

Remote School Bus Investigation  
Dynamic Science, Inc. (DSI), Case Number DS08012  
1999 Blue Bird TC2000 School Bus  
Montana  
April 2008

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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16. Abstract This remote investigation focused on the ejection of a child occupant of a Blue Bird school bus during a vehicle-to-vehicle crash. The crash occurred April 2008 at 1810 hours within a four-leg intersection. The subject vehicle was a 1999 Blue Bird full-size yellow school bus that was being driven by a restrained 44-year-old female. There were 10 unrestrained children on board the bus at the time of the crash. The children were returning home from an after-school program. The other vehicle was 2004 Dodge pickup that was being driven by a 64-year-old female. There was one additional occupant in the Dodge, a 63-year-old male. The Dodge pickup was towing a gooseneck trailer loaded with gravel. The school bus was initially traveling south. The school bus stopped at a stop sign at the intersection, and then initiated a left turn to go to the east. The Dodge pickup was traveling east approaching the four-leg intersection. There was no stop sign for eastbound traffic. The driver of Dodge pickup was unable to stop in time and the front of the Dodge struck the right side of the school bus. A 7-year-old female occupant of the school bus was ejected from the vehicle through a side window and was fatally injured. Eight of the remaining nine children in the school bus were injured. The driver of the school bus and both occupants of the Dodge pickup were also injured. The driver of the school bus was treated and released. The occupants of the Dodge pickup were hospitalized.				
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## Background

This remote investigation focused on the ejection of a child occupant of a Blue Bird school bus during a vehicle-to-vehicle crash. The crash occurred April 2008 at 1810 hours within a four-leg intersection. The subject vehicle was a 1999 Blue Bird full-size yellow school bus that was being driven by a restrained 44-year-old female (**Figure 1**). There were 10 unrestrained children on board the bus at the time of the crash. The children were returning home from an after-school program. The other vehicle was 2004 Dodge pickup that was being driven by a 64-year-old female. There was one additional occupant in the Dodge, a 63-year-old male. The Dodge pickup was towing a gooseneck trailer loaded with gravel.



**Figure 1.** On scene view of school bus.

The school bus was initially traveling south. The school bus stopped at the stop sign at the intersection, and then initiated a left turn to go to the east. The Dodge pickup was traveling east in approach of the four-leg intersection. There was no stop sign for eastbound traffic. The driver of Dodge pickup was unable to stop in time and the front of the Dodge struck the right side of the school bus. There was a second impact between the two vehicles as they sideslapped. The Dodge also impacted a small pole on its path to final rest.

A 7-year-old female occupant of the school bus was ejected from the vehicle through a side window and was fatally injured. Eight of the remaining nine children in the school bus were injured. The driver of the school bus and both occupants of the Dodge pickup were also injured. The driver of the school bus was treated and released. Both occupants of the Dodge pickup were hospitalized.

This remote school bus investigation was initiated in response to an internet news article that reported the ejection and death of a child occupant in a full-size school bus. DSI was notified of the crash on April 24, 2008 and instructed to obtain cooperation with the investigating police agency. DSI obtained cooperation on April 24, 2008. The following information was obtained from the police report and on-scene photographs.

## SUMMARY

### Crash Site

The crash occurred within a four-leg intersection in April 2008. At the time of the crash, there were no adverse weather conditions and the asphalt roadway surface was dry. The temperature was 5.5 degrees C (42 degrees F) with 50% humidity. The north/south roadway was configured with one lane in each direction



**Figure 2.** Southbound approach for 1999 Bluebird bus

(**Figure 2**). The roadway was controlled by stop signs in each direction. The southbound leg of the intersection was gravel covered and had a slight uphill grade of approximately 2 percent. The east/west roadway was configured with one lane in each direction that were separated by a solid yellow center line in the eastern direction and a dashed yellow center line in the western direction (**Figure 3**). The roadway was level, and bordered on both sides by solid white fog lines, asphalt shoulders, and sloping grass covered embankments. There was no stop sign for eastbound traffic. The posted speed limit was 113 km/h (70 mph).



**Figure 3.** Eastbound approach for 2004 Dodge Ram

### Pre Crash

The 1999 Blue Bird school bus was initially traveling southbound. There were a total of 11 occupants in the vehicle. An overview of seating positions and injuries is shown in Table 1. The police report stated that all the seating positions listed for the children were approximate except for the fatally injured child.

