

**NATIONAL TRANSPORTATION SAFETY
BOARD**

Vehicle Performance Division Washington, D.C.
20594

July 29, 2020

Brake Performance Study

By Shane K. Lack

A. Crash Information

Date: October 6, 2018

Location: Intersection of New York State Routes 30 and 30A, near Schoharie, Schoharie County, New York

Vehicle #1: 2001 Ford Excursion 18-passenger limousine

Operator #1: Prestige Limousine & Chauffeur Service, Gansevoort, New York

Vehicle #2: 2015 Toyota Highlander

Operator #2: Private citizen

NTSB #: HWY19MH001

B. Group

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C. Crash Summary

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

D. Details of Study

1.0 Introduction

In this accident a 2001 Ford Excursion, which had been modified into a limousine, crashed at a high rate of speed after descending a steep grade along State Route 30. The limousine failed to stop at a stop sign at the intersection of State Routes 30 and 30A. It crossed State Route 30A and entered a restaurant parking lot, where it collided with a parked 2015 Toyota Highlander. The limousine continued across the parking lot into a ravine, where it collided with the earthen embankment.

The vehicle involved in the accident was a 2001 Ford Excursion, which had been modified into a limousine by extending the length and modifying the interior to accommodate a bar and additional passenger seating. As a result of the modifications the estimated weight of the limousine at the time of the accident, 13565 lbs, exceeded the original gross vehicle weight rating (GVWR) of the Excursion when it was manufactured by Ford, which was 8600 lbs. No evidence was found during the investigation that the limousine or its brake system had been certified as conforming to the Federal Motor Vehicle Safety Standard (FMVSS) 105 (49 Code of Federal Regulations (CFR) Part 571.105) *Hydraulic and Electrical Brake Systems* requirements at the accident weight. The testing described in this report addresses concerns that the limousine at the accident weight (13565 lbs) with properly functioning brakes would not have had sufficient braking capacity to have safely negotiated the accident route or to have met the FMVSS 105 stopping distance requirements.

Following the accident NTSB investigators proposed using the performance-based criteria of FMVSS 105 as a baseline to evaluate the service brake performance of an Excursion operating at the accident weight with a properly functioning brake system. Additional inertia brake dynamometer testing was also proposed to simulate braking performance over the route the vehicle traveled. In order to accomplish this testing a contract was awarded to Greening Testing Laboratories, Inc. (GTL), of Detroit, Michigan.

As part of the NTSB contract with Greening, testing was conducted by the Nevada Automotive Test Center (NATC), Carson City, Nevada, with an exemplar Excursion, loaded to the accident weight and equipped with Ford recommended (Original Equipment – OE) brake components. The brake parts used in the testing were identified based on the Vehicle Identification Number (VIN) of the accident vehicle. The objective of the brake evaluation was to estimate if the limousine at the accident weight with a properly functioning brake system would have been able to meet the FMVSS 105 stopping distance and fade and recovery requirements for a vehicle other than a school bus with a GVWR greater than 10000 lbs. The first and second fade and recovery maneuvers are optional for vehicles with a GVWR of greater than 10000 lbs, but these tests were included in the study to address specific concerns regarding brake fade. The exemplar testing was also used to develop vehicle-specific data such as brake cooling and coast down curves for use in subsequent simulations.

Additional testing was conducted by Greening at its test facilities in Detroit, using Ford Motor Company branded replacement brake parts available through the Ford distribution channel for the unmodified Excursion in a dual-end inertia brake dynamometer. (These parts were identified based in the VIN of the accident vehicle.) This testing included using the dynamometer to simulate the braking

performance over the accident route. The objective of the simulations was to estimate if the limousine at the accident weight with a properly functioning brake system could have safely negotiated the accident route at the posted speed limit. Data on brake cooling and parasitic drag measured during the exemplar testing was used in the simulations to model brake cooling and parasitic energy losses. Energy losses/gains due to the road grade were accounted for in the simulations.

The remainder of this report contains a summary and discussion of the testing and the results. The full results of the testing are available in the attachments to this report.

2.0 Brake Components used in Testing

For the purposes of this report, brake components are broken down into categories as follows:

- Original Equipment Manufacturer (OEM) - Brake components (brakes, pads, rotors, etc.) that are installed during the vehicle build at the factory.
- Original Equipment Service (OES) - Brake components (brakes, pads, rotors, etc.) installed/purchased at the dealership, generally available for the first three years of the vehicle's life. Distributed under the vehicle manufacturer's name (General Motors (GM), Ford, Fiat Chrysler Automobiles (FCA)) through a channel different than the aftermarket distribution channel. These 'brands' are not usually available for makes/models other than those of the OEM. Additionally, these parts may be the same as the OEM as described above. If not the same as the OEM, they would most likely carry a different part number than the parts distributed through the Original Equipment Aftermarket.
- Original Equipment Aftermarket (OEA) – Brake components (brakes, pads, rotors, etc.) installed/purchased at the dealership or authorized distributor, available for a minimum of 10 years after the vehicle's last build date as required by law. Distributed under the vehicle manufacturer's aftermarket channel (GM = ACDelco, Ford = Motorcraft, FCA = Mopar, etc.) These 'brands' also many times have parts available for makes/models other than those of the OEM.
Please note that the OES and OEA products can also sometimes be one in the same.
- Traditional Aftermarket - Brake components (brakes, pads, rotors etc.) available through companies or retailers not generally engaged in providing products at the OEM or OES level.

These categories are based on discussions with industry. The reason for separating the brake parts into these categories is that performance of the brake components may differ depending on which category it falls under. The parts used in the testing for this investigation fall under the "OEA" category and are referred to as "OEA" or "Ford recommended OEA" in the text of this report (OES and OEM parts were no longer available). When OEA parts are referred to in this report it is referring to the Ford recommended OEA parts for the original unmodified 2001 Ford Excursion on which the accident limousine was built. These are the parts that a customer would purchase if they walked into the Ford dealership or supplier and purchased replacement parts based on the VIN number on the limousine.

In the text of the report the term "aftermarket" is used solely to describe parts that fall under the "traditional aftermarket" category. There are no FMVSS standards requiring that any replacement brake parts such as rotors and pads perform the same as the OE brake parts when placed on the vehicle. With the exceptions of federal requirements regarding brake hoses (FMVSS 106) and brake fluids (FMVSS 116) there are no federal requirements governing the quality or performance of replacement brake

components.

The brakes from the accident vehicle were not tested for this investigation. The objective of this project was to assert what would have been possible had the vehicle been properly maintained, independent of whatever brake and suspension upfitting should have been undertaken at the time of the limousine conversion. (It would be unlikely that someone would intentionally reduce the braking capacity when increasing the weight of a vehicle.) The tests were conducted using Ford recommended brake calipers, pads, and rotors (OEA) specified for the unmodified Excursion on which the accident limousine was built. OEA parts were chosen for the study because it is believed they best represent how Ford, the original manufacturer of the vehicle, intended the braking system to function. As indicated earlier these are the parts that a customer would purchase if they walked into the Ford dealership or supplier and purchased replacement parts based on the VIN number on the limousine. There is no evidence (such as FMVSS 105 certification) that Ford ever intended the brake design on the unmodified Ford Excursion to be used on a vehicle at the accident weight of 13565 lbs.

Due to an ongoing law enforcement investigation the brake parts from the accident vehicle were not available to the NTSB to be used in the testing and there was limited access for inspection. The manufacturer of the front brake pads on the accident vehicle could not be identified so it was not possible to test exemplar parts that were the same make and model as those on the accident vehicle.

3.0 Vehicle Testing/ FMVSS 105 Testing/ Brake Performance

3.1 Introduction

As part of the NTSB contract with Greening a brake performance evaluation was conducted by NATC using the test procedures in the National Highway Traffic Safety Administration's (NHTSA) Federal Motor Vehicle Safety Standard (FMVSS) 105 *Hydraulic and Electrical Brake Systems* for vehicles with a GVWR of greater than 10000 lbs. The testing focused on the performance standard portions of the FMVSS 105 testing specifically addressing brake fade and stopping distances since these were considered most relevant to the accident. This section of the report contains a short summary of the testing. A complete description of the testing is contained in Attachment 1. The 105 testing did not cover the entire FMVSS protocol since the results were intended as a performance baseline and not to establish regulatory compliance.

The vehicle used in the evaluation was a 2000 Ford Excursion XLT 4X2 shown in Figure 1. Brake components used in the testing were new OEA brake components that would have been specified for the unmodified accident vehicle. The vehicle instrumentation for the testing is described in Attachment 1.

Two different vehicle weights were used in the testing. The Heavy Test Load (HTL), 13555 lbs, was used to represent the estimated weight of the limousine when the accident occurred. The Light Test Load (LTL) used in the testing was 10145 lbs, which was the estimated weight of the limousine with a driver, fluids, and instrumentation.



Figure 1 – Test Vehicle

3.2 Evaluation of FMVSS 105 Stopping Distance Requirements

The purpose of the FMVSS 105 standard is to ensure safe braking performance under normal and emergency conditions. To ensure safe braking performance the standard requires that the service brakes be capable of stopping each vehicle in effectiveness tests within specific distances and speeds.

To estimate if the limousine at the accident weight with a properly functioning brake system would have been able to meet the stopping distance requirements for a vehicle other than a school bus with a GVWR of greater than 10000 lbs, a series of FMVSS 105 test procedures were performed using the exemplar Excursion. The FMVSS 105 test procedures performed as part of the evaluation include the first, second and third effectiveness tests, the system partial failure tests, antilock brake systems (ABS) failure test, and the inoperative power assist test. This set of maneuvers included all the tests required to evaluate the FMVSS 105 stopping distance requirements for a vehicle with a GVWR of greater than 10000 lbs. For a complete description of the testing and requirements please refer to Attachment 1 and the *49 CFR Part 571.105*. In the FMVSS 105 test procedures the HTL weight (13555 lbs) was used for the GVWR weight and the LTL weight (10145 lbs) was used for the Lightly Loaded Vehicle Weight (LLVW).

The results of the FMVSS 105 testing performed with the exemplar Excursion are summarized in Table 1 along with the applicable stopping distance requirements from FMVSS 105. As indicated by the data in the table the exemplar Excursion was able to meet all the FMVSS 105 stopping distance requirements for a vehicle with GVWR above 10000 lbs with the exception of the inoperative power boost requirement, which resulted in stopping distances that exceeded the standard's requirement.

The original GVWR of the accident Excursion as it was manufactured by Ford was 8600 lbs. As indicated by the data in Table 1 if the FMVSS stopping distance requirements for vehicles with a GVWR of 8000 to 10000 lbs were applied to the results of the exemplar Excursion testing it would have exceeded six of the thirteen stopping distance requirements for a vehicle with a GVWR of 8600 lbs.

Result summary: The testing with the exemplar Excursion indicates that the limousine at the accident weight of 13565 lbs with a properly functioning braking system would have been able to meet all of the FMVSS 105 stopping distance requirements for a vehicle with a GVWR above 10000 lbs, with the exception of the inoperative power boost requirement.

(It should be noted that there are two options available when performing the inoperative power boost test. The “Regular Procedure” was used for the testing and consists of rendering the brake assist unit inoperable and exhausting the reserve before performing the stopping maneuvers. A second option for the inoperative brake boost test, the “Optional Procedure”, does not deplete the power boost prior to the stopping portion of the test. The “Optional Procedure” was not performed as part of this study.)

3.3 FMVSS 105 Fade and Recovery Testing

One of the concerns in this accident was the potential for increased risk of brake fade associated with the greater vehicle weight resulting from the modifications.

The portion of the FMVSS 105 testing which deals most directly with the brake fade are the first and second fade and recovery tests. The FMVSS 105 first and second fade and recovery test maneuver procedures for a vehicle over 10000 lbs consists of a series of brake snubs from speeds of 40 to 20 mph. (FMVSS defines a “snub” as the braking deceleration of a vehicle from a higher reference speed to a lower reference speed that is greater than zero.) Timing and/or distances between the snubs are specified in the text of FMVSS 105. In order to pass the test, the vehicle must meet requirements for deceleration rates and pedal force listed in the text of the FMVSS 105.

A FMVSS 105 first and second fade recovery test was conducted with the exemplar Excursion at the accident (HTL) weight.

The results of the first and second fade and recovery tests are described in Table 9 of Attachment 1. The results of the tests indicate that the exemplar Excursion was able to meet the FMVSS 105 requirements for the first and second fade/recovery test procedures for vehicles with a GVWR of over 10000 lbs.

Result Summary: The results of the testing with the exemplar Excursion indicates that the limousine at the accident weight of 13565 lbs with a properly functioning brake system would have been able to pass the FMVSS 105 test requirements for the first and second fade and recovery procedures for vehicles with a GVWR over 10000 lbs.

3.4 Comparisons of Stopping Distance Results with Ford Data

Ford Motor Company also provided their FMVSS 105 test results for vehicles with a similar braking system. The stopping distances from the FMVSS 105 testing with the exemplar Excursion are shown in Table 2 along with the results of Ford's FMVSS 105 tests. As indicated by the data in the table the stopping distances were significantly greater for the exemplar Excursion which was heavier than the two vehicles used in the 105-test examples provided by Ford. While the data indicates the stopping distances were greater for the exemplar Excursion than for the vehicles Ford tested, the results still fell within the FMVSS 105 stopping distance requirements for vehicles with a GVWR of greater than 10000 lbs with the exception of the inoperative power boost stopping distance requirement.

Table 1 – Stopping Distances from the Exemplar Excursion Test (HTL weight = 13555 lbs, LTL weight = 10145 lbs)

FMVSS 105 Test Procedure for Stopping Distance Evaluation	FMVSS 105 Requirement For ≥ 8000 lbs & ≤ 10000 lbs (ft)	FMVSS 105 Requirement For >10000 lbs (ft)	Measured Stopping Distance (ft)	Measured Pedal Force (lbs) **
First Effectiveness (HTL) 30 mph*	72	88	84.2	135.5
First Effectiveness (HTL) 60mph	267	388	337.4	142.6
Second Effectiveness (HTL) 30 mph	57	78	64.2	142.2
Second Effectiveness (HTL) 60 mph	216	310	268.8	137.5
Third effectiveness (LTL) 60 mph	242	335	208.5	134.0
Partial Systems Fail front (LTL) 60 mph	517	613	445.2	144.6
Partial Systems Fail Rear (LTL) 60 mph	517	613	361.7	140.9
Partial Systems Fail Front (HTL) 60 mph	517	613	594.1	146.5
Partial Systems Fail Rear (HTL) 60 mph	517	613	466.9	124.8
ABS Failure (HTL), 60 mph	517	613	269.7	128.7
Inoperative Power Assist (HTL), 60 mph	517	613	718.5	151.7
Fourth Effectiveness 30 mph* (HTL)	72	88	70.8	130.6
Fourth effectiveness 60 mph* (HTL)	267	388	260.7	129.7

*Not Required for non-school buses with GVWR's of Greater than 10,000 lbs

** Pedal Force limits are 15 to 150 lbs

Table 2 – Comparison of Exemplar Excursion Stopping Distances with Results of Ford FMVSS 105 Tests with Similar Brake Systems. The First Two Columns of the Table Contain the Data Provided by Ford. The Weights in the Top Row of the Table are the GVW's of the vehicle used in the Testing.

Test	2000 Ford Excursion 8600 lbs Stopping Distance (ft)	1999 Ford Pickup Truck 11253 lbs Stopping Distance (ft)	Exemplar NATC 2000 Ford Excursion 13565 lbs Stopping Distance (ft)
First Effectiveness (GVW) 30 mph*	49.5	54.8	84.2
First Effectiveness (GVW) 60 mph	192.0	209.3	337.4
Second Effectiveness (GVW) 30 mph	47.6	52.9	64.2
Second Effectiveness (GVW) 60 mph	174.3	200.7	268.8
Third Effectiveness (LLVW) 60 mph	170.3	169.4	208.5
Partial Systems Fail Front (LLVW) 60 mph	364	393.4	445.2
Partial Systems Fail Rear (LLVW) 60 mph	241	251.9	361.7
Partial Systems Fail Front (GVW) 60 mph	352.1	449.2	594.1
Partial Systems Fail Rear (GVW) 60 mph	289.5	414.0	466.9
ABS Failure (GVW) 60 mph	174.1	243.7	269.7
Inoperative Power Assist (GVW) 60 mph	416.8	494.2	718.5
Fourth Effectiveness (GVW) 30 mph*	46.1		70.8
Fourth effectiveness (GVW) 60 mph*	161.7		260.7
Fourth effectiveness (GVW) 80 mph* (Ford)	305.5		

*Not Required of for non-school buses with GVWR's of Greater than 10,000 lbs

4.0 Dual- End Dynamometer Tests

4.1 Description of Dynamometer Testing

The accident vehicle was equipped with four-wheel disc brakes. When applied, the brakes generate torque which slow the rotation of the tires. As the tires rotate more slowly the contact patch with the road deforms or “stretches” generating forces which in turn slow the vehicle. During normal braking (when tire slip is low) most of the kinetic energy is dissipated as heat generated by the friction between the brake pad and the rotor.

The magnitude of the torque generated by a brake can vary significantly depending on the brake’s temperature, speed, and pressure. A tool used to measure the relationships among brake torque, speed, brake pressure and brake temperature is an inertia brake dynamometer. An inertia brake dynamometer uses a rotating mass and actual brake components to measure braking performance.

To evaluate the braking performance of the OEA brakes for the accident vehicle a series of tests were conducted using a dual-end dynamometer and Ford recommended OEA brake components. A dual-end brake dynamometer is a brake dynamometer in which two brake assemblies can act simultaneously on a common rotating inertia mass. Typically, a front and rear brake assembly of a vehicle are tested together to simulate a vehicle braking system. A sketch and photograph of the dynamometer used in this testing are shown in Figure 2. In order to model the energy of a vehicle using a dual-end dynamometer, one-half the total vehicle inertia is installed on the dynamometer according to equation (1). Various braking conditions can be modeled by rotating the inertia at targeted speeds and applying braking to slow the rotating mass. The brake torque, pressure, speed, and temperature values are recorded during the testing. One of the advantages of a dual-end dynamometer is that since the pressure is applied simultaneously at each brake as it is in a vehicle, the work fraction at each brake is known.

$$(1) \quad Test\ Inertia = \frac{1}{2} * \left(\frac{Vehicle\ Weight}{Gravity} \right) * (Rolling\ Radius\ of\ Tires)^2$$

It is possible to model the cooling of the brakes by varying the air flow across the brakes during testing to reflect the cooling rates as measured on the vehicle. Air flow can be calibrated using vehicle specific brake data. The effects of road grades can be modeled by adding or reducing energy (inertia) using the drive motor in Figure 2.

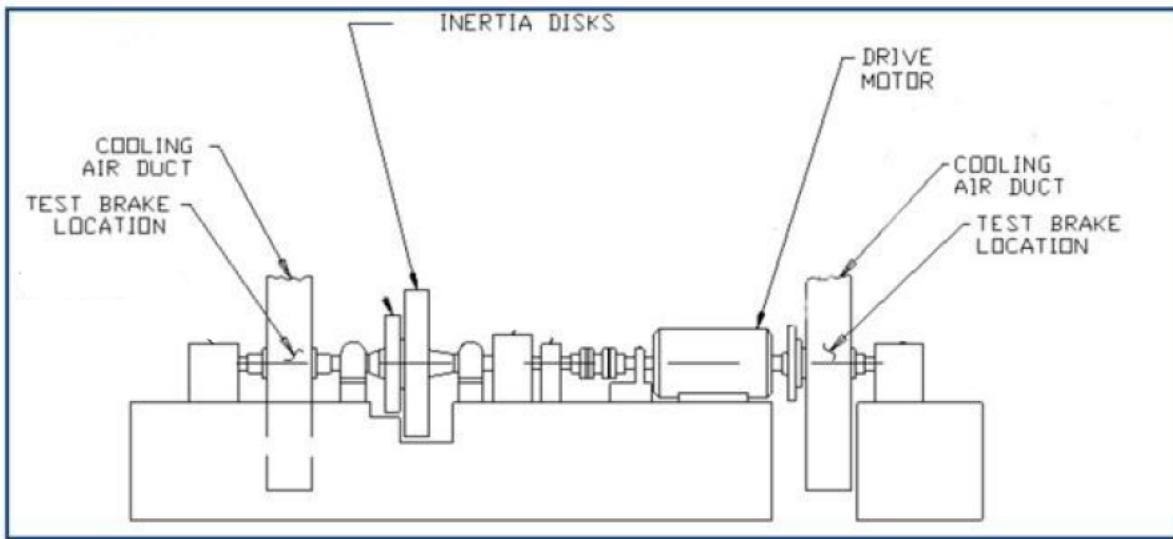


Figure 2 – Dual-End Brake Dynamometer

4.2 Brake Performance Matrix

To evaluate the overall brake performance a series of tests were conducted by Greening at its testing facility in Detroit using the dual-end inertia brake dynamometer. The brake parts used in the testing were new OEA brake components that are specified for the unmodified accident vehicle. The weight of the vehicle modeled in the tests was the accident weight of 13565 lbs. The objective of the testing was to measure the brake torques over a wide range of speeds, brake temperatures, and brake pressures.

The brake performance test matrix used in the testing consisted of a series of 10 mph snubs over ranges of initial speeds (50 to 65 mph in 5 mph increments), initial brake pressures (400 psi to 1800 psi, in 200 psi increments), and initial front brake temperatures (300 F to 900 F, in 150 F increments). Since the testing was performed on a dual-end dynamometer the initial temperature of the rear brake was less than the initial temperature for the front brake. (The rear brake is cooler than the front brake in the matrix test because it did less work than the front and the energy absorbed by the rear disc as a fraction of its mass (KE/kg) may be less, allowing it to dissipate heat more quickly than the front. The use of a dual-end dynamometer does not automatically create a situation in which the rear brake must be cooler.) In addition to the snubs the performance matrix included a full effort stop from 55 mph to 0, at 1800 psi which was performed at each initial application temperature (300 F to 900 F in 150 F increments). In order to evaluate repeatability, the test matrix was performed twice. A simulated FMVSS 105 burnish was performed prior to the matrix sequences.

The results of the test matrix are contained in Attachment 2 of this report.

5.0 Simulations

5.1 Introduction/Description of the Dynamometer Simulations

Due to GVWR restrictions on vehicles with brake systems similar to those of the limousine's it was not possible to drive an exemplar vehicle at the accident weight over the same route the limousine traveled to test how a properly functioning brake system would have performed. To evaluate the braking of the limousine along the accident route a series of simulations were performed using the dual-end inertia brake dynamometer with OEA brake parts specified for the unmodified Excursion at the Greening test facility in Detroit. A summary of the simulations/results are contained in this section. For the actual test reports please refer to Attachments 3-6 of this report.

The route of the limousine modeled in the simulations is shown in Figure 3. The simulated route included the portion of the limousine's route from where it first entered Interstate 90 up to the stop sign at the intersection of New York State Route 30 and New York State Route 30A where the crash occurred. In total more than 30 miles of the limousine's route prior to the crash were modeled in the simulations. The road profile along the simulated route is shown in Figure 4. As illustrated by the diagram the simulated route included two long descents that occurred prior to the crash. These descents are where the brake temperatures would have tended to increase significantly, and the risk of brake fade would be the greatest.

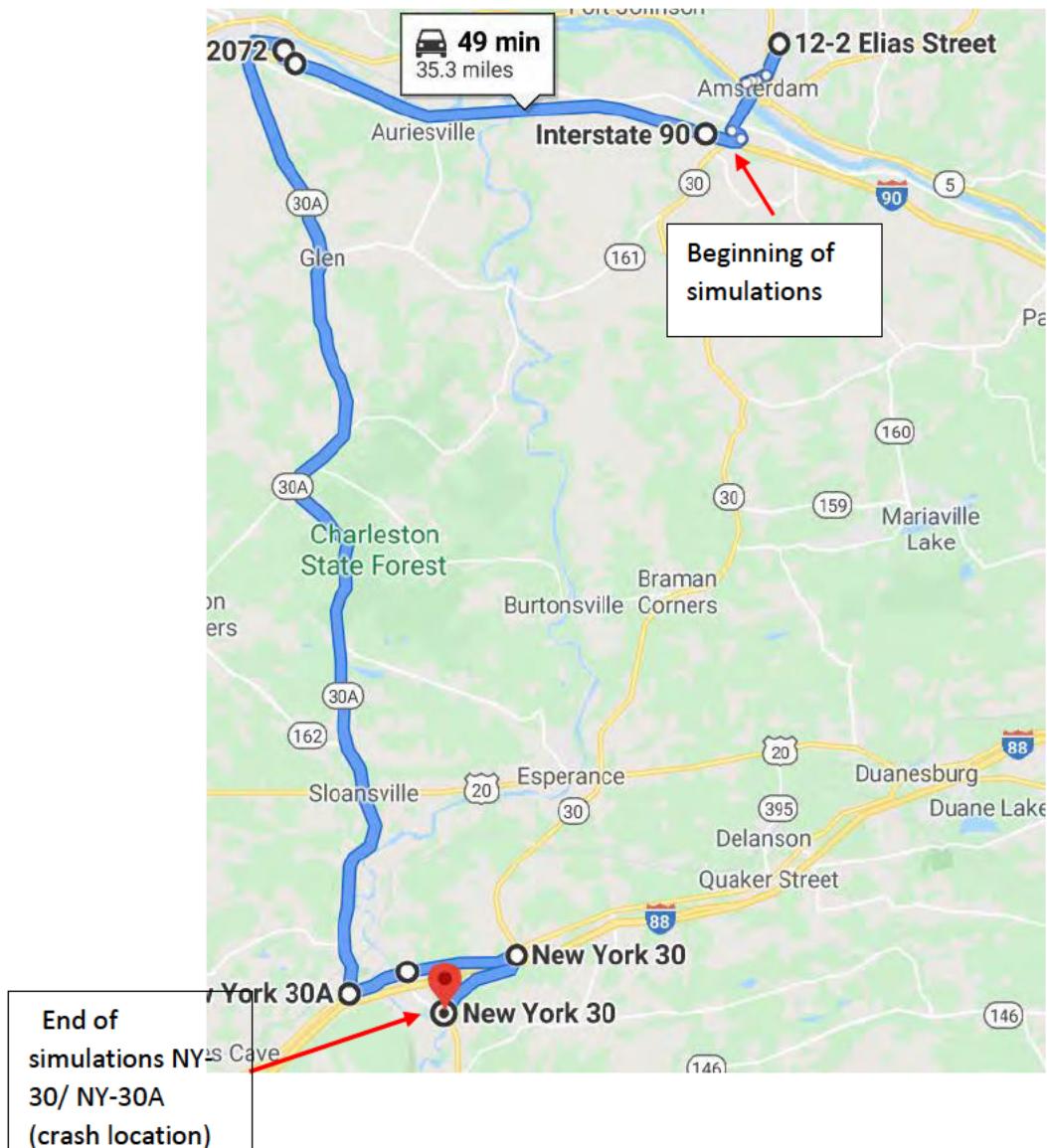


Figure 3 – Route of accident limousine modeled in the simulations

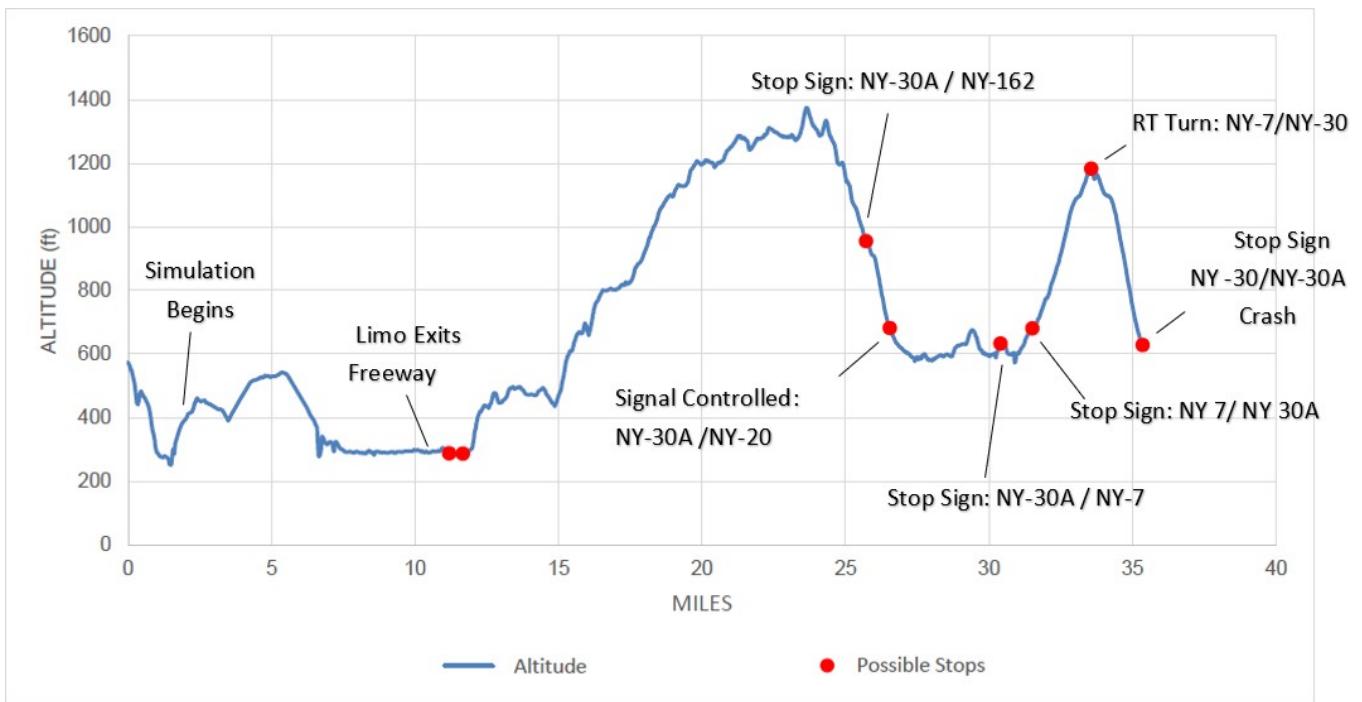


Figure 4 – Route Profile

The control logic used in the simulations was as follows:

- Speed limit and warning signs were identified along the simulated route and used to control speed.
- At stop signs and controlled signalized intersections along the simulated route complete stops were modeled.
- During downhill portions of the simulations if the speed exceeded the posted speed limit by 5 mph braking was applied at a maximum of 0.2 g to reduce the speed to the posted speed limit.
- During all brake applications the maximum braking applied was 0.2 g.

A description of the location of braking points (snubs and stops) based on this logic is contained in Attachments 2-6 of this report.

In the simulations the effects of the road grades were modeled by adding or subtracting energy through the drive motor on the dynamometer.

5.2 Brake Cooling and Parasitic Drag

Cooling of the brakes during the simulations was modeled by controlling air flow across the brakes to match brake cooling data measured from the NATC testing of the exemplar Excursion (see Attachment 1). An example of a cooling curve calibration used in the simulations is shown in Figure 5. Refer to Attachment 7 for additional calibration curves.

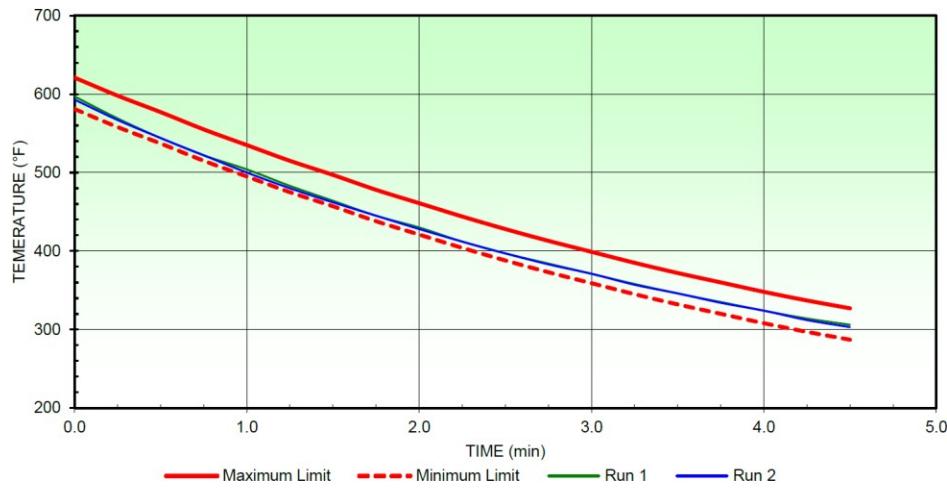


Figure 5 – Example cooling calibration curve for the simulations. The limit curves represent the brake cooling curve data collected during the NATC testing with the exemplar Excursion. The blue and green curves represent the brake rotor temperature measurements from the calibration on the dynamometer.

