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

VEHICLE FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

A. CRASH INFORMATION

Location:	Intersection of State Route 30A and State Route 30, near Schoharie, Schoharie County, New York
Vehicle 1:	2001 Ford Excursion "Stretch" Limousine
Operator 1:	Prestige Limousine Chauffeur Service
Vehicle 2:	2015 Toyota Highlander
Operator 2:	Private Citizen
Date:	October 6, 2018
Time:	Approximately 01:55 p.m. EDT
NTSB #:	**HWY19MH001**

B. VEHICLE FACTORS GROUP

Brian Bragonier, Vehicle Factors Investigator, Group Chairman
NTSB Office of Highway Safety
490 L'Enfant Plaza East, S.W., Washington, DC 20594

Investigator Jeremy Shultis, New York State Police
Collision Reconstruction Unit
760 Troy-Schenectady Road
Latham, NY 12110

C. CRASH SUMMARY

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

D. DETAILS OF THE VEHICLE FACTORS INVESTIGATION

This Vehicle Factors Group Chairman's Report is a collection of factual information obtained during restricted inspections of the involved vehicles. NTSB Investigators were allowed

only limited access to the involved vehicles and components, therefore some details regarding major mechanical systems, including steering and braking, could not be collected. The 2001 Ford Excursion limousine and 2015 Toyota Highlander were initially visually inspected October 8 - 9, 2018 at the New York State Police (NYSP) Troop G Headquarters, 760 Troy-Schenectady Road, Latham, New York. Overall crash damage was documented. Some areas of the limousine could not be reliably documented due to extensive collision damage. Supporting photographs, vehicle specifications, maintenance records, and prior inspection reports were collected and analyzed.

NTSB Investigators gained additional access to the limousine January 29 – 31, 2019. This access gave investigators the ability to inspect the condition of the frame and suspension of the limousine. Mechanical systems, such as the brakes and transmission could not be documented or inspected at this time since most of these components had been removed by the New York State Police and placed into evidence.

Three additional Lincoln Towncar limousines owned by the operator, Prestige Limousine, were inspected February 6 – 7, 2019. These inspections were conducted by the NYSP in the presence of NTSB Investigators at the Premier Limousine maintenance facility located at 456 N. Pearl Street, Albany, New York. Details regarding these inspections will be discussed in the appropriate sections of this document.

On February 11, 2019, NTSB Investigators were given access to the crash limousine for documentation of the interior, including seatbelt inspection and seating configuration.

On May 23, 2019, NTSB Investigators were allowed to conduct a visual only inspection on the individual brake components which had been removed from the limousine and placed into NYSP evidence on October 14 and 15, 2018. After removal, these components were transported to Concord, New Hampshire to be analyzed by an expert who was retained by the NYSP. This analysis was conducted over a period of eight weeks. Upon completion of the expert's analysis, the components were re-packaged and transported back to the NYSP Troop G Headquarters, where they were returned to evidence until the May 23, 2019 NTSB visual inspection. Information regarding this inspection may be found in the appropriate section of this report.

1. Vehicle Inspection

1.1. Vehicle #1: 2001 Ford Excursion 18-Passenger Limousine

1.1.1. General Information

This vehicle was originally manufactured by Ford Motor Company as a four door Excursion sport utility vehicle, with three rows of seating. The following information is as originally manufactured. The Excursion was subsequently altered into a stretch limousine. Data on the altered vehicle is shown in italics where applicable.

VIN[1] :	1FMNU40S51EB10299
Manufacturer:	Ford
Model:	Excursion XLT

[1] Vehicle Identification Number (VIN) used by the automotive industry to identify individual motor vehicles.

Manufactured:	2001
Mileage[2] :	Approximately 194,000
Unit #:	16
GVWR[3] :	8600 lbs.[4] *13,080 lbs.*[5]
GAWR[6] #1:	4700 lbs.
GAWR[7] #2:	7000 lbs.
GCWR[8]:	17,000 lbs.
Towing Capacity[9]:	10,000 lbs.
Passenger Capacity:	8 (including driver) *18 (including driver)*[10]
Engine:	6.8L V10 SOHC Gasoline
Transmission:	4 Speed Automatic Ford E40OD (4R100)
Drive Type:	2 Wheel Rear Drive
Brake System:	4-Wheel Hydraulic Disc with Anti-Lock Braking (ABS)

1.1.2. Vehicle Modification

The Excursion was purchased on March 28, 2001 by 21st Century Coachworks in Springfield, Missouri, and then altered into a limousine.[11] The alteration process entailed cutting the factory frame of the Excursion and welding an additional 144-inches of frame rail to the factory frame rail. Additional chassis support structure was also added. This process is discussed in detail in the suspension and frame section of this document. The interior of the vehicle was then reconfigured with limousine-style seating and entertainment accommodations. Total seating capacity was increased from 8 to 18, including the driver.

21st Century Coachworks is no longer in business and no details are available regarding any changes they may have made to the vehicle's brake system or suspension during the modification process. Additionally, no information is available regarding 21st Century Coachworks compliance with the National Highway Traffic Safety Administration's (NHTSA)

[2] According to inspection records, as the odometer located on the dash of limousine was destroyed.
[3] Gross Vehicle Weight Rating (GVWR). Title 49 CFR Part 567 Certification defines GVWR as the appropriate value in pounds, which shall not be less than the sum of the unloaded vehicle weight, rated cargo load, and 150 pounds times the number of the vehicle's designated seating positions. 13,080 lbs. is the GVWR value assigned to the modified vehicle by the final stage manufacturer based upon the increased occupancy and the original manufacturer GVWR.
[4] GVWR from Ford Motor VIN Build Sheet for this vehicle.
[5] GVWR designated during a 2010 re-certification process.
[6] GAWR is the maximum weight a given axle is designed to carry as specified by the manufacturer of the axle.
[7] For consistency in describing the axles of the limousine, the front (steer) axle will be referred to as Axle #1, the drive axle as Axle #2.
[8] Gross combination weight rating (GCWR) is the greater of either the value specified by the manufacturer of the power unit, or the sum of the gross vehicle weight ratings or the gross vehicle weights of the power unit and the towed unit.
[9] According to the owner's manual for the Ford Excursion.
[10] Capacity designated during a 2010 re-certification process.
[11] CFR Title 49 Part 567.3 defines *Altered vehicle* as a completed vehicle previously certified in accordance with CFR Title 49 Part 567.4 or 567.5 that has been altered other than by the addition, substitution, or removal of readily attachable components, such as mirrors or tire and rim assemblies, or by minor finishing operations such as painting, before the first purchase of the vehicle other than for resale, in such a manner as may affect the conformity of the vehicle with one or more Federal Motor Vehicle Safety Standard(s) or the validity of the vehicle's stated weight ratings or vehicle type classification.

Federal Motor Vehicle Safety Standards (FMVSS) during the alteration process. 21st Century Coachworks was required to register with NHTSA as a vehicle manufacturer but is not listed in the NHTSA database.