According to the driver of the school bus, she brought the vehicle to a controlled stop at the intersection. She indicated that she looked and did not see any eastbound traffic. She proceeded into the intersection and began a left turn to travel east. The unrestrained driver of the Dodge pickup was operating the vehicle in the eastbound lane at a driver reported speed of 97-105 km/h (60-65 mph). Prior to the crash, the front right passenger had unbuckled his seat belt and had turned around to get something out of the rear seat. The driver of the Dodge saw the school bus pull into the intersection.

**Table 1. Overview of Seating Positions and Injury Severity**

Occupant No.	Age	Sex	Seat Position	Police Injury Severity
1	44	Female	1L	Non-Incapacitating Injury
2	6	Female	2L	Non-Incapacitating Injury
3	7	Female	2R	Fatal
4	8	Female	3L	Non-Incapacitating Injury
5	6	Female	4R	Non-Incapacitating Injury
6	7	Female	5R	Non-Incapacitating Injury
7	6	Female	6R	Non-Incapacitating Injury
8	9	Female	7R	Non-Incapacitating Injury

Occupant No.	Age	Sex	Seat Position	Police Injury Severity
9	9	Female	8R	Non-Incapacitating Injury
10	11	Male	9R	Non-Incapacitating Injury
11	8	Male	Unknown	Not Injured

## Crash

The driver of the Dodge braked but was unable to stop in time and the front of the pickup struck the right side of the school bus near the right front wheel. A 7-year-old female occupant of the school bus was ejected from the vehicle through a right side window and was fatally injured. She came to rest in the eastbound travel lane. The bus was displaced in a counterclockwise direction and began moving east. The left side of the Dodge's trailer moved in a clockwise direction and contacted the right rear of the bus. The Dodge was displaced in a southeast direction, left the roadway, and struck a small pole on its path to final rest. The bus continued moving east. Its steering had been damaged and the vehicle veered off the roadway



**Figure 4.** Area of impact and final rest (east).

where it came to rest on its wheels facing southeast with most of the length of the bus off the south side of the roadway (**Figure 4**). The pickup and trailer remained connected via the safety chain, though the goose-neck trailer hitch had disconnected. The Dodge came to rest off the roadway and slightly west of the bus facing east, roughly parallel with the south side of the roadway

## Post Crash

The ejected child was conscious for a short time after the crash. The driver of the bus placed a coat over her and told her to lie still, as she was calling for her mother and attempting to get up. The father of the child arrived on scene and spoke with his daughter before she lost consciousness. Fire and ambulance began CPR efforts upon their arrival. Shortly after the arrival of the police, the CPR efforts were discontinued. The coroner later indicated that the 7-year-old child died of blunt force trauma injuries to the chest. The coroner's report identified the following injuries: left lung contusion, left side fracture of ribs 1-4, a large splenic laceration, a large forehead contusion, and a variety of contusions, abrasions, and lacerations over her entire body. There were multiple abrasions over the whole right side of the body, including the trunk and right side of thigh with some type of sharp force injury within the abraded area of the thigh.

The bus driver evacuated the vehicle through the rear door. Eight of the remaining nine children in the school bus were injured. Six were treated at the scene and released to their parents and two were transported to a local hospital where they were treated and released.

The driver of the school bus and both occupants of the Dodge pickup were also injured. The driver of the school bus was transported to a local trauma center where she was treated and released. The driver of the Dodge pickup was transported by ground ambulance to a local trauma center where she was admitted. The front right occupant of the pickup was transported by helicopter to a local trauma center where he was hospitalized.

#### Vehicle Data - 1999 Blue Bird School Bus

The 1999 Blue Bird TC2000 forward engine school bus was identified by the Vehicle Identification Number (VIN): 1BAANCSA0XFxxxxxx. The Blue Bird was equipped with a Cummins 5.9-liter, 6-cylinder engine and an automatic transmission. The bus had a total weight of 6,713 kg (14,800 lbs) and was configured with 13 rows with seating for 54. The vehicle was equipped with an after-market video camera. The police examined the video and no footage of the crash or the trip prior to the crash was found on the tape.

