



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

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

A. CRASH INFORMATION

Location: State Route 12 (SR-12) mile marker 10.4 near Bryce Canyon City,
Garfield County, Utah

Vehicle 1: 2017 Freightliner, Embassy body 37-passenger medium-size bus

Operator 1: America Shengjia Inc.

Date: September 20, 2019

Time: Approximately 11:30 a.m. MDT

NTSB #: **HWY19MH012**

B. SURVIVAL FACTORS GROUP

Ronald A. Kaminski, Survival Factors Investigator, Group Chairman
NTSB Office of Highway Safety
490 L'Enfant Plaza East, S.W., Washington, DC 20594

C. CRASH SUMMARY

For a summary of the crash, refer to the *Crash Summary Report of the Investigation*, in the docket for this investigation.

D. DETAILS OF THE SURVIVAL FACTORS INVESTIGATION

The survival factors investigation focused on the deformation sustained by the medium-size bus, the occupants' injuries, the bus restraint systems, and the emergency response.

For uniform description, "left" will refer to the driver's side, and "right" will refer to the loading door side of the vehicle.

NTSB investigators inspected the medium-size bus on September 25, 2019 and again on November 19, 2019 at Ramsey's Towing located in Kanab, Utah.

1. 2017 Freightliner with Embassy 36-passenger medium-size bus body

The crash-involved vehicle was a Freightliner cab with an Embassy 37-passenger bus body (hereafter the bus). The bus was operated by a 59-year old male driver and had 30 passengers on-board.

1.1. Exterior Damage

The bus sustained extensive roof damage with significant downward vertical intrusion. The top fiberglass portion of the driver compartment roof was torn off the bus. The bus roof was displaced and shifted to the right side approximately 31 inches as shown in **Figures 1 and 2**. Additionally, the roof on the left side was crushed downward and shifted approximately 47 inches rightward, exposing the two passenger seats adjacent to the sidewall on the left side as shown in **Figures 3 and 4**. The left side window post showed signs of having been in contact with pavement, with portions worn through and asphalt debris present.



Figure 1. Right side view of roof crush and rollover damage. **Figure 2.** Left side view of damage to roof.

The driver's door was ajar and unable to close due to the frame being deformed with the front passenger door (chassis cab) being operational. The windshield was totally displaced and laid out in the engine compartment. The bus was equipped with 8 windows on the left side and 7 windows on the right side. There were 6 emergency exit windows (#3, #5, and #7 on the left side and #2, #4, and #6 on the right side) and an emergency roof hatch. Due to the deformation to the roof structure, most of the window frames along both sides were displaced. At the time of inspection, the Transpec roof hatch located above the center aisle near rows 6-7 was found closed and damaged (exterior road rash) and was not fully operable. The passenger loading bi-fold door was damaged and was stuck partially open. The aft window of the passenger loading bi-fold door was broken out while the forward window remained intact. For detailed exterior examination description, *Refer to the Vehicle Factors Factual Report of the Investigation* in the docket.



Figure 3. View looking aft at lateral roof shift on right side. **Figure 4.** View of lateral roof shift on left side.

1.2. Interior Damage

The bus sustained severe vertical intrusion from the roof collapse in addition to right sidewall intrusion towards the middle portion of bus. As noted in section 1.1, the driver and front right seating area remained undamaged except for the fiberglass roof above this section which was entirely displaced as shown in **Figure 5**. The modesty panels along both sides of the loading stairwell were displaced from their original attachment points.



Figure 5. Interior view of missing roof above driver seating. **Figure 6.** View looking forward of roof collapse.

Roof intrusion to the passenger compartment was measured in the center of the aisle from front to back at each seat row. The bus was equipped with an overhead luggage rack down both sides which remained attached to the collapsed roof. The roof and luggage racks were collapsed onto the seatbacks in seat rows 4-6 as shown in **Figure 6**. Measurements showing the vertical distance from floor to roof taken in the aisle at each row are shown in **Table 1**. According to the manufacturer, the normal interior height of the bus roof is 81 7/8 inches.

Table 1. Vertical Distance from Floor to Roof at Each Row

Row 1 – 64 inches	Row 6 - 51 inches
Row 2 – 69.5 inches	Row 7 – 46 inches
Row 3 – 48 inches	Row 8 – 53 inches
Row 4 – 50 inches	Row 9 – 76.5 inches
Row 5 – 40 inches	

1.2.1. Driver and Front Passenger Seats

The chassis cab driver and front right passenger seat positions were bucket-style seats equipped with lap-shoulder belts. The Embassy bus body passenger seats were configured as follows: on the left, there were 8 rows of 2-person seats and on the right were 7 rows of 2-person seats. The last row, consisting of 5 seats in a single row across the bus rear wall. This is labeled as row 9 based on the left side having 8 rows and the right side comprised of 7 rows of seats from front to back.

The passenger seats were manufactured by Freedman Seating Company and were equipped with an adjustable/self-tightening lap-belt manufactured by Shield Restraint Systems Inc.¹ The restraints were attached to the back of the seat frame with two bolts (one for the latch plate and the other for the buckle) that were spaced 11.5 inches apart.

