning signal at driver location (left)
- Expired chassis inspection card
- Missing clamp on exhaust system tailpipe

At the time of the post-crash inspection, Investigators were able to determine that the missing clamp on the exhaust pipe had not been replaced. The state of repair for the other violations could not be determined due to fire damage.

1.1.11. Documented Recalls and Warranty Claims

Recall and warranty claim information was received from the manufacturer. This information indicates three recalls on the school bus, but all had been satisfied according to manufacturer records.

The first recall affecting this bus (G-04507) was issued in June 2004. The defect description stated that the anti-lock brake system (ABS) electronic control unit may misinterpret a corrupt wheel speed signal. The corrupt wheel speed signals may improperly activate the ABS, instead of deactivating the ABS. This may result in the driver experiencing a hard-pedal feel and a decrease in deceleration at the end of the stop, resulting in extended stopping distances.

⁶ See Vehicle Attachment- Iowa Department of Education District Bus Inspection Summary

The second recall on the bus (G-05516) was issued in October 2005. This was a recall for the micro switch that controls the stop arm position. It stated the switch can malfunction intermittently in operating conditions below 32 degrees Fahrenheit. This condition may cause the stop arm to open or close to an improper position, or not at all, which could increase the likelihood of a vehicle passing a stopped school bus and striking pedestrians in the vicinity of the stopped bus.

The third recall (G-09501) was issued in June 2009. This defect recall was for the heater blower motor located in certain entrance door stepwell heater units and rear wall mounted heater units. The recall stated that the blower may fail in low speed operation causing elevated temperatures that can result in ignition of any nearby combustible materials.

The repair for this recall (G-09501) was completed on December 11, 2009 at Cornhusker International Trucks in Omaha, Nebraska.⁷

Investigators removed the fire damaged cover for the stairwell heater and inspected the unit for evidence of failure or internal combustion. No evidence of failure was found in the unit.

E. DOCKET MATERIAL

The following attachments and photographs are included in the docket for this investigation:

LIST OF ATTACHMENTS

Vehicle Attachment – 2004 IC CE School Bus Vehicle Specifications/Build Sheet

Vehicle Attachment – Accident Vehicle Inspection & Maintenance Records

Vehicle Attachment – Navistar Vehicle Recall G-09501

Vehicle Attachment – International Warranty Claim Details for Recall G-09501

Vehicle Attachment – Navistar Vehicle Recall G-04507

Vehicle Attachment – Navistar Vehicle Recall G-05516

LIST OF PHOTOGRAPHS

Vehicle Photograph 1 – 2004 IC School Bus – Overall School Bus Damage Facing Right Front Corner

Vehicle Photograph 2 – 2004 IC School Bus – Damage to Right Rear Corner of School Bus

⁷ See Vehicle Attachment- Stepwell Heater Blower Motor Recall Repair Details

END OF REPORT

Brian Bragonier

Vehicle Factors Investigator