Parasitic drag losses in the simulations were modeled based on data from the NATC testing of the exemplar Excursion. This data indicated that at 50 to 60 mph the parasitic drag would have been approximately 0.03 g. An example of a coast down curve used to measure the parasitic drag is shown in Figure 6.

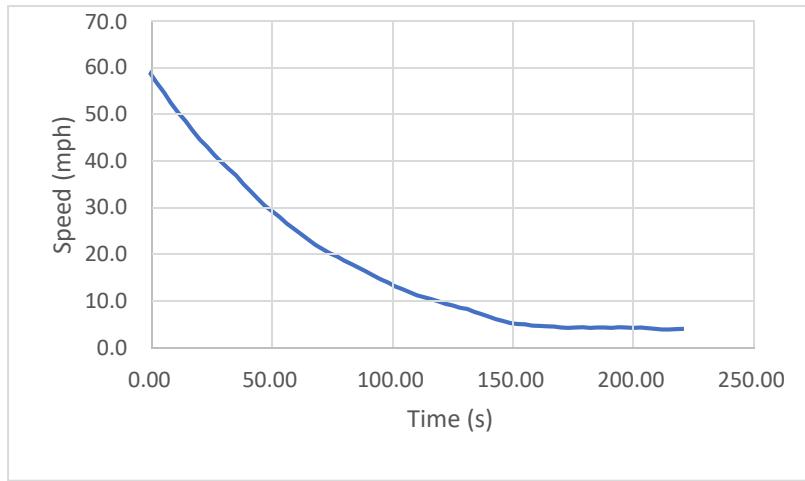


Figure 6 – Example of coast down curve from Excursion testing. Transmission is in drive; no throttle applied.

A summary of the vehicle conditions modeled in the simulations is provided in Table 3. The 8600 lb weight used in the simulations represents the GVWR of the Excursion when it was manufactured by Ford. The 13565 lb weight is the estimated weight of the limousine at the time of the accident.

Table 3

Vehicle	Description	Brake function
8600 lbs	Original GVWR of Excursion	All brakes functioning properly
13565 lbs	Accident weight	All brakes functioning properly
13565 lbs	Accident weight	No rear brakes
13565 lbs	Accident weight	½ rear brakes

5.3 Simulation Results

This section summarizes the key results of the simulations. The complete results and details of the simulations are contained in Attachments 3-7 of this report.

The results of the simulations are summarized in Table 4. As indicated by the data in the table in each of the simulations the limousine was able to safely stop at the intersection of NY30 and NY30A at the bottom of the final descent where the crash occurred.

Table 4 – Simulation Results

Vehicle Weight	Brake function	Simulation Result
8600 lbs	All brakes functioning properly	Vehicle stops at the bottom of final descent at NY 30 and NY30 A
13565 lbs	All brakes functioning properly	Vehicle stops at the bottom of final descent at NY 30 and NY30 A
13565 lbs	No rear brakes	Vehicle stops at the bottom of final descent at NY 30 and NY30 A
13565 lbs	$\frac{1}{2}$ rear brakes	Vehicle stops at the bottom of final descent at NY 30 and NY30 A

The maximum brake temperatures in the simulations occurred at the bottom of the final descent during the stop at New York State Route 30 and New York State Route 30A. Table 5 shows a comparison between the maximum temperatures from the 900 F full effort stop tests performed as part of the test matrix and the maximum brake temperatures from the simulations. (The maximum temperatures reached in the test matrix occurred during the full effort stop performed at 900 F.)

5.4 Discussion/Summary of Simulations at the Accident Weight with all Brakes Functioning Properly

In the simulations performed at the accident weight (13565 lbs) with all brakes functioning properly the simulated vehicle was able to negotiate the simulated route and stop at the intersection of New York State Route 30 and New York State Route 30A at the bottom of the final descent where the crash occurred.

The results of the test matrix measurements shown in table 5 indicate that a fully functioning brake system would have additional braking capacity beyond what was required to safely negotiate the simulated route at the accident weight (as indicated by the greater brake temperatures and torques for the full-effort stop maneuver from the test matrix). The temperature and torque data from the full effort stop indicates that the limousine with all brakes functioning properly would have been able to brake to a stop at temperatures several hundred degrees higher than the maximum temperatures

predicted in the downhill simulation performed at the accident weight with all brakes functioning. This additional braking capacity would have provided a margin of safety and allowed for additional braking.

Table 5 – Maximum brake Rotor Temperatures from Simulations vs Maximum temperatures for Full-Effort Stop at 900 °F from the Test Matrix. The Initial Temperature is the Brake Temperature when the Brakes are Applied. (The maximum rotor temperatures in the simulations occurred during the stop at the bottom of the final descent were the accident occurred.)

	Front Rotor Temp (Initial/Max) (°F)	Rear Rotor Temp (Initial/Max) (°F)	Sustained Torque Front (lbf-ft)	Sustained Torque Rear (lbf-ft)
13565 lb, Full Effort Stop-1800 psi, 55-0 mph (Test Matrix)	(900/1143)	(723/985)	3225	2526
8600 lb, all brakes functioning, 50-0 mph, (Simulation)	(388/618)	(388/598)	847	579
13565 lbs, all brakes functioning, 50-0 mph, (Simulation)	(544/784)	(537/744)	1346	868
13565 lbs, Front brakes only, 50-0 mph (Simulation)	(773/1054)	N/A	1889	N/A
13565 lbs ½ rear brake, 50-0 mph, (Simulation)	(622/904)	(471/633)	1602	971

5.5 Comparison of Simulated Braking Conditions

Table 6 contains a comparison of the maximum brake rotor temperatures for the different simulated vehicle conditions.

Table 6

Description: Condition 1 vs Condition 2	Max Temperature Front Brake Rotor Condition 1 vs Condition 2	Max Temperature Rear Brake Rotor Condition 1 vs Condition 2
8600 lbs vs 13565 lbs	618 °F vs 784 °F (+23%)	598 °F to 744 °F (+24%)
13556 lbs vs 13565 lbs no rear brakes	784 °F vs 1054°F (+34%)	-----
8600 lbs vs 13565 lbs no rear brakes	618 °F vs 1054 °F (+70%)	-----
13565 lbs vs 13565 lbs ½ rear	784 °F vs 904 °F (+15 %)	744 °F vs 633 °F (-22 %)
8600 lbs vs 13565 lbs ½ rear	618 °F vs 904 °F (+46%)	598 °F vs 633 °F (+ 6%)

Table 7 shows the change in maximum brake rotor temperatures between different simulated vehicle conditions. Positive values in the table indicate that the temperature is higher for condition 2 than condition 1.

Table 7

Description: Condition 1 vs Condition 2	Change in Max Temperature Front Brake Rotor	Change in Max Temperature Rear Brake Rotor
8600 lbs vs 13565 lbs	+166 °F	+146 °F
13556 lbs vs 13565 lbs no rear brakes	+270 °F	-----
8600 lbs vs 13565 lbs no rear brakes	+436 °F	-----
13565 lbs vs 13565 lbs ½ rear brakes	+120 °F	-111 °F
8600 lbs vs 13565 lbs ½ rear brakes	+286 °F	+35 °F

5.6 Summary/Discussion of Simulation Results

The results of the braking simulations conducted on the dynamometer indicate that the limousine at the accident weight (13565 lbs) with properly functioning brakes would have had sufficient braking capacity to safely negotiate the simulated route at the posted speed limit.

In the simulations increasing the weight of the limousine from 8600 lbs to 13565 lbs resulted in increases in maximum brake rotor temperatures of between 146 °F to 166 °F. These higher temperatures would have increased the risk of brake fade.

The highest brake temperatures occurred in the simulations in which no rear braking was modeled. This resulted in front brake rotor temperatures of 1054 °F which were approximately 270 °F greater than for simulations conducted at the accident weight with all brakes functioning properly.

6.0 Post-Test inspection of the Brake Rotors and Pads

The post-test photographs of the brake pads and rotors from the dynamometer testing are contained in Attachments 2-6 along with a description of their condition. The post-test inspections of the pads noted light glazing, light grooving, moderate pitting, and resin bleed. The post-test inspections of the rotors noted conditions such as light grooving, light hot spots, brake lining transfer from pad onto rotor and the rotor being black/blue grey in color. All these conditions occurred without severe brake fade or loss of braking occurring during the testing.

7.0 Discussion

The testing in this report was conducted with Ford recommended OEA brake components (pads, rotors, calipers, etc.) purchased through the Ford supply chain. Until the brake parts on the accident vehicle are tested, correlation between the accident brakes and those used in the testing is unknown. The point of this project was to assert what would have been possible had the vehicle been properly maintained, independent of whatever brake and suspension upfitting should have been undertaken at the time of the limousine conversion.

E. Summary of Findings/Testing

A braking performance evaluation was conducted using test procedures in FMVSS 105 for vehicles with a GVWR of greater than 10000 lbs. The purpose of the FMVSS 105 standard is to ensure safe braking performance under normal and emergency conditions. The vehicle used in the testing was an exemplar Ford Excursion equipped with new Ford recommended (OEA) brake components specified for the unmodified accident vehicle.

To ensure safe braking performance the FMVSS 105 standard requires that a vehicle be able to stop within specific distances and speeds subject to the test procedures described in the standard. The results of the testing with the exemplar Excursion indicate that the limousine at the accident weight of 13565 lbs with a properly functioning brake system would have been able to meet all of the FMVSS 105 stopping distance requirements for a vehicle with a GVWR of greater than 10000 lbs, with the exception of the inoperative power boost stopping distance requirement.

A specific concern in this accident was the risk of brake fade. The FMVSS 105 first and second fade and recovery procedures are the FMVSS test procedures which address fade and recovery performance on dry surfaces. This test is optional for vehicles with GVWR's of greater than 10000 lbs that are not school buses but was included in the evaluations for this investigation. The results of the testing with the exemplar Excursion indicates that the limousine at the accident weight of 13565 lbs with a properly functioning brake system would have been able to meet the FMVSS 105 performance requirements for the first and second fade and recovery procedures for vehicles with a GVWR of greater than 10000 lbs.

Additional testing was conducted using a dual-end brake dynamometer and new Ford recommended OEA brake components specified for the unmodified 2001 Ford Excursion on which the accident limousine was built. This testing included using the dynamometer to simulate the braking performance of the limousine over several miles prior to where the crash occurred at New York State Route 30 and New York State Route 30A. Vehicle specific brake cooling data and parasitic drag measurements were used in the simulations to model brake cooling and parasitic energy losses. Energy losses/gains due to the road grade were accounted for in the simulations.

The results of the braking simulations conducted on the dynamometer indicate that at the accident weight of 13565 lbs the limousine with a properly functioning brake system would have had sufficient braking capacity to have safely negotiated the accident route at the posted speed limit and stopped safely at the bottom of the final descent at the intersection of New York State Route 30 and New York State Route 30A.

In the simulations increasing the weight of the limousine from 8600 lbs (the original GVWR weight of the Excursion when it was manufactured) to 13565 lbs, (the accident weight) increased the maximum temperatures of the brake rotors by 146 °F to 166 °F. The higher brake temperatures associated with the greater weight could increase the risk of brake fade in certain situations.

F. Attachments Included in this Report

The following attachments are included at the end of this report:

Attachment 1: Brake Cooling and Performance Evaluation for Ford Excursion XLT 4x2

Attachment 2: Dynamometer Testing Report: Performance Matrix O.E. Brake Parts- 2001 Ford Excursion with Limousine Conversion, 13565 lbs

Attachment 3: Dynamometer Testing Report: Downhill Braking Simulation Test- 2001 Ford Excursion with Limousine Conversion, 8600 lbs

Attachment 4: Dynamometer Testing Report: Downhill Braking Simulation Test- 2001 Ford Excursion with Limousine Conversion, 13565 lbs

Attachment 5: Dynamometer Testing Report: Downhill Braking Simulation Test- 2001 Ford Excursion with Limousine Conversion, 13565 lbs – Front Brakes Only

Attachment 6: Dynamometer Testing Report: Downhill Braking Simulation Test- 2001 Ford Excursion with Limousine Conversion, 13565 lbs – ½ rear brake

Attachment 7: Dynamometer Testing Report: Example Cooling Curve Calibration for Simulations

Attachments



**Brake Performance Study Attachment 1 – 2000 Ford Excursion XLT 4x2 Brake Cooling
and Performance Evaluations**

Schoharie, NY

HWY19H001

NTSB Performance Study

FINAL REPORT
PREPARED FOR

GREENING TESTING LABORATORIES, INC.
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DETROIT, MI 48234-2742

2000 FORD EXCURSION XLT 4X2
BRAKE COOLING AND PERFORMANCE EVALUATIONS

AUTHORIZATION:
PURCHASE ORDER NO. 24425

NATC PROJECT NO. 22330
NATC DOCUMENT NO. 22330-FR-REV 0

JANUARY – MARCH 2020

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1.0 BACKGROUND

Greening Testing Laboratories, Inc. (GTL) contracted the Nevada Automotive Test Center (NATC), under Purchase Order number 24425, to conduct brake cooling and performance evaluations on a 2000 Ford Excursion XLT 4X2.

2.0 OBJECTIVE

The objective of these evaluations is to characterize the brake cooling and performance of a Ford Excursion at axle weights that exceed the gross vehicle weight rating (GVWR).

3.0 TEST ARTICLE

The test article was a 2000 Ford Excursion XLT 4X2, as shown in Figure 1. Test article information is listed in Table 1.



Figure 1
Test Article in Tested Configuration

Table 1
Test Article Data

Model Year	2000
Make	Ford
Model	Excursion
Trim	XLT
Drive	4X2
Vehicle Identification Number (VIN)	1FMNU40L4YEC33336
Exterior Color	Oxford White Clearcoat
Engine	5.4 liter V-8 Gasoline
Transmission	Electronic 4-speed Automatic
Tire Make	BF Goodrich
Tire Model	All-Terrain T/A M+S
Tire Size	LT 265/75R16
Brakes	4-wheel Power Disk with Anti-Lock Braking System (ABS)
Axle Ratio	3.75
GVWR	8,400 pounds (lb)

4.0 TEST ARTICLE MODIFICATIONS

The suspension springs were replaced with components of greater capacity. The front wheel-end brake components were replaced. The rear wheel-end brake components were replaced. The parts that were installed on the vehicle are listed in Table 2; all replacement parts were Ford, or Ford Motorcraft brand. In addition to replacing the parts listed, the brake fluid was flushed and replaced with the manufacturer's recommended fluid.

Table 2
Replacement Parts List

Part Number	Quantity	Description
F81Z-2B292-AB	2	Front Caliper Bracket
BR1266 (2V001)	2	Front Brake Pads
BRR262 (1V102)	2	Front Brake Rotors
BRCF111 (2B120)	1	Roadside Front Caliper
BRCF112 (2B121)	1	Curbside Front Caliper
F81Z-5310-RA	2	Front F-250 Coil Spring
BR1275 (2V200)	2	Rear Brake Pads
BRRF102 (2C206)	2	Rear Brake Rotors
BRC344RM (2V553)	1	Roadside Rear Caliper
BRCLF109 (2552)	1	Curbside Rear Caliper
518-00555A	2	Rear F-250 Leaf Spring
F81Z-5705-AA	4	Rear F-250 Axle U-Bolt

5.0 WEIGHT EVALUATION

The test article was weighed in three configurations as follows.

Heavy Test Load (HTL) – HTL comprised the test article with all operational fluids full, driver, occupant simulator, bumper weight, four ballast bags, and five ballast blocks with ballast cradle.

Light Test Load (LTL) – LTL comprised the test article with all operational fluids full, driver, occupant simulator, bumper weight, and two ballast blocks with ballast cradle.

Cooling Test Load (CTL) – CTL comprised the test article with all operational fluids full, driver, assistant driver, bumper weight, six ballast bags, and five ballast blocks with ballast cradle.

5.1 Weight Evaluation Instrumentation and Equipment

Drive-over scales are used to perform this evaluation.

The equipment used for this measurement includes:

- Tire pressure gauge

5.2 Weight Evaluation Courses and Facilities

Weights are measured on a level, concrete area.

5.3 Weight Evaluation Conduct

Weight is measured as follows.

1. Zero the scales.
2. Drive the front axle of the test article onto the scales.
3. Wait until scales record measurement.
4. Drive the rear axle of the test article onto the scales.
5. Wait until scales record measurement.
6. Drive the vehicle off the scales.
7. Print the weight record.
8. Repeat steps 1 through 7 two more times.

5.4 Weight Evaluation Data Processing

The weights recorded for the test article are averaged at each location, summed for each side, each axle, and overall weight.

5.5 Weight Evaluation Results

The test article weights are listed in Table 3 through Table 5.

Table 3
Test Article HTL Weight

Axle	Roadside (lb)	Curbside (lb)	Total (lb)
1	2,860	3,010	5,870
2	3,905	3,780	7,685
Total	6,765	6,790	13,555

Table 4
Test Article LTL Weight

Axle	Roadside (lb)	Curbside (lb)	Total (lb)
1	2,650	2,655	5,305
2	2,505	2,335	4,840
Total	5,155	4,990	10,145

Table 5
Test Article CTL Weight

Axle	Roadside (lb)	Curbside (lb)	Total (lb)
1	2,840	3,025	5,865
2	3,915	3,760	7,675
Total	6,755	6,785	13,540

6.0 BRAKE COOLING EVALUATION

The brake cooling evaluation was performed using the Society of Automotive Engineers (SAE) Surface Vehicle Recommended Practice J1247 Simulated Mountain-Brake Performance Test Procedure, section 5.5 First Simulated Mountain Descent Procedure, to heat the brakes. After the brakes were heated, the brake temperature was recorded over time while maintaining nominal steady state speeds of 60 miles per hour (mph), 50 mph, 40 mph, and zero mph.

6.1 Brake Cooling Evaluation Instrumentation and Equipment

Test and measurement equipment used in this evaluation and in the brake performance evaluation was calibrated using measurement standards and reference instruments whose accuracy are traceable to the National Institute of Standards and Technology (NIST) or nationally accepted systems. NATC measurement equipment is calibrated on a schedule that is adjusted to ensure traceability at the required accuracy levels.

The instrumentation included two digital data acquisition devices sampling at 100 samples per second (s/s). The description of the data collected is listed in Table 6.

Table 6
Brake Cooling Evaluation Instrumentation

Instrument	Parameter	Location
GPS Antenna	Speed	Roof
GPS Antenna	Distance	Roof
GPS Antenna	Longitudinal Acceleration	Roof
Thermocouple	Ambient Temperature	Roof
Thermocouple	Brake Pad Temperature	Roadside Front (RF) Brake Pad
Thermocouple	Brake Pad Temperature	Curbside Front (CF) Brake Pad
Thermocouple	Brake Pad Temperature	Roadside Rear (RR) Brake Pad
Thermocouple	Brake Pad Temperature	Curbside Rear (CR) Brake Pad
Thermocouple	Brake Rotor Temperature	RF Brake Rotor
Thermocouple	Brake Rotor Temperature	CF Brake Rotor
Thermocouple	Brake Rotor Temperature	RR Brake Rotor
Thermocouple	Brake Rotor Temperature	CR Brake Rotor
Thermocouple	Brake Fluid Temperature	RF Brake Caliper
Thermocouple	Brake Fluid Temperature	CF Brake Caliper
Thermocouple	Brake Fluid Temperature	RR Brake Caliper
Thermocouple	Brake Fluid Temperature	CR Brake Caliper
Pressure Transducer	Brake Pressure	Front Circuit Master Cylinder
Pressure Transducer	Brake Pressure	Rear Circuit Master Cylinder
Pressure Transducer	Brake Pressure	RF Brake Caliper
Pressure Transducer	Brake Pressure	CF Brake Caliper
Pressure Transducer	Brake Pressure	RR Brake Caliper
Pressure Transducer	Brake Pressure	CR Brake Caliper
Inertial Measurement Unit (IMU)	Lateral Acceleration	Approximate Center of Gravity (CG)
IMU	Longitudinal Acceleration	Approximate CG
IMU	Vertical Acceleration	Approximate CG
IMU	Roll Rate	Approximate CG
IMU	Pitch Rate	Approximate CG
IMU	Yaw Rate	Approximate CG
Load Cell	Pedal Force	Brake Pedal

The equipment used for this evaluation includes:

- Tire pressure gauge
- Digital video camera
- Digital photographic camera

6.2 Brake Cooling Evaluation Courses and Facilities

NATC's WesTrack paved oval course was used for this evaluation. The section that was used is flat (with less than 2% grade in all directions). Prior to the start of testing, the course was inspected to ensure that it was dry and free of debris or damage that would influence test results.

6.3 Brake Cooling Evaluation Conduct

The test article was at CTL for the brake cooling evaluation, which is performed as follows.

1. Visually inspect the test article; if any unusual conditions are noted they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within manufacturer's recommended range.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the test article to 35 (+ 0, - 2) mph.
5. After a period of 15 seconds (s), use the brakes to decelerate to 20 mph while limiting the deceleration rate to 8 feet per second per second (fpsps).
6. Repeat steps 4 and 5 until a total of 80 snubs are completed.
7. Accelerate to 60 mph.
8. Maintain speed until the hottest brake rotor and pad temperature has decreased to less than 200 degrees Fahrenheit (°F).
9. Repeat steps 3 through 8 three times.
10. Repeat steps 3 through 9 achieving the speeds of 50 mph, 40 mph, and zero mph in step 7.

6.4 Brake Cooling Evaluation Data Processing

Speed and temperature data were processed into time history plots. Raw data in comma separated variable (CSV) format was provided to Greening for further analysis.

6.5 Brake Cooling Evaluation Results

Representative plots of the 60 mph, 50 mph, 40 mph, and 0 mph brake cooling evaluations are shown in Figure 2 through Figure 5.

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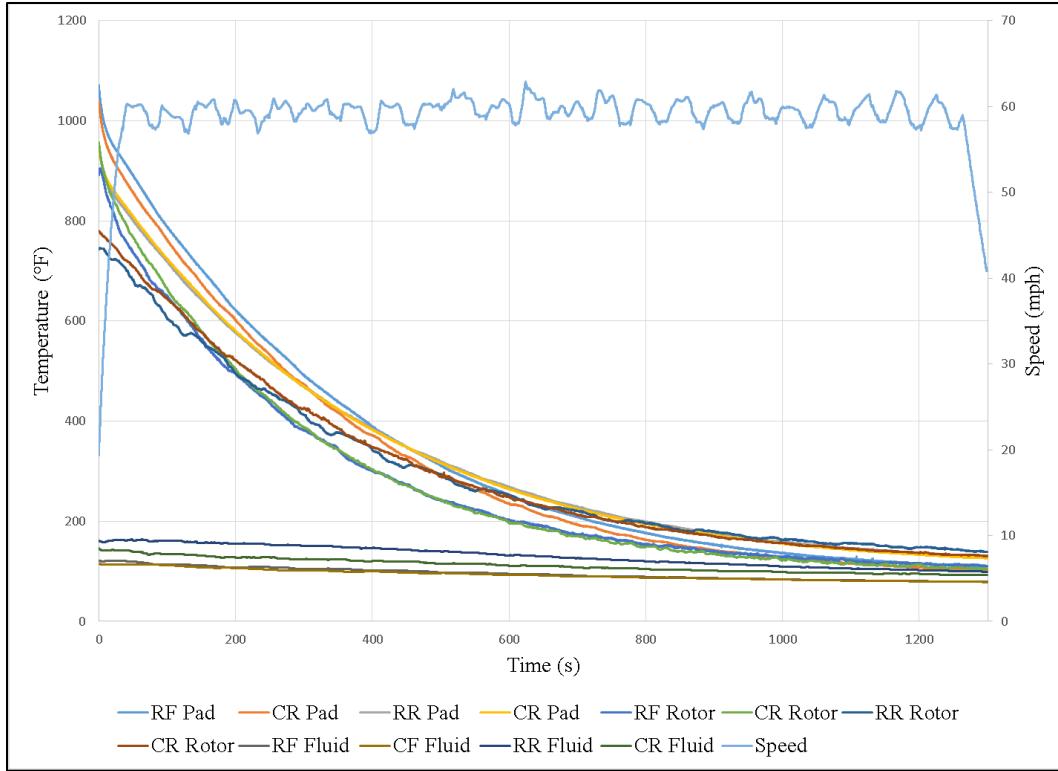


Figure 2
Representative Brake Cooling Data at Nominal 60 mph

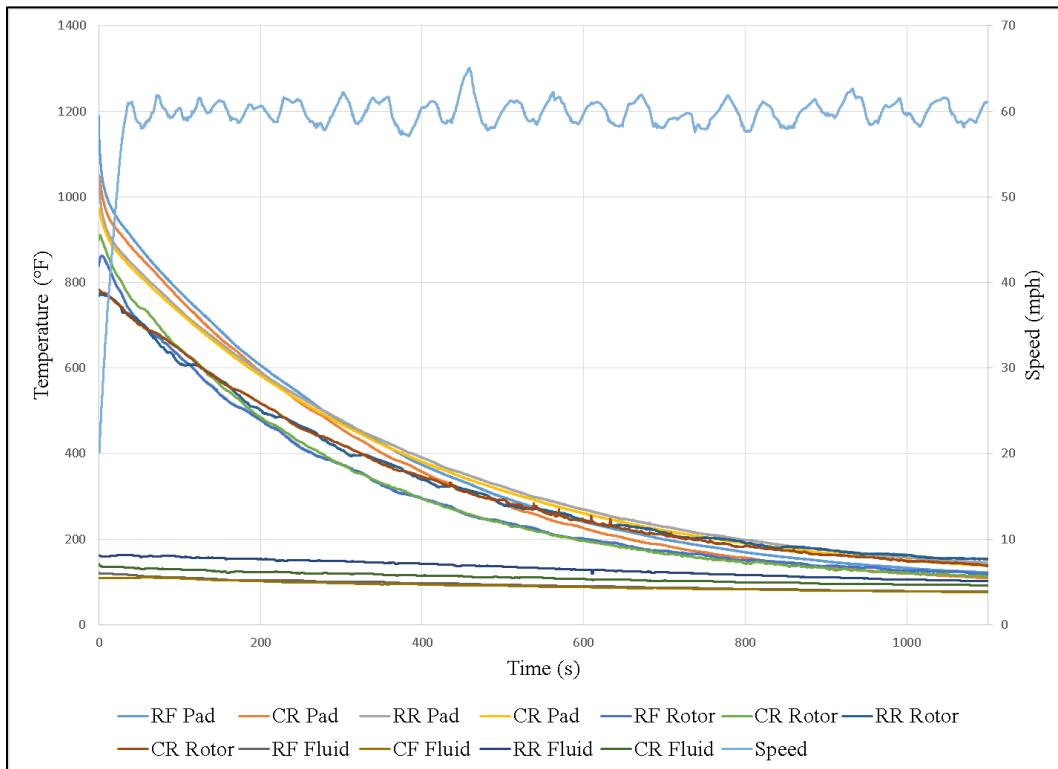


Figure 3
Representative Brake Cooling Data at Nominal 50 mph

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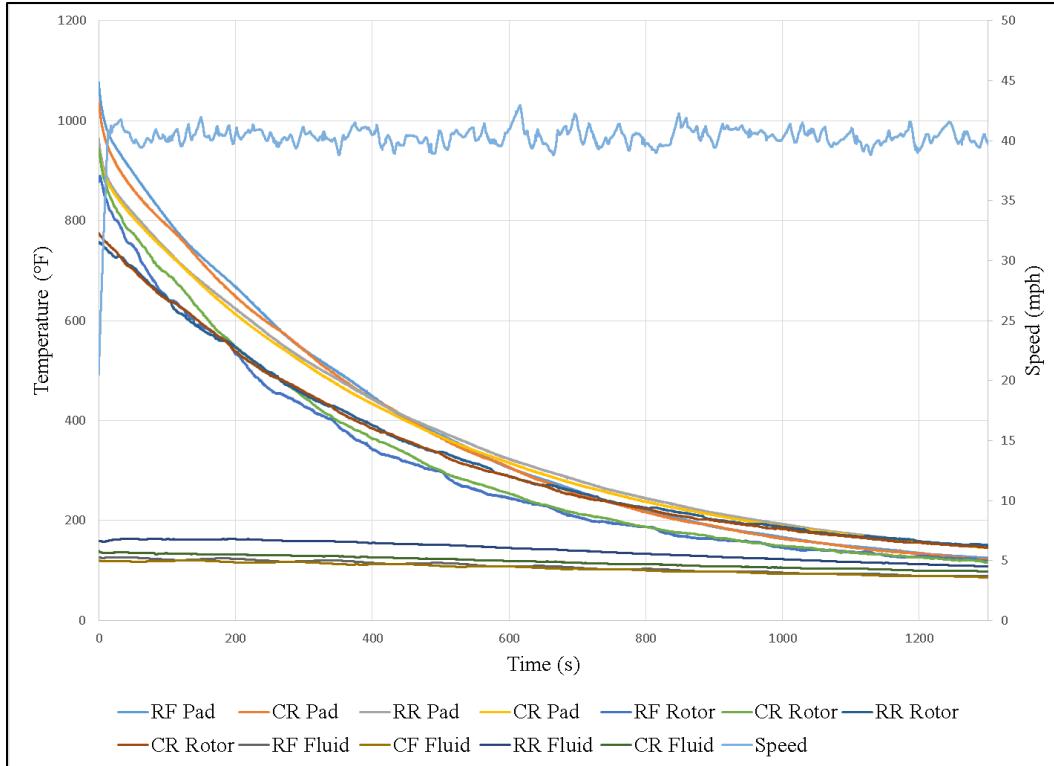


Figure 4
Representative Brake Cooling Data at Nominal 40 mph

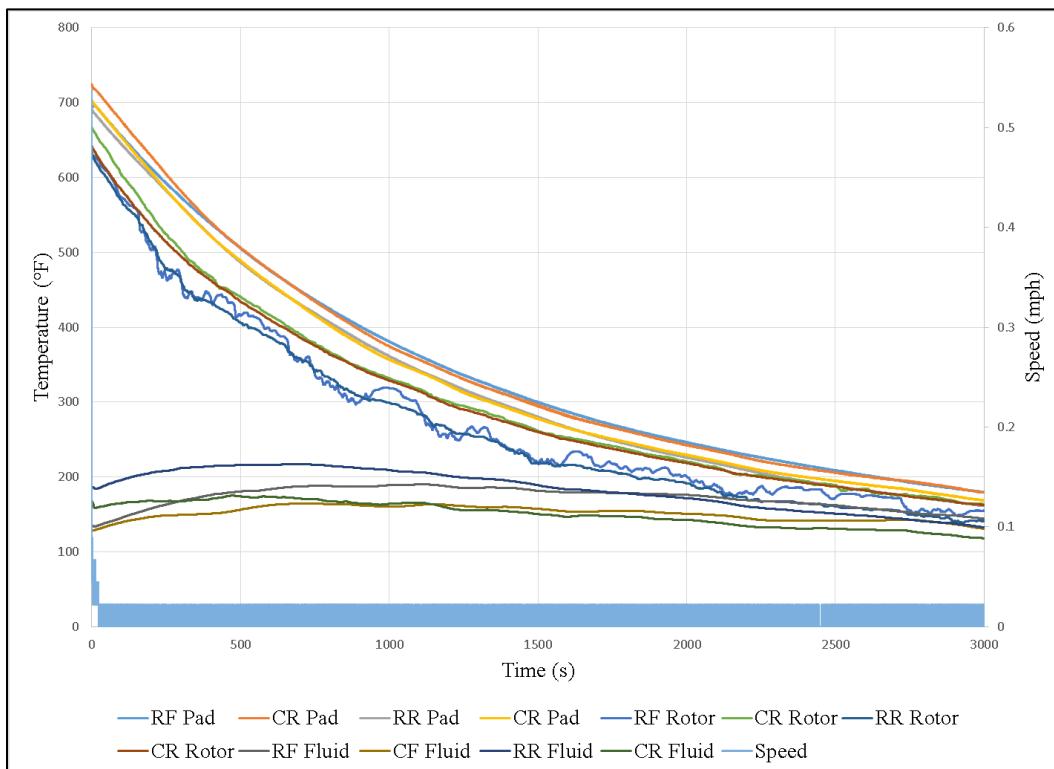


Figure 5
Representative Brake Cooling Data at 0 mph

7.0 BRAKE PERFORMANCE EVALUATION

A brake performance evaluation was performed using the procedures in the National Highway Traffic Safety Administration's (NHTSA) Federal Motor Vehicle Safety Standard (FMVSS) 105, Hydraulic and Electric Brake Systems.