The Blue Bird was equipped with Goodyear G149RSA 11R22.5 tires on the front and Kelly KDA Armorsteel 11R22.5 tires on the rear duals. The police reported that both the front and rear tires had a tread depth of approximately 10 mm (13/32 in).

#### Vehicle Damage

##### Exterior Damage - 1999 Blue Bird School Bus

The 1999 Blue Bird school bus sustained moderate right side damage as a result of the initial impact with the Dodge truck (**Figure 5**). The direct damage began at the double outward folding doors and extended rearward to the right front wheel well. The damage extended vertically from the frame to the bottom of the rub rail. There was a small fracture to the right lower aspect of the windshield and a star-shaped fracture in front of the driver's position. The right front tire was rotated clockwise at a 45 degree clockwise angle. A police investigator checked the front suspension and reported that the shaft from the steering gear to the pitman arm was broken off. There was minor contact damage as a result of the impact with the striking vehicle's trailer (**Figure 6**). The damage was located aft of the rear tires and beneath the rub rail.

##### Interior Damage - 1999 Blue Bird School Bus

There was lateral crush and buckling to the entrance steps. The lower door glazing was



**Figure 5.** Right side damage (Event 1)



**Figure 6.** Right side damage (Event 2)

disintegrated. The partition between the entrance and the right side second row seat was deformed. There was gravel from the striking vehicle found inside the bus.

The bus was configured with 15 split sash windows on each side of the bus. The glazing for the second right side window was disintegrated for both the lower and upper portions of the window. The center frame of the window was bowed outward due to occupant contact (Occupant 3). Hairs and fibers were located on the frame. The glazing for the lower portion of the third right side window was disintegrated. The glazing for the lower portion of the fourth right side (emergency exit) window was cracked due to occupant contact (Occupant 5). The base of the window was open approximately 7-10 (2.8-3.9 in). A blood deposit was located at the bottom frame of the window. The glazing for the eighth right side window was disintegrated. The center frame was deformed inward and there were indications that the glass may have been broken by flying gravel.

### Manual Restraints - 1999 Blue Bird School Bus

There was one safety belt in this vehicle located in the driver's seating position. The driver was using the 3-point manual lap and shoulder belt. There were no other required safety belts.

### Emergency Egress

The Bluebird School bus had a total of 7 emergency exits: 1 emergency exit door at the rear of the bus, 2 emergency exit roof hatches (front and rear), and 4 emergency exit windows (2 on each side). The driver indicated that all the child occupants on the bus exited through the rear emergency door with her assistance. The first right side emergency window was partially open. It was not known if there was an attempt to actually open the emergency window post-crash.

### Vehicle Data - 2004 Dodge Ram pickup

The 2004 Dodge Ram 3500 series four-door pickup (**Figure 7**) was identified by the VIN: 3D7LU38C04Gxxxxxx. The Dodge was equipped with a 6.0 liter, 6-cylinder diesel engine, automatic transmission, and four-wheel drive. The Dodge was towing a Load Trail tandem axle gooseneck dump trailer (**Figure 8**). The trailer was manufactured in November 2007. The bed of the truck and the trailer were loaded with landscaping gravel. The truck's loaded weight was 3538 kg (7800 lbs), the trailer's loaded weight was 3674 kg (8100), and the total loaded weight of the two units was 7212 kg (15,900 lbs).

The Dodge was traveling eastbound with two



**Figure 7.** 2004 Dodge pickup



**Figure 8.** Load Trail trailer

occupants on board. At impact with the right side of the bus, the Dodge sustained moderate front end damage. As the vehicle rotated, the Dodge sustained minor left side sideslap type damage to the trailer. As the vehicle continued forward, it ran over and bent a metal delineator on the roadside. The Collision Deformation Classification (CDC) for the initial bus impact was 12FDEW2.