The seat backs could be reclined 5 degrees. The seat frames are attached to the base frame at five attachment points. The base frame was attached to a longitudinal sidewall track at two attachment points. The base frame is also attached to the leg, which is attached to the floor with three attachment points (one forward, two aft). Postcrash inspection showed the passenger seat frames remained intact and attached to the base frame, floor and sidewall.

1.3. Seat Belt Usage

As described previously, the 35 Embassy medium-size bus passenger seats were equipped with lap-belts. According to passenger statements, 16 admitted to wearing the lap-belts (either because their spouses told them to put them on or because they felt the driver was driving too fast.) Eight passengers that stated they were restrained by their lap-belt voluntarily showed NTSB staff the belt pattern abrasions or bruising sustained during the crash on their hips, thighs, and/or abdomens.

Postcrash lap-belt examination uncovered: five restraints still buckled; one restraint with the cover of the buckle broken off; one restraint with twisted webbing; and 26 of 35 restraints had the webbing length adjusted. The belt webbing on 19 lap belts had been adjusted in length between 7 to 16 inches. Eight restraint webbings were documented as adjusted in length between 3.5 to 6 inches. Descriptions of the on-scene lap-belt and seat examinations are presented in **Table 2**.

¹ <https://www.trustshield.com/about/>

Table 2: Documentation of the medium-size bus seats and lap belts.

Seat Row/Position	Examination of Seats and Lap Belts
Chassis Cab Driver	Seatback in upright position. Lap and shoulder belt found unbuckled and retracted. Small heat abrasion mark to D-ring. Some striations to latch plate, diagonal mark on webbing in location of buckle location with slight cupping to webbing.
Chassis Cab Front Right Passenger	Seatback in the upright position Lap and shoulder belt in stored position.
EMBASSY BUS BODY	
1A	Sidewall intrusion into seat approximately 7 inches at the seatback. Lap belt was buckled. No evidence of damage/usage found on latch plate. Webbing length not adjusted.
1B	Lap belt webbing adjusted 9 inches. No evidence of damage/usage found on latch plate. Seatback tilted outward. Armrest bent inward approximately 3.5 inches.
1D	Lap belt webbing adjusted 12.5 inches. No evidence of damage/usage found on latch plate.
1E	Armrest bent inward 4 inches. No evidence of damage/usage found on latch plate. Lap belt webbing adjusted 11 inches.
2A	Lap belt was buckled. Abrasion to topside of plastic latch housing. Latch plate clean. No webbing adjustment.
2B	Top half of seatback deformed and crushed outward approximately 9 inches. Armrest in upward position and bent outward with seatback. Lap belt webbing adjusted 13 inches. No evidence of damage/usage found on latch plate.
2D	Luggage rack lying on top of seatback. Lap belt webbing not adjusted. Latch plate clean. Bus roof resting on top of seatback.
2E	Luggage rack lying on top of seatback. Lap belt webbing adjusted 7 inches. Lap belt was buckled. No evidence of damage/usage found on latch plate. Armrest bent outward 1 inch. Sidewall intrusion approximately 1.5 inches.
3A	Lap belt webbing adjusted 8.5 inches. No evidence of damage/usage found on latch plate.
3B	Seatback slightly tilted outward. Lap belt webbing adjusted 16 inches. Scratch on latch plate. Armrest bent inward 2.5 inches.
3D	Lap belt webbing was adjusted 5 inches. Scuff on latch plate.
3E	Lap belt webbing adjusted 10.5 inches. Scuff on latch plate. Latch plate has blood on it. Armrest bent inward 1.5 inches. Sidewall intrusion approx..
4A	Lap belt webbing was adjusted 9 inches. Scratch on latch plate.
4B	Lap belt webbing adjusted 10 inches. Seatback bent back to 77 degrees. Armrest in upwards position. No evidence of damage/usage found on latch plate.