7.1 Brake Performance Evaluation Instrumentation and Equipment

The instrumentation included two digital data acquisition devices sampling at 100 s/s. The description of the data collected is listed in Table 7.

Table 7
Brake Performance Evaluation Instrumentation

Instrument	Parameter	Location
GPS Antenna	Speed	Roof
GPS Antenna	Distance	Roof
GPS Antenna	Longitudinal Acceleration	Roof
Thermocouple	Ambient Temperature	Roof
Thermocouple	Brake Pad Temperature	RF Brake Pad .040-inch Depth
Thermocouple	Brake Pad Temperature	CF Brake Pad .040-inch Depth
Thermocouple	Brake Pad Temperature	RR Brake Pad .040-inch Depth
Thermocouple	Brake Pad Temperature	CR Brake Pad .040-inch Depth
Thermocouple	Brake Pad Temperature	RF Brake Pad .080-inch Depth
Thermocouple	Brake Pad Temperature	CF Brake Pad .080-inch Depth
Thermocouple	Brake Pad Temperature	RR Brake Pad .080-inch Depth
Thermocouple	Brake Pad Temperature	CR Brake Pad .080-inch Depth
Thermocouple	Brake Rotor Temperature	RF Brake Rotor
Thermocouple	Brake Rotor Temperature	CF Brake Rotor
Thermocouple	Brake Rotor Temperature	RR Brake Rotor
Thermocouple	Brake Rotor Temperature	CR Brake Rotor
Thermocouple	Brake Fluid Temperature	RF Brake Caliper
Thermocouple	Brake Fluid Temperature	CF Brake Caliper
Thermocouple	Brake Fluid Temperature	RR Brake Caliper
Thermocouple	Brake Fluid Temperature	CR Brake Caliper
Pressure Transducer	Brake Pressure	Front Circuit Master Cylinder
Pressure Transducer	Brake Pressure	Rear Circuit Master Cylinder
Pressure Transducer	Brake Pressure	RF Brake Caliper
Pressure Transducer	Brake Pressure	CF Brake Caliper
Pressure Transducer	Brake Pressure	RR Brake Caliper
Pressure Transducer	Brake Pressure	CR Brake Caliper
IMU	Lateral Acceleration	Approximate CG
IMU	Longitudinal Acceleration	Approximate CG
IMU	Vertical Acceleration	Approximate CG

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Instrument	Parameter	Location
IMU	Roll Rate	Approximate CG
IMU	Pitch Rate	Approximate CG
IMU	Yaw Rate	Approximate CG
Load Cell	Pedal Force	Brake Pedal
Displacement Transducer	Brake Pedal Position	Brake Pedal
Encoder	Wheel Speed	RF Wheel Encoder
Encoder	Wheel Speed	CF Wheel Encoder
Encoder	Wheel Speed	RR Wheel Encoder
Encoder	Wheel Speed	CR Wheel Encoder

The equipment used for this evaluation includes:

- Tire pressure gauge
- Digital video camera
- Digital photographic camera

7.2 Brake Performance Evaluation Courses and Facilities

NATC's WesTrack paved oval course was used for this evaluation. The section that was used is flat (with less than 2% grade in all directions). Prior to the start of testing, the course was inspected to ensure that it was dry and free of debris or damage that would influence test results.

7.3 Brake Performance Evaluation Conduct

The brake performance evaluation consisted of 14 individual tests that were performed in the order listed below. The following procedures outline how each of the individual test are performed.

7.3.1 Brake Warming Conduct

Prior to test conduct for each day of testing or any time the brakes have cooled below the target initial brake temperature (IBT), brake warming is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the test article to 40 (+ 0, - 2) mph.
5. Use the brakes to decelerate to 10 mph while limiting the deceleration rate to no more than 10 fpsps.
6. Repeat steps 4 and 5 until the brake temperatures reach the required level, or you have performed 10 snubs, whichever occurs first.

7.3.2 Instrumentation Check Conduct

The instrumentation check is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the test article to 30 (+ 0, - 2) mph.
5. Use the brakes to decelerate to a stop while limiting the deceleration rate to no more than 10 fpsps.
6. Repeat steps 4 and 5 once.
7. Download and review the data for accuracy and consistency.
8. If issues are discovered, resolve the issues and repeat steps 4 through 7. Do not perform more than 10 events for the purpose of an instrumentation check.

7.3.3 Service Brake System First Effectiveness Test Conduct

The service brake system first effectiveness test is performed at HTL using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the test article to over 30 mph.
5. Shift the transmission to Neutral and coast to 30 (+ 0, - 2) mph.
6. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
7. Repeat steps 4 through 6 for a total of six stops from 30 mph.
8. Accelerate the test article to over 60 mph.
9. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
10. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
11. Repeat steps 8 through 10 for a total of six stops from 60 mph.

7.3.4 Service Brake System Burnish Conduct

The service brake system burnish is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.

4. Accelerate the vehicle to 40 (+ 0, - 2) mph.
5. Use the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
6. Accelerate the vehicle to 40 mph.
7. Repeat steps 5 and 6 at 1-mile intervals between initiations of the snubs until 125 snubs have been completed.
8. Stop the vehicle and visually inspect the brakes.
9. Repeat steps 4 through 8 until 500 snubs have been completed.

7.3.5 Service Brake System Second Effectiveness Conduct

The service brake system second effectiveness test is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the test article to over 30 mph.
5. Shift the transmission to Neutral and coast to 30 (+ 0, - 2) mph.
6. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
7. Repeat steps 4 through 6 for a total of six stops from 30 mph.
8. Accelerate the test article to over 60 mph.
9. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
10. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
11. Repeat steps 8 through 10 for a total of six stops from 60 mph.

7.3.6 Service Brake System First Reburnish Conduct

The service brake system first reburnish is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the vehicle to 40 (+ 0, - 2) mph.
5. Use the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
6. Accelerate the vehicle to 40 mph.
7. Repeat steps 5 and 6 at 1-mile intervals between initiations of the snubs until 35 snubs have been completed.

7.3.7 Service Brake System Third Effectiveness Test Conduct

The service brake system third effectiveness test is performed at LTL using the following procedure.

1. Reduce the payload in the test article to achieve the LTL.
2. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
3. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
4. Check fuel level to ensure the fuel tank is full.
5. Accelerate the test article to over 60 mph.
6. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
7. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
8. Repeat steps 5 through 7 for a total of six stops from 60 mph.

7.3.8 Service Brake System Partial Failure Test Conduct

The service brake system partial failure test is performed at LTL and HTL using the following procedure.

1. Reduce payload from the test article as necessary to achieve the LTL.
2. Modify the brake system to allow a failure in each of the following circuits: front brakes, rear brakes, and ABS.
3. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
4. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
5. Check fuel level to ensure the fuel tank is full.
6. Disable the front brake circuit with an open failure.
7. Accelerate the test article to over 60 mph.
8. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
9. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
10. Repeat steps 7 through 9 for a total of four stops from 60 mph with the front brake circuit disabled.
11. Bring the test article to a stop, restore operation of the front brake circuit, and bleed entrained air from the system.
12. Disable the rear brake circuit with an open failure.
13. Accelerate the test article to over 60 mph.
14. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
15. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
16. Repeat steps 13 through 15 for a total of four stops from 60 mph with the rear brake circuit disabled.

17. Bring the test article to a stop, restore operation of the rear brake circuit, and bleed entrained air from the system.
18. Increase the payload to achieve the HTL.
19. Disable the front brake circuit with an open failure.
20. Accelerate the test article to over 60 mph.
21. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
22. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
23. Repeat steps 20 through 22 for a total of four stops from 60 mph with the front brake circuit disabled.
24. Bring the test article to a stop, restore operation of the front brake circuit, and bleed entrained air from the system.
25. Disable the rear brake circuit with an open failure.
26. Accelerate the test article to over 60 mph.
27. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
28. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
29. Repeat steps 26 through 28 for a total of four stops from 60 mph with the rear brake circuit disabled.
30. Bring the test article to a stop, restore operation of the rear brake circuit, and bleed entrained air from the system.
31. Disable the ABS by removing the fuse.
32. Accelerate the test article to over 60 mph.
33. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
34. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
35. Repeat steps 32 through 34 for a total of four stops from 60 mph with the ABS disabled.
36. Bring the test article to a stop, restore operation of the ABS, and bleed entrained air from the system.

7.3.9 Service Brake System Inoperative Power Assist Test Conduct

The service brake system inoperative power assist test is performed using the following procedure.

1. Modify the brake system to allow a failure of the power brake assist.
2. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
3. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
4. Check fuel level to ensure the fuel tank is full.
5. Disable the power brake assist.
6. Accelerate the test article to over 60 mph.
7. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
8. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.

9. Repeat steps 5 through 8 for a total of four stops from 60 mph with the power brake assist disabled.
10. Bring the test article to a stop and restore the service brake system to normal.

7.3.10 Service Brake System First Fade and Recovery Test Conduct

The service brake system first fade and recovery test is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.
4. Conduct baseline snubs.
 - a. Accelerate the vehicle to 42 mph.
 - b. Place the transmission in Neutral.
 - c. Once the vehicle decelerates to 40 (+ 0, - 2) mph, apply the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
 - d. Accelerate the vehicle to and maintain 40 mph until IBT is between 150 °F and 200 °F.
 - e. Repeat steps a through d until three snubs have been completed.
5. Calculate the average of the maximum control force from each snub.
6. Conduct fade snubs.
 - a. Establish the IBT between 130 °F and 150 °F.
 - b. Accelerate the vehicle to 42 mph.
 - c. Place the transmission in Neutral.
 - d. Once the vehicle decelerates to 40 (+ 0, - 2) mph, apply the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
 - e. Accelerate the vehicle to and maintain 40 mph.
 - f. Repeat steps b through e with 30-second intervals between the start of each snub until 10 snubs have been completed.
7. Accelerate to 40 mph and drive for 1.5 miles.
8. Conduct recovery snubs.
 - a. Accelerate the vehicle to 42 mph.
 - b. Place the transmission in Neutral.
 - c. Once the vehicle decelerates to 40 (+ 0, - 2) mph, apply the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
 - d. Accelerate the vehicle to and maintain 40 mph.
 - e. Repeat steps a through d with 1.5-mile intervals between the start of each snub until five snubs have been completed.

7.3.11 Service Brake System Second Reburnish Conduct

The service brake system second reburnish is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.

2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the vehicle to 40 (+ 0, - 2) mph.
5. Use the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
6. Accelerate the vehicle to 40 mph and hold for approximately 1 mile.
7. Repeat steps 5 and 6 until 35 snubs have been completed.

7.3.12 Service Brake System Second Fade and Recovery Test Conduct

The service brake system second fade and recovery test is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.
4. Conduct baseline snubs.
 - a. Accelerate the vehicle to 42 mph.
 - b. Place the transmission in Neutral.
 - c. Once the vehicle decelerates to 40 (+ 0, - 2) mph, apply the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
 - d. Accelerate the vehicle to and maintain 40 mph until IBT is between 150 °F and 200 °F.
 - e. Repeat steps a through d until three snubs have been completed.
5. Calculate the average of the maximum control force from each snub.
6. Conduct fade snubs.
 - a. Establish the IBT between 130 °F and 150 °F.
 - b. Accelerate the vehicle to 42 mph.
 - c. Place the transmission in Neutral.
 - d. Once the vehicle decelerates to 40 (+ 0, - 2) mph, apply the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
 - e. Accelerate the vehicle to and maintain 40 mph.
 - f. Repeat steps b through e with 30-second intervals between the start of each snub until 20 snubs have been completed.
7. Accelerate to 40 mph and drive for 1.5 miles.
8. Conduct recovery snubs.
 - a. Accelerate the vehicle to 42 mph.
 - b. Place the transmission in Neutral.
 - c. Once the vehicle decelerates to 40 (+ 0, - 2) mph, apply the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
 - d. Accelerate the vehicle to and maintain 40 mph.
 - e. Repeat steps a through d with 1.5-mile intervals between the start of each snub until five snubs have been completed.

7.3.13 Service Brake System Third Reburnish Conduct

The service brake system third reburnish is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the vehicle to 40 (+ 0, - 2) mph.
5. Use the brakes to decelerate to 20 mph while limiting the deceleration rate to no more than 10 fpsps.
6. Accelerate the vehicle to 40 mph and hold for approximately 1 mile.
7. Repeat steps 5 and 6 until 35 snubs have been completed.

7.3.14 Service Brake System Fourth Effectiveness Test Conduct

The service brake system fourth effectiveness test is performed using the following procedure.

1. Visually inspect the test article; if any unusual conditions are noted, they should be remedied before conducting the evaluation.
2. Check tire pressures to verify that they are within the manufacturer's recommended range; do not decrease tire pressures if the tires are warm from operation.
3. Check fuel level to ensure the fuel tank is full.
4. Accelerate the test article to over 30 mph.
5. Shift the transmission to Neutral and coast to 30 (+ 0, - 2) mph.
6. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
7. Repeat steps 4 through 6 for a total of six stops from 30 mph.
8. Accelerate the test article to over 60 mph.
9. Shift the transmission to Neutral and coast to 60 (+ 0, - 2) mph.
10. Use the brakes to decelerate to a stop while limiting the pedal force to no more than 150 lb.
11. Repeat steps 8 through 10 for a total of six stops from 60 mph.

7.3.15 Final Inspection

The final inspection is performed using the following procedure.

1. Park the vehicle in a location where the wheels can be removed.
2. Raise each wheel off the ground using a jack in the manufacturer's recommended location and secure its position using a jack stand.
3. Remove each of the four wheels.
4. Inspect the brake system at each location for detachment or fracture of any component, such as brake springs and brake shoes. All mechanical components of the braking system should be intact and functional.
5. Inspect the entire brake system for brake fluid or lubricant leaks.

6. Remove each of the calipers or drums paying close attention to the torque of all of the brake hardware to ensure none of the securement hardware has come loose during the evaluation.
7. Remove the brake pads from the calipers.
8. Inspect each of the pads or shoes for facing other than minor cracks that do not impair attachment of the friction facings. Any friction facing tear-out (complete detachment of lining) shall not exceed 10 percent of the lining on any single friction element.

7.4 Brake Performance Evaluation Data Processing

Speed at brake application and distance to stop were measured and adjusted for speed correction using SAE J299, Stopping Distance Procedure, as a guide. The shortest stopping distance is reported in the results. The stopping distance correction formula from SAE J299 is shown in Equation 1.

$$S_c = S_m \frac{V_d^2}{V_a^2} \quad (\text{Eq. 1})$$

Where:

V_d = desired initial vehicle stopping speed, (mph)

V_a = actual initial vehicle stopping speed, (mph)

S_m = measured stopping distance, (ft)

S_c = calculated stopping distance from V_d , (ft)

Maximum brake pedal force was measured for each stop to verify compliance with FMVSS 105 test criteria.

Pedal force for the fade and recovery data was calculated and compared to the baseline in accordance with FMVSS 105 procedures. The raw data for the fade and recovery tests were provided in CSV format to the customer for further analysis.

7.5 Brake Performance Evaluation Results

The following FMVSS 105 procedures were performed in the following order based on the requirements for a vehicle with a GVWR greater than 10,000 lb. The list corresponds to the 14 procedures described in sections 7.3.1 through 7.3.14, above, and includes the final inspection. Procedures marked with an asterisk (*) are not required for vehicles with GVWR greater than 10,000 pounds but were performed based on the inclusion of the fade and recovery tests requested by the customer. The results of the evaluations are listed in Table 8 through Table 10.

1. Brake Warming: completed at the beginning of each shift (FMVSS 105 S7.1)
2. Instrumentation Check: completed at the beginning of each shift (FMVSS 105 S 7.2)
3. Service Brake System First Effectiveness Test*: 6 stops from 30 mph and 6 stops from 60 mph (FMVSS 105 S 7.3)
4. Service Brake System Burnish Procedure: 500 snubs from 40 to 20 mph at 1.0-mile intervals (FMVSS 105 S 7.4.2)

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5. Service Brake System Second Effectiveness Test: 6 stops from 30 mph and 6 stops from 60 mph (FMVSS 105 S 7.5)
6. Service Brake System First Reburnish: 35 snubs from 40 to 20 mph at 1.0-mile intervals (FMVSS 105 S 7.6)
7. Service Brake System Third Effectiveness Test (LTL): 6 stops from 60 mph (FMVSS 105 S 7.8)
8. Service Brake System Partial Failure Tests: 4 stops each from 60 mph at LTL and at HTL for each failure (FMVSS 105 S 7.9)
9. Service Brake System Inoperative Power Assist Test: 4 stops from 60 mph (FMVSS 105 S 7.10.1)
10. Service Brake System First Fade and Recovery Test* (FMVSS 105 S 7.11.1.2, 7.11.2.2, 7.11.3.2)
11. Service Brake System Second Reburnish* (FMVSS 105 S 7.12)
12. Service Brake System Second Fade and Recovery Test* (S 7.13)
13. Service Brake System Third Reburnish* (FMVSS 105 S 7.14)
14. Service Brake System Fourth Effectiveness Test* (FMVSS 105 S 7.15)
15. Final Inspection (FMVSS 105 S 7.18)

Table 8
First, Second, and Third Effectiveness, and Partial Failure Results

Evaluation	FMVSS 105 Requirement > 8,000 lb & < 10,000 lb (ft)	FMVSS 105 Requirement > 10,000 lb (ft)	Measured Stopping Distance (ft)	Measured Pedal Force (lb)
First Effectiveness 30 mph	72	88	84.2	135.5
First Effectiveness 60 mph	267	388	337.4	142.6
Second Effectiveness 30 mph	57	78	64.2	142.7
Second Effectiveness 60 mph	216	310	268.8	137.5
Third Effectiveness 60 mph	242	335	208.5	134.0
Part Fail Front LTL 60 mph	517	613	445.2	144.6
Part Fail Rear LTL 60 mph	517	613	361.7	140.9
Part Fail Front HTL 60 mph	517	613	594.1	146.5
Part Fail Rear HTL 60 mph	517	613	466.9	124.8
ABS Failure HTL 60 mph	517	613	269.7	128.7
Inop. Power Assist HTL 60 mph	517	613	718.5	151.7

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Table 9
First and Second Fade and Recovery Results

Evaluation	Minimum Pedal Force Requirement (lb)	Maximum Pedal Force Requirement (lb)	Measured Pedal Force (lb)	Measured Deceleration Rate (fpsps)
First Fade and Recovery Baseline Snubs	10.0	90.0	30.1	9.2
First Recovery Snub 1	18.1	150.0	30.6	8.2
First Recovery Snub 2	18.1	150.0	27.3	9.2
First Recovery Snub 3	18.1	150.0	27.9	9.2
First Recovery Snub 4	18.1	150.0	28.5	9.3
First Recovery Snub 5	18.1	50.1	29.6	8.4
Second Fade and Recovery Baseline Snubs	10.0	90.0	35.9	9.1
Second Recovery Snub 1	21.6	150.0	30.1	8.5
Second Recovery Snub 2	21.6	150.0	28.4	8.7
Second Recovery Snub 3	21.6	150.0	34.2	10.0
Second Recovery Snub 4	21.6	150.0	30.8	9.6
Second Recovery Snub 5	21.6	55.9	40.1	11.5

Table 10
Fourth Effectiveness Results

Evaluation	FMVSS 105 Requirement > 8,000 lb & < 10,000 lb (ft)	FMVSS 105 Requirement > 10,000 lb (ft)	Measured Stopping Distance (ft)	Measured Pedal Force (lb)
Fourth Effectiveness 30 mph	72	88	70.8	130.6
Fourth Effectiveness 60 mph	267	388	260.7	129.7

REFERENCES

- Society of Automotive Engineers (SAE), Surface Vehicle Recommended Practice J1247
Simulated Mountain-Brake Performance Test Procedure, section 5.5 First Simulated
Mountain Descent Procedure, May 2014
- National Highway Traffic Safety Administration's (NHTSA) Federal Motor Vehicle Safety
Standard (FMVSS) 105, Hydraulic and Electric Brake Systems

ABBREVIATIONS AND ACRONYMS

°F	Degrees Fahrenheit
ABS	Anti-lock Braking System
CF	Curbside Front
CG	Center of Gravity
CR	Curbside Rear
CTL	Cooling Test Load
FMVSS	Federal Motor Vehicle Safety Standards
FPSPS	Feet per Second per Second
FT	Feet
GTL	Greening Testing Laboratories
GVWR	Gross Vehicle Weight Rating
HTL	Heavy Test Load
IBT	Initial Brake Temperature
IMU	Inertial Measurement Unit
LB	Pounds
LTL	Light Test Load
MPH	Miles per Hour
NATC	Nevada Automotive Test Center
NHTSA	National Highway Traffic Safety Administration
RF	Roadside Front
RR	Roadside Rear
S/S	Samples per Second
SAE	Society of Automotive Engineers
VIN	Vehicle Identification Number

**APPENDIX A
PHOTOGRAPHIC SUPPLEMENT**

NTSB Performance Study



NATC Photograph Number 22330-0001
Test Article Front View



NATC Photograph Number 22330-0002
Test Article Roadside Front Three-Quarter View

NTSB Performance Study



**NATC Photograph Number 22330-0003
Test Article Roadside View**



**NATC Photograph Number 22330-0004
Test Article Roadside Rear Three-Quarter View**

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**NATC Photograph Number 22330-0005
Test Article Rear View**



**NATC Photograph Number 22330-0006
Test Article Curbside Rear Three-Quarter View**

NTSB Performance Study



**NATC Photograph Number 22330-0007
Test Article Curbside View**

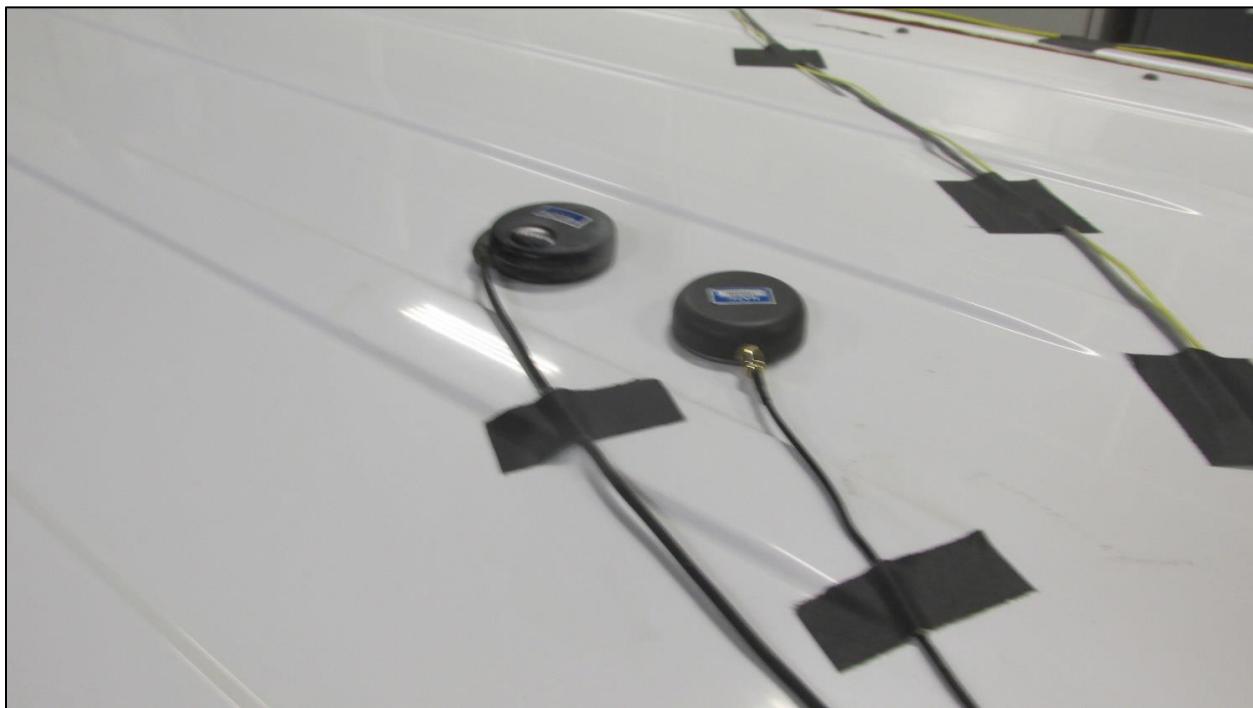


**NATC Photograph Number 22330-0008
Instrumentation – Roadside Wheel Encoders**

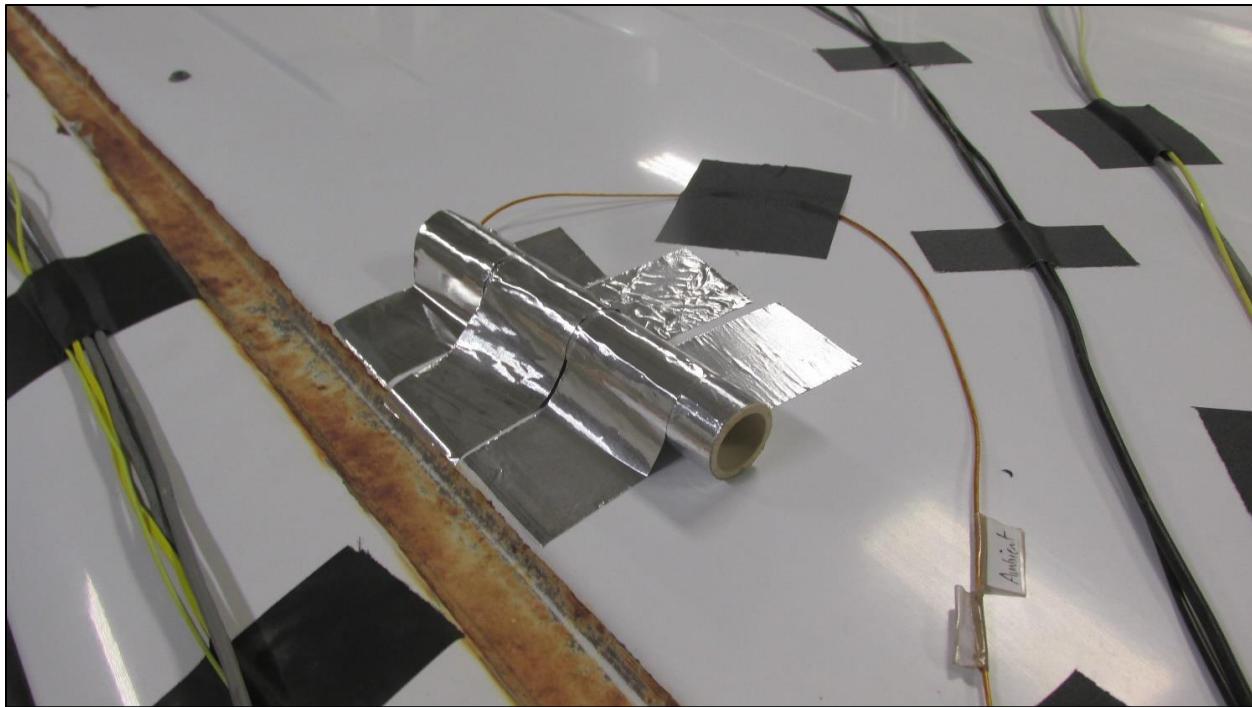
NTSB Performance Study



**NATC Photograph Number 22330-0009
Instrumentation – Curbside Wheel Encoders**



**NATC Photograph Number 22330-0010
Instrumentation – GPS Antenna**



NATC Photograph Number 22330-0011
Instrumentation – Ambient Temperature Sensor



NATC Photograph Number 22330-0012
Instrumentation – Decelerometer

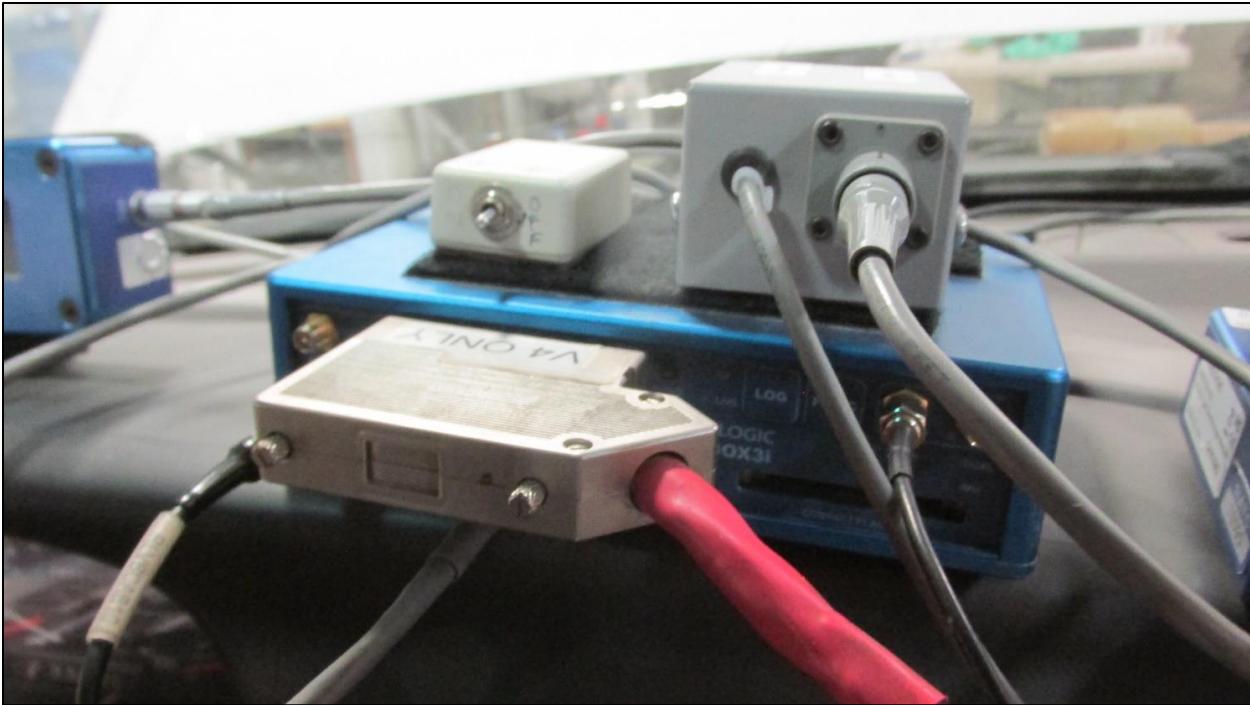
NTSB Performance Study



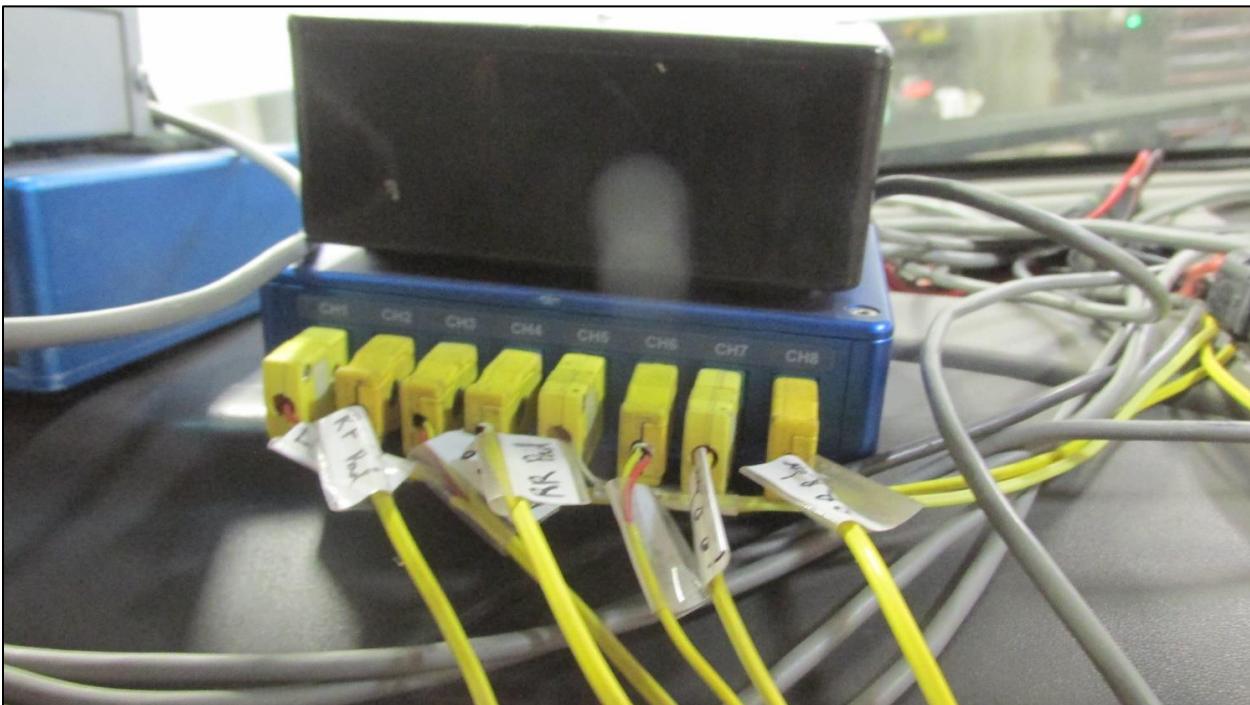
NATC Photograph Number 22330-0013
Instrumentation – Brake Pedal Load Cell