### **OCCUPANT DEMOGRAPHICS - 1999 Blue Bird School Bus**

	<b>Driver</b>	<b>Second Row Left (02)</b>
Age/Sex:	44/Female	6/Female
Seated Position:	Front row left	Second row left
Seat Type:	Bucket	Bench
Seat Track Position:	Unknown	N/A
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Alcohol/Drug Involvement:	None	N/A
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used	None
	<b>Second Row Right (03)</b>	<b>Third Row Right (04)</b>
Age/Sex:	7/Female	8/Female
Seated Position:	Second row right	Third row left
Seat Type:	Bench	Bench
Seat Track Position:	N/A	N/A
Height:	135 cm (53 in)	147 cm (58 in)
Weight:	39 kg (85 lbs)	43 kg (95 lbs)
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	None	None

	<b>Fourth Row Right (05)</b>	<b>Fifth Row Right (06)</b>
Age/Sex:	6/Female	7/Female
Seated Position:	Fourth row right	Fifth row right
Seat Type:	Bench	Bench
Seat Track Position:	N/A	N/A
Height:	122 cm (48 in)	107 cm (42 in)
Weight:	32 kg (70 lbs)	23 kg (50 lbs)
Body Posture:	Unknown	Upright
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	None	None

	<b>Sixth Row Right (07)</b>	<b>Seventh Row Right (08)</b>
Age/Sex:	6/Female	9/Female
Seated Position:	Sixth row right	Seventh row right
Seat Type:	Bench	Bench
Seat Track Position:	N/A	N/A
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	None	None

	<b>Eighth Row Right (09)</b>	<b>Ninth Row Right (10)</b>
Age/Sex:	9/Female	11/Male
Seated Position:	Eighth row right	Ninth row right
Seat Type:	Bench	Bench
Seat Track Position:	N/A	N/A
Height:	Unknown	132 cm (52 in)
Weight:	Unknown	Unknown
Body Posture:	Unknown	Upright
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	None	None

	<b>Unknown (11)</b>
Age/Sex:	8/Male
Seated Position:	Unknown
Seat Type:	Bench
Seat Track Position:	N/A
Height:	Unknown
Weight:	Unknown
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	None

## Occupant Kinematics

### Driver Kinematics (01)

The 45-year-old female driver was seated in an unknown posture and was restrained by the manual 3-point manual lap and shoulder belt. Her height and weight were unknown. The driver was actively steering the vehicle and reported that she did not see the other vehicle and did not take any evasive maneuvers. At impact, she initiated a right lateral and slightly rearward trajectory. The driver sustained injuries of an unknown nature. She was able to open the rear emergency exit and assist the passengers as they exited the vehicle.

### Second Row Left Occupant Kinematics (02)

The 6-year-old female second row left occupant was seated in an unknown posture. She was unrestrained. Her height and weight were unknown. At impact, she initiated a lateral and slightly rearward trajectory to the right. According to the police report, she sustained non-incapacitating injuries. She was examined at the scene and then released to her parents.

### Second Row Right Occupant Kinematics (03)

The 7-year-old female second row right occupant was seated in an unknown posture and was unrestrained (**Figure 9**). She was 135 cm (53 in) in height and weighed 39 kg (85 lbs). She was wearing a short-sleeve pullover shirt, lightweight sweat pants, and socks. She may have also been wearing a maroon jacket that was removed post-crash. At impact, she initiated a right lateral and slightly rearward trajectory and was ejected through the side window. The window sash was deformed outward (**Figure 10**). She sustained multiple contusions along the right side of her body from contact to the side interior surface and multiple abrasions from the side window frame as she was ejected. She impacted the ground and came to rest in the eastbound travel lane. She sustained left side rib fractures, a left lung contusion, a splenic laceration, and multiple contusions and abrasions from the ground impact. She was conscious for a short time after the crash. Fire and ambulance personnel began CPR efforts upon their arrival. Shortly after the arrival of the police, the CPR efforts were discontinued.



**Figure 9.** Second row right occupant seating position



**Figure 10.** Area of ejection, contact evidence on sash

### Third Row Left Occupant Kinematics (04)

The 8-year-old female third left right occupant was seated in an unknown posture. She was unrestrained. She was 147 cm (58 in) in height and weighed 43 kg (95 lbs). At impact, she initiated a right lateral and slightly rearward trajectory and contacted the right side seat. According to the interviewee, she sustained contusions all over the right side of her body. She was transported to a local hospital where she was treated and released.