4D	Lap belt webbing adjusted 10.5 inches. Scuff on latch plate. Approx. 15 inches of sidewall intrusion into occupant space.
4E	Sidewall intrusion approximately 15 inches into seatback. Seatback deformed laterally and aft due to sidewall intrusion. Lap belt webbing was adjusted 3.5 inches. Scuff on latch plate. Latch plate also has blood on it. Armrest bent inward 2 inches.
5A	Lap belt webbing adjusted 5 inches. No evidence of damage/usage found on latch plate.
5B	Lap belt webbing adjusted 12.5 inches. No evidence of damage/usage found on latch plate. Armrest bent inward 2.5 inches. Roof/luggage racks resting on top of seatback.
5D	Lap belt webbing adjusted 10 inches. Scuff on latch plate.
5E	Sidewall intrusion approximately 4 inches. Seatback deformed. Lap belt webbing adjusted 7.5 inches. Scuff and blood on latch plate. Armrest bent outward 6 inches.
6A	Lap belt webbing not adjusted. No evidence of damage/usage found on latch plate.
6B	Lap belt webbing adjusted 7.5 inches. No evidence of damage/usage found on latch plate. Armrest bent outward 3 inches.
6D	Lap belt webbing not adjusted. No evidence of damage/usage found on latch plate.
6E	Lap belt webbing adjusted 4 inches. No evidence of damage/usage found on latch plate. Armrest bent slightly outward. Seatback bent back to a 74 degree angle
7A	Seatback shifted outward approximately 15.5 inches and crushed downward 11 inches. Lap belt webbing adjusted 5 inches. Scuff on latch plate.
7B	Seatback shifted outward approximately 3 inches. Armrest bent inward 5 inches. Lap belt webbing adjusted 11 inches. Scuff on latch plate. Plastic cover on latch plate broken off. Topside of buckle housing has what appears to be road rash abrasion with specs of brown/red on inside of buckle button. The underside of buckle has abrasion to front end of housing.
7D	Lap belt webbing adjusted 6 inches. Lap belt was buckled. No evidence of damage/usage found on latch plate.
7E	Lap belt webbing adjusted 7 inches. No evidence of damage/usage found on latch plate.
8A	Seatback tilted back to 84 degrees. Lap belt webbing adjusted 9 inches. Scuff on latch plate.
8B	Seatback tilted back to 84 degrees. Armrest shifted inward 3.5 inches. Lap belt webbing adjusted 8.5 inches. Webbing twisted at latch plate. Scuff on latch plate.
Back row seat A	Latch plate tucked behind seat and was not readily accessible.
Back row seat B	Lap belt webbing adjusted 5 inches. No evidence of damage/usage found on latch plate.
Back row seat C	Lap belt was buckled. No evidence of damage/usage found on latch plate. Webbing adjusted 11.5 inches.

Back row, seat D	Lap belt webbing adjusted 12.5 inches. No evidence of damage/usage found on latch plate.
Back row, seat E	Lap belt webbing adjusted 4.5 inches. No evidence of damage/usage found on latch plate.

1.4. Postcrash Seat Belt Removal and Examination

NTSB investigators removed 2 bus lap belts (3D and 5A) while on scene postcrash. NTSB investigators returned to the bus for further inspection on November 19, 2019 and removed an additional 3 lap-belts (restraints were removed from seats 2A, 3D, 5A, 7A, and 7B). In addition, investigators removed 2 roof supports for examination and testing at the NTSB Materials Laboratory in Washington, DC.²

On January 21, 2020, NTSB investigators examined then photographed the 5 removed lap-belts at the NTSB Materials Laboratory to document evidence of passenger usage precrash.³ This examination included looking for evidence of restraint failure based on passenger statement regarding restraint use with ejection (as noted above in section 1.3). See **Table 3** below for a description of the examinations. NTSB investigators performed several tests in an attempt to cause the buckles to release but were unsuccessful.

NTSB investigators also examined the welds on the 2 roof support posts removed from the Embassy bus body for possible structural failure.⁴

Table 3 – NTSB Laboratory Examination Findings

Seat Belt Position	Description of Findings
7A	Belt not used in crash. All the lap belt webbings were manufactured as 7-panel belts. Buckle side - damage to webbing at fold into anchor at first panel on topside. Underside of latch belt has puncture hole to 1 st panel near Shield belt tag.
2A	Lap belt worn passenger thrown into loading stairwell. ⁵ Lap belt was found buckled. Length of belt with adjustment was 29 ¼ inches. Abrasion to topside of plastic latch housing. Topside of latch plate webbing at 5 th panel is frayed. There was fraying to 2 nd panel to both top and backside. Slight web fraying to 1 st panel measured at 20 ½ inches to latch plate. No witness or loading marks visible.
5A	Lap belt worn; occupant ejected with serious injuries. Load bar was stuck in an angle. Mark on webbing of latch plate at 21 ¼ inches. No witness or loading marks visible.

² Refer to Vehicle Group Chairman’s Factual Report for more information regarding the roof posts examination.

³ Refer to Table 3 regarding lap belt examination findings.

⁴ Refer to Vehicle Group Chairman’s Factual Report for more information regarding the roof posts examination.

⁵ Belt use information gathered from interpreter who communicated with other passengers.

7B	Lap belt worn; occupant ejected with serious injuries. Topside of webbing has a distinct crease in webbing at 20 ½ - 19 ¾. Topside of buckle housing had what appears to be road rash abrasion with specs of brown/red on inside of buckle button. The underside of buckle had an abrasion to front end of the housing. The latch plate has use marks and there's also a narrow brown/red mark on underside. Plastic cover on latch plate broken off. The underside of buckle showed 5-6 inches of frayed webbing.
3D	Lap belt worn; Underside of buckle at panel 7 is frayed near stitching. Damage to latch webbing at the fold and at panel 7. Loading to webbing point on top side 7-8 inches from anchor. Loading to webbing point on underside 7-8 inches from anchor. Top side near anchor fold frayed. Also damage to underside at 5 th panel spot of frayed webbing near anchor. Belt length on latch plate 31 inches.