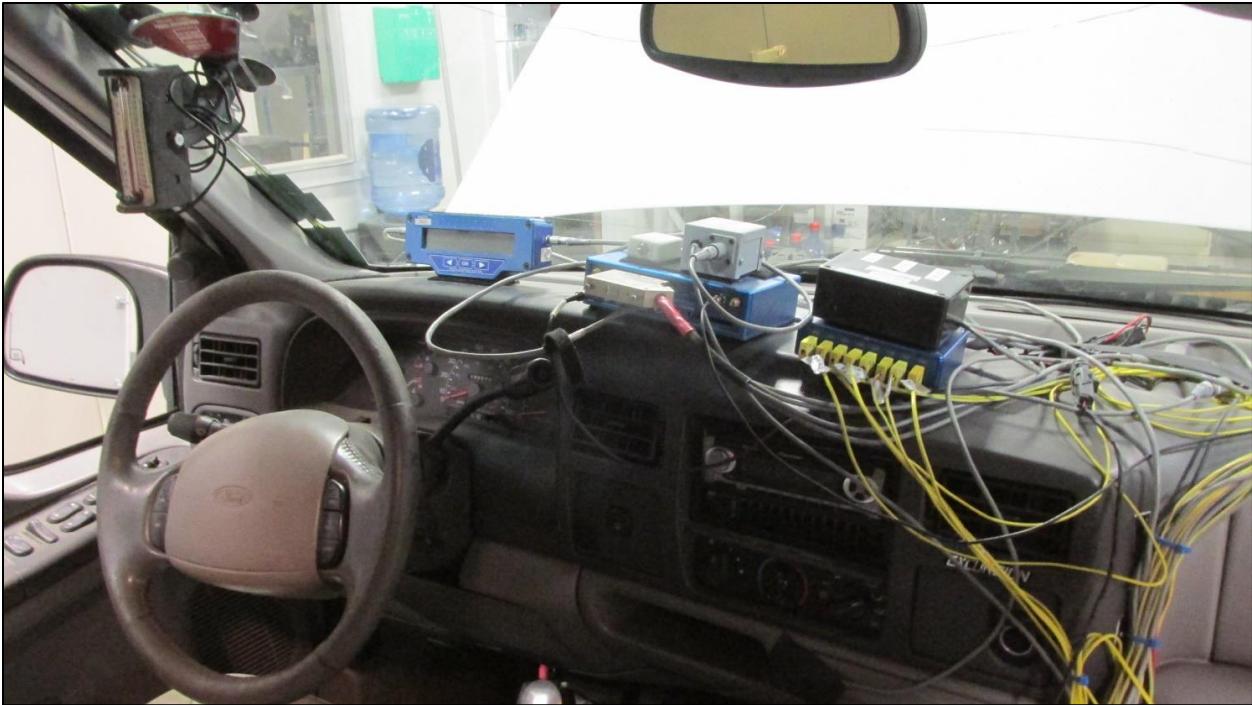
NATC Photograph Number 22330-0014
Instrumentation – VBOX Display



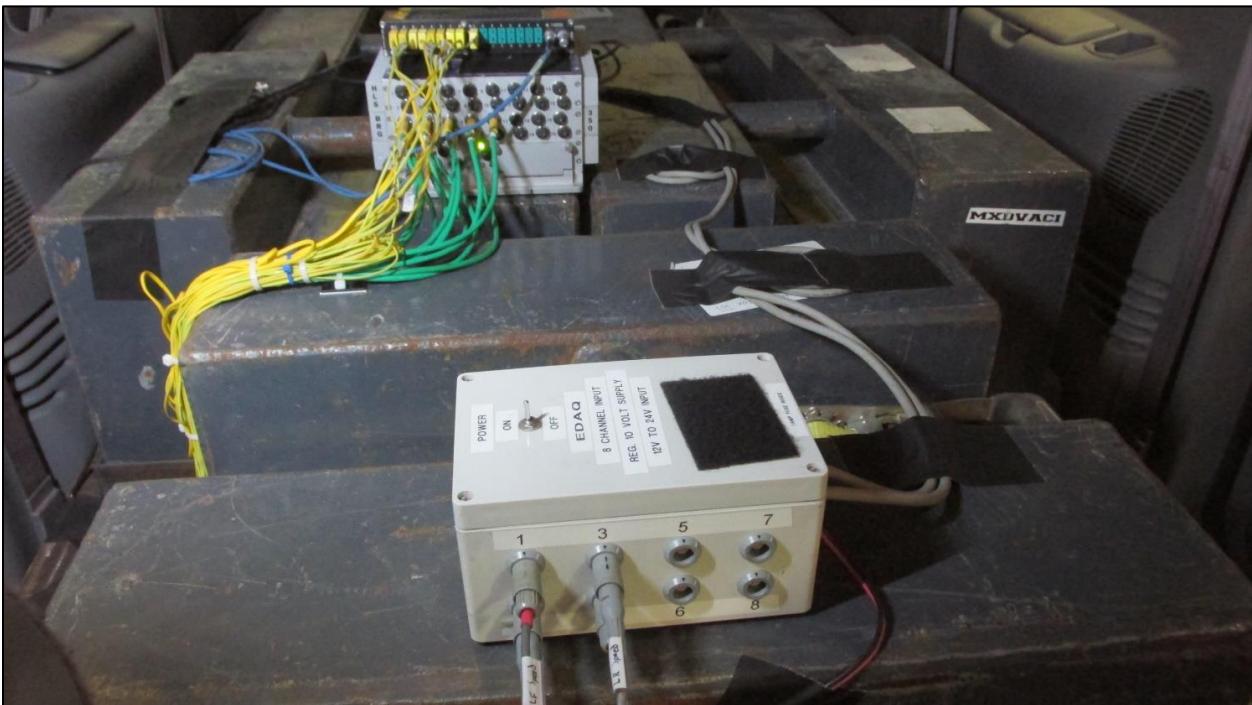
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Instrumentation – Data Acquisition VBOX



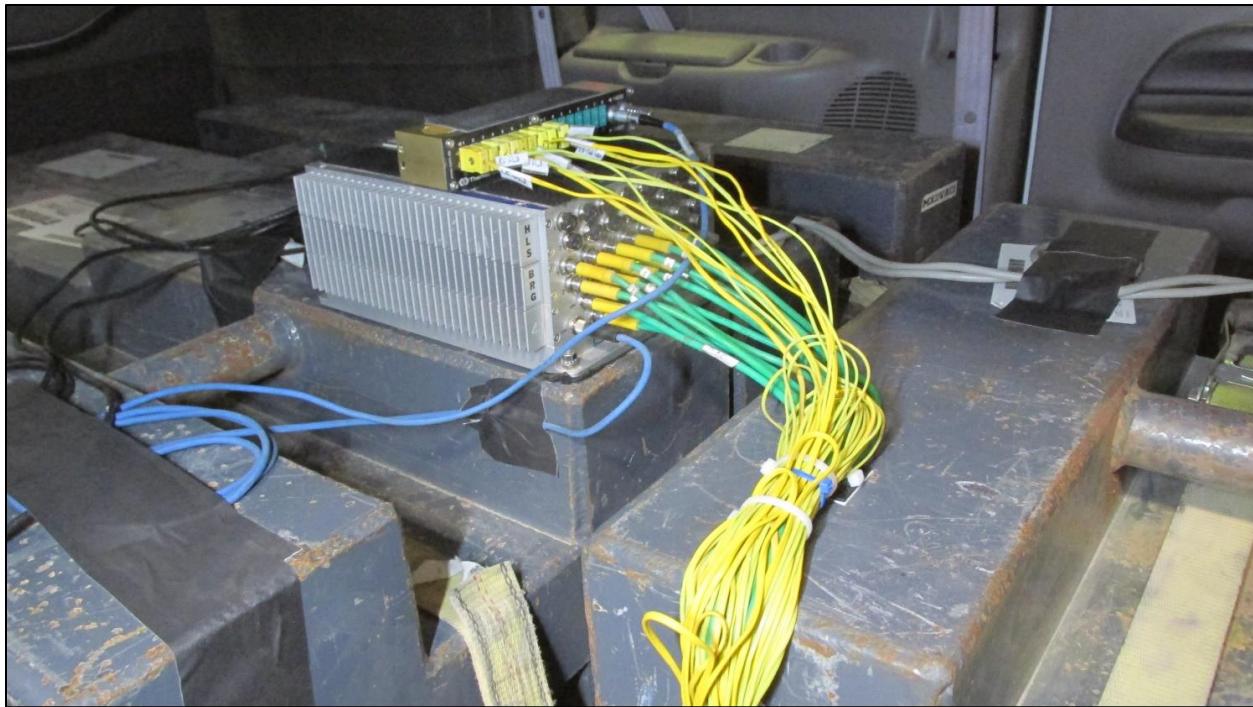
NATC Photograph Number 22330-0016
Instrumentation – Data Acquisition VBOX Thermocouple Breakout Box



**NATC Photograph Number 22330-0017
Instrumentation – Data Acquisition VBOX**



**NATC Photograph Number 22330-0018
Instrumentation – Data Acquisition eDAQ and Pulse Counter**



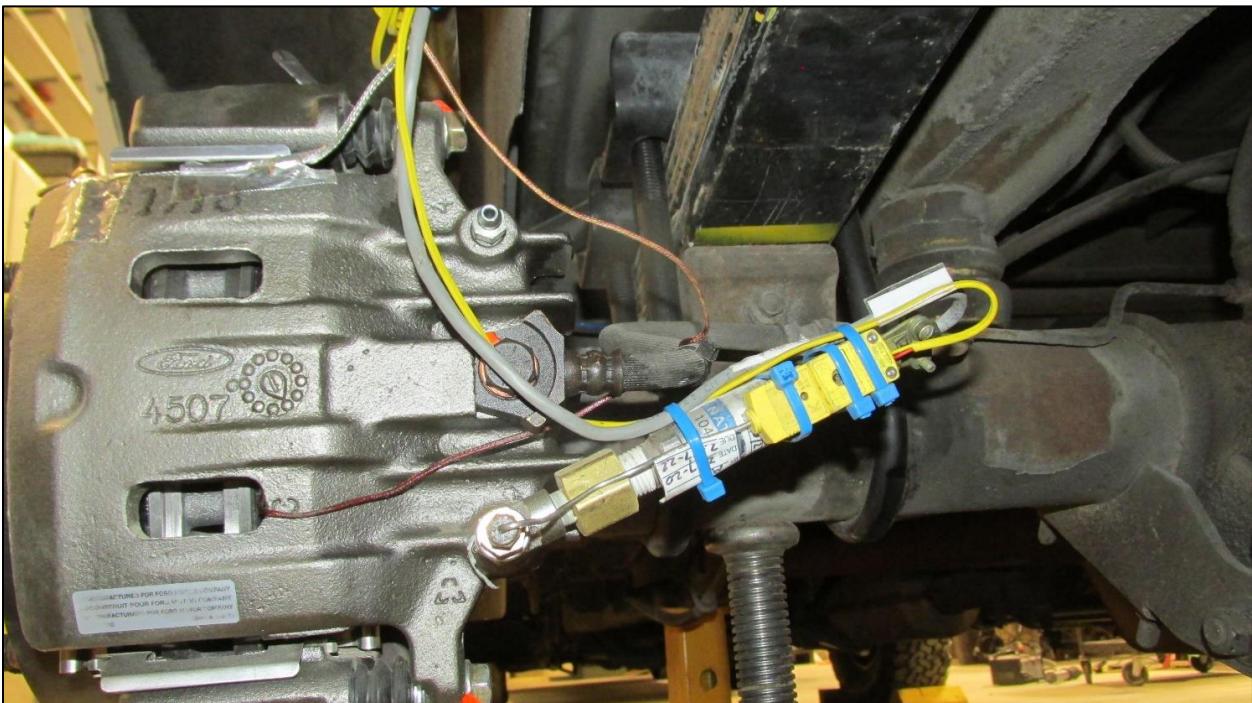
NATC Photograph Number 22330-0019
Instrumentation – Data Acquisition eDAQ



NATC Photograph Number 22330-0020
Instrumentation – Curbside Rear Brake Pressure Transducer



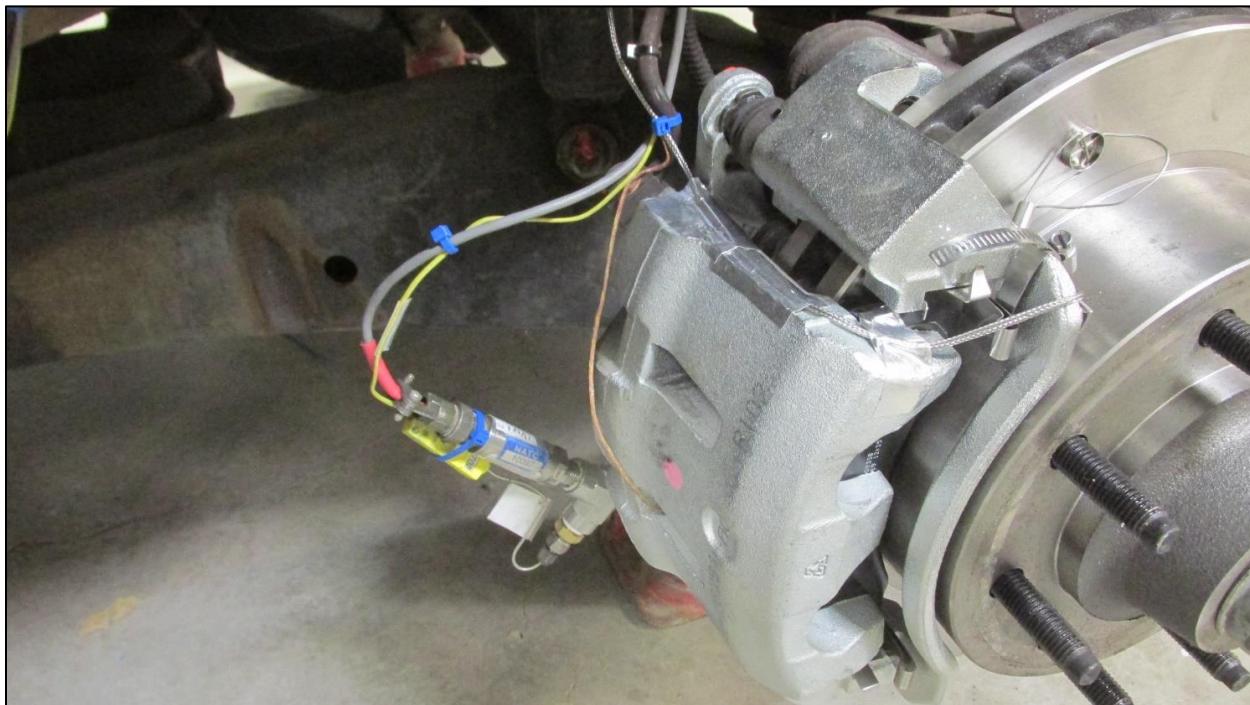
NATC Photograph Number 22330-0021
Instrumentation – Curbside Rear Rotor Thermocouple



NATC Photograph Number 22330-0022
Instrumentation – Roadside Rear Brake Pressure Transducer



NATC Photograph Number 22330-0023
Instrumentation – Roadside Rear Rotor Thermocouple



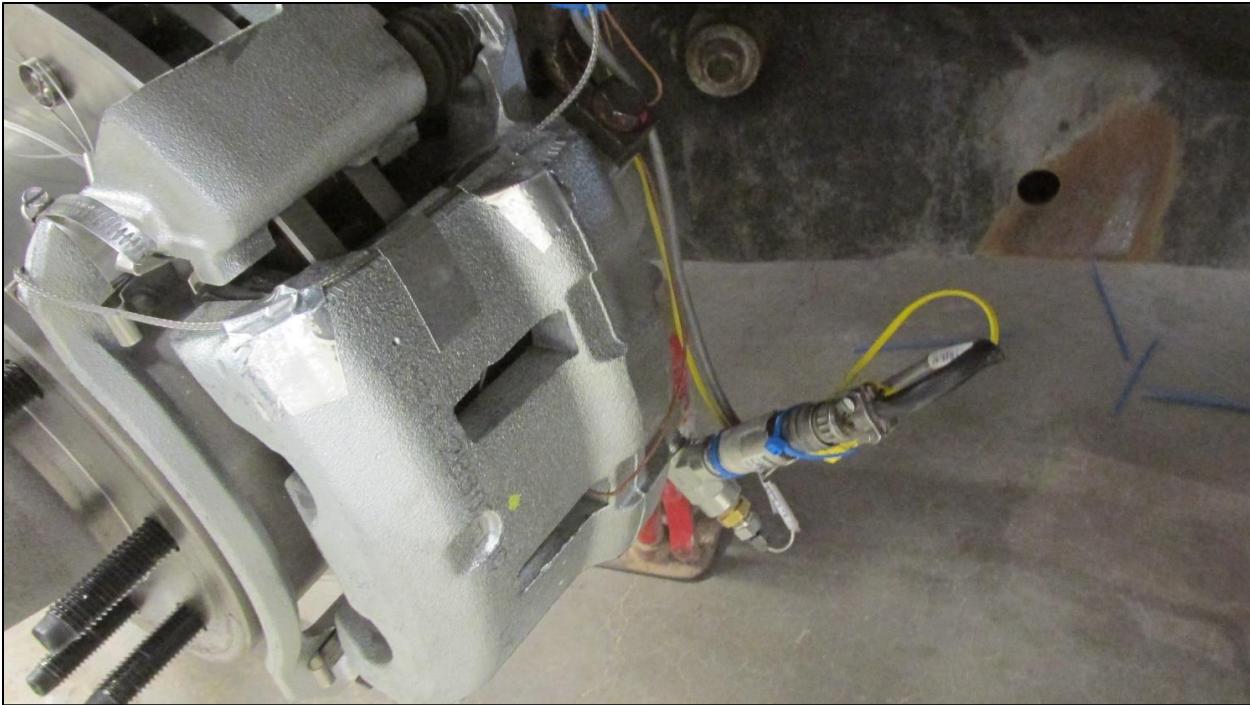
NATC Photograph Number 22330-0024
Instrumentation – Curbside Front Brake Pressure Transducer



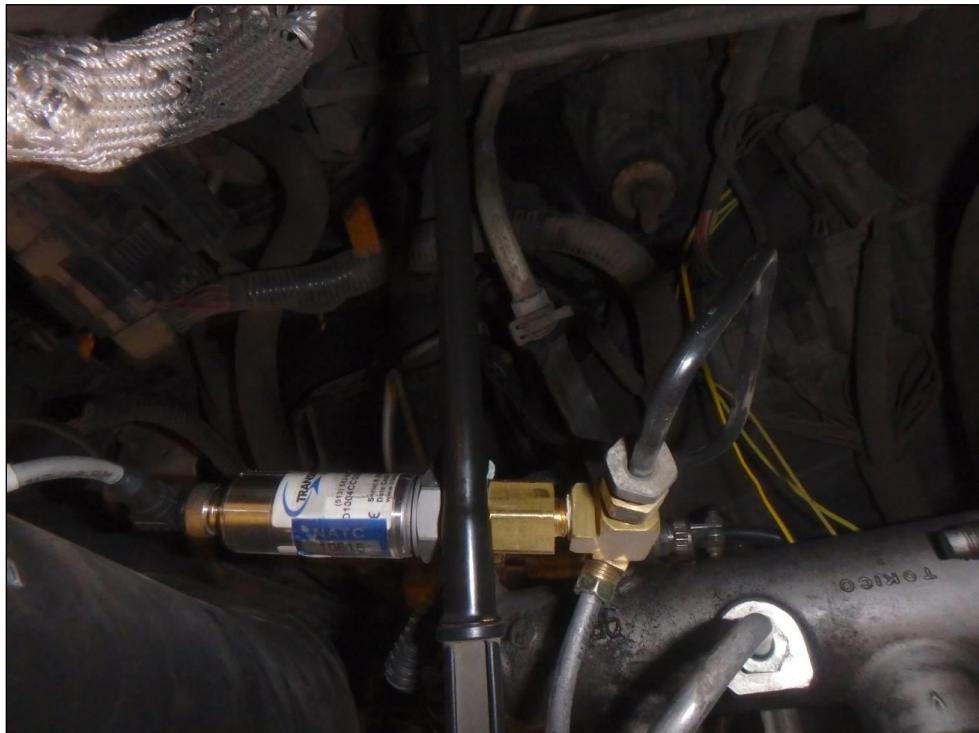
NATC Photograph Number 22330-0025
Instrumentation – Curbside Front Rotor Thermocouple



NATC Photograph Number 22330-0026
Instrumentation – Roadside Front Rotor Thermocouple



NATC Photograph Number 22330-0027
Instrumentation – Roadside Front Brake Pressure Transducer



NATC Photograph Number 22330-0028
Instrumentation – Master Cylinder Front Brake Pressure



**NATC Photograph Number 22330-0029
Instrumentation – Master Cylinder Rear Brake Pressure**

**APPENDIX B
CERTIFICATES OF TRACEABILITY**



Nevada Automotive Test Center

A Division of Hedges Transportation, Inc.

Real Time,
Real World
Solutions™

P.O. Box 234
Carson City, Nevada 89702-0234
Phone: (775) 629-2000
Fax: (775) 629-2029
email: info@natac-ht.com

CERTIFICATE OF TRACEABILITY

Nevada Automotive Test Center (NATC) certifies that the test and measurement equipment listed below has been calibrated using measurement standards and reference instruments whose accuracy is traceable to the National Institute of Standards and Technology (NIST) or nationally accepted measurement systems.

The measurement and reference standards which support the NATC calibration system meet or exceed the requirements set forth in MIL-STD 45662A, and are calibrated on a schedule which is adjusted to ensure traceability at the required accuracy level.

NATC Project / Task No. 22330 - 1211

Job No. 4771 & 4774

Test Description: Braking Evaluations

Test Start Date: 2/25/2020

Test Completion Date: 3/11/2020

NTSB Performance Study

Project 22330 Jobs 4771, 4774

Certificate of Traceability
Instrumentation List

Device	Manufacturer	Model #	Asset #	Date Calibrated	Date on Test	Date off Test	Calibration Due Date
VBOX 3i SL	RaceLogic	VB3iSL-V4	10594	2/21/2019	2/25/2020	3/11/2020	2/21/2021
Thermocouple Input Module	RaceLogic	RLVBTIC8-V2	10595	2/24/2020	2/25/2020	3/11/2020	CBU
Inertial Measurement Unit	RaceLogic	RLVBIMU04	10175	9/17/2018	2/25/2020	3/11/2020	9/17/2020
Multifunction Display	RaceLogic	RLVBDSP03	9031	CNR	2/25/2020	3/11/2020	CNR
Bridge Amplifier	Analog Devices	5B38-05	1985	4/19/2019	2/25/2020	3/11/2020	4/19/2021
GPS Antenna	RaceLogic	RLACSL156	10596	CNR	2/25/2020	3/11/2020	CNR
Pedal Force Cell	Key Transducers	1515-03	7048	7/3/2019	2/25/2020	3/11/2020	7/3/2021
Type K Thermocouples, qty 4.	Temprel	B520B18K2F	K918B	9/11/2018	2/25/2020	3/11/2020	9/11/2020
Brake Disc Thermocouples, qty 4.	TC Direct	201-138	SN 1 to 4	1/23/2020	2/25/2020	3/11/2020	1/23/2022
EDAQ CPU	Somat	ECPU-PLUS	9073	CNR	2/25/2020	3/11/2020	CNR
EDAQ Bridge Layer	Somat	MSBRG	10009	10/18/2019	2/25/2020	3/11/2020	10/18/2020
Thermocouple Input Module	CSM	THMM 16 Pro	9861	2/24/2020	2/25/2020	3/11/2020	CBU
GPS Antenna	Garmin	GPS18x-5Hz	10024	CNR	2/25/2020	3/11/2020	CNR
String Potentiometer	TE Connectivity	SM2-12	10769	2/24/2020	2/25/2020	3/11/2020	CBU
Pressure Transducer	APG	PT-L9-5000	9614	10/24/2019	2/25/2020	3/11/2020	10/24/2020
Pressure Transducer	APG	PT-L9-5000	10097	2/12/2020	2/25/2020	3/11/2020	2/12/2021
Pressure Transducer	APG	PT-L9-5000	10489	10/23/2019	2/25/2020	3/11/2020	10/23/2020
Pressure Transducer	APG	PT-L9-5000	10487	10/24/2019	2/25/2020	3/11/2020	10/24/2020
Pressure Transducer	Transducers Direct	TD1004CCG5000	10616	2/12/2020	2/25/2020	3/11/2020	2/12/2021
Pressure Transducer	APG	PT-L9-5000	9857	2/12/2020	2/25/2020	3/11/2020	2/12/2021
Optical Encoder	BEI	XH20DB	9291	3/2/2020	2/25/2020	3/11/2020	CBU
Optical Encoder	BEI	XH20DB	10234	3/2/2020	2/25/2020	3/11/2020	CBU
Optical Encoder	BEI	XH20DB	10618	3/2/2020	2/25/2020	3/11/2020	CBU
Optical Encoder	BEI	XH20DB	9296	3/2/2020	2/25/2020	3/11/2020	CBU
Type K Thermocouple Probe	Omega	KMQSS-062U-6	10612	2/17/2020	2/25/2020	3/11/2020	2/17/2022
Type K Thermocouple Probe	Omega	KMQSS-062U-6	10702	2/17/2020	2/25/2020	3/11/2020	2/17/2022
Type K Thermocouple Probe	Omega	KMQSS-062U-6	10252	2/17/2020	2/25/2020	3/11/2020	2/17/2022
Type K Thermocouple Probe	Omega	KMQSS-062U-6	9648	2/17/2020	2/25/2020	3/11/2020	2/17/2022
Type K Thermocouples, qty 4.	Temprel	B520B18K2F	K918B	9/11/2018	2/29/2020	3/11/2020	9/11/2020

CNR: Calibration Not Required.
CBU: Calibrate Before Use. A thorough system calibration is performed on these items for the specific test application.



**Brake Performance Study Attachment 2: Dynamometer Testing Report - Performance
Matrix O.E. Brake Parts – 2001 Ford Excursion with Limousine Conversion**

Schoharie, NY

HWY19H001

NATIONAL TRANSPORTATION SAFETY BOARD PERFORMANCE MATRIX

Client	NTSB Acquisition and Lease Management Division 490 L'Enfant Plaza East SW Washington, DC 20594-0003
Report Number	203145-1
Vehicle Simulated	2001 Ford Excursion with Limousine Conversion
Front Lining Edge Code	MPV 2000-EE
Rear Lining Edge Code	MPV 2000-EE
Test Completion Date	06 March 2020

Signature

Kevin C. Machus, Test Engineer
for Greening Testing Laboratories, Inc.

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Original retained on file at

Greening Testing Laboratories, Inc.

Complete test report in Microsoft® Excel format available upon request.



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Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

Test Numbers	M20-063-23 / M20-064-06
Test Program Number	3946.01.20V01 - 2001 FORD EXCURSION.TST
Vehicle System Simulated	2001 Ford Excursion with Limousine Conversion
Reference	Contract No. 9531BM20P0015
Test Date(s)	20 - 21 February, 06 March 2020
Date Test Report Prepared	10 March 2020
Test Report Prepared By	K. Machus
Gross Vehicle Weight	13,565 lbs (per NTSB)
Static Rolling Radius	16.1 inches (based on revolutions per mile of LT265/75R16D tires)
Test Inertia	379.2 slug·ft ²
Equivalent 1/2 Vehicle Weight	6,783 lbs

	Front Disc Brake	Rear Disc Brake
Lining Edge Code	MPV 2000-EE	MPV 2000-EE
Brake Pad Part Number	Motorcraft BR1266	Motorcraft BR1275
Brake Pad FMSI® Number	7625-D756	7626-D757
Brake Configuration	dual piston, separate function caliper disc brake	dual piston, separate function caliper disc brake
Piston Diameter(s)	2 x 54 mm	2 x 46 mm
Rotor Part Number	Ford 1G3Z-1V102-AB	Ford YC3Z-2C026-BB
Brake Size (nominal)		
Rotor Diameter x Thickness	13.0 x 1.5 inches	12.8 x 1.2 inches
Rotor Mass (nominal)	#REF!	#REF!
Rotor Effective Radius	5.599 inches	5.529 inches
Wheel Rotation	right hand	left hand
Test Fixture	096622	190316
Date Parts Received	16 January 2020	16 January 2020

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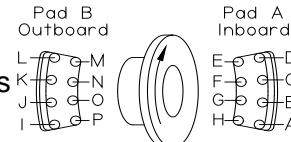
2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

FRONT BRAKE PAD MEASUREMENTS

Instrument Check - 2nd Effectiveness Matrix			3rd Effectiveness Matrix			4th Effectiveness Matrix							
			Pre	Post	Loss	Pre	Post	Loss					
Inboard Pad													
Thickness (inch)	A	0.717	0.633	0.084		0.633	0.618	0.015					
	B	0.720	0.625	0.095		0.625	0.607	0.018					
	C	0.725	0.632	0.093		0.632	0.610	0.022					
	D	0.725	0.644	0.081		0.644	0.628	0.016					
	E	0.725	0.652	0.073		0.652	0.632	0.020					
	F	0.718	0.640	0.078		0.640	0.612	0.028					
	G	0.718	0.628	0.090		0.628	0.605	0.023					
	H	0.714	0.638	0.076		0.638	0.620	0.018					
Average Loss			0.084	Average Loss			0.020	Average Loss			0.013		
Cumulative Total			0.084	Cumulative Total			0.104	Cumulative Total			0.117		
Mass (kg)	0.667			0.628			0.619			0.570			
	Loss			Loss			Loss			Loss			
	Cumulative Total			0.039			0.048			0.049			
	Outboard Pad									Cumulative Total			
	I	0.716	0.621	0.095		0.621	0.599	0.022		0.599			
	J	0.712	0.623	0.089		0.623	0.599	0.024		0.599			
	K	0.712	0.621	0.091		0.621	0.597	0.024		0.597			
	L	0.703	0.624	0.079		0.624	0.607	0.017		0.607			
Thickness (inch)	M	0.703	0.655	0.048		0.655	0.638	0.017		0.638			
	N	0.705	0.648	0.057		0.648	0.635	0.013		0.635			
	O	0.704	0.649	0.055		0.649	0.632	0.017		0.632			
	P	0.711	0.648	0.063		0.648	0.630	0.018		0.630			
	Average Loss			0.072	Average Loss			0.019	Average Loss			0.020	
	Cumulative Total			0.072	Cumulative Total			0.091	Cumulative Total			0.111	
	0.659			0.627	0.619			0.570			0.570		
	Loss			0.032	Loss			0.008	Loss			0.049	
Cumulative Total			0.032	Cumulative Total			0.040	Cumulative Total			0.089		
Total (Inboard Pad + Outboard Pad)													
Thickness Loss			0.156	Thickness Loss			0.039	Thickness Loss			0.033		
Cumulative			0.156	Cumulative			0.195	Cumulative			0.228		
Mass Loss			0.071	Mass Loss			0.017	Mass Loss			0.098		
Cumulative			0.071	Cumulative			0.088	Cumulative			0.186		

NOTE: Values in parentheses indicate an increase in thickness.