According to United States Code of Federal Regulations (CFR) Title 49 Part 567.7, each person who alters a vehicle assumes legal responsibility for all FMVSS certification-related duties. CFR Title 49 Part 567.5 also requires that the alterer affix a certification label with the completion date, the GVWR and the GAWR. This label is to be in addition to the original manufacturer's label. NTSB investigators were unable to locate any certification label on the limousine, either from 21st Century Coachworks, Ford Motor Company, or a 2010 re-certification. Pre-crash inspections of the limousine refer to certification labels being present on the vehicle. See the maintenance and inspection section of this document for details.

The vehicle was sold by 21st Century Coachworks and transported to New York, where it was first titled and registered on May 2, 2001.

1.1.3. Ford Qualified Vehicle Modifier Program

In 1989, Ford Motor Company (Ford) developed a program to provide guidance to modifiers when working with Ford vehicles. This program is called the Qualified Vehicle Modifier Program (QVM).[12] The QVM program is voluntary for modifiers and alterers, however adhering to the QVM program ensures that the final product meets Ford's engineering parameters. All QVM manufacturers are still responsible for the certification and safety performance of their products.

The Ford QVM program has a multiple phase approval process for potential vehicle modifiers and alterers. These include a written request from the modifier or alterer for consideration and details as to which Ford vehicles they intend to modify. Only certain model vehicles can be modified under the QVM program. The applicant must also be capable of performing weight and FMVSS compliance analysis. Ford conducts an on-sight inspection of an applicant's manufacturing facility before final approval.

General Motors operates a similar program, called the Cadillac Master Coachbuilder.

Although they were altering Ford products, 21st Century Coachworks did not participate in the QVM program. There is no regulatory requirement for any vehicle modifier to participate in either the Ford QVM, or the Cadillac Master Coachbuilder programs.

The 2001 Ford Excursion was one of the vehicle models allowed to be altered under the QVM program. On July 13, 2001, Ford's Engineering Office issued guidance to all QVM builders regarding the alteration and modification of Excursions.[13] This guidance limited the vehicle stretch to a maximum length of 120-inches. It also restricted the seating capacity to 10 occupants, including the driver. Ford set the maximum gross vehicle weight (GVW) of the stretched vehicle at 9900 lbs. This weight included all passengers, luggage, optional equipment and full fluids.

[12] See Vehicle Attachment – Ford QVM Program Principles November 2002
[13] See Vehicle Attachment – Ford QVM Excursion Guidance July 2001

Additionally, Ford required the installation of a chassis upgrade kit, which included a brake hydra boost kit, load range "E" tires, and a new rear spring assembly. Front springs were to be upgraded based on the length of stretch and weight added. The spring rate was to be adjusted to what was required to keep the base chassis bumper height within a tolerance of +/- 1-inch of its originally manufactured height.

On December 3, 2002, Ford issued an updated guidance regarding the stretching of Excursions.[14] This updated guidance allowed for up to a 140-inch stretch, a 15-passenger capacity, and a maximum GVW of 11,000 lbs. Additional safety requirements were included with this guidance, such as roof and side emergency exits. **Table 1** shows the Ford Excursion QVM guidance issued in 2001, updated in 2002, and the as modified vehicle data.

Table 1: Excursion Alteration Data

Specification	2001 Ford QVM Guidance	2002 Ford QVM Guidance	As Modified April 2001
Stretch Length	120-inches	140-inches	144-inches
Seating Capacity[15]	10	15	18
GVWR	9900	11000	13080

1.1.4. Crash Damage Description

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

There was contact damage to the entire front end, with more rearward displacement on the left side than the right.[16] The left side of the radiator was displaced rearward to axle 1. The rear portion of the engine was in what would have been the driver's footwell area of the vehicle. The steering wheel was displaced upward and was at the roofline of the vehicle. The bottom portion of the driver's seat was displaced upward approximately 90 degrees and compressed into the seatback. The right front passenger seat was deformed in a similar manner.

The left fender was twisted, distorted and displaced. The driver's door was distorted and mostly torn away from the frame. The "A" pillar on the left side was folded in half.[17] The "B" pillar on the left side was missing, having been cut by emergency responders for post-crash access. The windshield was displaced and the glass from the driver's door and the window to the rear of the driver was missing. The three additional windows on the left side were intact. **Figure 1** shows the vehicle damage as seen from the left front corner.

[14] See Vehicle Attachment – Ford QVM Excursion Guidance December 2002
[15] Seating capacity refers to the total number of occupants the vehicle was designed for, including passengers and driver.
[16] Orientation references left or right based upon a person sitting in the driver's seat facing forward.
[17] Pillars are the vertical or near vertical supports of a car's window area —designated respectively as the A, B, C or (in larger cars) D-pillar, moving from front to rear, in profile view.

Figure 1: Left Front View 2001 Ford Excursion Limousine

The right fender was damaged but in place. The front passenger door was still attached at the “A” pillar, but the top of the pillar and the top of the door were displaced rearward and to the right. The door was folded almost in half. The “B” pillar on the right side had been cut approximately halfway between the floorboard and the roof. The “C” and “D” pillars had been removed during the extrication process. The rear two windows on the right side were intact, but the front two windows were missing. The rear window was missing. **Figure 2** shows the damage as seen from the right front corner of the vehicle.

Figure 2: Right Front View 2001 Ford Excursion Limousine

There was considerable corrosion noted throughout the vehicle. The roof was folded upward and had partially detached from the side panels of the vehicle, exposing the sheet metal and headliner. Portions of the body panels had also separated exposing the corrosion within.

1.1.5. Driver's Controls

The driver's controls were crushed and inaccessible due to damage and the deformation of the driver's seatback and steering wheel. The brake pedal was worn, and a portion of the steel backing plate was showing through the rubber covering.

1.1.6. Steering, Suspension and Frame

The upper portion of the steering column was displaced forward against the dash. As noted above, the steering wheel was displaced to the roofline. Damage prevented the rotation of the steering wheel or column. The steering gearbox was still mounted on the vehicle frame, but further inspection was not possible.

The front suspension of the limousine consisted of coil springs and shock absorbers. These had been displaced rearward in their mounts but appeared undamaged. According to the vehicle build sheet obtained from Ford, the front axle weight rating was 4700 lbs.

The rear suspension was a 7-leaf spring type. The leaves appeared undamaged and were still securely held in place by the hanger bracket. There was corrosion evident on the springs, but their structural integrity appeared intact. The build sheet listed a 7000 lbs. weight rating on the rear axle. The vehicle was equipped with a heavy-duty tow package with a trailer towing capacity of 10,000 lbs. and a combined vehicle weight rating of 17,000 lbs.[18]

To stretch the Excursion, the alterer had fused two C-section frame rails together and installed them on the vehicle after cutting the original frame aft of the "B" pillar. One of the rails was 144-inches long and the other was 189-inches long. These new rails were then placed between the two halves of the Excursion with the shorter rail to the outside. The longer rail on the inside overlapped the original frame by 40-inches at the front of the vehicle and 5-inches at the rear. Ford QVM guidance does not require two new fused rails in the frame extension but does call for a 10-inch minimum overlap between the new rail and the factory frame on each end. **Figure 3** illustrates how the two new rails were fused and installed on the factory frame of the Excursion.