### Fourth Row Right Occupant Kinematics (05)

The 6-year-old female fourth row right occupant. She was 122 cm (48 in) in height and weighed 32 kg (71 lbs). At impact, she initiated a right lateral and slightly rearward trajectory. She contacted the emergency side window (**Figure 11**). The window was fractured in a star pattern. She sustained a contusion to the right arm from the contact with the window and a contusion to the right leg from contact with the lower side panel. She was transported from the scene to a local hospital where she was treated and released.



**Figure 11.** Occupant 5 seating position

### Occupants 06, 08, 09 Kinematics

These occupants were seated on the right side of the bus in unknown postures. They were unrestrained, and their heights and weights were unknown. At impact, they initiated right lateral and slightly rearward trajectories. They likely contacted the interior side surface of the bus. According to the police report, they sustained non-incapacitating injuries. They were examined at the scene and then released to their parents.

### Sixth Row Right Occupant Kinematics (07)

The 6-year-old female occupant was seated in an upright posture. Her height and weight were unknown. At impact, she initiated a right lateral and slightly rearward trajectory. She contacted the right interior side surface of the bus with the right side of her body. The interviewee reported multiple unspecified contusions. She was treated at the scene and released to her parents.

### Ninth Row Right Occupant Kinematics (10)

The 11-year-old male occupant was seated in an upright position. He was 132 cm (51 in) in height and his weight was unknown. At impact, he initiated a right lateral and slightly rearward trajectory. He contacted the right interior side surface of the bus. There were no reported injuries and he was not treated.

### Unknown Seat Occupant Kinematics (11)

The 8-year-old male occupant was seated in an unknown posture in an unknown seating position.

His height and weight were not known. He did not sustain any injuries.

### **OCCUPANT INJURIES -1999 Blue Bird School Bus**

Driver: Nature and extent of injuries not known. Police reported that she sustained non-incapacitating injuries.

Occupant 02: Nature and extent of injuries not known. Police reported that she sustained non-incapacitating injuries.

Occupant 03: Injuries obtained from autopsy report.

<u>Injury</u>	<u>AIS Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Left lung contusion and laceration	441406.3,2 441414.3,2	Ground	Possible
Left rib fractures, 1-4	450230.3,2	Ground	Possible
Splenic laceration	544222.2,2	Ground	Possible
Forehead contusion (2-3 inches)	290402.1,7	Right side window frame	Possible
Contusion, right breast	490402.1,1	Right side panel	Probable
Contusion, right shoulder and right elbow	790402.1,1	Right side panel	Probable
Abrasion, right side, trunk	590202.1,1	Right side panel	Probable
Abrasion, right thigh, with some type of sharp force injury within the abraded area. Abrasion, medial aspect, right knee.	890202.1,1	Right side window frame	Probable
Superficial sharp force injuries, lateral aspect of right shoulder	790600.1,1	Right side panel	Probable
Heat injury, left shoulder and above left breast	Not codeable	Unknown	Unknown
Abrasion, left abdomen	590202.1,2	Ground	Possible
Contusion, left side of back	690402.1,2	Ground	Possible
Contusion, above left illiac crest	890402.1,2	Ground	Possible
Lacerations, lateral aspect, left lower leg. Lacerations, left heel, extending to toes. Lacerations, left lower thigh.	890600.1,2	Right side window frame	Possible

Laceration, right temple	190600.1,1	Side glass	Probable
Contusions, lower legs	890402.1,3	Unknown	Unknown

Occupant 04: Injuries obtained from interviewee.

<u>Injury</u>	<u>AIS Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Multiple contusions to right side of body	990400.1,0	Seat	Probable

Occupant 05: Injuries obtained from interviewee.

<u>Injury</u>	<u>AIS Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Contusions, right arm	790402.1,1	Side window	Probable
Contusions, right leg	890402.1,1	Side panel	Probable

Occupant 06: Nature and extent of injuries not known. Police reported that she sustained non-incapacitating injuries.

Occupant 07: Injuries obtained from interviewee.

<u>Injury</u>	<u>AIS Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Multiple contusions	990400.1,0	Right side panel	Possible

Occupant 08: Nature and extent of injuries not known. Police reported that she sustained non-incapacitating injuries.

Occupant 09: Nature and extent of injuries not known. Police reported that she sustained non-incapacitating injuries.

Occupant 10: No reported injuries.

Occupant 11: No reported injuries.

Attachment 1. Scene Diagram