Pad Thickness Measurement Locations



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

FRONT BRAKE PAD MEASUREMENTS

Overall

	Pre	Post	Loss	
				Inboard Pad
				Outboard Pad

Thickness (inch)	A	0.717	0.613	0.104	
	B	0.720	0.603	0.117	
	C	0.725	0.602	0.123	
	D	0.725	0.609	0.116	
	E	0.725	0.608	0.117	
	F	0.718	0.594	0.124	
	G	0.718	0.594	0.124	
	H	0.714	0.605	0.109	
		Average Loss	0.117		
Mass (kg)		0.667	0.570		
		Loss	0.097		

Outboard Pad

Thickness (inch)	I	0.716	0.573	0.143	
	J	0.712	0.574	0.138	
	K	0.712	0.579	0.133	
	L	0.703	0.587	0.116	
	M	0.703	0.625	0.078	
	N	0.705	0.612	0.093	
	O	0.704	0.613	0.091	
	P	0.711	0.618	0.093	
		Average Loss	0.111		
Mass (kg)		0.659	0.570		
		Loss	0.089		

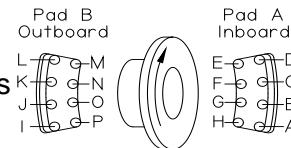
Total (Inboard Pad + Outboard Pad)

Thickness Loss 0.228	
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Mass Loss 0.186	
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NOTE: Values in parentheses indicate an increase in thickness.

Pad Thickness Measurement Locations



NTSB - PERFORMANCE MATRIX

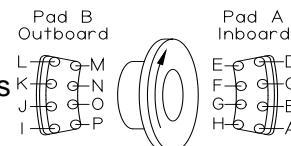
2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

REAR BRAKE PAD MEASUREMENTS

Instrument Check - 2nd Effectiveness Matrix			3rd Effectiveness Matrix			4th Effectiveness Matrix		
			Pre	Post	Loss	Pre	Post	Loss
Inboard Pad								
Thickness (inch)	A	0.697	0.628	0.069		0.628	0.614	0.014
	B	0.692	0.626	0.066		0.626	0.615	0.011
	C	0.694	0.631	0.063		0.631	0.624	0.007
	D	0.687	0.660	0.027		0.660	0.652	0.008
	E	0.684	0.655	0.029		0.655	0.644	0.011
	F	0.691	0.630	0.061		0.630	0.616	0.014
	G	0.692	0.622	0.070		0.622	0.607	0.015
	H	0.692	0.623	0.069		0.623	0.608	0.015
Average Loss			Average Loss			Average Loss		
Cumulative Total			Cumulative Total			Cumulative Total		
Mass (kg)		0.449	0.423			0.423	0.419	
			Loss	0.026			Loss	0.004
			Cumulative Total	0.026			Cumulative Total	0.030
Outboard Pad								
Thickness (inch)	I	0.691	0.646	0.045		0.646	0.633	0.013
	J	0.699	0.644	0.055		0.644	0.638	0.006
	K	0.699	0.630	0.069		0.630	0.618	0.012
	L	0.701	0.619	0.082		0.619	0.616	0.003
	M	0.698	0.639	0.059		0.639	0.634	0.005
	N	0.698	0.652	0.046		0.652	0.646	0.006
	O	0.698	0.667	0.031		0.667	0.654	0.013
	P	0.691	0.664	0.027		0.664	0.650	0.014
Average Loss			Average Loss			Average Loss		
Cumulative Total			Cumulative Total			Cumulative Total		
Mass (kg)		0.459	0.434			0.434	0.427	
			Loss	0.025			Loss	0.007
			Cumulative Total	0.025			Cumulative Total	0.032
Total (Inboard Pad + Outboard Pad)								
Thickness Loss			Thickness Loss			Thickness Loss		
Cumulative			Cumulative			Cumulative		
Mass Loss			Mass Loss			Mass Loss		
Cumulative			Cumulative			Cumulative		

NOTE: Values in parentheses indicate an increase in thickness.

Pad Thickness Measurement Locations



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

REAR BRAKE PAD MEASUREMENTS

Overall

	Pre	Post	Loss	
				Inboard Pad
				Outboard Pad

Thickness (inch)	A	0.697	0.594	0.103	
	B	0.692	0.593	0.099	
	C	0.694	0.603	0.091	
	D	0.687	0.638	0.049	
	E	0.684	0.635	0.049	
	F	0.691	0.601	0.090	
	G	0.692	0.593	0.099	
	H	0.692	0.592	0.100	
		Average Loss	0.085		
Mass (kg)		0.449	0.411		
		Loss	0.038		

Outboard Pad

Thickness (inch)	I	0.691	0.596	0.095	
	J	0.699	0.589	0.110	
	K	0.699	0.576	0.123	
	L	0.701	0.567	0.134	
	M	0.698	0.582	0.116	
	N	0.698	0.600	0.098	
	O	0.698	0.604	0.094	
	P	0.691	0.615	0.076	
		Average Loss	0.106		
Mass (kg)		0.459	0.419		
		Loss	0.040		

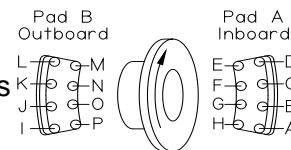
Total (Inboard Pad + Outboard Pad)

Thickness Loss	0.191	
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Mass Loss	0.078	
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NOTE: Values in parentheses indicate an increase in thickness.

Pad Thickness Measurement Locations



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

BRAKE DISC MEASUREMENTS**FRONT THICKNESS, MASS AND RUN-OUT**

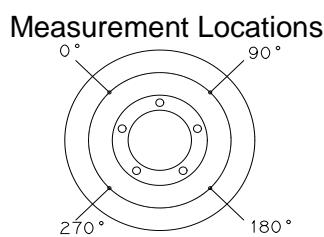
	Instrument Check -			3rd Effectiveness Matrix			4th Effectiveness Matrix				
	2nd Effectiveness Matrix			Pre	Post	Loss	Pre	Post	Loss		
Thickness (inch)	0° (A)	1.495	1.495	0.000	1.495	1.494	0.001	1.494	1.495 (0.001)		
	90° (B)	1.495	1.495	0.000	1.495	1.494	0.001	1.494	1.495 (0.001)		
	180° (C)	1.495	1.494	0.001	1.494	1.494	0.000	1.494	1.495 (0.001)		
	270° (D)	1.495	1.494	0.001	1.494	1.494	0.000	1.494	1.495 (0.001)		
	Average	1.495	1.495	0.000	1.495	1.494	0.001	1.495	1.494 0.001		
		Cumulative Total		0.000	Cumulative Total		0.001	Cumulative Total		0.002	
Mass (kg)	20.692	20.692			20.692	20.684		20.692	20.683		
		Loss		0.000		Loss		0.008	Loss		0.009
		Cumulative Total		0.000		Cumulative Total		0.008		Cumulative Total	
Run-Out (in)	0.009	0.005	---		0.004	0.003	---	0.004	0.003		
		---				---			---		

REAR THICKNESS, MASS AND RUN-OUT

	Instrument Check -			3rd Effectiveness Matrix			4th Effectiveness Matrix				
	2nd Effectiveness Matrix			Pre	Post	Loss	Pre	Post	Loss		
Thickness (inch)	0° (A)	1.181	1.180	0.001	1.180	1.180	0.000	1.180	1.180 0.000		
	90° (B)	1.181	1.180	0.001	1.180	1.180	0.000	1.180	1.180 0.000		
	180° (C)	1.181	1.180	0.001	1.180	1.180	0.000	1.180	1.180 0.000		
	270° (D)	1.181	1.180	0.001	1.180	1.180	0.000	1.180	1.180 0.000		
	Average	1.181	1.180	0.001	1.180	1.180	0.000	1.181	1.180 0.001		
		Cumulative Total		0.001	Cumulative Total		0.001	Cumulative Total		0.002	
Mass (kg)	10.896	10.882			10.882	10.879		10.896	10.875		
		Loss		0.014		Loss		0.003	Loss		0.021
		Cumulative Total		0.014		Cumulative Total		0.017		Cumulative Total	
Run-Out (in)	0.009	0.005	---		0.004	0.003	---	0.004	0.003		
		---				---			---		

NOTE: Values in parentheses indicate an increase in thickness.

	Physical Characteristics				Measurement Locations	
	FRONT		Pre Test			
	Pre Test	Post Test	Pre Test	Post Test		
Surface Roughness (μin) (0° Inboard Face)	46	56	27	44		
Brinell Hardness (0° Inboard Face)	207	207	228	228		



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

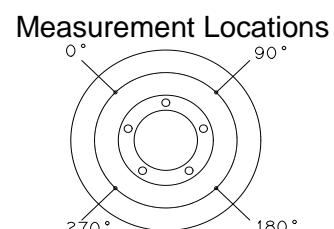
BRAKE DISC MEASUREMENTS**FRONT THICKNESS, MASS AND RUN-OUT****Overall**

	Pre	Post	Loss
Thickness (inch)			
0° (A)	1.495	1.495	0.000
90° (B)	1.495	1.495	0.000
180° (C)	1.495	1.495	0.000
270° (D)	1.495	1.495	0.000
Average	1.495	1.495	0.000
Mass (kg)	20.692	20.683	
		Loss	0.009

REAR THICKNESS, MASS AND RUN-OUT**Instrument Check -
2nd Effectiveness Matrix**

	Pre	Post	Loss
Thickness (inch)			
0° (A)	1.181	1.180	0.001
90° (B)	1.181	1.180	0.001
180° (C)	1.181	1.180	0.001
270° (D)	1.181	1.180	0.001
Average	1.181	1.180	0.001
Mass (kg)	10.896	10.875	
		Loss	0.021

NOTE: Values in parentheses indicate an increase in thickness.



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

DATA NOTES

- 1 All average and sustained values shown in this report are calculated with respect to **DISTANCE**.
- 2 The data presented in this report has been gathered as follows:

START Threshold = 50 lbf·ft of brake torque during brake apply.

AVERAGE = average value between START and STOP Threshold levels.

INITIAL Data Point = Values are taken at the point where the control level is achieved.

SUSTAINED Data = average value between the INITIAL and END data points.

END Data Point = Values are taken 0.1 seconds prior to the STOP threshold

MAXIMUM = maximum value observed in the SUSTAINED Data Interval.

STOP Threshold = brake release

FINAL temperature is the highest temperature value observed in a 4.0 second "window" beginning 1.0 seconds after brake release.

- 3 Brake application is initiated when the control temperature (rotor) reaches the desired initial brake temperature.
- 4 Cooling Air Temperature = 80°F ($\pm 5^{\circ}\text{F}$)
- 5 Cooling Air Velocity = 30 mi/h for burnish and 300°F Effectiveness, 5 mi/h all other sections.
- 6 For all stops which show "zero" (0) or negative values for some of the computed pressure, torque or coefficient values:

These stops achieved final speed but did not achieve the torque level required for the particular stop. Since the START data and STOP data thresholds were satisfied, deceleration rate, distance, time to stop, etc., are accurate values, and can be used for data comparison purposes.

The presence of "zero" values generally is caused by lack of brake performance, resulting in a "clamp" condition. "Clamp" condition is defined by the brake calling for the maximum pressure the test section allows ("clamp" pressure) and the brake being unable to attain the deceleration rate required in the test section at that pressure.

- 7 Thermocouple locations and depths:
 - Front Rotor: Center of inboard rubbing track at a depth of 0.040 inches
 - Front Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches
 - Front Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches
 - Rear Rotor: Center of inboard rubbing track at a depth of 0.040 inches
 - Rear Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches
 - Rear Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

COMPUTED DATA DESCRIPTIONS

SPEED

INIT = Speed start threshold is achieved.

FNL = Brake release speed

TIME

STOP = Time elapsed between start threshold and brake release

REPT = Time elapsed between cycles

DISTANCE

STOP = Distance elapsed between start threshold and brake release

REPT = Distance elapsed between cycles

DECCEL

AVG = Average deceleration measured from start threshold to brake release

PRESSURE

AVERAGE = Average pressure from start threshold to brake release

SUSTAINED = Average pressure from point control level is achieved to brake release

MAXIMUM = Maximum pressure from start threshold to brake release

TORQUE

AVERAGE = Average torque from start threshold to brake release

SUSTAINED = Average torque from point control level is achieved to brake release

MAXIMUM = Maximum torque from start threshold to brake release

TEMPERATURE

INT = Temperature at start threshold

MAX = Maximum temperature between start threshold and 0.1 seconds after brake release

FLUID DISPLACEMENT

MAX = Maximum fluid displacement between start threshold and brake release

FRICITION COEFFICIENT

SUST = Friction coefficient (μ) calculated using the following formula:

$$\mu = \frac{\text{Sustained Torque (lbf-ft) / Rotor Effective Radius (ft)}}{\text{Sustained Pressure (lbf/in}^2\text{) * Total Caliper Piston Area (in}^2\text{)}} * 0.5$$

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

TEST SYNOPSIS

Step	Description	FMVSS 105 Reference	Braking Speed (mi/h)	Brake Application Control (IBT or Distance)	Deceleration Level (g) or Pressure Level (lbf/in²)	Number of Stops/Snubs
1	Instrument Check	7.2 Instrumentation Check at GVWR	30-0	<200°F	0.31	10
2	Burnish	7.4 Burnish at GVWR	40-0	IBT = 200°F or 1 mile distance	0.37	200
3	50 mi/h Effectiveness	--	50-40	300°F	400, 600, 800, 1000, 1200, 1400, 1600, 1800 lbf/in²	8
4	55 mi/h Effectiveness	--	55-45	300°F	400, 600, 800, 1000, 1200, 1400, 1600, 1800 lbf/in²	8
5	60 mi/h Effectiveness	--	60-50	300°F	400, 600, 800, 1000, 1200, 1400, 1600, 1800 lbf/in²	8
6	65 mi/h Effectiveness	--	65-55	300°F	400, 600, 800, 1000, 1200, 1400, 1600, 1800 lbf/in²	8
7	Best Effort	--	55-0	300°F	1800 lbf/in²	2
8	Warm brake to 450°F at the conditions outlined in Step 2 and repeat sections 3-7 at an initial temperature of 450°F					
9	Warm brake to 600°F at the conditions outlined in Step 2 and repeat sections 3-7 at an initial temperature of 600°F					
10	Warm brake to 750°F at the conditions outlined in Step 2 and repeat sections 3-7 at an initial temperature of 750°F					
11	Reburnish	--	40-0	IBT = 200°F or 1 mile distance	0.37	35
12	Repeat Sections 3 - 10					
13	Inspection					
14	Reburnish	--	40-0	IBT = 200°F or 1 mile distance	0.37	35
15	Repeat Sections 3 - 10					
16	Inspection					
17	Reburnish	--	40-0	IBT = 200°F or 1 mile distance	0.37	35
18	Repeat Sections 3 - 10					
19	Warm brake to 900°F at the conditions outlined in Step 2 and repeat sections 3-7 at an initial temperature of 900°F					
20	End Of Test					

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

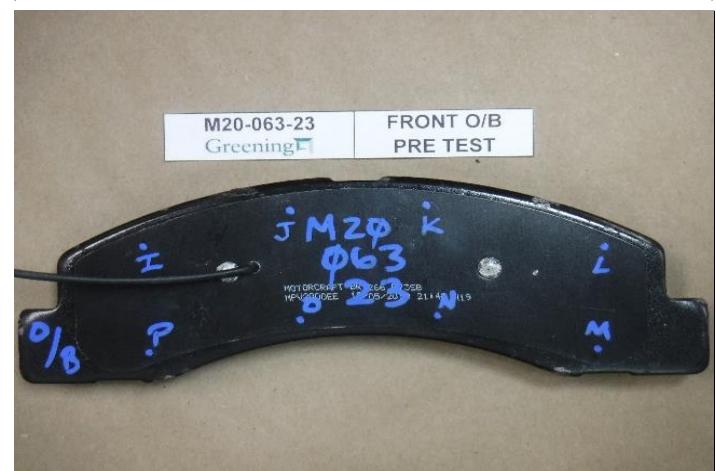
NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

PRE TEST PHOTOGRAPHS - FRONT BRAKE



Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

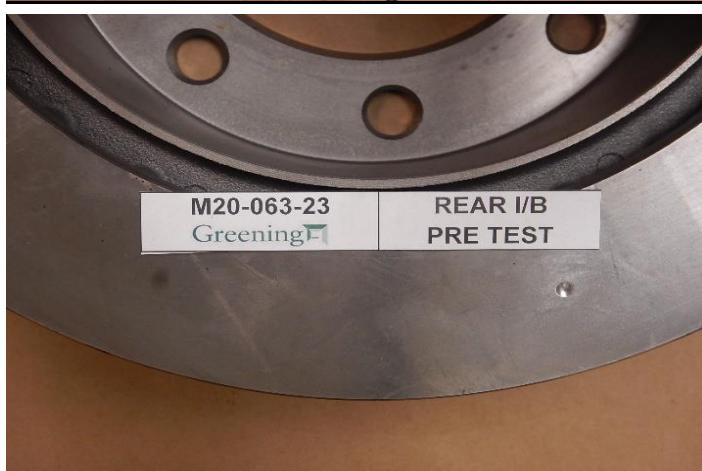
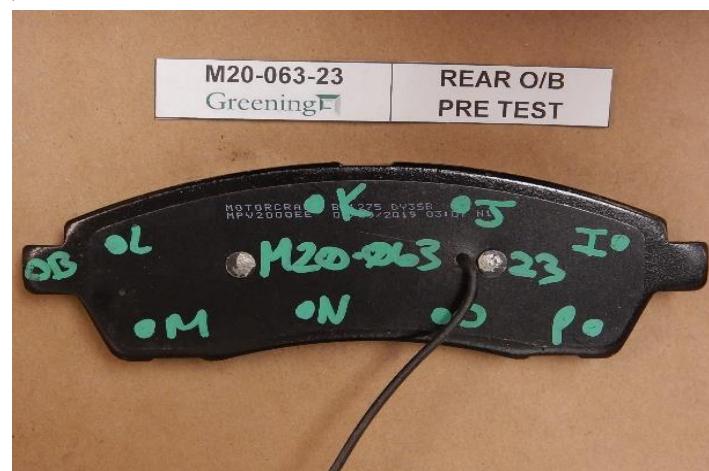
NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

PRE TEST PHOTOGRAPHS - REAR BRAKE



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

POST SECOND EFFECTIVENESS MATRIX VISUAL INSPECTION - FRONT BRAKE

Inboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is grey/black in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

POST SECOND EFFECTIVENESS MATRIX VISUAL INSPECTION - REAR BRAKE

Inboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is grey/black in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

POST THIRD EFFECTIVENESS MATRIX VISUAL INSPECTION - FRONT BRAKE

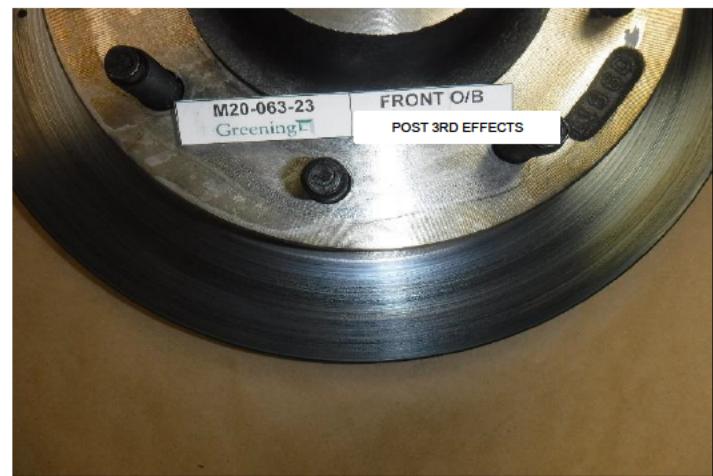
Inboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is blue/grey in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

POST THIRD EFFECTIVENESS MATRIX VISUAL INSPECTION - REAR BRAKE

Inboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is blue/grey in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

POST TEST VISUAL INSPECTION - FRONT BRAKE

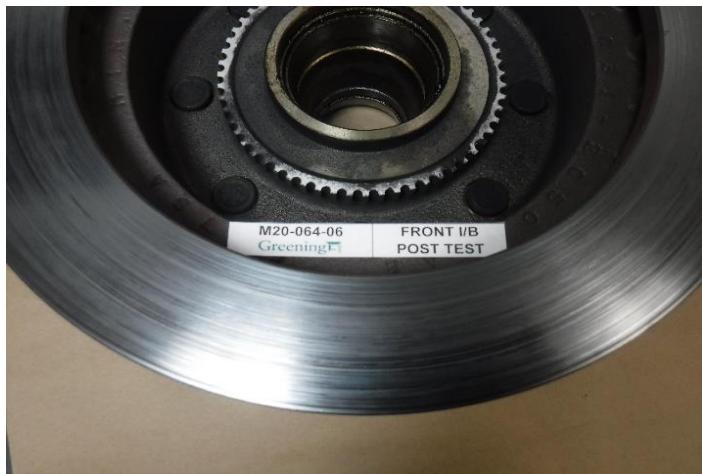
Inboard Pad: The pad has moderate glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has moderate glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is black/grey in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

POST TEST VISUAL INSPECTION - REAR BRAKE

Inboard Pad: The pad has moderate glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has moderate glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is black/grey in color.

All other test hardware appears in good condition.

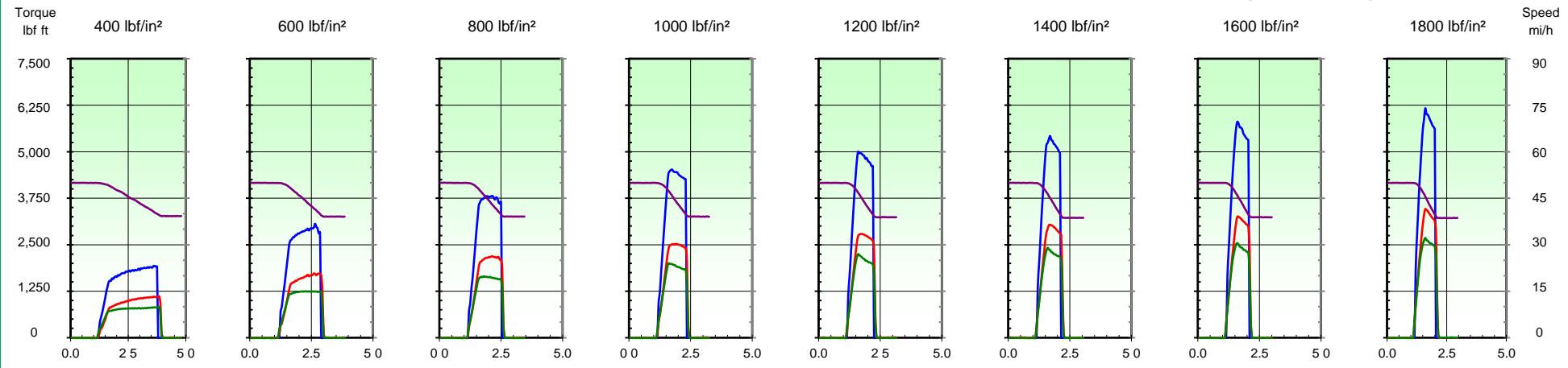
PHOTOGRAPHS



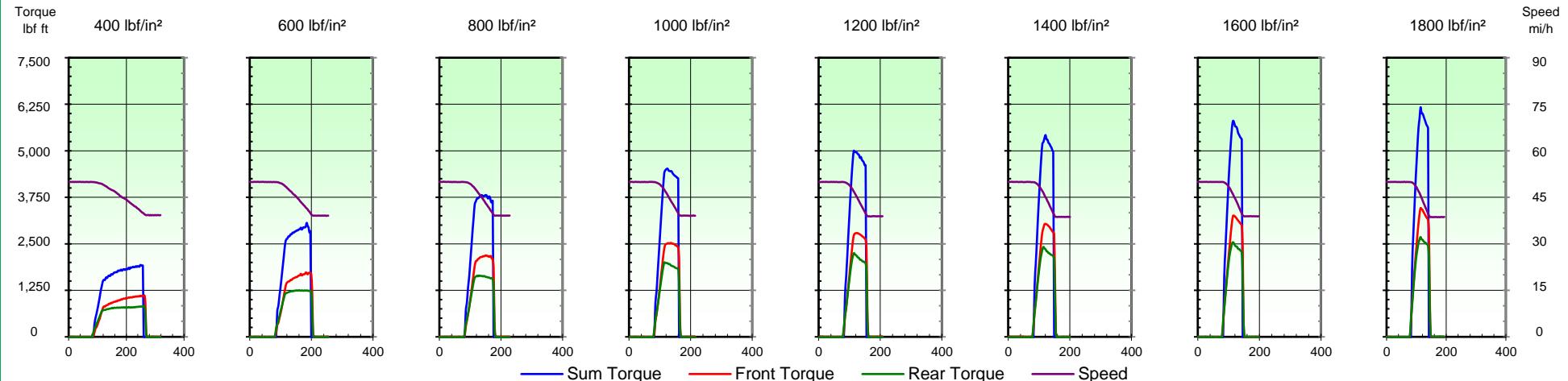
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

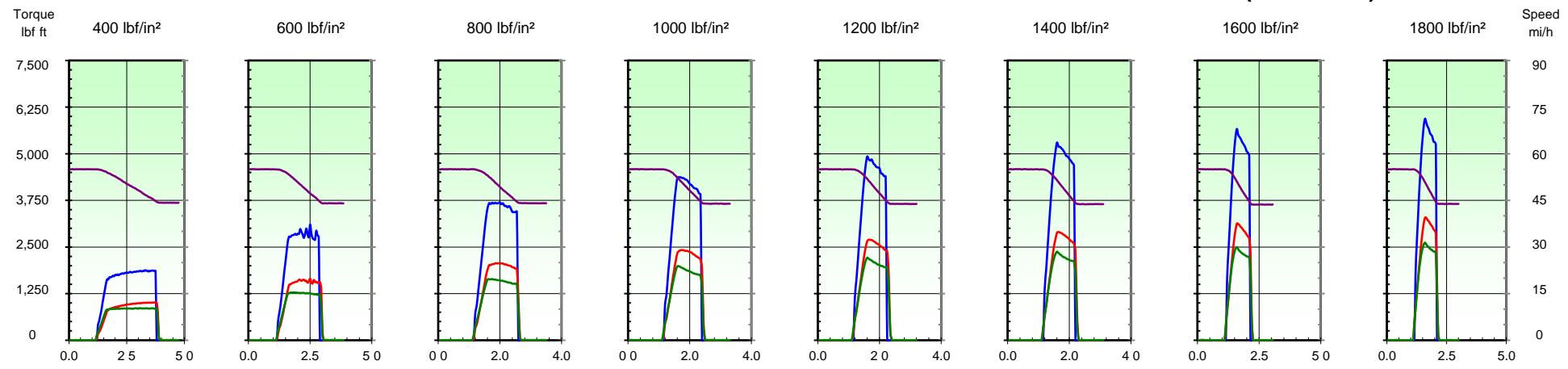
Report Number: 203145-1

Test Report Date: 06 March 2020

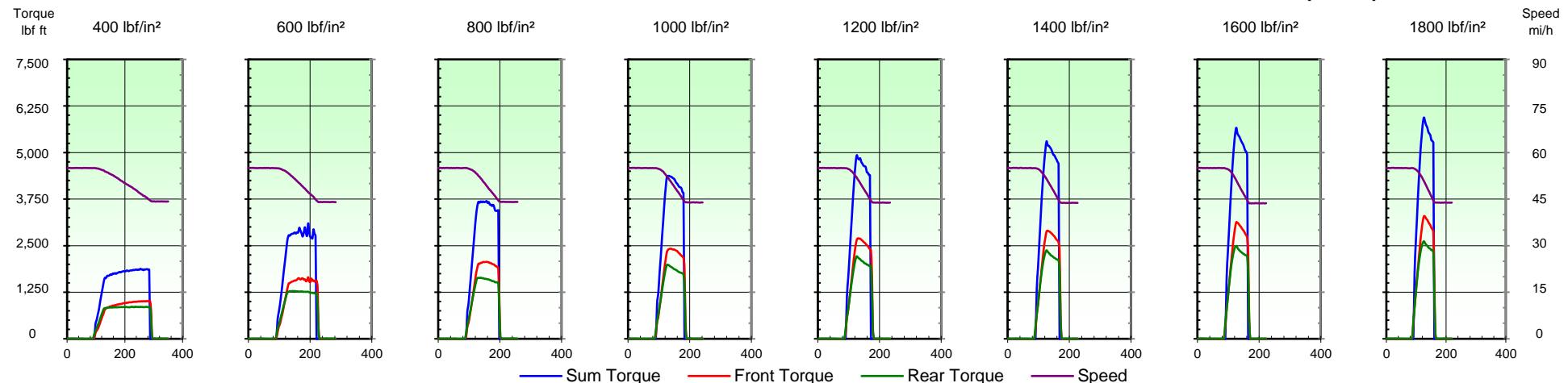
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

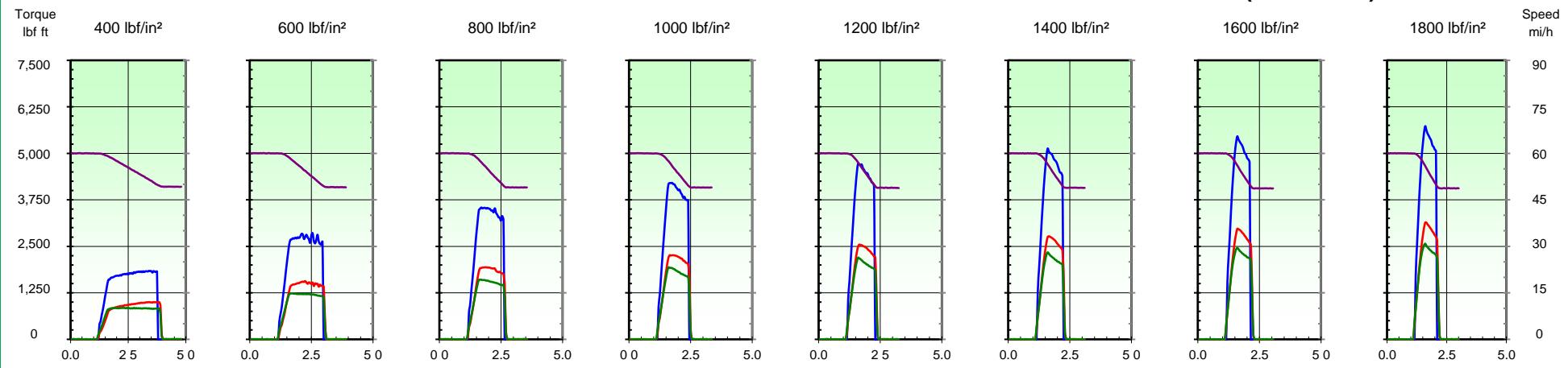
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Test Report Date: 06 March 2020