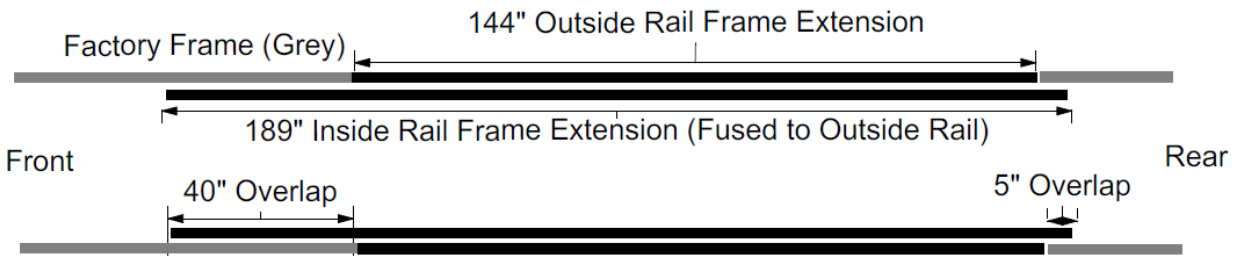

Figure 3: Frame Extension

The two rails were continuously welded together at the ends but were just spot welded every 13-inches along the remaining length. This left an open gap between the rails where they were not welded. These gaps showed evidence of corrosion between the two rails. **Figure 4** shows one of the spot welds and the corrosion between the two rails.

Figure 4: Spot Weld Joining Two Rails

[18] According to the owner's manual for the Ford Excursion.

The frame and chassis were inspected for corrosion and possible failure. Frame welds and underbody structural supports were inspected. All welds were intact and undamaged. There was substantial corrosion present on the underbody supports and the where the chassis support gussets connected to the frame. **Figure 5** shows chassis corrosion near a gusset on the right rear of the limousine.

Figure 5: Corrosion to Right Rear Chassis

The frame rail itself was straight and appeared structurally sound rearward of the area of contact damage from the crash. **Figure 6** shows the weld on the right front frame rail.

Figure 6: Right Front Frame Weld

The floorboard of the vehicle showed severe deterioration and was rusted through in locations, leaving openings exposing the interior carpeting. **Figure 7** shows one such opening in the floorboard as viewed from beneath the vehicle.

Figure 7: Opening in Floorboard

1.1.7. Weights and Measurements

NYSP weighed the limousine using certified portable scales during their post-crash vehicle inspection. Due to damage, parts of the vehicle were supported by jack stands which were then placed on the scales to determine the overall weight. This weight was then subtracted from the overall total weight. Tire weights and individual axle weights were not available for this reason. Loose interior debris, such as seats and tables, had been removed and placed into a utility trailer. NYSP weighed the trailer empty and full to determine the net weight of the internal debris. **Table 2** shows the total limousine weight including vehicle and internal debris.

Table 2: Vehicle Weights

	Weight (lbs.)		
	Left	**Right**	**Total**
Limousine	6200	3100	9300
Debris	N/A	N/A	700
Passengers	N/A	N/A	3565[19]
		Total Weight:	**13,565**

[19] See Survival Factors Group Chair Report

Table 3 shows the wheelbase and overall length of the limousine both pre modification and after the 144-inch insert was installed.

Table 3: Vehicle Measurements

	Measurements (inches)	
	Pre-modification	**Post-modification**
Wheelbase	137	281
Overall Length	227	371

1.1.8. Tires and Wheels

Investigators were not able to locate any DOT certification labels in the wreckage. Vehicle build information received from Ford Motor Company shows that the original equipment tire size for the Excursion was LT265/75R16. Ford 2001 QVM guidance for the Excursion limousine also specified this same size tire. The 2002 QVM guidance for the longer 140-inch stretch called for a specific tire, a Pirelli BSW, in the same size.

The crash vehicle had three different brands, and two different sizes of tires installed on it. None of the tires were the make and model specified in the 2002 QVM guidance. The rear tires were both Firestone brand and were the correct size as per Ford original equipment specifications and the 2001 QVM guidance. The right front tire was an Antares brand, and was the proper size. The left front tire was a Dunlop brand tire but was not the specified size. This size difference reduced the load rating for this tire under that of the other three tires on the vehicle, but still placed it in the load rating "E" category.[20]

Tire pressure measurements were taken using a commercial grade tire pressure gauge. Tread depth measurements were taken in 2 locations within the major tread grooves of a given tire, the lowest of which is entered in Table 1 and represents the minimum tread depth. All tread depths measured were within the minimum tread depth regulation for commercial vehicle tires, which is 4/32 of an inch for the steer axle and 2/32 of an inch for all other axles.[21] **Table 4** includes the tire and wheel information documented at the time of inspection.

[20] The load range/ply rating branded on a tire's sidewall identifies how much load the tire is designed to carry at its industry specified pressure. Passenger tires feature named load ranges while light truck tires use load ranges that ascend in alphabetical order (letters further along in the alphabet identify stronger tires that can withstand higher inflation pressures and carry heavier loads).
[21] According to 49 CFR 393.75

Table 4: Tire Information

Axle 1	Left	Right
Tire Make	Dunlop Radial Rover	Antares Sierra S6
Tire Size	LT245/75R16	LT265/75R16
Pressure	0	0
Tread Depth	9/32”	5/32”
DOT #	DA11A13V	KBUU 2213
Load Rating	3042lbs Single@ 80PSI (E)	3417lbs Single@ 80PSI (E)

Axle 2	Left	Right
Tire Make	Firestone Transforce G-HT	Firestone Transforce G-HT
Tire Size	LT265/75R16	LT265/75R16
Pressure	52PSI	54PSI
Tread Depth	6/32”	5/32”
DOT #	8XW8TH0 4409	8XW8TH0 4409
Load Rating	3415lbs Single@ 80PSI (E)	3415lbs Single@ 80PSI (E)

During the tire examination, damage was noted to the rims and tires. The tire and rim damage, when possible, is referenced to a clock position with the valve stem being at 12:00. The tire and rim damage observed during the examination included the following:

- RF tire deflated with a tear extending from the rim to the tread on the inside sidewall at the 1:30 position. There was also minor damage to the rim at this location.

- LF tire deflated with large indentation in rim at the 11:00 position.

All rims were inspected for additional cracks, welds, and elongated lug nut holes. No non-collision related defects were found on any of the rims.

1.1.9. Brakes

The accident vehicle was equipped with a hydraulic disc brake system with ABS on all axles. As noted above, most brake components were removed by the NYSP during their post-crash inspection on October 14-15, 2018 and placed into evidence. During this inspection, NTSB investigators were required by NYSP to remain behind a police barricade a distance away from the limousine. Due to the distance and other sight barriers, NTSB investigators were unable to directly observe either the component removal process or the packaging of the components for placement into evidence.

Access to the components was not provided to NTSB investigators until May 23, 2019, at which time, a visual only inspection was allowed. Following is a description of the components and their condition on May 23, 2019. Some of the components had been further disassembled by

the NYSP expert during his analysis and were not reassembled. **Table 5 and 6** list the component measurements at the time of the NTSB inspection.