1.4.1. Seat Belt Information from Shield Restraint Systems Inc.

Schematics of the lap belt component, quality control and test documentation were obtained from the seat belt manufacturer, Shield Restraint Systems. The drawings and quality information were identified as proprietary. The belts installed on the bus satisfied the applicable requirements according to the documentation obtained.

The paperwork included part identification and traceability of manufacture, Statement of Conformance, strength test results, dimensional inspection data for samples from the part lots used in the build, raw material certifications and inspection certificates.

An examination of the lap belt schematics and compliance certificates obtained from Shield Restraint Systems revealed that the materials used in the Production Lot Number for these lap belts used in the bus showed any evidence of non-conforming parts.

1.4.2. Utah Seat Belt Law

According to Utah's "Motor Vehicle Safety Belt Usage Act", ALL passengers in this bus should have been wearing the available seat belts. In addition, had there been any children on-board, those up to age 8 would have had to be properly restrained in a car seat or booster seat.^{6, 7} Section 1803 of Utah Code Title 41, Chapter 6a, Part 18, the "Motor Vehicle Safety Belt Usage Act", reads:⁸

Effective 1/1/2018

41-6a-1803. Driver and passengers -- Seat belt or child restraint device required.⁹

⁶ Utah Code 41-6a-1802 Seating position" means any area within the passenger compartment of a motor vehicle in which the manufacturer has installed a safety belt

⁷ Seatbelt laws do not apply to passengers on school buses or public transit vehicles with a gross vehicle weight that exceeds 10,000 pounds.

⁸ Utah Code Title 41, Chapter 6a, Part 18, Section 1803 (41-6a-1803), see: <https://le.utah.gov/xcode/Title41/Chapter6A/41-6a-S1803.html>, accessed January 30, 2020.

⁹ "Child restraint device" means a child restraint device that meets standards adopted under Section 41-6a-1601.

(1) (a) The operator of a motor vehicle operated on a highway shall:¹⁰

(i) wear a properly adjusted and fastened safety belt;¹¹

(ii) provide for the protection of each person younger than eight years of age by using a child restraint device to restrain each person in the manner prescribed by the manufacturer of the device; and

(iii) provide for the protection of each person eight years of age up to 16 years of age by securing, or causing to be secured, a properly adjusted and fastened safety belt on each person.

(b) Notwithstanding the requirement under Subsection (1)(a)(ii), a child under eight years of age who is 57 inches tall or taller:

(i) is exempt from the requirement in Subsection (1)(a)(ii) to be in a child restraint device; and

(ii) shall use a properly adjusted and fastened safety belt as required in Subsection (1)(a)(iii).

(2) A person 16 years of age or older who is a passenger in a motor vehicle operated on a highway shall wear a properly adjusted and fastened safety belt.

(3) If more than one person is not using a child restraint device or wearing a safety belt in violation of Subsection (1), it is considered only one offense, and the driver may receive only one citation for that offense.

1.5. Ejections

As reported in passenger interviews and witness statements, the following information was documented for 25 of the bus passengers. In total, there were at least 11 passengers fully ejected and 2 partially ejected during the crash sequence.

All of the ejected passengers were found postcrash on the west side of the bus's final rest position. Three of the fully ejected passengers sustained fatal injuries. The passenger who had been seated in 8A was found approximately 45 feet west of the bus, next to the end treatment of the damaged guardrail. The passenger who had been seated in 1E was found next to the bus. The passenger who had been seated in 4A was found near the rear of the bus and near the guardrail. The fourth fatally injured passenger, seated in 2A, was found postcrash in the loading stairwell. It was reported she had been pulled out of the stairwell then placed on the roadway next to the bus loading door by a good Samaritan (she was not ejected from the bus during the crash sequence).

The passenger seated in 7E stated she was partially ejected and when the bus came to rest, she was hanging out the bus window with her right leg caught by the seatbelt she was wearing. The passenger seated in 3E reported that postcrash she also was hanging out the window and her leg was caught under the crushed roof.

¹⁰ "Motor vehicle" means a vehicle defined in Section 41-1a-102, except vehicles that are not equipped with safety belts by the manufacturer.

¹¹ "Safety belt" means a safety belt or seat belt system that meets standards adopted under Section 41-6a-1601.

As previously mentioned, 8 passengers seated in 2E, 3A, 5A, 4D, 4E, 6E, 7B, and 7D reported wearing the lap-belt and stated they were either ejected or they woke up outside the bus or in the hospital. When asked about any seatbelt pattern markings to their abdomens, four passengers (5A, 6E, 7B, and 7D) voluntarily showed NTSB investigators seatbelt patterned bruising and/or abrasions to their abdomen and hips.

The lap belts examined in **Table 3** above were identified due to either known usage with ejection (5A and 7B), known usage with no ejection (3D), known usage with displacement from seat leaving lap belt buckled (2A), and a lap belt not used in the crash (7A).

1.3 Passenger Egress

After the crash, the majority of passengers that remained inside the bus indicated they went out the front bi-fold loading door. One passenger stated he climbed out window due to the roof crush thinking it was easier than crawling on floor to get to the front loading door. Witnesses stated that the remaining surviving passengers had exited the bus immediately after the crash and prior to first responders arriving on scene.