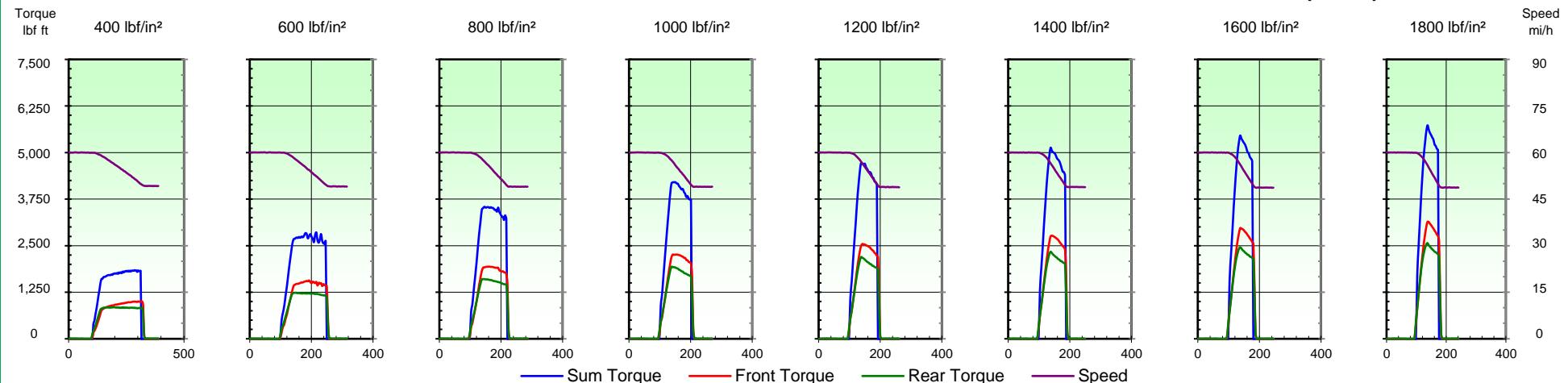
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 60-50 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 60-50 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

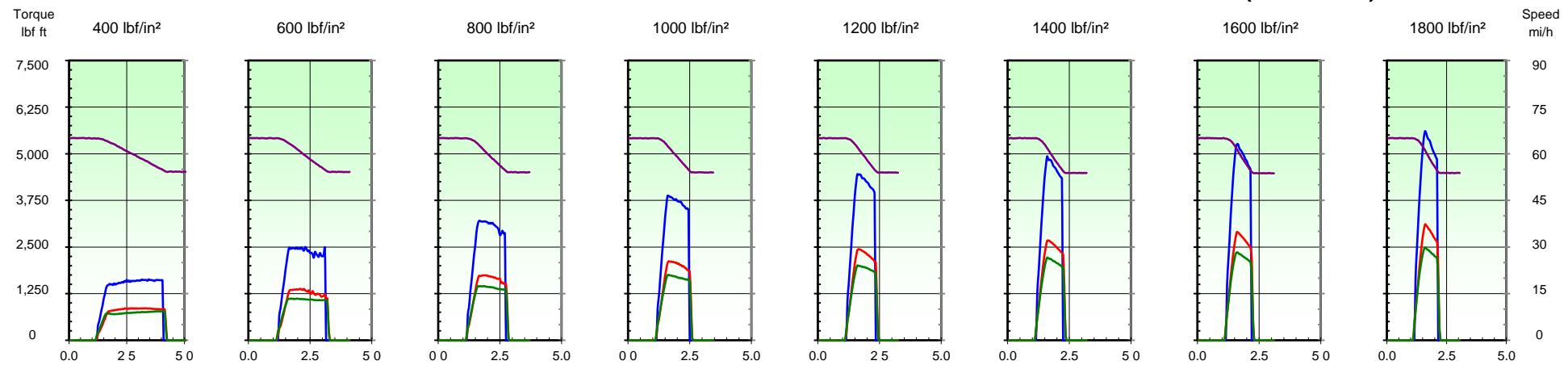
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Test Report Date: 06 March 2020

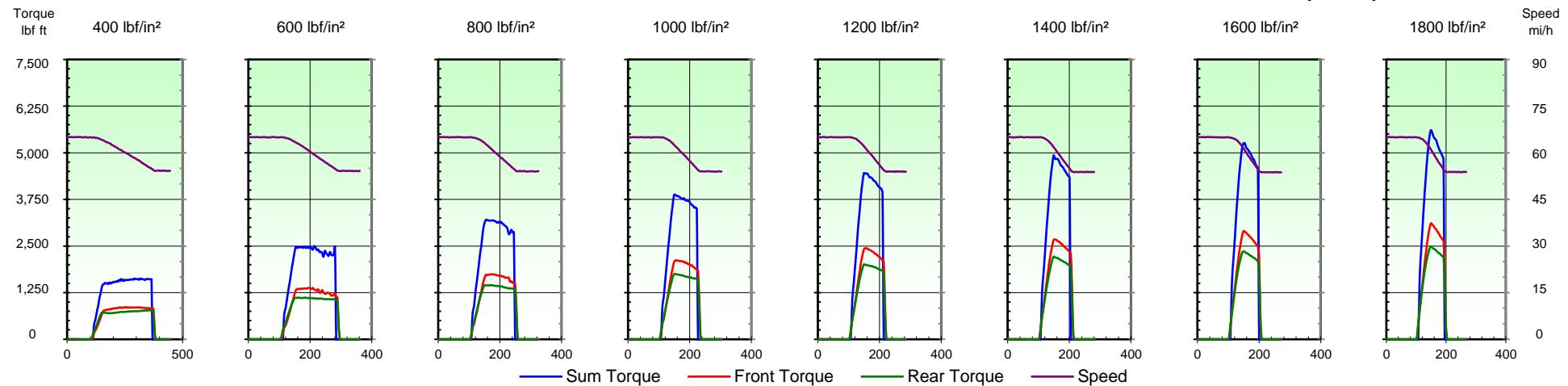
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 65-55 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 65-55 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

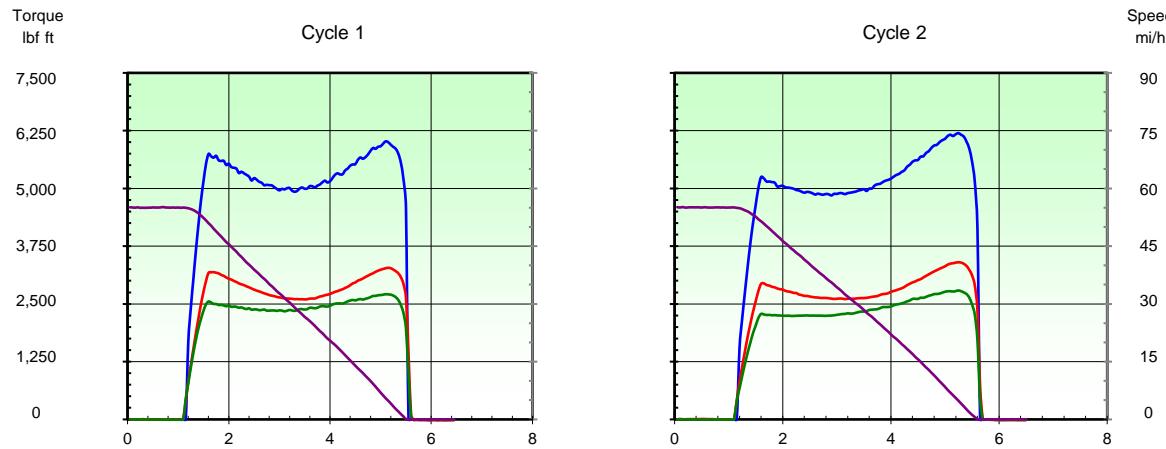
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Test Report Date: 06 March 2020

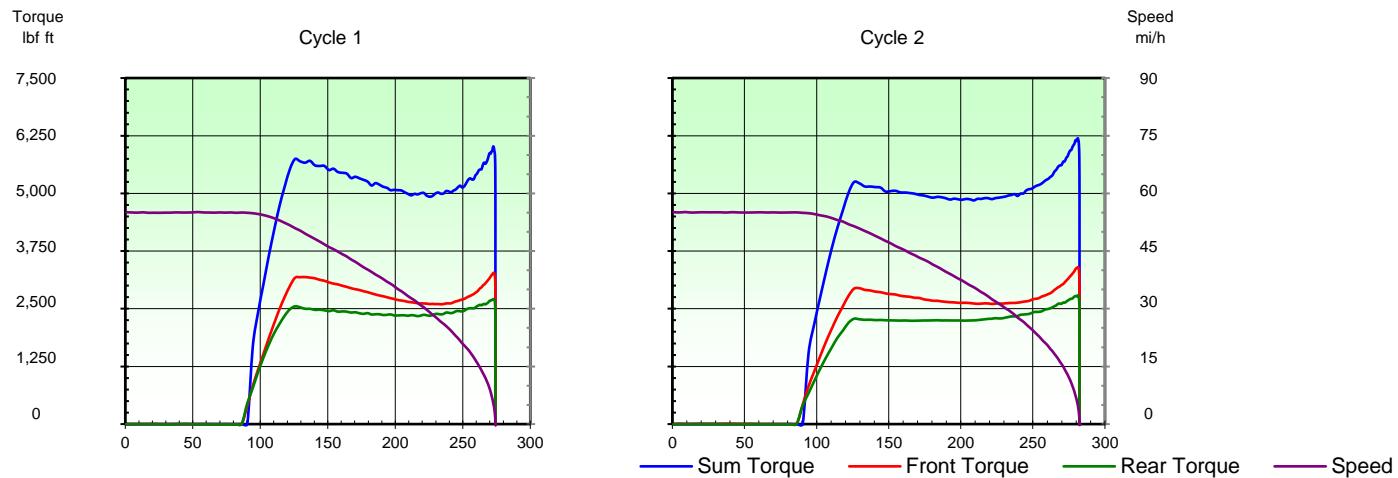
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

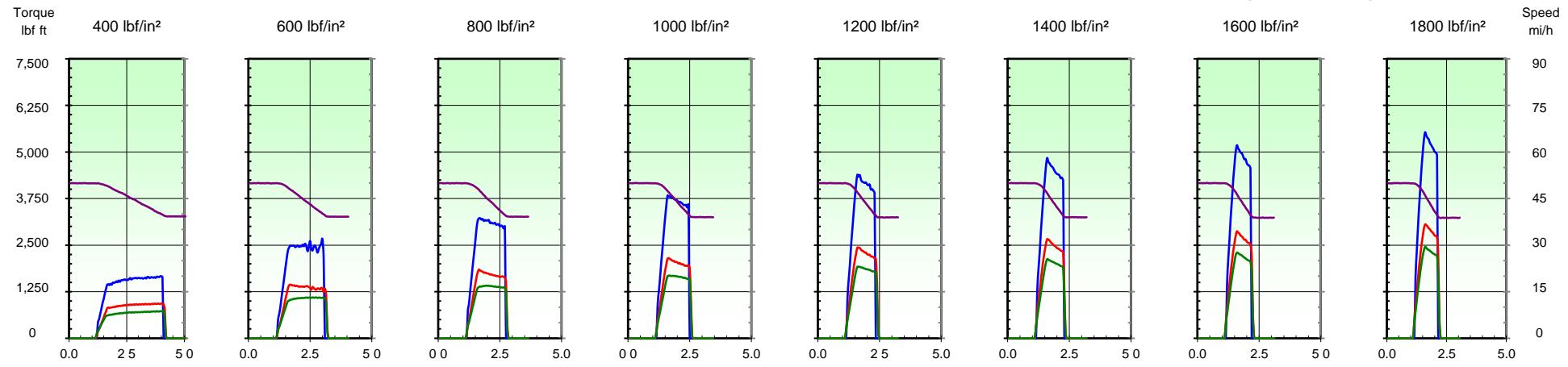
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Test Report Date: 06 March 2020

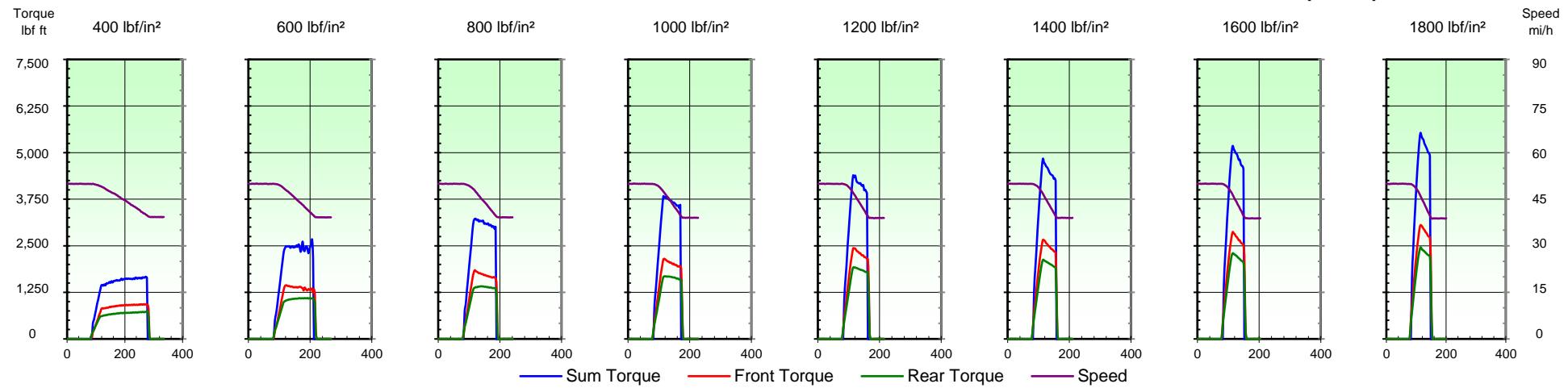
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 50-40 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 50-40 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

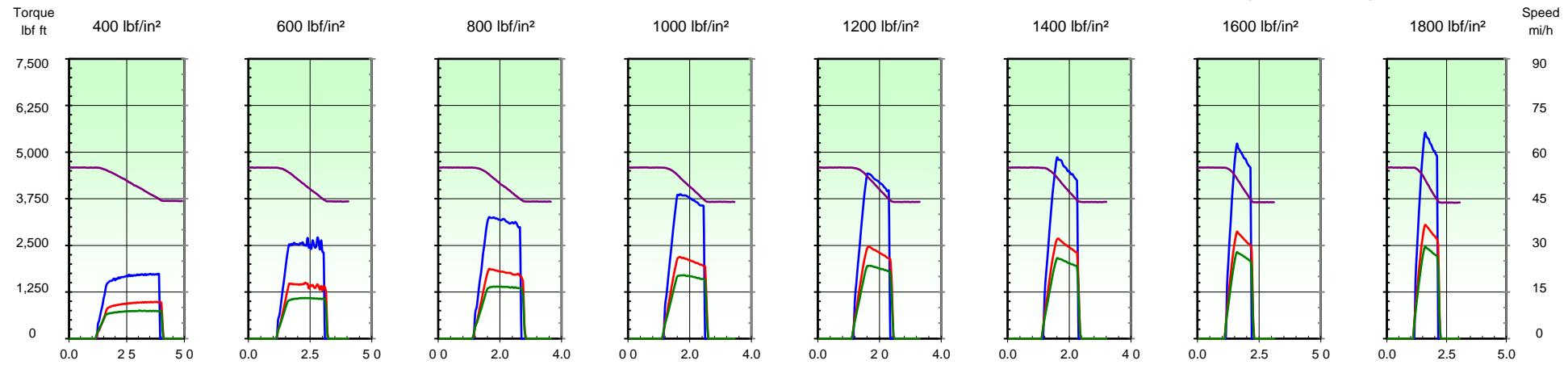
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Test Report Date: 06 March 2020

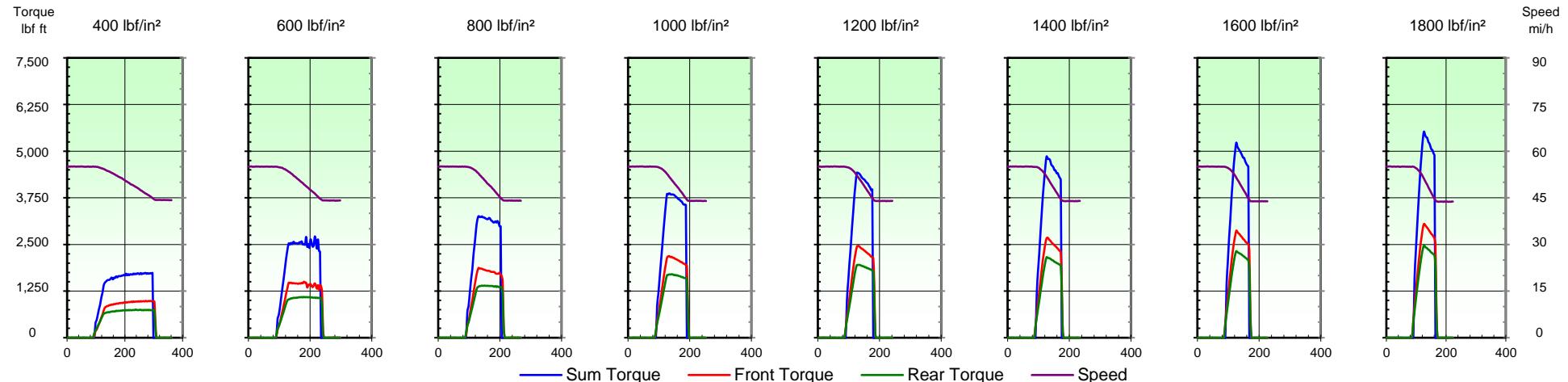
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

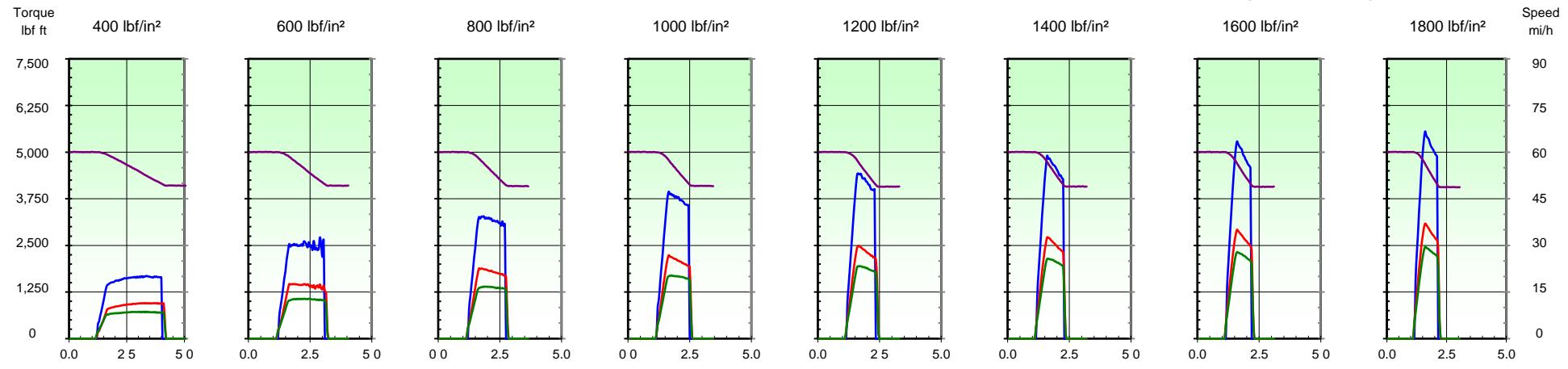
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Test Report Date: 06 March 2020

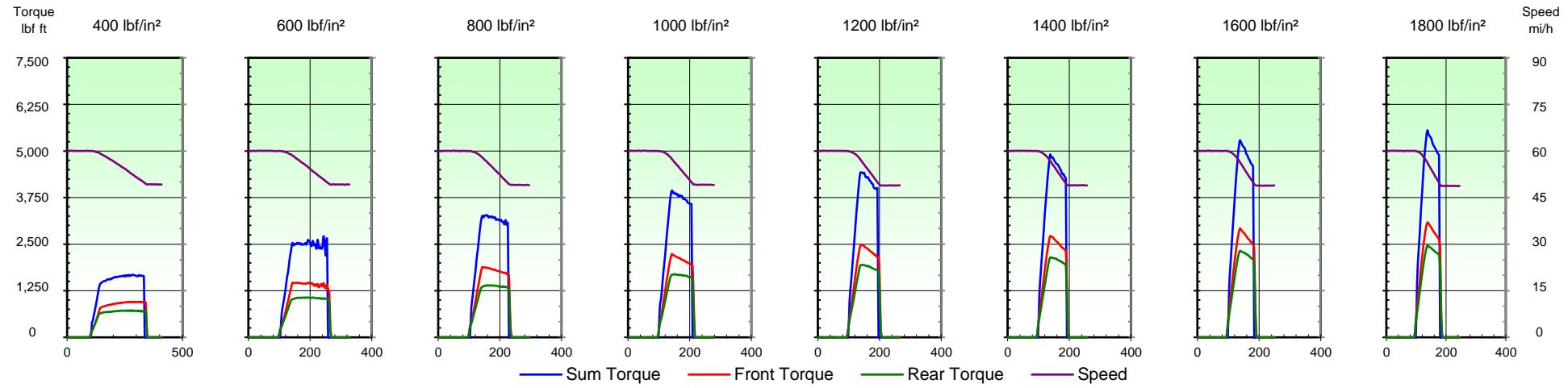
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 60-50 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 60-50 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

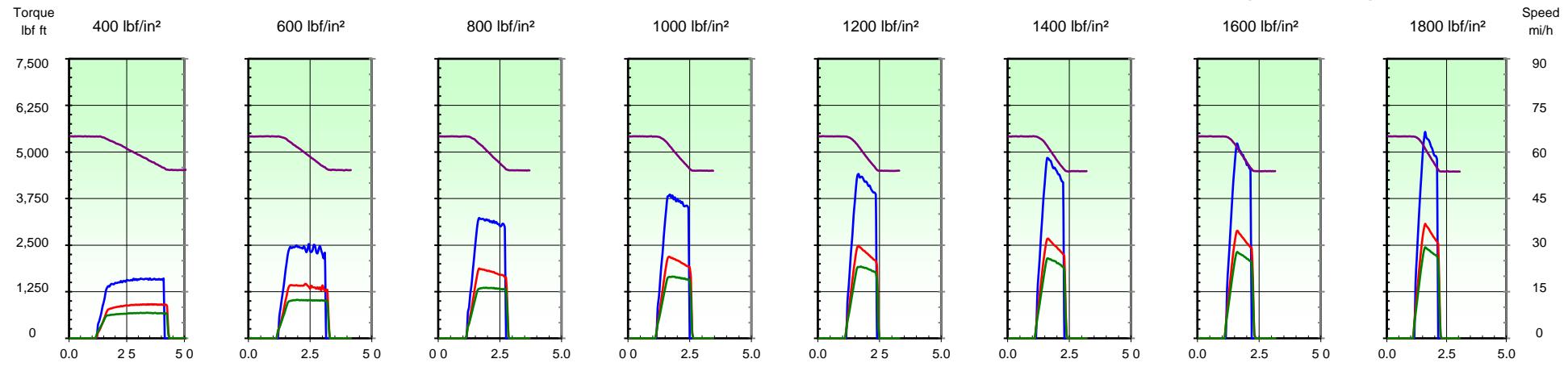
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Test Report Date: 06 March 2020

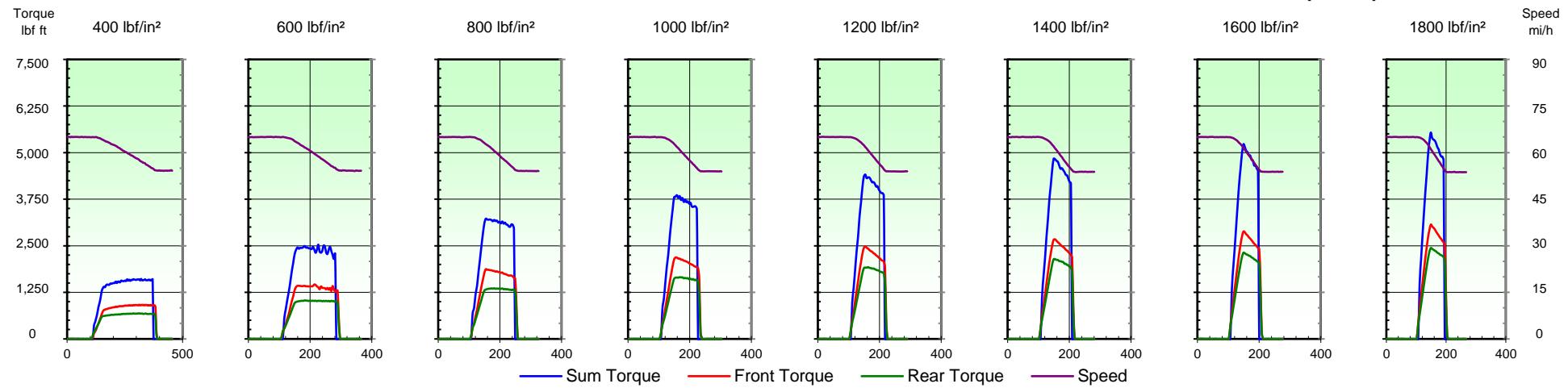
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 65-55 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 65-55 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

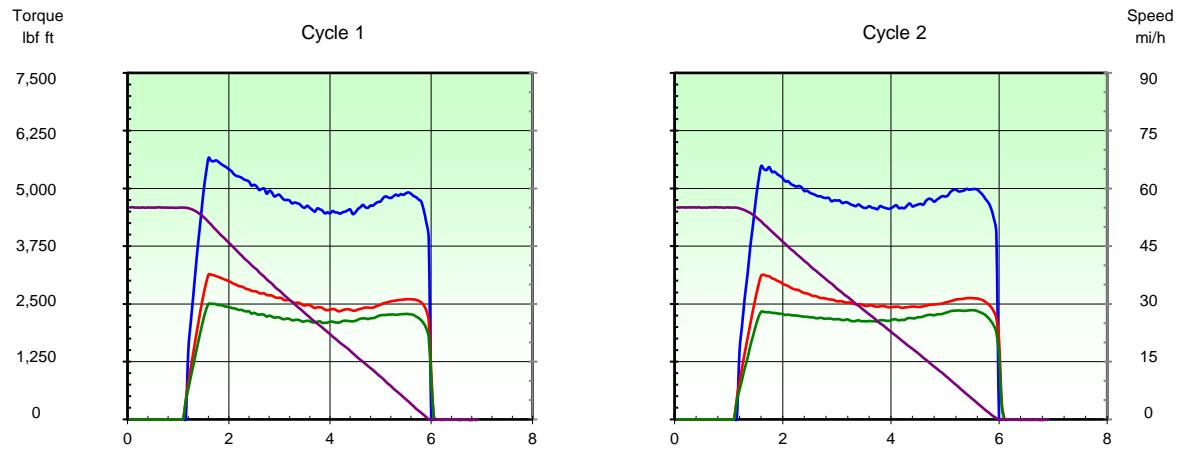
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Test Report Date: 06 March 2020

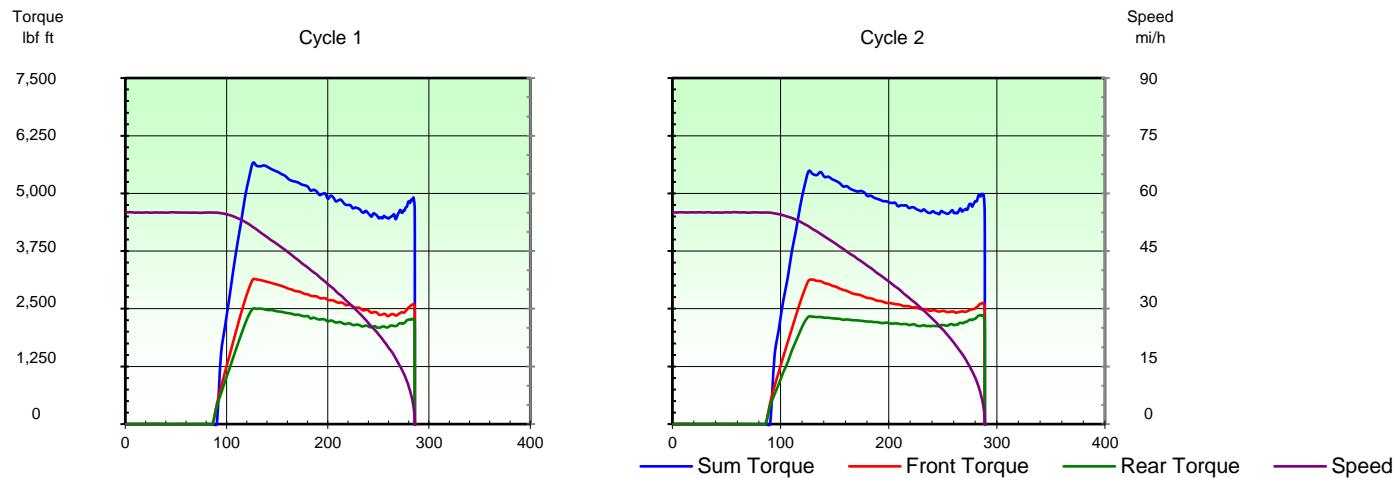
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

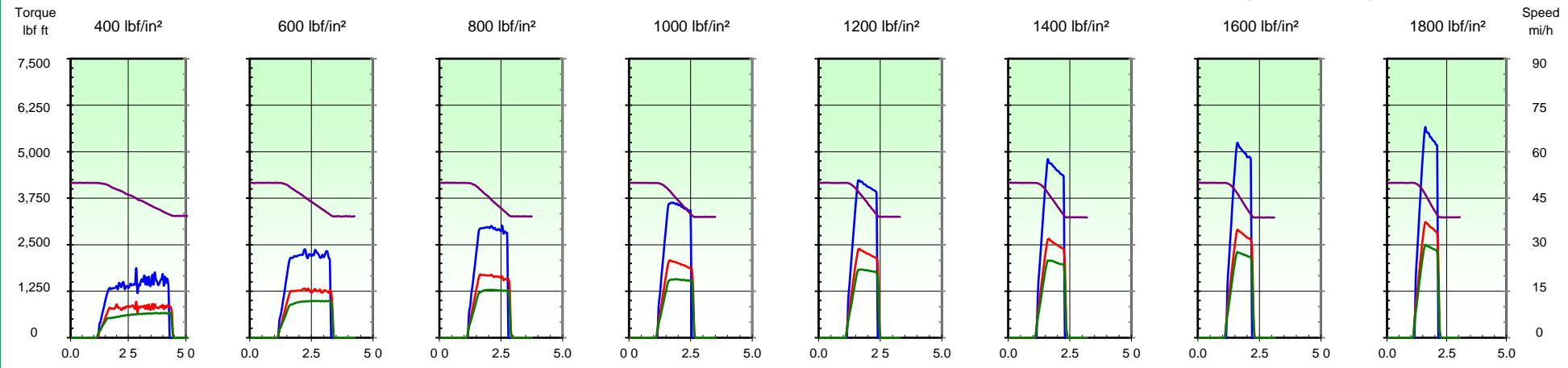
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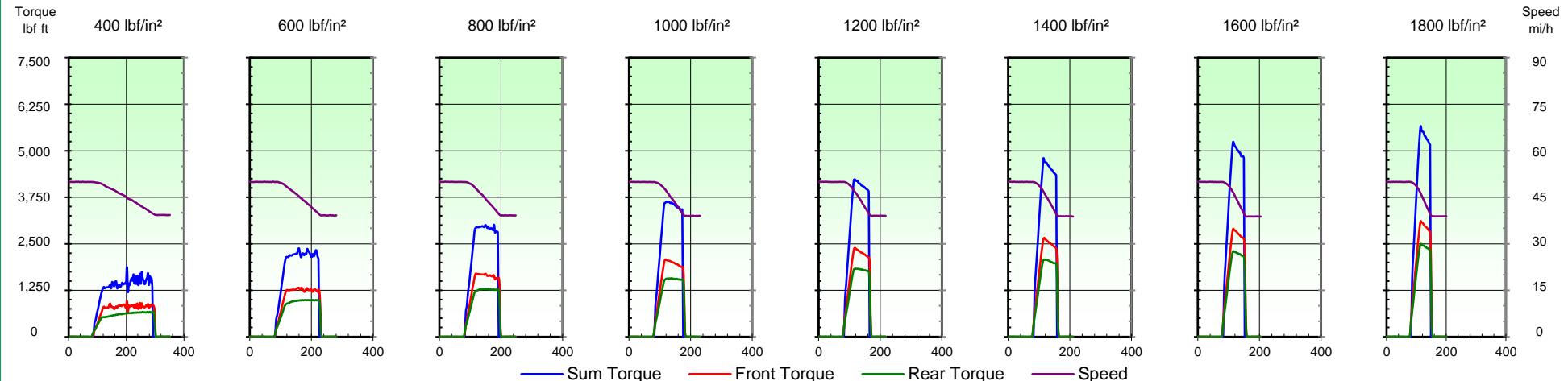
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 50-40 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 50-40 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