Table 5: Limousine Front Axle Brake Component Measurements

Axle 1	**Left**		**Right**	
Mfg. Rotor Diameter	13.02-inches		13.02-inches	
Original Rotor Thickness	1.50-inches		1.50-inches	
Measured Rotor Thickness	1.500-inches		1.497-inches	
Minimum Rotor Thickness	1.420-inches		1.420-inches	
Pad Thickness[22]	Inboard Pad	Outboard Pad	Inboard Pad	Outboard Pad
Original Pad Thickness	0.443-inches	0.443-inches	0.443-inches	0.443-inches
Minimum Measured Pad Thickness	0.210-inches	0.248-inches	0.248-inches	0.314-inches

Table 6: Limousine Rear Axle Brake Components

Axle 2	**Left**		**Right**	
Mfg. Rotor Diameter	12.83-inches		12.83-inches	
Original Rotor Thickness	1.185-inches		1.185-inches	
Minimum Measured Rotor Thickness	1.124-inches		1.183-inches	
Minimum Rotor Thickness	1.10-inches		1.10-inches	
Pad Thickness	Inboard Pad	Outboard Pad	Inboard Pad	Outboard Pad
Original Pad Thickness	0.460-inches	0.460-inches	0.460-inches	0.460-inches
Minimum Measured Pad Thickness	0.460-inches	0.460-inches	0.338-inches	0.378-inches

[22] According to 49 CFR 393.47(d), the minimum brake pad thickness for hydraulic disc brakes is 1.6mm or 1/16-inch on both the steering axle and non-steering axle brakes.

1.1.9.1. Left Rear Brake

The left rear caliper showed minor oxidation across its surface. There were two phenolic pistons in the caliper.[23] One of the two pistons was missing from the piston bore but was located in the same evidence package. The other piston was extruding from the piston bore and appeared to be seized in place. Superficial striations were noted on the metal disc flange surface of the pistons. **Figure 8** shows the condition of the caliper and pistons at the time of inspection.

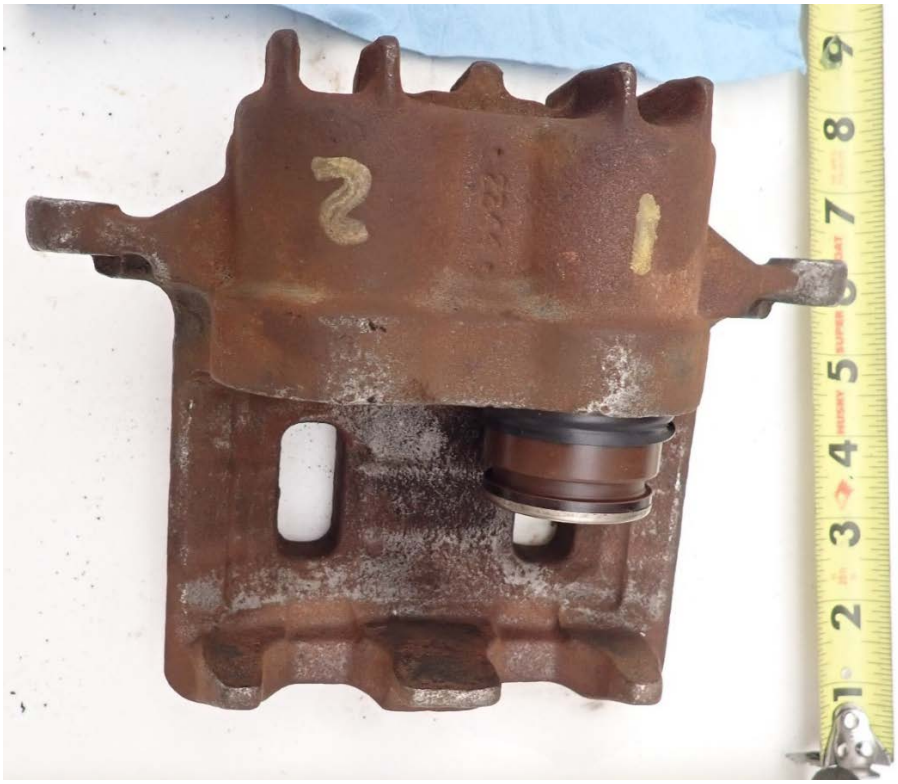

Figure 8: The Left Rear Brake Caliper of the Limousine

The left rear disc brake rotor was 12.83-inches in diameter with 8 stud holes and was a vented design. Corrosion and significant scoring observed on both the inner and outer swept areas.[24] There was heavy corrosion located in the cooling vent vanes between the two swept surfaces. **Figure 9** shows the corrosion and scoring on the swept area of the left rear disc brake rotor.

[23] Phenolic pistons are made using plastic; therefore, they maintain original size regardless of age and are not affected by heat or moisture in the brake system. Phenolic pistons do not transfer heat to the brake fluid.
[24] The swept area of a rotor is the portion of the rotor surface that the brake pad operates on to cause friction and slow the vehicle.

Figure 9: Left Rear Brake Rotor of the Limousine

The left rear disc brake pads, both inner and outer, were in good condition with little to no wear evident. Part markings were evident on both. **Figure 10** shows the friction surface of the inner brake pad. **Figure 11** is the metal backing plate of the same pad.

Figure 10: Friction Surface of Left Rear Brake Pad

Figure 11: Backing Plate of Left Rear Brake Pad

1.1.9.2. Right Rear Brake

The right rear disc brake caliper showed heavy oxidation across all surfaces. Both pistons were still seated within their respective bores. Light manual manipulation of these pistons resulted in no movement. The metal disc flange surface of both pistons also showed oxidation with one missing a small fragment of the metal. **Figure 12** shows the caliper with the pistons still seated in their respective bores and the missing metal fragment.

Figure 12: Right Rear Disc Brake Caliper

The right rear disc brake rotor was similar in manufacture to the left rear. Both inner and outer swept areas showed corrosion and scoring. There was corrosion in the cooling vent vanes between the two swept surfaces and all other portions of the rotor. **Figure 13** shows the condition of the brake rotor at the time of the NTSB inspection.

Figure 13: Right Rear Brake Rotor of the Limousine

The right rear brake pads were heavily corroded on all metal surfaces and the friction material showed uneven wear. **Figure 14** shows the friction surface of the outer brake pad. **Figure 15** shows the metal backing plate of the same pad.

Figure 14: Right Rear Brake Pad Friction Surface

Figure 15: Metal Backing Plate of Right Rear Brake Pad

1.1.9.3. Left Front Brake

The left front disc brake caliper showed minor oxidation across all metal surfaces. The brake hose fitting was sheared at the housing. The phenolic caliper pistons were not located in the caliper bores and were packaged in individual plastic bags within the same evidence box. Both pistons had slight scoring and the metal disc flange surface showed oxidation. The piston bores had what appeared to be brake fluid and particles contaminating them. There was a burnt odor present when examining the caliper. **Figure 16** shows the interior of one of the caliper piston bores.

Figure 16: Interior of the Left Front Caliper Piston Bores

The left front disc brake rotor was 13-inches in diameter with 8 stud holes and was a vented design. There was heavy corrosion in the cooling vent vanes and all areas of the rotor except for the two swept surfaces. There was minor pitting and corrosion present on the swept surfaces and what appeared to be embedded friction material. **Figure 17** shows the corroded vent vanes on the rotor.