1.4 Pre-trip Safety Briefing

According to interviews with the passengers, the majority recalled the tour guide making the announcement to wear their lap-belts the first 3 days of the trip and explained the emergency exits. However, the passengers reported that he did not repeat the seat belt information after the 3rd day. The tour guide stated the same information in his interview.

1.5 Seating Chart

The seating chart in **Figure 8** was based on information provided during passenger interviews. Additional passenger information (height, weight, seat belt usage, and detailed injuries sustained) was also obtained through an interpreter who assisted the NTSB during these passenger interviews.

Figure 8. Bus Seating Chart

^a Although 49 *Code of Federal Regulations* (CFR) Part 830 pertains only to the reporting of aircraft accidents and incidents to the 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 or nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.

The Utah Department of Health Office of the Medical Examiner (ME) performed external autopsies with postmortem radiograph on the four fatally injured bus occupants. The ME gave the cause of death for all four passengers as, “blunt force injuries”. The following injury information was obtained for the four fatalities;

- The 65-year-old male passenger seated in 8A sustained multiple rib fractures anterior and posterior with hemothorax, fracture of proximal right arm, left to right shift to aorta and mediastinum, left diaphragmatic rupture, a large 16.5 x 18.5 inch diagonal abrasion to back, extensive soft tissue hemorrhage within right upper neck, deep scalp lacerations with punctate and irregular abrasions and lacerations to the right side of his face and neck. Ejected. Seat belt use unknown.
- The 62-year-old female passenger was seated in 4A sustained an open comminuted skull fractures, avulsion laceration of frontal lobe of the brain, extensive facial abrasions, fractures to her left clavicle, left scapula, left humerus with near amputation of left arm. Ejected. Seat belt use unknown.
- The 67-year-old female passenger was seated in 1E sustained multiple bilateral rib fractures with hemothoraces, fracture of thoracic spine, abrasions and contusions of head and body. Ejected. Seat belt use unknown.
- The 68-year-old female passenger was seated in 2A sustained a cervical spine fracture with a large 7 x 9.5 inch abrasion with full thickness lacerations to right side of face from forehead to jawline, large abraded full thickness lacerations posterior surface of right wrist, hand, and fingers, with multiple abrasions and contusions to extremities. Thrown into loading stairwell. Interior bus examination found her lap belt was still buckle.

Passenger age, height, weight, seat position, with a brief description of the crash events, their injuries, and lap belt usage was gathered during the interview process.¹²

- 60-year-old, male; seated row 7D; sustained multiple right rib fractures, L2 compression fracture, multiple abrasions to back, concussion, multiple cuts and bruises. Was wearing lap belt and has a belt pattern bruising across waist. Ejected and woke up in hospital.
- 57-year-old, female; seated row 7E; sustained a head injury, multiple fractures to left humerus, left shoulder dislocation, and bruise to right leg from lap belt.

¹² Refer to Survival Factors Attachment: Bus Passenger Interviews

Wearing lap belt loosely and has no abdominal bruising. Partially ejected but lap belt caught at feet and held her legs inside.

- 60-year-old, female; seated in back row right side window seat (E); sustained a Subdural hematoma, cervical fracture, lacerations to right hand and left knee, multiple teeth loosened. Wearing lap belt and has belt pattern abdominal bruising.
- 67-year-old, male; seated in back row on left side seat B; sustained concussion, contusions to left knee and neck. Wearing seat belt loosely, no bruising.
- 64-year-old, female; seated row 5A; lost 8 teeth to lower jaw with multiple fractures to jaw, left humerus fracture, and cervical fracture. Wearing lap belt and has belt pattern abdominal bruising. Ejected, woke up outside.
- 67-year-old, female; seated row 7B; sustained a subdural hematoma, left wrist fracture, fractured right hand with avulsion, and left side of face abraded and swollen. Wearing lap belt and has belt pattern abdominal bruising. Ejected, woke up outside on ground.
- 68-year-old male; seated in 8B; 2 right rib fractures, severe avulsion laceration to left forearm. Wearing lap belt and showed investigators his lap belt bruising to his waist.
- 65-year-old, male; seated row 5B; sustained a laceration under left eye and left finger. Wore lap belt but has no abdominal bruising.
- 77-year-old, male; seated row 3D; sustained a laceration to lip with stitches. Wearing lap belt but no abdominal bruising. Ended up on floor. Found wife partially ejected and hanging out window.
- 73-year-old, female; seated row 3E; sustained bilateral rib fractures (L1-10, R1-5), left pulmonary contusion, left scapula fracture, T12 burst fracture, sacral fracture, comminuted fracture humerus and distal radius. Husband stated she was wearing her lap belt loosely and was partially ejected. A piece of debris (overhead luggage racks that collapsed) caught her legs and kept her from complete ejection.
- 63-year-old, female; seated row 3A; sustained bilateral rib fractures, a left shoulder fracture, a cervical fracture, a left arm fracture, and abrasion to forehead. Not wearing lap belt was fully ejected.
- 32-year-old, male; seated row 3B; sustained a spinous process fracture, multiple scratches. Wearing lap belt and has minor belt pattern abdominal bruising.
- 32-year-old, male; seated row 1A; sustained a laceration with 7 stitches, neck strain with spasms, bruise on left hip from wearing lap belt.¹³
- 60-year-old, female; seated row 2D; sustained a right hip contusion, heavy bruising to thighs and cuts to scalp. Wearing seat belt loosely and it slid down on thighs.
- 61-year-old, male; seated row 2E; head injury, C7 fracture, laceration with stitches to face, abrasions and bruising to whole left side of face. Was fully ejected and doesn't recall if he was belted.
- 56-year-old, female; seated row 6E; sustained a head injury, a torn left ear with numerous stitches, left hand badly bruised, left cheek laceration with stitches, bruises and cuts to both legs. Wearing lap belt but she says belt broke and was fully ejected. Has belt pattern bruising to abdomen.