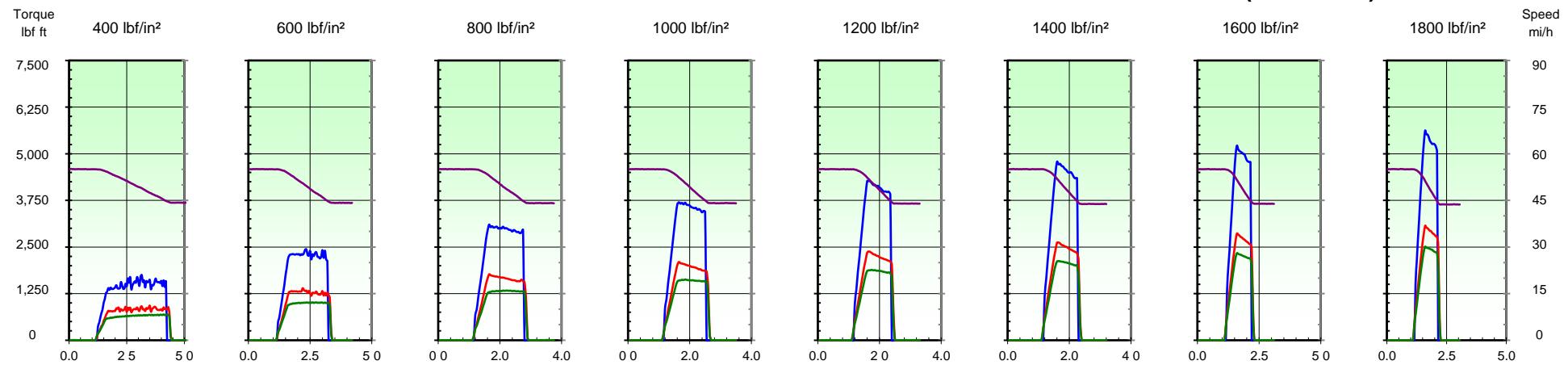
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Test Report Date: 06 March 2020

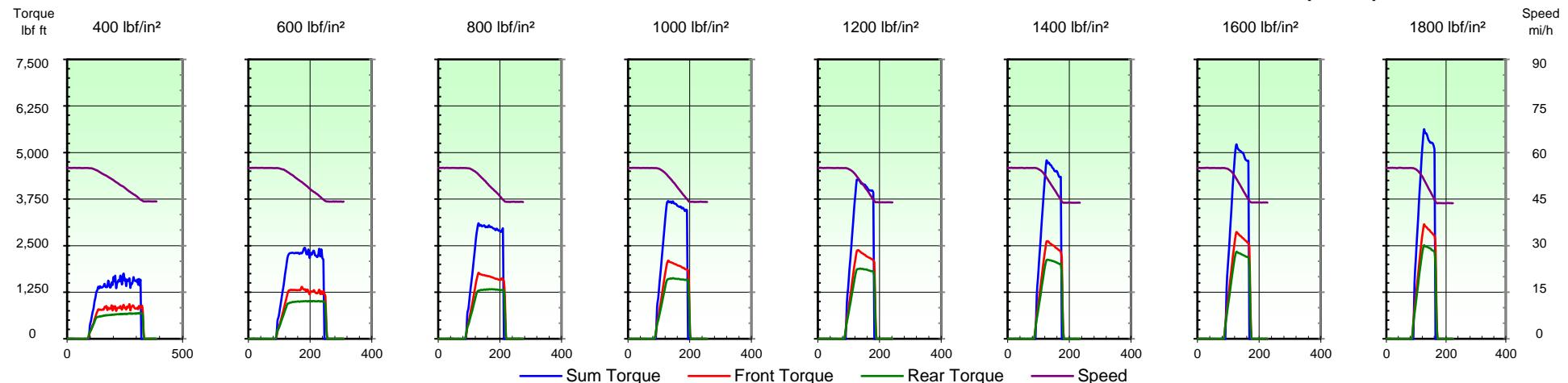
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 55-45 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 55-45 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

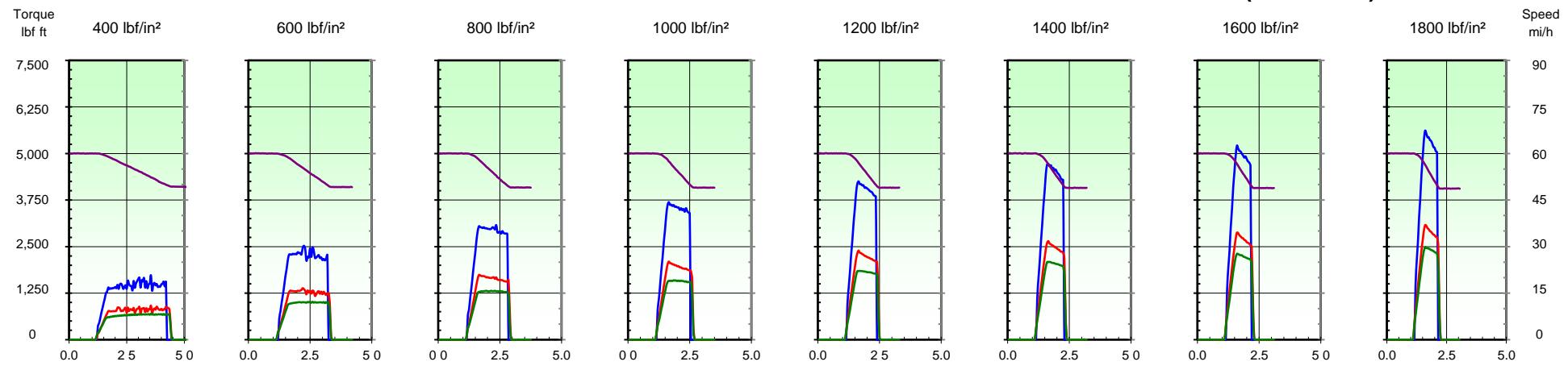
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Test Report Date: 06 March 2020

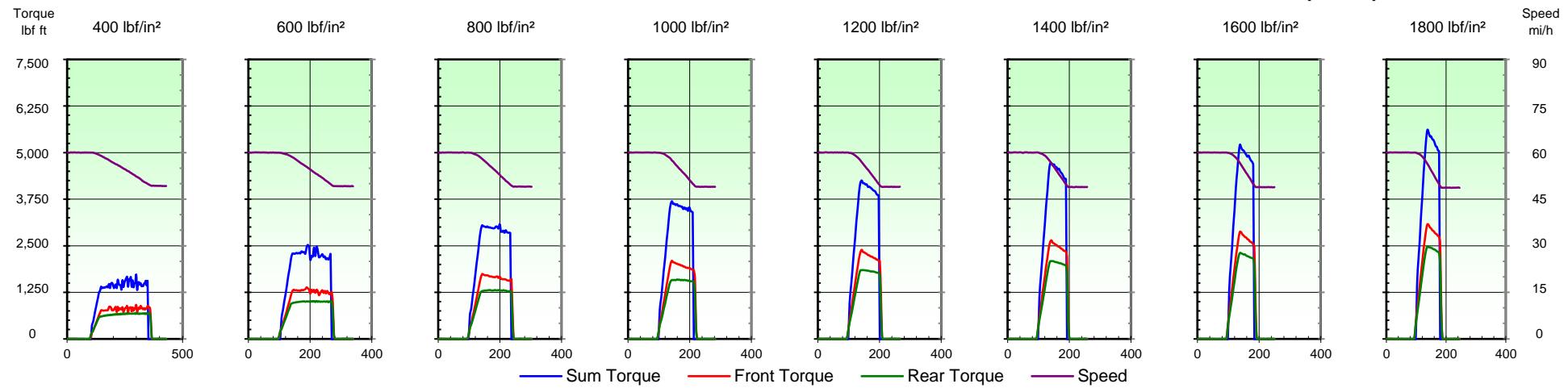
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 60-50 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 60-50 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

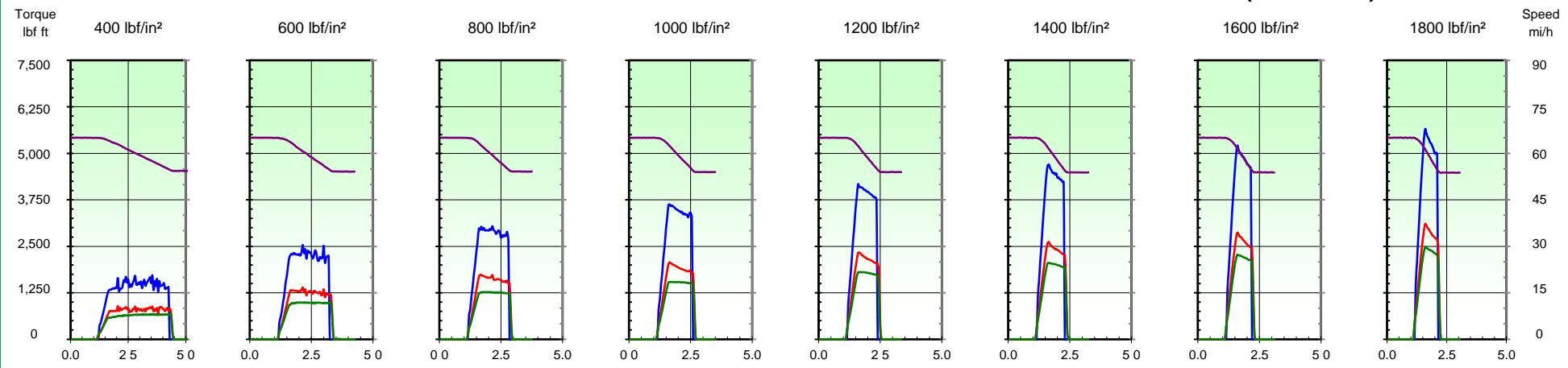
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Test Report Date: 06 March 2020

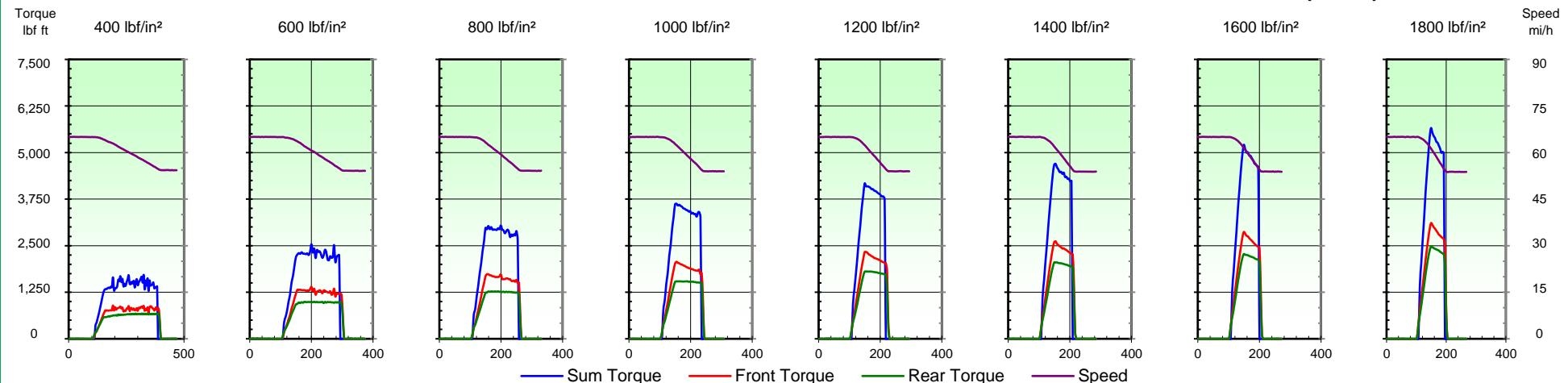
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 65-55 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 65-55 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

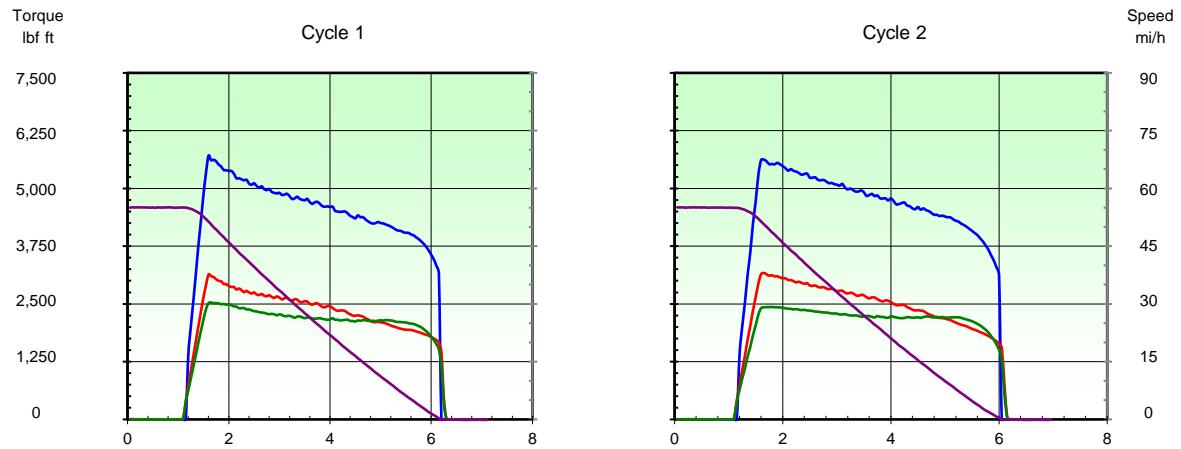
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Test Report Date: 06 March 2020

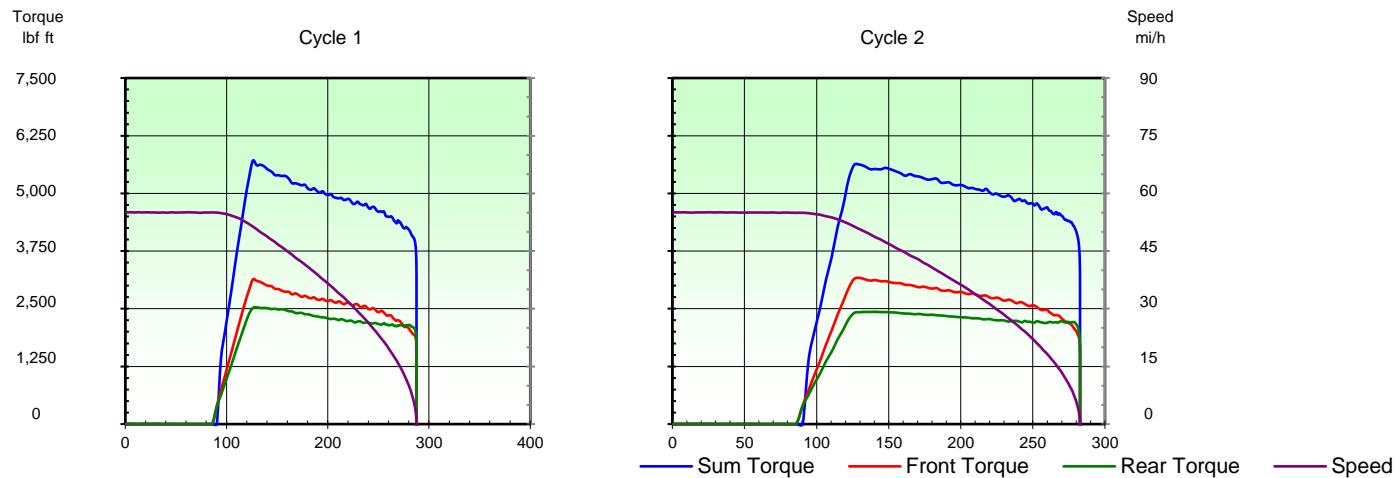
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

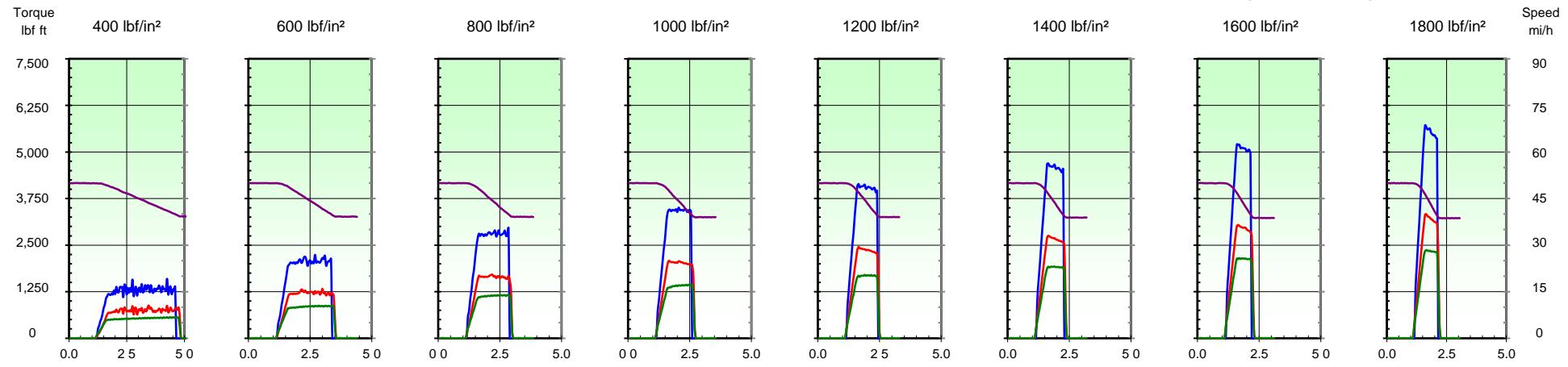
Report Number: 203145-1

Test Report Date: 06 March 2020

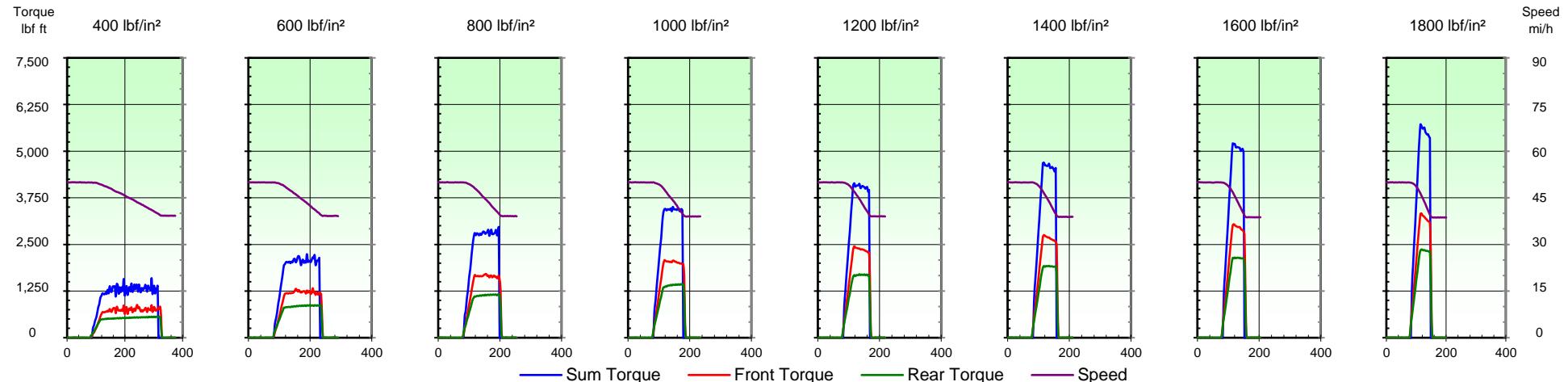
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 50-40 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 50-40 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

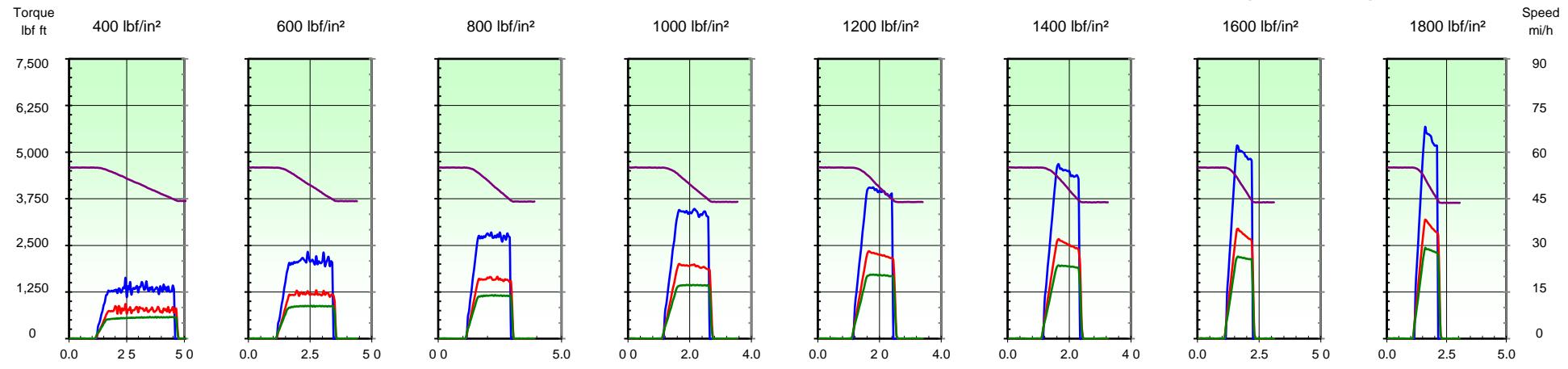
Report Number: 203145-1

Test Report Date: 06 March 2020

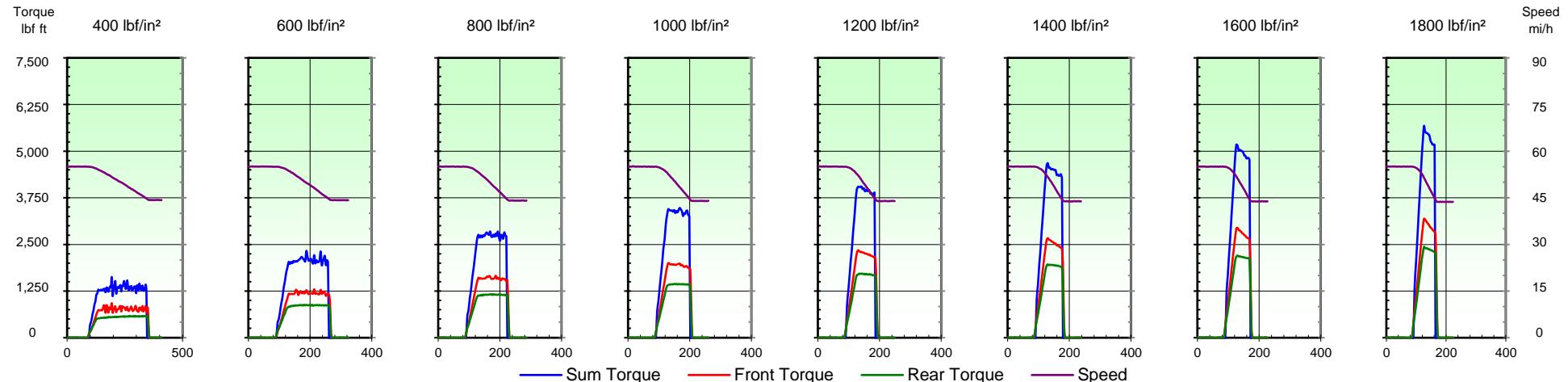
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 55-45 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 55-45 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

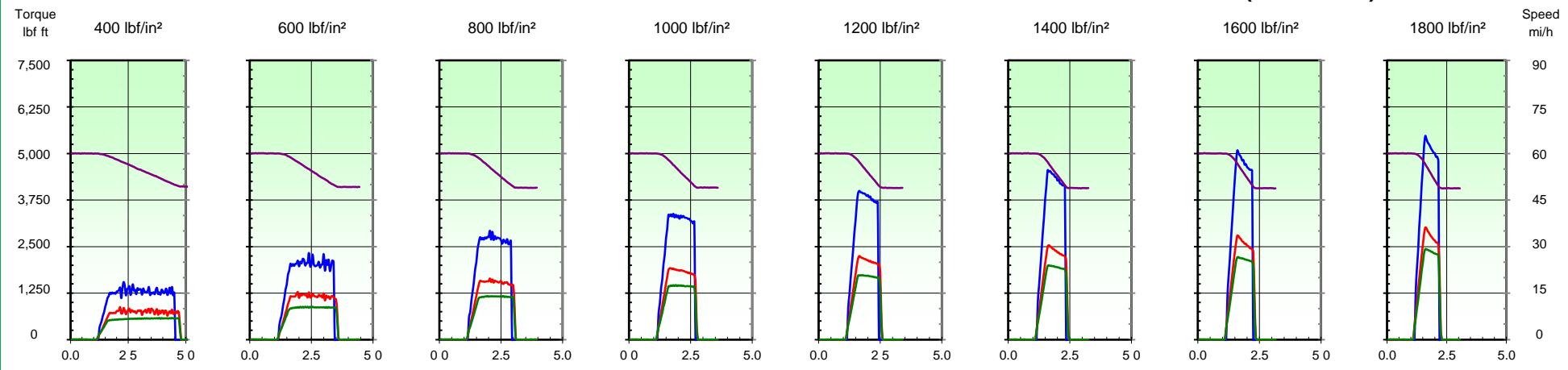
Report Number: 203145-1

Test Report Date: 06 March 2020

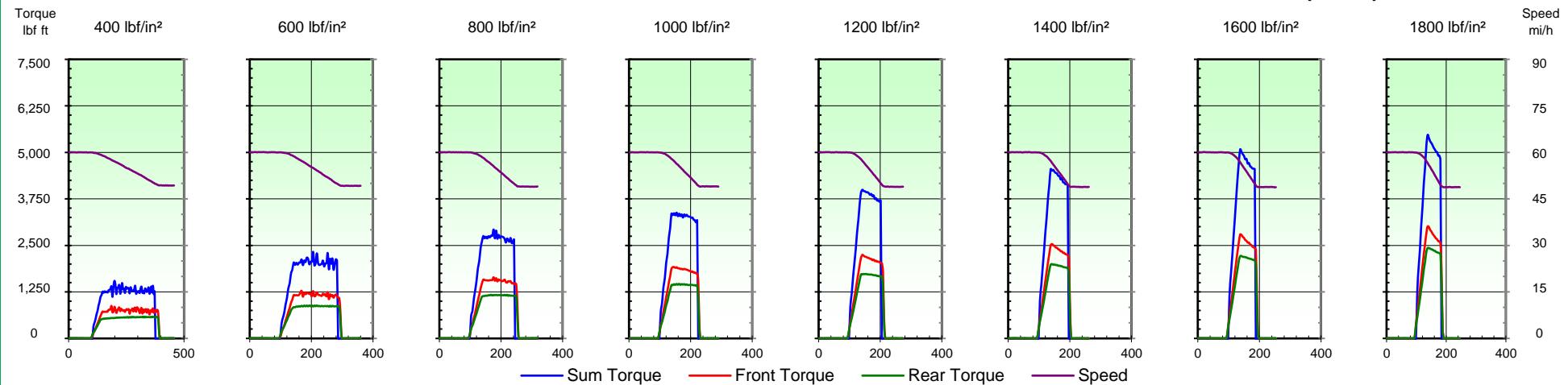
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 60-50 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 60-50 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

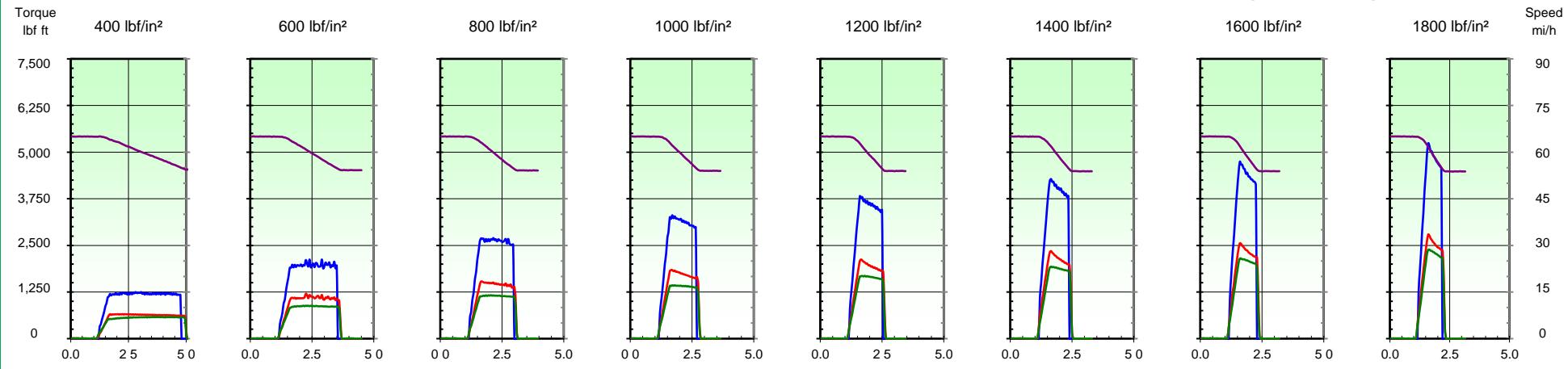
Report Number: 203145-1

Test Report Date: 06 March 2020

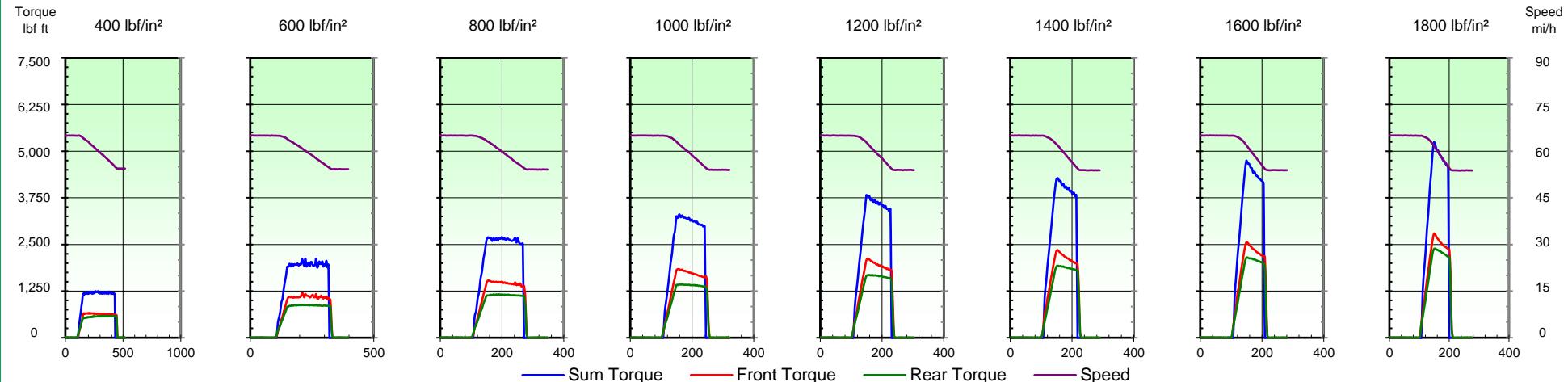
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 65-55 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 65-55 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