Figure 17: Left Front Brake Rotor Vent Vanes

All metal parts of the left front disc brake pads were severely corroded. The pads showed glazing and evidence of deterioration on the friction surface, which was beginning to delaminate from the metal mounting plate. There were uneven wear patterns on both pads. **Figure 18** shows

the friction surface of the inner brake pad. **Figure 19** shows the metal backing plate of the same brake pad and the heavy corrosion present.

Figure 18: Friction Surface of Left Front Brake Pad

Figure 19: Metal Backing Plate of Left Front Brake Pad

1.1.9.4. Right Front Brake

The right front disc brake caliper showed minor oxidation across all metal surfaces. The brake hose fitting was sheared at the housing. The phenolic caliper pistons were not located in the caliper and were packaged in individual plastic bags within the same evidence box. Both pistons had slight scoring and the metal disc flange surface showed heavy oxidation. The piston bores had what appeared to be brake fluid and particles contaminating them. There was a burnt odor present when examining the caliper. **Figure 20** shows the interior of the right front caliper piston bores. **Figure 21** displays the corrosion present on the metal flange of one of the pistons.

Figure 20: Interior of Right Front Caliper Piston Bore

Figure 21: Corroded Right Front Caliper Piston

The right front disc brake rotor was similar in manufacture to the left front and was a vented design. There was heavy corrosion in the cooling vent vanes and all areas of the rotor except for the two swept surfaces. There was minor pitting and corrosion present on the swept surfaces and what appeared to be embedded friction material. **Figure 22** is the right front rotor showing the corrosion present in the vent vanes and on the swept surface.

Figure 22: Right Front Disc Brake Rotor

All metal parts of the right front disc brake pads were severely corroded. The pads showed glazing and evidence of deterioration on the friction surface, which was beginning to delaminate from the metal mounting plate. There were uneven wear patterns on both pads. **Figure 23** shows the friction surface of the inner brake pad. **Figure 24** is the metal backing plate of the same pad.

Figure 23: Inner Pad Friction Surface from Right Front Brake

Figure 24: Metal Pad Backing Plate from Right Front Brake

1.1.9.5. Master Cylinder and Brake Booster

The limousine was equipped with a split service, tandem master cylinder assisted by a power brake vacuum booster.[25] The brake system master cylinder and the power brake vacuum booster were damaged in the crash. The brake fluid reservoir was separated from the master cylinder and had a small puncture in the side. The vacuum booster housing was deformed. **Figure 25** shows the damaged vacuum booster. **Figure 26** is the brake fluid reservoir showing the puncture to the side.

[25] A split service brake system means a brake system that operates the brakes on all wheels, consisting of two or more subsystems actuated by a single control designed so that a single failure in any subsystem does not impair the operation of any other subsystem.

Figure 25: Damaged Brake Vacuum Booster

Figure 26: Limousine's Brake Fluid Reservoir

1.1.9.6. Steel Brake Tubing

The steel brake tubing crossing over the rear differential was severely corroded with a crimp in the tubing near the connection with the right rear flexible brake hose. One portion of the tubing appeared to still be coated with brake fluid at the time of the inspection. **Figure 27** shows the corrosion present on the tubing at the time of the inspection. **Figure 28** is the brake tubing with arrows pointing to the crimp. A coating of brake fluid is evident on the tubing. **Figure 29** is another view of the corrosion with brake fluid coating the tubing.

Figure 27: Corroded Steel Tubing Removed from Rear Brakes of Limousine

Figure 28: Crimped and Corroded Steel Tubing from Limousine Brake System

Figure 29: Corroded Steel Tubing with Brake Fluid Coating

1.1.9.7. Brake Heat Testing

On June 8, 2019, NTSB investigators, along with NYSP, drove the same route the limousine had taken the day of the crash to determine the effect of roadway elevation change and vehicle load on brake temperatures. Higher brake component temperatures increase the likelihood of a reduction in stopping power, or brake fade. A 2019 GMC Yukon Denali loaded to 8125 lbs. was used as an exemplar for this testing. The crash vehicle's weight was 13,565 lbs. **Table 5** shows the brake component temperatures of the Yukon at specific locations along the route.

Table 7: Exemplar Brake Component Temperatures

Location (1st Run)	Component	Temperature °F			
		RF	RR	LR	LF
County Line 67 Westine Rd *Trip Miles: 0*	Rotor	243	134	136	247
	Caliper	150	99	102	157
	Pad	182	127	133	201
19 Pleasant Ave, Amsterdam *Trip Miles: 6.7*	Rotor	280	145	156	251
	Caliper	163	105	108	178
	Pad	163	139	147	224
30A/Brandon Rd *Trip Miles: 31*	Rotor	240	138	147	237
	Caliper	144	95	104	161
	Pad	161	115	125	182
30A/SR20 *Trip Miles: 32.9*	Rotor	433	255	250	410
	Caliper	185	111	119	187
	Pad	213	156	167	250
30/SR7 *Trip Miles 39.9*	Rotor	292	147	156	280
	Caliper	188	112	120	200
	Pad	230	143	152	240
Apple Barrel *Trip Miles: 41.7*	Rotor	456	250	254	436
	Caliper	210	112	125	215
	Pad	246	170	179	274
Stopped @ Applebarrel Approximately 2 min	Rotor	350	XXX	XXX	UNK
	Caliper	235	XXX	XXX	230
	Pad	UNK	XXX	XXX	UNK
Stopped @ Applebarrel Approximately 5 min	Rotor	327	XXX	XXX	345
	Caliper	240	XXX	XXX	233
	Pad	UNK	XXX	XXX	UNK

Test Date: 06/08/2019
Test Vehicle: 2019 GMC Yukon Denali 4WD SUV VIN: 1GKS2HKJ7KR375877
Test Weight: 8125lbs

Location (2nd Run)	Component	Temperature °F			
		RF	RR	LR	LF
County Line 67 Westine Rd	Rotor	XXX	XXX	XXX	XXX
	Caliper	XXX	XXX	XXX	XXX
	Pad	XXX	XXX	XXX	XXX
19 Pleasant Ave, Amsterdam	Rotor	XXX	XXX	XXX	XXX
	Caliper	XXX	XXX	XXX	XXX
	Pad	XXX	XXX	XXX	XXX
30A/Brandon Rd	Rotor	246	148	148	246
	Caliper	180	112	118	193
	Pad	207	129	133	216
30A/SR20	Rotor	474	270	271	445
	Caliper	190	116	125	214
	Pad	224	160	161	255
30/SR7	Rotor	283	148	160	271
	Caliper	181	112	123	203
	Pad	218	134	154	235
Apple Barrel	Rotor	464	262	278	444
	Caliper	207	120	131	212
	Pad	235	167	185	264
Stopped @ Applebarrel Approximately 2 min	Rotor	404	XXX	XXX	404
	Caliper	224	XXX	XXX	238
	Pad	262	XXX	XXX	285
Stopped @ Applebarrel Approximately 5 min	Rotor	360	XXX	XXX	355
	Caliper	234	XXX	XXX	244
	Pad	280	XXX	XXX	250
Stopped @ Applebarrel Approximately 8 min	Rotor	321	XXX	XXX	323
	Caliper	234	XXX	XXX	243
	Pad	274	XXX	XXX	281
Stopped @ Applebarrel Approximately 10 min	Rotor	299	XXX	XXX	300
	Caliper	234	XXX	XXX	243
	Pad	266	XXX	XXX	277
Stopped @ Applebarrel Approximately 12 min	Rotor	279	XXX	XXX	274
	Caliper	231	XXX	XXX	236
	Pad	256	XXX	XXX	259

1.1.10. Transmission

The automatic transmission was damaged, fractured into several pieces, and found under the vehicle. The transmission main case and extension housing were separated. There was severe wear to the transmission bushings and the forward clutch friction disc showed very little friction material remaining. This was taken into evidence by the NYSP and an analysis was performed by their expert. **Figure 30** shows the fractured transmission main case. **Figure 31** is the transmission output shaft photographed near the vehicle on October 8, 2019.