¹³ Tour Guide for trip

- 63-year-old, female; seated row 5D; sustained a left clavicle fracture, right eye bruised, laceration with stitches to left hand and to top of head. Wearing lap belt and has belt pattern abdominal bruising.
- 58-year-old, female; seated row 5E; sustained a bruise to right eye with stitches, a left arm bruise, belt pattern bruises to bilateral hips and abdomen from wearing lap belt.

Medical records of passengers not interviewed disclosed the following information:

- 68-year-old, female; seated in in row 6A; sustained a chest wall contusion, pneumomediastinum, and a laceration left knee. Wearing lap belt per interpreter interview.
- 61-year-old, female seated in row 4D; sustained a right clavicle fracture, abrasions/contusions to upper shoulders, right pulmonary contusion. Ejected per interpreter. Belt use unknown.
- 61-year-old, male seated in row 4B; sustained a left-hand laceration and abrasions. Wearing lap belt per interpreter interview.
- 68-year-old, male seated in row 2B; sustained facial lacerations. Belt use unknown.
- 68-year-old, male seated in row 1D; sustained minor abrasions and contusions. Belt use unknown.
- 56-year-old, female seated in row 6D; sustained left rib fractures, left pulmonary contusion, T8 vertebrae fracture, T10 vertebrae fracture, flail chest, left hand abrasions, forehead abrasion and left foot abrasion. Wearing lap belt per interpreter interview.
- 32-year-old, female seated in row 4E; sustained a grade 3 spleen laceration, left rib fractures 8-12, T5 and T7 compression fractures, abrasions to left scapula and left rear hip, bruising laterally under umbilicus to abdomen noted. Ejected per interpreter interview. Belt use unknown.
- 67-year-old, male seated in row 6B; sustained left rib fractures 2-11, pneumothorax and hemothorax, left clavicle fracture, degloving to scalp, transverse process fracture T4-T9, subarachnoid hemorrhage, multiple scalp lacerations. Not wearing lap belt per interpreter interview.

1.7 Applicable Federal Motor Vehicle Safety Standards for Bus Passenger Restraints

The 2017 bus when manufactured was required to provide occupant crash protection for the driver and front right seat positions only per the National Highway Traffic Safety Administration’s FMVSS. The FMVSS occupant crash protection standard¹⁴ states that a bus with a GVWR over 10,000 lbs. but not greater than 26,000 lbs. must provide either a complete passenger protection system for the driver only or a belt system for the driver only. No other requirements for passenger protection, other than the driver and front right passenger seat position, are required

¹⁴ FMVSS 571.208 S4.4.4

for buses in this weight range, unless they meet the definitions for a school bus or an over-the-road bus. Although not required to be equipped with restraint systems for the passengers, the accident bus was equipped with Type 1 seat belt assemblies (lap belts) at all rear passenger seating locations and a Type 2 lap and shoulder belt for the driver and front right passenger seats.

2. Emergency Response

The Garfield County Sheriff's Office (GCSO) was notified of the crash through the 911 system at 11:32 a.m. Dispatchers were told there was a bus accident 1 mile north of Ruby's Inn in Bryce Canyon with 20 injured.¹⁵ GCSO dispatchers immediately relayed the information to the Utah Department of Public Safety (DPS) Richfield Communication dispatchers at 11:33 a.m.¹⁶ A Bryce Canyon City Volunteer Fire Department (BCCVFD) Engine unit and several Garfield County ambulance units (501, 502, 503, 504, and 505) were dispatched between 11:35 – 11:37 a.m. The Tropic Volunteer Fire Department (TVFD) and Panguitch Volunteer Fire Department (PVFD) were dispatched at 11:35 a.m. and 11:36 a.m. respectively. GCSO deputy unit 197 was dispatched at 11:38 a.m. to confirm the accident location, which was confirmed to be in the "pines area" at 11:40 a.m.

BCCVFD ambulance unit 504 with the BCCVFD Chief (as an EMT) arrived first on-scene at 11:41 a.m. The BCCVFD Chief assumed Incident Command (IC) and after doing a quick walk around. He declared the scene a Mass Casualty Incident (MCI) to dispatch and immediately requested: 2 medivac helicopters, the MCI trailer, and requested Kane and Piute County ambulances be dispatched.¹⁷ The IC then initiated Simple Triage and Rapid Transport (START), to assess the respirations, perfusion and mental status of the injured for identification of the most critical patients. GCSO dispatchers also requested 2 additional medical helicopters along with a fixed wing medical transport aircraft be on standby (based on radio traffic from on-scene responders).

The first Utah Highway Patrol (UHP) unit arrived on scene at 11:48 a.m. followed by 12 other UHP units.¹⁸ The TVFD was the second volunteer fire department to respond to the scene at 11:42 a.m. with a brush truck followed by a rescue unit (11:50 a.m.) and an engine unit (12:10 p.m.) with three personnel. The PVFD was the third volunteer fire department to respond to the scene at 11:54 a.m. A volunteer firefighter/EMT on the PVFD Rescue unit spoke Mandarin and after arriving on-scene, he assisted with patient triage and his unit transported several patients to Garfield Hospital. He assisted with language interpretation between the bus passengers and medical personnel at the Garfield Memorial hospital emergency department.

The IC stated that two Park Rangers from Bryce Canyon National Park heard the radio traffic and responded to the scene. One Ranger was an EMT and started helping triage passengers while the other Ranger helped direct traffic until more help arrived. The IC stated that additionally

¹⁵ Refer to Survival Factors Attachment, Fire Department Logs and Reports

¹⁶ The Richfield Communications Center is the Public Safety Answering Point for Millard, Piute, Sevier, and Wayne Counties and provides communications services to Garfield, Juab, Kane, and Sanpete Counties. They dispatch State & Federal Law Enforcement, Police and Fire, other Emergency Services. They also dispatch for Highway Maintenance, Corrections, Forestry and Wildfire Services, Wildlife Resources, and Parks and Recreation

¹⁷ Refer to Survival Factors Attachment; First Responder and Witness Interviews

¹⁸ Refer to Survival Factors Attachment, Utah highway Patrol CAD Logs

two of Bryce Parks medical staff responded as did two passerby's that happened to be off duty ER nurses that stopped to help with passenger triage. The IC stated that he made another walk around to ensure that all the patients were triaged (tagged with triage information) and ready for transport to medical facilities.

A GCSO deputy arrived and assumed the IIC from the Chief so the Chief could continue to triage the injured. The Garfield County ambulance director arrived at 11:54 a.m. and was assigned to be the Transportation Officer. Once the MCI trailer arrived on-scene, the Chief directed a GCSO deputy to pull-out needed equipment and colored tarps to set up a formal triage area. According to the Chief, every passenger had at least one injury.

The Chief requested that the Classic Air Medical helicopter land adjacent to the scene; the helicopter transported one patient to Dixie Regional Medical Center at 12:37 p.m. The Chief stated another patient, initially tagged as less severely injured was upgraded (based on subsequent triage examination) and was transported by ambulance at 12:25 p.m. to Bryce Canyon airport (KBCA).¹⁹ She was flown by fixed wing medical transport to Utah Valley Medical Center in Provo, Utah. The fixed wing transport had 2 extra nurses that were not needed for the return flight, so they returned in the ambulance to assist with injured on scene.

As previously mentioned, Garfield County responded with six ambulances with the first one arriving at 11:41 a.m. and the others arriving at 11:54 a.m., 11:56 a.m., 12:03 p.m., 12:15 p.m., and 12:30 p.m. Ambulance units 502, 504 and 505 made two trips from the crash scene to Garfield Memorial hospital (17 miles away). Ambulances from Kane County hospital in Kanab, UT (75 miles away) and Piute County (99 miles away) also responded to the scene. Kane County ambulance transported 2 passengers with minor injuries back to Kane County hospital. The Piute County ambulance transported the last 3 passengers with minor injuries to depart the crash scene to Sevier Valley Hospital in Richfield, Piute County, UT approximately 100 miles away.²⁰ Two passengers with serious but non-life threatening injuries were transported to Dixie Regional hospital approximately 140 miles away. In total, 26 occupants were transported from the scene in 1:57 minutes after being dispatched.

The first medical helicopter responded to the scene at 12:27 p.m. followed by the fixed wing medical transport aircraft which landed at the Bryce Canyon airport. Several more medivac helicopters were later dispatched to Garfield Memorial hospital in order to transport patients in need of a higher level of trauma care to Dixie Regional Medical Center in St. George, Utah.

As shown in **Table 5**, no less than 12 local and State emergency service agencies responded to the scene of the crash.

Table 5. Responding agencies

Utah Highway Patrol	Panguitch Volunteer Fire Department
Tropic Volunteer Fire Department	Garfield County Sheriff's Department

¹⁹ Bryce Canyon airport is about 3 miles east of the accident scene.

²⁰ These three passengers were the husbands of three of the fatalities and requested to be transported to a hospital near where their wives were being taken.