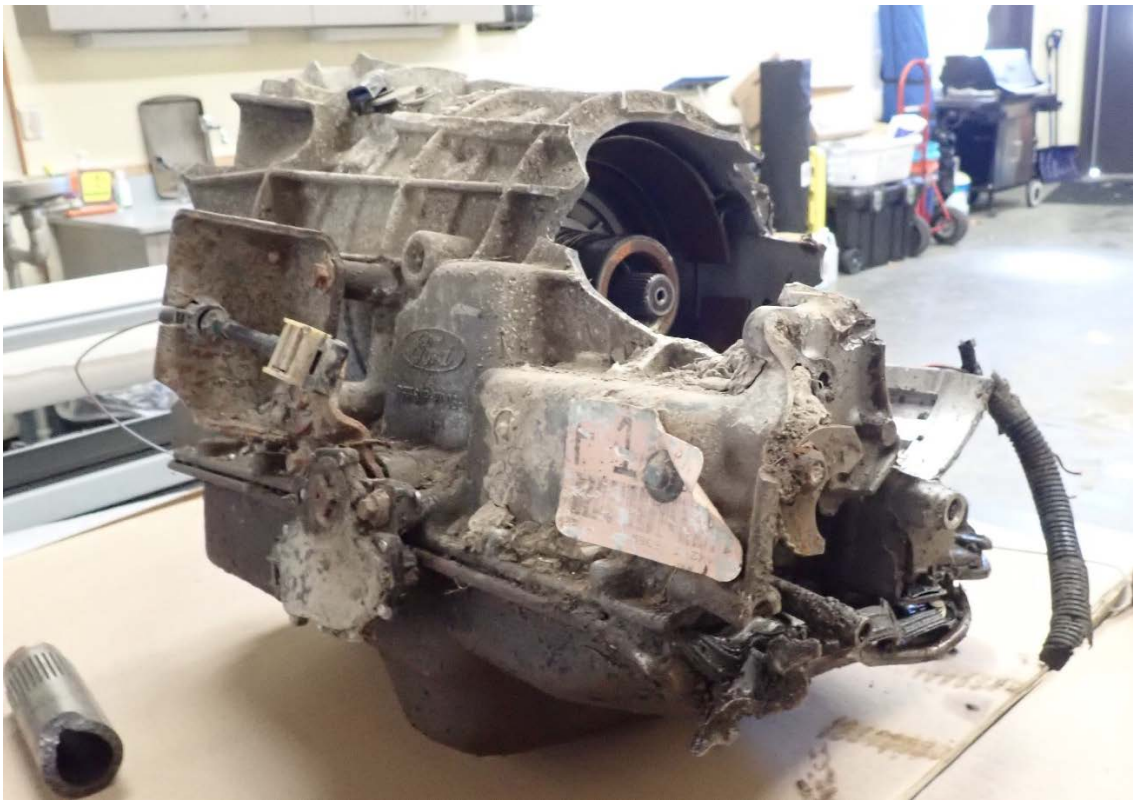

Figure 30: Fractured Transmission Main Case of Limousine

Figure 31: Transmission Output Shaft

1.1.11. Electrical

Due to the extent of damage, the vehicle' s entire electrical system was compromised. No functional or circuit checks were able to be performed.

1.1.12. Event Data

This vehicle was equipped with modules capable of recording event data. The airbag control module (ACM) is part of an automobile's supplemental restraint system. Depending on vehicle, the module may be capable of recording data when triggered by an airbag event known as a deployment or non-deployment. A non-deployment event involves no airbags firing however the change in velocity was significant enough to initialize the ACM.

Typically, several seconds of pre-collision and post-collision data is recorded when triggered. Parameters recorded vary by manufacturer and manufacturer year but may include vehicle speed, engine speed, brake application, throttle position, seatbelt usage, and airbag performance. The ACM from the vehicle was imaged by the New York State Police and a copy of the data was provided to NTSB Investigators.[26] **Figure 32** is the damaged ACM from the limousine.

Figure 32: Damaged ACM from Ford Limousine

The data from the limousine ACM was limited in nature due to the age of the vehicle. The recorded event included 106 milliseconds of longitudinal acceleration and a cumulative change in velocity (delta-V) of 29.36 miles per hour.

[26] See Vehicle Attachment – 2001 Ford Excursion Limousine Airbag Control Module Image

The damaged engine powertrain control module (PCM) was also removed by the NYSP who attempted to access any data it may contain. No information was recovered from the module. **Figure 33** is the Ford PCM from the limousine.

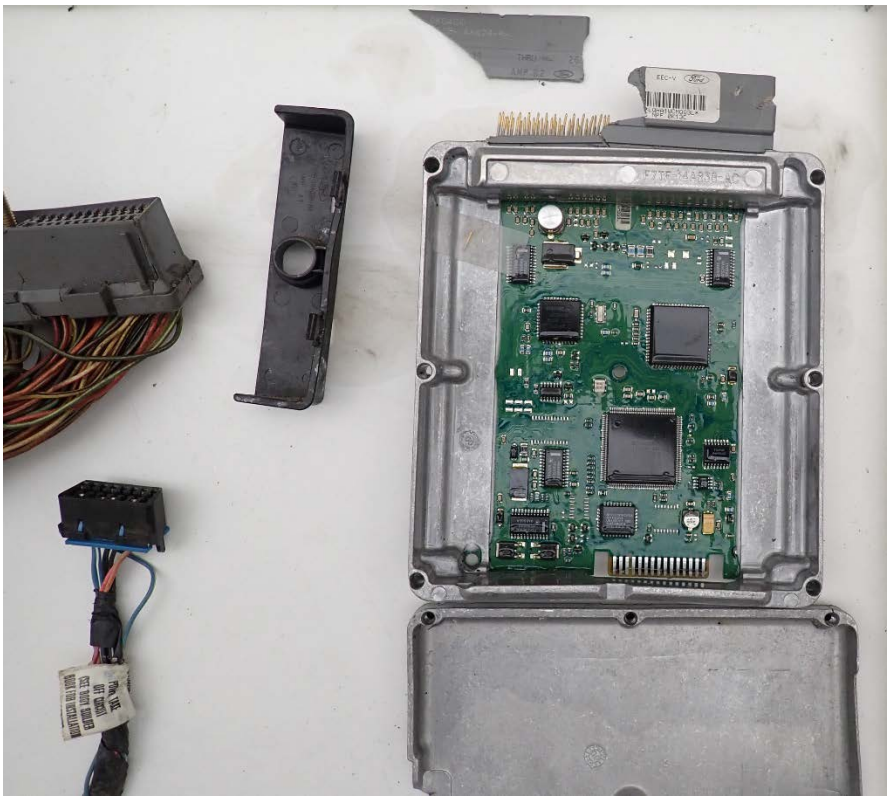

Figure 33: Ford PCM Obtained from Limousine

1.1.13. Maintenance and Inspection History

In February 2010, the original owner of the limousine took it to A1 Limo Depot in Massapequa, New York to be re-certified.[27] A1 Limo repaired several items on the vehicle, including an exhaust leak and replaced several ball joints. The repairs consisted of using 30-feet of 1x2-inch box steel to install new chassis support gussets on the left and right side of the vehicle. Once the re-certification process was complete, a new DOT certification label was affixed to the vehicle by A1, which placed the GVWR at 13,080 lbs.

On February 24, 2010, the New York State Department of Transportation (NYSDOT) Passenger and Freight Safety Division conducted an initial inspection of the limousine at A1 Limo Depot. This inspection was part of the NYSDOT bus safety inspection program. Refer to the Motor Carrier Group Chairman's report for details on the inspection protocol under this program. Among other inspection items, the presence of the DOT manufacturer label, and the GVWR were verified. The limousine passed this inspection and A1 Limo returned it to the original owner.

[27] See Vehicle Attachment – 2001 Ford Excursion Limousine Re-Certification Invoice

Between February 24, 2010 and December 2015, the limousine was inspected 16 times.[28] These inspections include regular semi-annual inspections, re-inspections if an inspection was failed, and random unscheduled roadside inspections. On June 25, 2015, the limousine failed a regular inspection due to a leaking power steering pump. The pump was replaced, and the vehicle passed a re-inspection the following day. On December 4, 2015 a final inspection was conducted with the inspection type noted as "Permanent Out of Service". All 16 of these inspections indicate a GVWR of 13,080 lbs. with a seating capacity of 18, and a vehicle type of "bus".

On July 21, 2016, the limousine was sold by the original owner to Prestige Limousine. No inspections under the NYSDOT Bus Safety Inspection Program were performed since this sale. Registration records indicate that Prestige Limousine improperly registered it as a livery vehicle, instead of a bus, by inaccurately reporting the seating capacity and vehicle weights. See the Motor Carrier Group Chairman's report for details regarding the improper registration.

NTSB Investigators located limited maintenance records for the limousine during the time it was owned by Prestige Limousine. These records were obtained from the auto repair shop the vehicle was taken to for service, Mavis Discount Tire (Mavis), in Saratoga Springs, New York.[29] The records listed several vehicles other than the 2001 Excursion, but investigators were able to determine which records reflected the repairs done to the crash involved vehicle. Investigators received no records from Prestige Limousine.

Mavis records for the limousine show that on September 10, 2016, the vehicle had the right rear brakes repaired. Mavis replaced the right rear brake caliper, brake pads, and rotor. The brake system was also flushed on this date. These records show the part numbers used during the repair. NTSB Investigators were not able to compare these part numbers to those on the vehicle at the time of the crash.

On November 14, 2019, during a NYSP DMV hearing, a former Mavis employee who had performed work on the limousine testified that the brake line was flushed, and one brake had been bled following the system flush.

Mavis records indicate they replaced the limousine's alternator on June 9, 2017 and repaired the exhaust and flushed the power steering system on January 25, 2018.

On March 21, 2018, NYSDOT performed an inspection of the limousine while it was parked at Prestige Limousine's location in Saratoga Springs, New York.[30] This inspection was not the inspection required by the NYSDOT's Bus Safety Inspection Program, but rather a Commercial Vehicle Safety Alliance (CVSA) level five terminal inspection. This inspection noted that the vehicle was improperly registered and had several regulatory violations. See Motor Carrier Group Chairman's Report for details on the regulatory and registration violations documented for this vehicle.

This inspection also noted that the vehicle was missing the DOT certification label which had been placed on the vehicle by A1 Limo Depot in February 2010. The label located on the

[28] See Vehicle Attachment - NYSDOT Bus Inspection History on 2001 Ford Excursion Limousine
[29] See Vehicle Attachment – 2001 Ford Excursion Limousine Maintenance Records from Mavis Tire
[30] See Vehicle Attachment – NYSDOT CVSA Level V Terminal Inspection March 21, 2018

vehicle at the time of this inspection was the original Ford Motor Excursion certification label which indicated a seating capacity of 10, and a GVWR of 8600.

Equipment violations documented on the March 21, 2018 inspection included a brake hydraulic line dangling and able to make contact with the left front tire. The anti-lock brake system (ABS) malfunction indicator light remained on while the vehicle was in operation. There were locking pliers attached to, and constricting, the rubber hydraulic brake line leading to the left rear brake. The inspector also noted that the "B" pillar on the left side showed deterioration and was rusted through, and the emergency exits were inoperable.

The NYSDOT inspector placed the limousine out-of-service for the brake violations, the inoperable emergency exits, and for the missing final manufacturer label. An out-of-service vehicle sticker was placed on the vehicle and the owner was notified that it could not be operated until the violations were repaired.

According to the records obtained from Mavis, the limousine was brought in for service on May 11, 2018. On this date, the records indicate that the customer requested a brake check, and a New York State Safety and Emission Inspection. As a result of the brake check, the brake master cylinder and some brake lines were replaced. The left rear brake caliper and pads were also replaced. NTSB Investigators were able to confirm part numbers for the brake pads and caliper on the work order to those on the vehicle at the time of the crash. The work order shows that the brake system was flushed after these repairs, and the oil was changed. The vehicle passed the emissions test but failed the safety inspection. No details were available regarding the reason for the failed safety inspection.

On August 25, 2018, a NYSP Trooper conducted a roadside inspection on the limousine.[31] This was a CVSA level three, driver's only, inspection and the vehicle was not included in the inspection protocol. The driver was placed out-of-service during this inspection for not having a passenger endorsement.

The final pre-crash inspection of the limousine occurred on September 4, 2018.[32] This inspection was conducted by the NYSDOT and took place at the Prestige Limousine's Saratoga Springs, New York location. This inspection was once again a CVSA level five terminal inspection rather than a bus inspection.

Violations noted on this inspection were many of the same regulatory items that were noted on the previous inspections. The inspection also documented many of the same equipment violations, including the ABS malfunction lamp, the emergency exits remained inoperable, and the deterioration of the "B" pillar. The inspection also documented the ABS wire on the left front axle was hanging and able to contact the left front tire.[33] The final stage manufacturer label was

[31] See Vehicle Attachment – NYSP CVSA Level III Roadside Inspection August 25, 2018
[32] See Vehicle Attachment – NYSDOT CVSA Level V Terminal Inspection September 4, 2018
[33] In post-crash conversations between NTSB investigators and the NYSDOT inspector who performed both the March 21, 2018 and the September 4, 2018 inspections, it was clarified that both inspection reports referred to a dangling ABS wire. The March 21, 2018 report had erroneously documented a violation involving a dangling hydraulic line at the left front brake. This should have been listed as a dangling ABS wire. NTSB investigators were unable to obtain documentation to corroborate this statement.

still missing. Due to the lack of repairs, an additional violation was issued noting the failure to correct the defects recorded on the previous inspection. The vehicle was again declared out of service and another out-of-service sticker was placed on the vehicle. This sticker was not observed on the vehicle during the post-crash inspection.