Henryville Volunteer Fire Department	Bryce Canyon City Volunteer Fire Department
Piute County Ambulance (Marysvale)	Kane county Ambulance (Kanab)
Classic Medical Helicopter and Fixed wing	Intermountain Health care Helicopter Medivac
Bryce Canyon State Park Forest Rangers and Medical staffers	Utah Department of Transportation

2.1 Garfield County Office of Emergency Management

A copy of Garfield County’s Emergency Operations Plan (EOP) for handling emergencies and disasters was reviewed. The plan considers the emergencies and disasters likely to occur in Garfield County and the response required. The EOP provides for the coordination of government, private sector, and volunteer resources and outlines the roles and responsibilities of county agencies in relation to state codes, local ordinances, and state and Federal laws.

The State of Utah Department of Health, Bureau of Emergency Medical Services and Preparedness has an Emergency Operations Plan specifically for handling Mass Casualty Incidents (MCI’s). This plan has been prepared to provide a coordinated response to the single site disaster that could overwhelm the day-to-day emergency health care delivery system. The Utah MCI Plan is designed to supplement the Garfield County disaster plan.

The state of Utah EMS MCI Plan defines an MCI as an event with injuries that may exceed the normal response capability of an emergency care provider agency. Classification of a mass casualty incident may vary throughout the State based upon the number of patients, severity of injuries, the cause of the incident, and available resources.

3 Hospital and Medical Examiner Information

Twenty-six occupants were transported from the scene to four hospitals. One occupant was transferred by medevac to Utah Valley Hospital and fourteen occupants were later medevac’d to Dixie Regional Medical Center. The deceased were transported to the Utah Department of Health Office of Medical Examiner in Salt Lake City, Utah for External Exam Autopsies.

3. Interviews

Interviews were conducted with the Initial Incident Commander and several first responders. In addition, the initial Utah Highway Patrol trooper that responded and a witness was also interviewed. Seventeen bus passengers were interviewed.²¹ Below are short, bulleted lists of statements made by first responders and a witness.

3.1 First Responder Statements

- Initial call-out was for a bus rollover but the initial location wasn’t specific.
- Saw three deceased bodies near passenger side of bus near the center.

²¹ Due to length of interviews, refer to Survival Factors Attachments, for all interviews.

- The Landing Zone was set up east of the bus on Route 12.
- Two patients were flown out from the scene.
- All the passengers were off the bus when I arrived.

3.2 Witness Statements (Traveling in opposite direction from bus)

- I was traveling on Route 12 and saw the bus coming around the corner and it seemed to be going really fast.
- It looked like the bus made a subtle move to right then it overcorrected to the left then back right and it rolled right at me.
- The bus seemed to have rolled a half dozen times ending up partially in a ditch and on the roadway.
- I stopped my car, grabbed my cellphone and called 911. I then grabbed my first aid kit and ran around to the passenger side of the bus.
- When I got to the passenger side of the bus, I saw about 15-20 people outside the bus lying on the ground.
- I didn't see any body that was thrown out the driver side of the bus.

E. DOCKET MATERIAL

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

LIST OF ATTACHMENTS

Survival Factors Attachment -	Responding Fire Department Logs and Reports
Survival Factors Attachment -	Utah Highway Patrol CAD Logs
Survival Factors Attachment -	Bus Passenger Interviews
Survival Factors Attachment -	First Responder Interviews
Survival Factors Attachment -	Witness and Good Samaritan Interviews
Survival Factors Attachment -	The NHTSA's Email Response on Bus Classification

LIST OF PHOTOGRAPHS

Survival Factors Photo 1 -	Front left angle view of deformation to 2017 Freightliner, Embassy bus body.
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- Survival Factors Photo 2 - Rear left angle view of deformation to roof of 2017 Freightliner, Embassy bus body.
- Survival Factors Photo 3 - View looking from front to rear showing roof shift and integrity loss.
- Survival Factors Photo 4 - View looking from rear to front showing roof shift and integrity loss.
- Survival Factors Photo 5 - Front right-angle view of deformation and roof shift to 2017 Freightliner, Embassy bus body.
- Survival Factors Photo 6 - Rear right angle view of deformation and roof shift to 2017 Freightliner, Embassy bus body.
- Survival Factors Photo 7 - Interior view looking at undamaged driver seating area and missing roof structure.
- Survival Factors Photo 8 - View of loading evidence on bus driver's shoulder belt webbing.
- Survival Factors Photo 9 - Interior view of roof collapse looking from front to rear.
- Survival Factors Photo 10 - View of sidewall intrusion to Row 4 right side.
- Survival Factors Photo 11 - View of roof collapse on top of Row 7 left side seatbacks.
- Survival Factors Photo 12 - View of roof collapsed on top of Row 3 left side seatbacks.
- Survival Factors Photo 13: Close-up view of loading evidence to 7B lap belt webbing.
- Survival Factors Photo 14. Close-up of 7B buckle showing evidence of roadway contact to top of plastic housing and latch plate cover broken off.
- Survival Factors Photo 15. View inside lap belt buckle 7A prior to removal of interior components.
- Survival Factors Photo 16. View of undamaged lap belt components removed and examined.

END OF REPORT

(Ronald Kaminski)
(Sr. Survival Factors Investigator)