No records were located or provided for any repairs done to the limousine between the September 4, 2018 inspection and the October 6, 2018 crash date.

1.1.14. Documented Recalls and Warranty Claims

Recall and warranty claim information received from the manufacturer indicated only one recall.[34] This recall involved a possible issue with the front driver and passenger seatbelts not fully latching. NHTSA records indicated that this recall was incomplete on this vehicle.

Warranty claim information received from the manufacturer indicated three claims on this vehicle.[35] The first two claims involved replacing a faulty alternator, the first on September 25, 2001, and the second October 10, 2002. The third warranty claim was the replacement of a cruise control switch on August 15, 2006.

1.1.15. Prestige Limousine Fleet Inspection

At the time of the crash, Prestige Limousine maintained a fleet of four limousines. In addition to the involved Excursion limousine, Prestige owned three Lincoln Towncar limousines. To determine company maintenance standards, the three Towncars were inspected by the NYSP on February 6 – 7, 2019. NTSB Investigators were present during these inspections but were only allowed to photograph the vehicles and components. No details regarding the condition of specific components on each vehicle were obtained during the inspection.

All Towncars had been stretched 120-inches. Based on a visual inspection, the vehicles were all poorly maintained and had extensive corrosion throughout. The floorboards had disintegrated through to the carpet in multiple locations of all three vehicles.

No maintenance records on any fleet vehicles were obtained from Prestige Limousine by the NTSB.

1.2. Vehicle #2: 2015 Toyota Highlander SUV

This vehicle was parked, not running, and unoccupied. Information gathered was limited to general data and a damage description. This vehicle is equipped with modules capable of recording event data. The airbag control module (ACM) was imaged by the NYSP, but no crash related data was available.

[34] A search of the safety recall database on October 10, 2018 that is maintained by the National Highway Traffic Safety Administration (NHTSA) The safety recall database was accessed via the NHTSA safety recall website: https://www.nhtsa.gov/recalls

[35] See Vehicle Attachment – 2001 Ford Excursion Limousine Repair Claims Record

1.2.1. General Information

VIN:	5TDJKRFH0FS1*****
Manufacturer:	Toyota
Model:	Highlander Hybrid
Manufactured:	2015
Mileage[36] :	Approximately 75,000
GVWR:	5,001-6,000 lbs.
Engine:	2GR-FE 6 cylinder
Transmission:	Automatic 4-wheel drive

1.2.2. Damage Description

There was contact damage to both the front and rear of the Toyota. The radiator and hood were displaced rearward, and the hood folded upward. The front bumper was damaged, but intact and in place. The windshield was shattered, but in place. The driver's door was jammed in a partially open position and there was damage and distortion to the bottom portion of the door. The door window was missing. The left rear passenger door sheet metal was torn away from the vehicle. **Figure 33** shows the damage as seen from the left front corner of the Toyota.

Figure 34: Left Front View 2015 Toyota Highlander

[36] According to insurance records as the odometer located on the dash of the Toyota was destroyed.

The rear of the Toyota was displaced forward, and the rear axle was under the “B” pillar of the vehicle. The top of the rear hatch was displaced forward to the “C” pillar. The right rear passenger door was crushed and distorted forward. The right front passenger door was jammed in place, but with minor damage and the glass was intact. The roof was folded forward and the sunroof frame was distorted, and the glass was missing. **Figure 34** shows the damage as seen from the right rear corner of the Toyota.

Figure 35: Right Rear View 2015 Toyota Highlander

E. DOCKET MATERIAL

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

LIST OF ATTACHMENTS

Vehicle Attachment – 2001 Ford Excursion Limousine Airbag Control Module Image

Vehicle Attachment – 2001 Ford Excursion Limousine Build Sheet

Vehicle Attachment – 2001 Ford Excursion Limousine Maintenance Records from Mavis Tire

Vehicle Attachment – 2001 Ford Excursion Limousine Re-Certification Invoice

Vehicle Attachment – 2001 Ford Excursion Limousine Repair Claims Record

Vehicle Attachment – Ford QVM Body Builders Book

Vehicle Attachment – Ford QVM Excursion Guidance December 2002

Vehicle Attachment – Ford QVM Excursion Guidance July 2001

Vehicle Attachment – Ford QVM Program Principles November 2002

Vehicle Attachment - NYSDOT Bus Inspection History on 2001 Ford Excursion Limousine

Vehicle Attachment – NYSDOT CVSA Level V Terminal Inspection March 21, 2018

Vehicle Attachment – NYSDOT CVSA Level V Terminal Inspection September 4, 2018

Vehicle Attachment – NYSP CVSA Level III Roadside Inspection August 25, 2018

LIST OF PHOTOGRAPHS

Vehicle Photograph 1 – 2001 Ford Excursion Limousine – Overall Damage View Facing Left Front Corner

Vehicle Photograph 2 – 2001 Ford Excursion Limousine – Overall Damage View Facing Right Front Corner

Vehicle Photograph 3 – 2001 Ford Excursion Limousine – Spot Weld Joining Two Rails

Vehicle Photograph 4 – 2001 Ford Excursion Limousine – Corrosion to Right Rear Chassis

Vehicle Photograph 5 – 2001 Ford Excursion Limousine – Right Front Frame Rail Weld

Vehicle Photograph 6 – 2001 Ford Excursion Limousine – Opening in Floorboard Showing Interior Carpet

Vehicle Photograph 7 – 2001 Ford Excursion Limousine - Left Rear Brake Caliper

Vehicle Photograph 8 – 2001 Ford Excursion Limousine - Left Rear Brake Rotor

Vehicle Photograph 9 – 2001 Ford Excursion Limousine - Friction Surface of Left Rear Brake Pad

Vehicle Photograph 27 – 2001 Ford Excursion Limousine - Crimped and Corroded Steel Tubing

Vehicle Photograph 28 – 2001 Ford Excursion Limousine - Corroded Steel Tubing with Brake Fluid Coating

Vehicle Photograph 29 – 2001 Ford Excursion Limousine - Fractured Transmission Main Case

Vehicle Photograph 30 – 2001 Ford Excursion Limousine - Transmission Output Shaft

Vehicle Photograph 31 – 2001 Ford Excursion Limousine - Damaged Ford ACM

Vehicle Photograph 32 – 2001 Ford Excursion Limousine – Damaged Ford PCM

Vehicle Photograph 33 – 2015 Toyota Highlander – Overall Damage View Facing Left Front Corner

Vehicle Photograph 34 – 2015 Toyota Highlander – Overall Damage View Facing Right Rear Corner

END OF REPORT

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