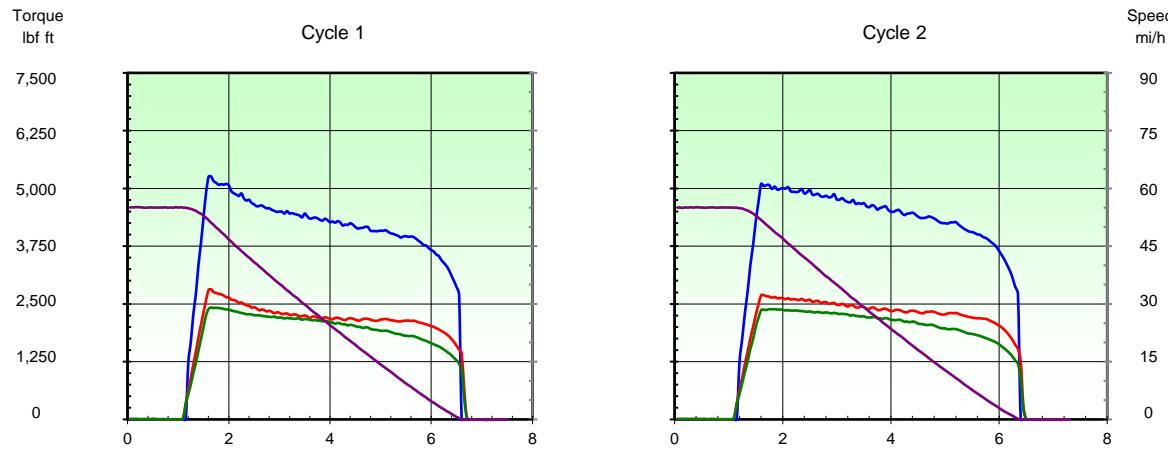
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Test Report Date: 06 March 2020

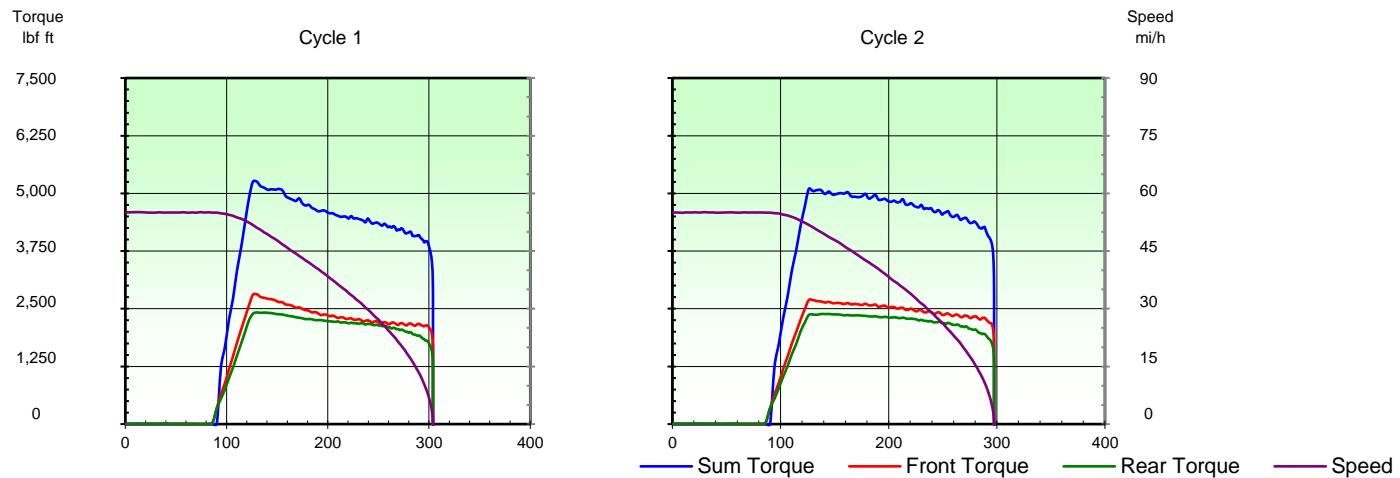
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

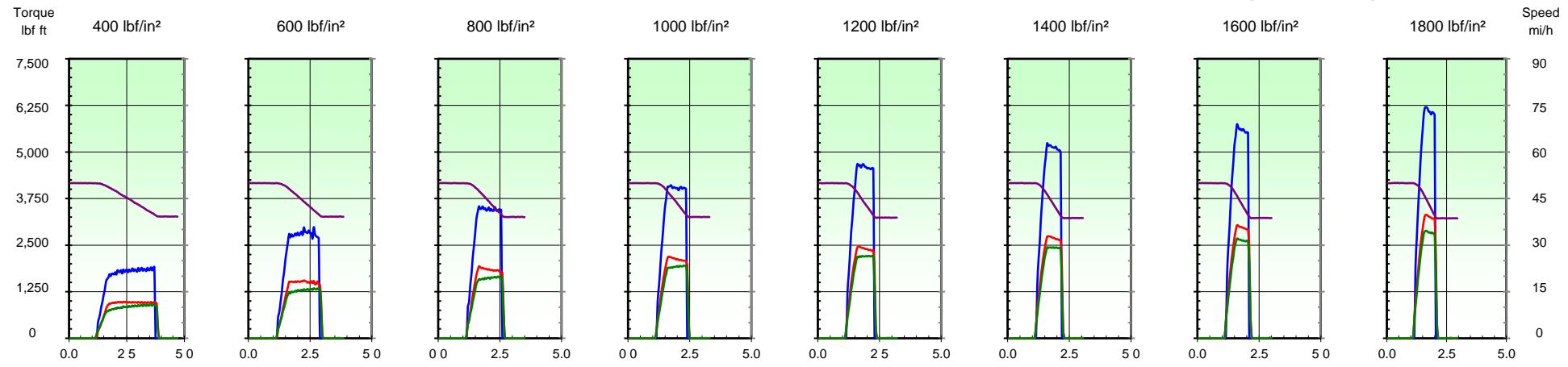
Report Number: 203145-1

Test Report Date: 06 March 2020

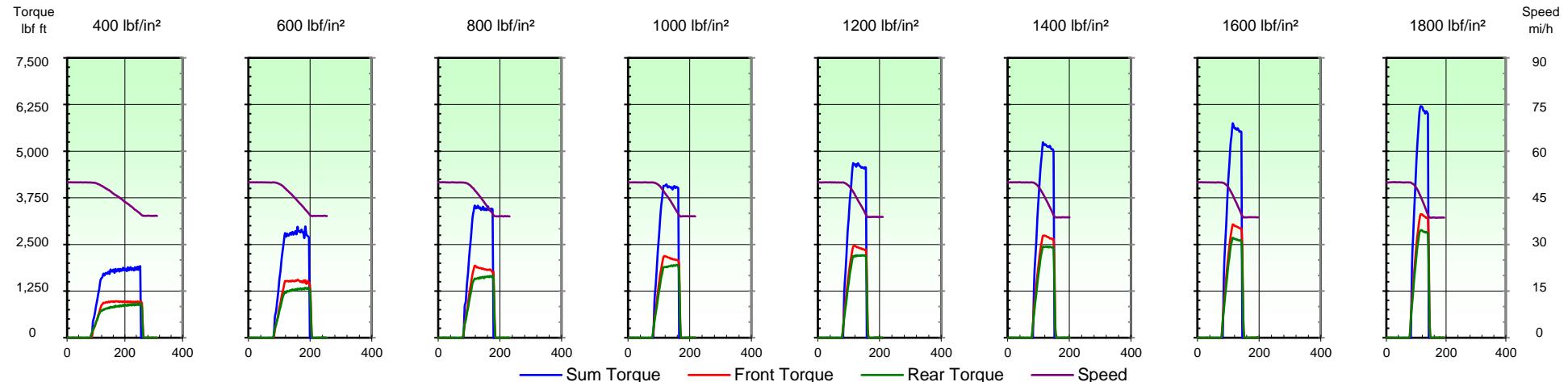
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

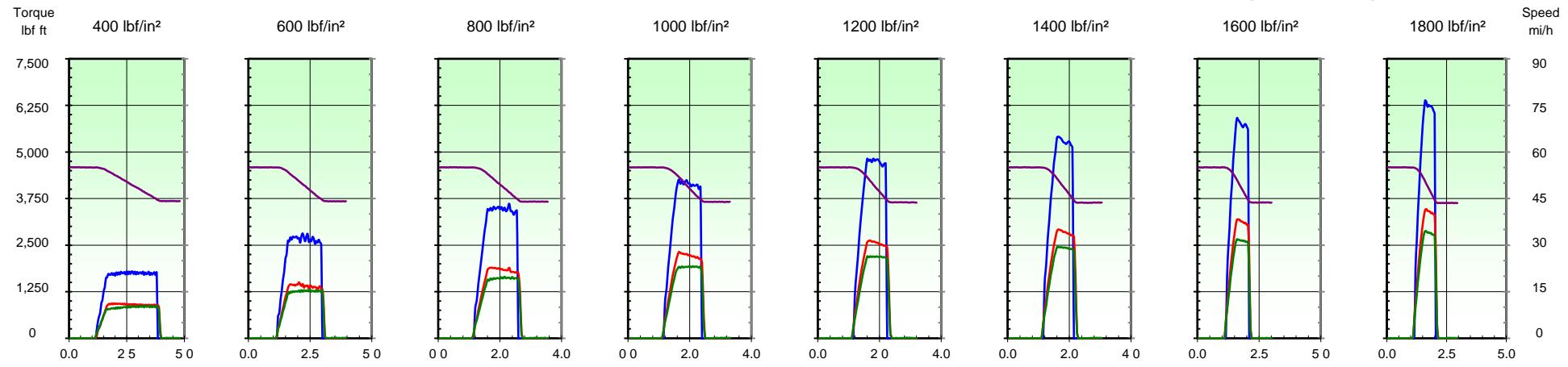
Report Number: 203145-1

Test Report Date: 06 March 2020

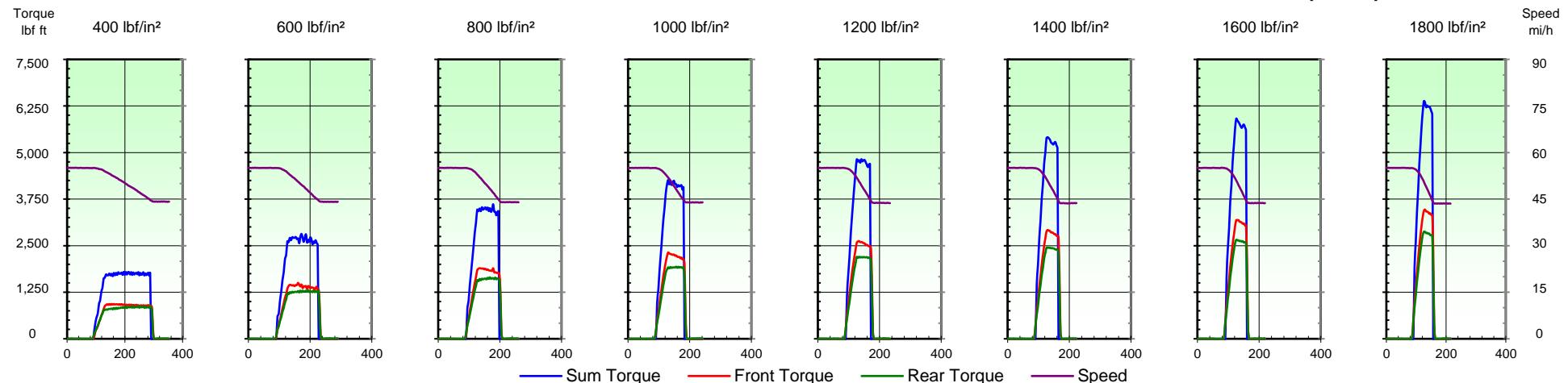
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

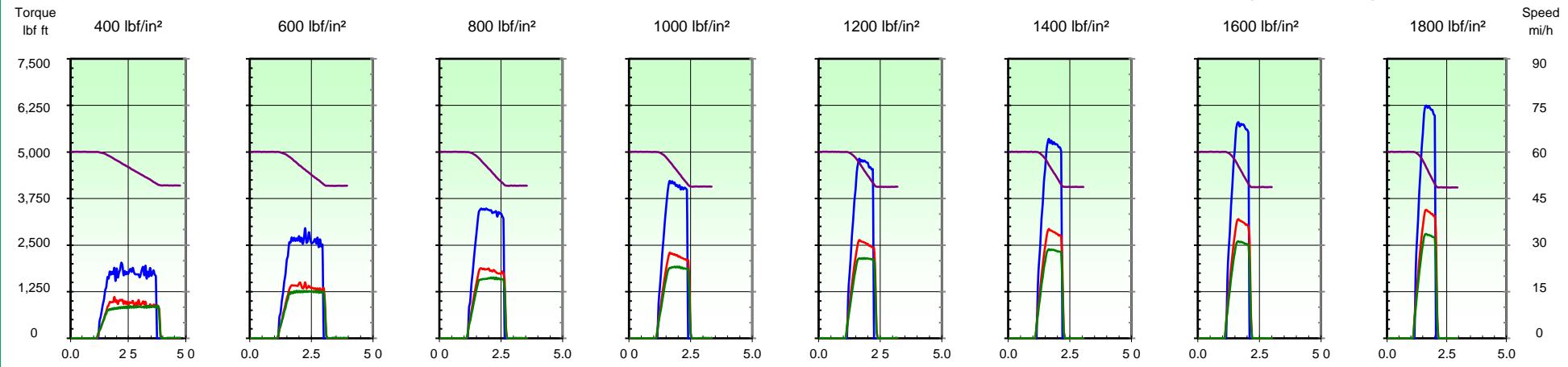
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Test Report Date: 06 March 2020

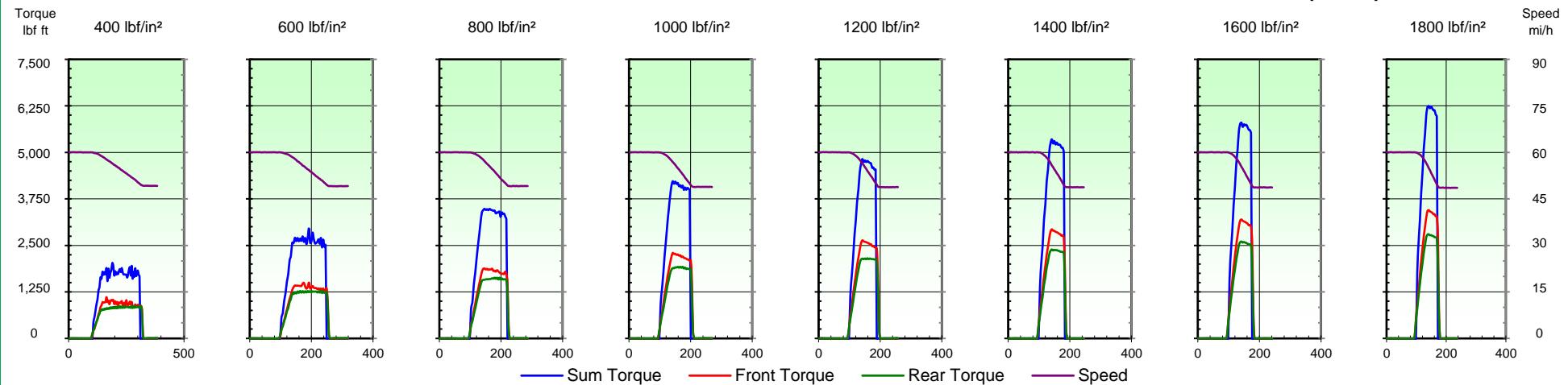
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 60-50 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 60-50 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

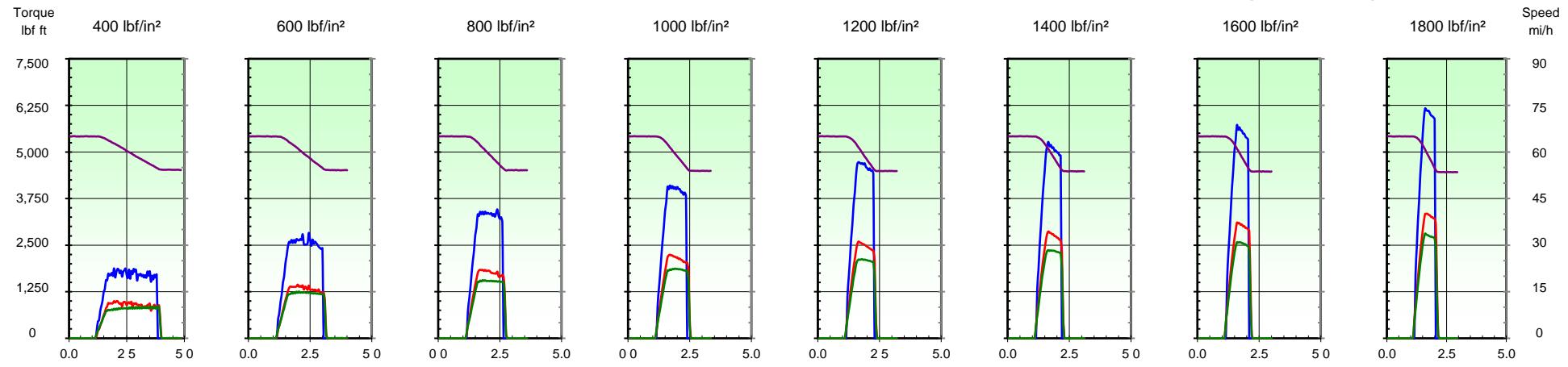
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Test Report Date: 06 March 2020

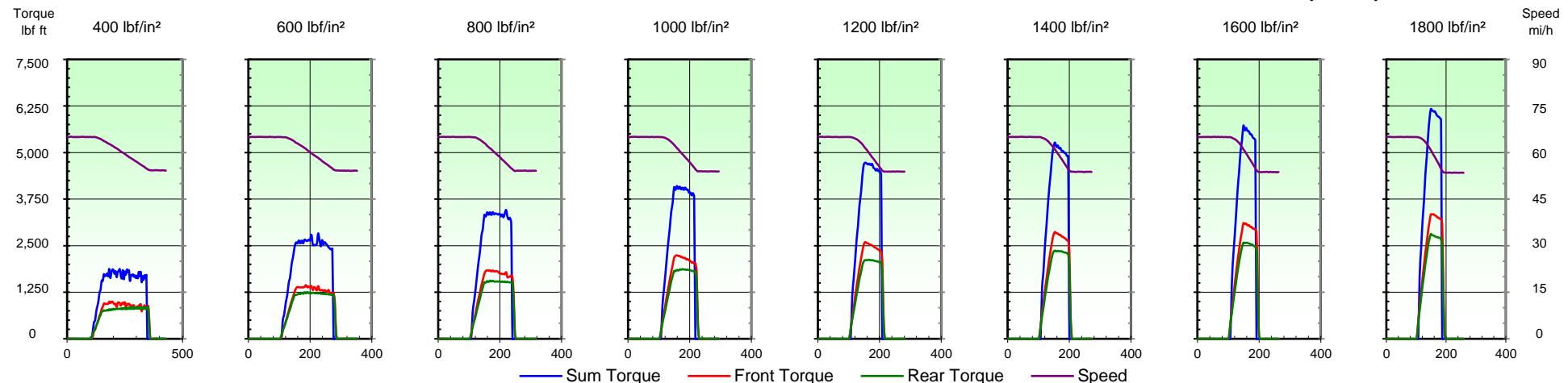
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 65-55 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 65-55 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

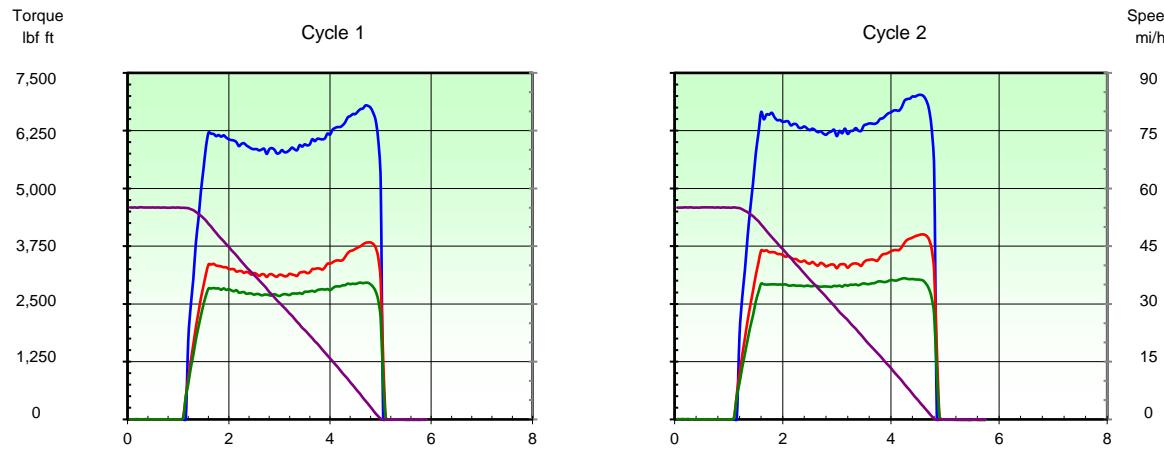
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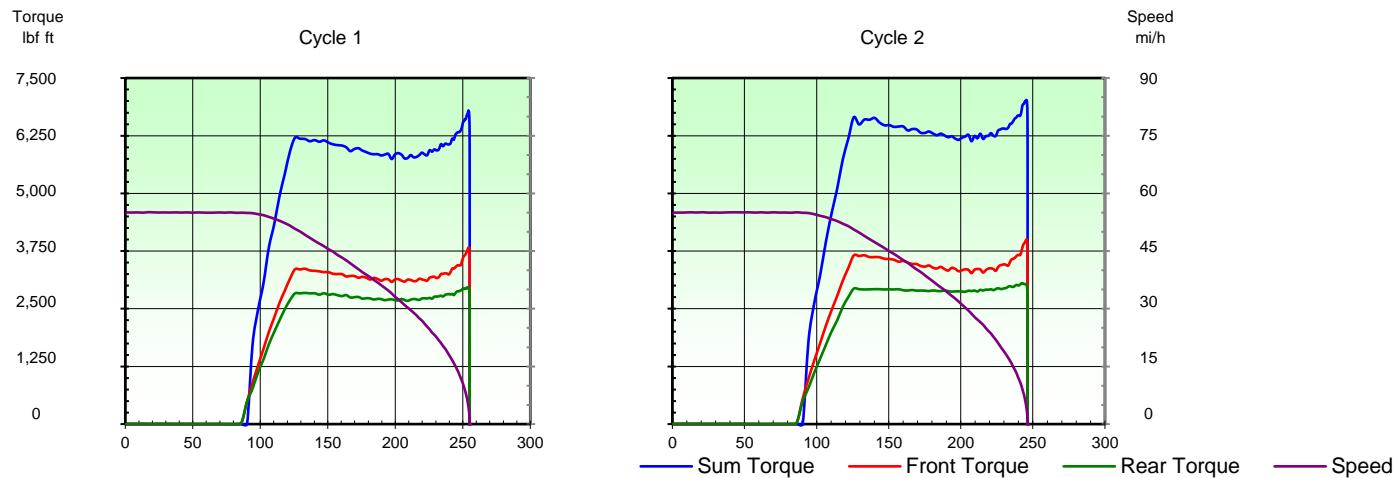
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2nd EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

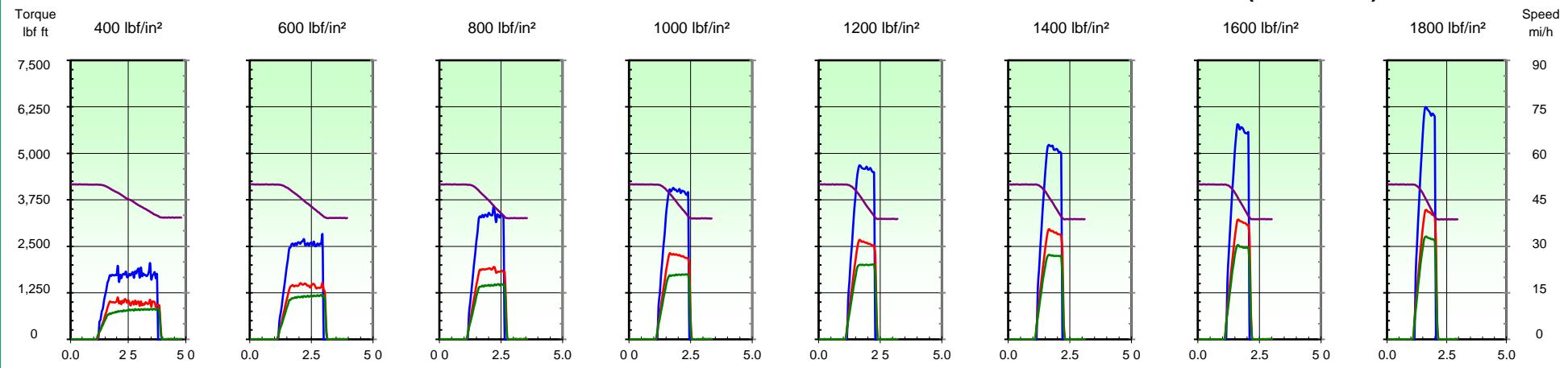
Report Number: 203145-1

Test Report Date: 06 March 2020

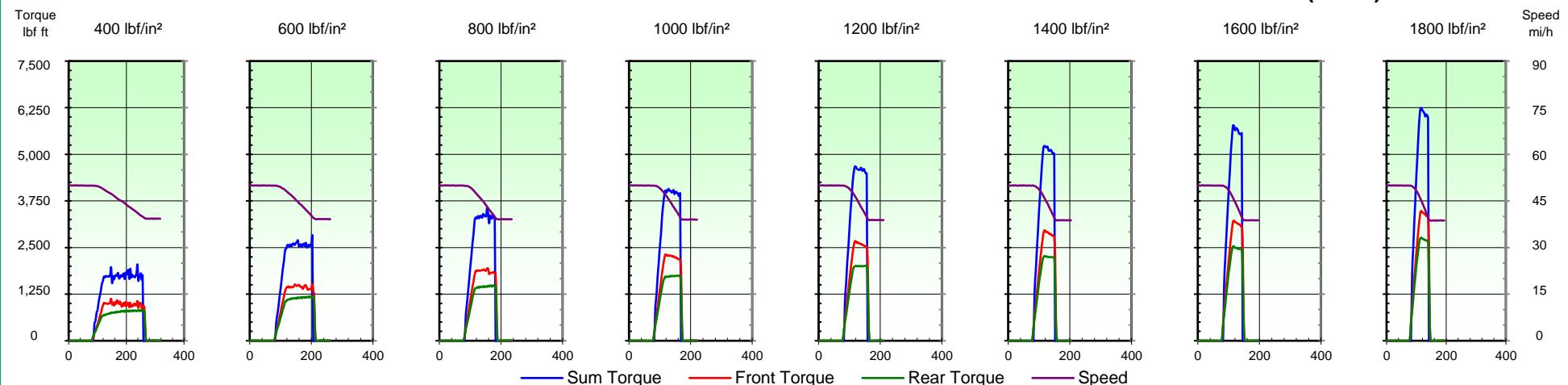
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 50-40 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 50-40 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

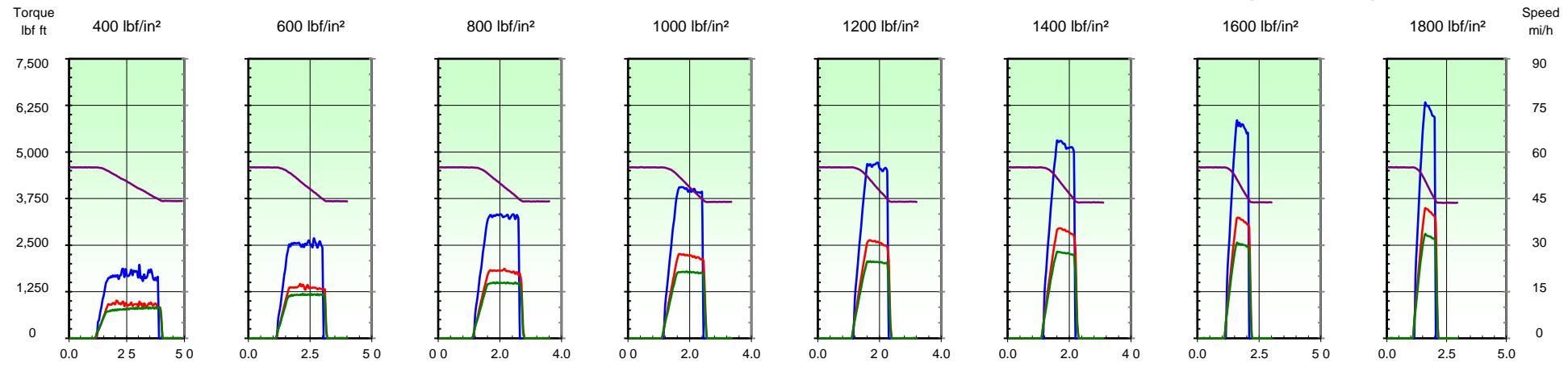
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Test Report Date: 06 March 2020

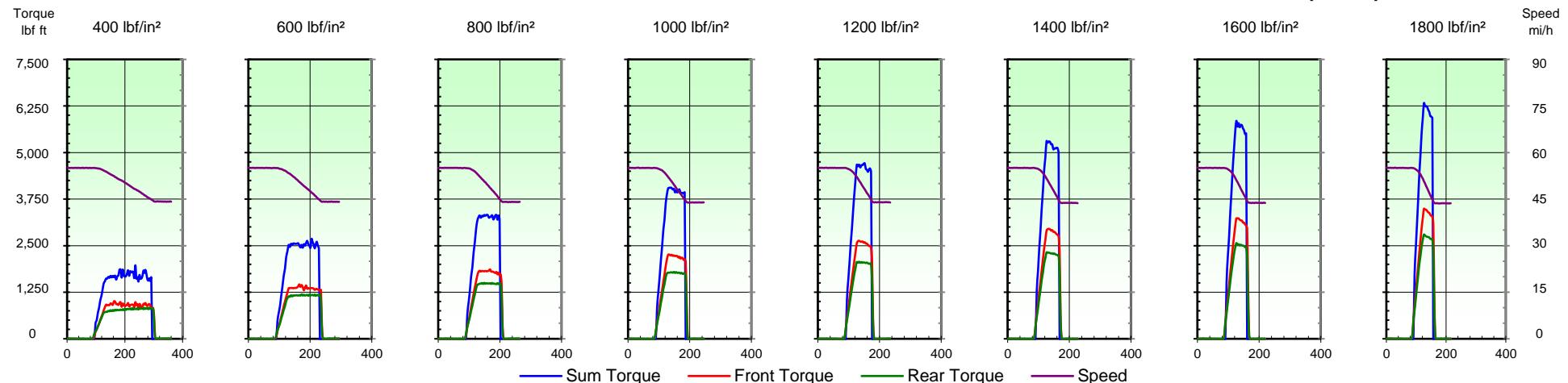
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

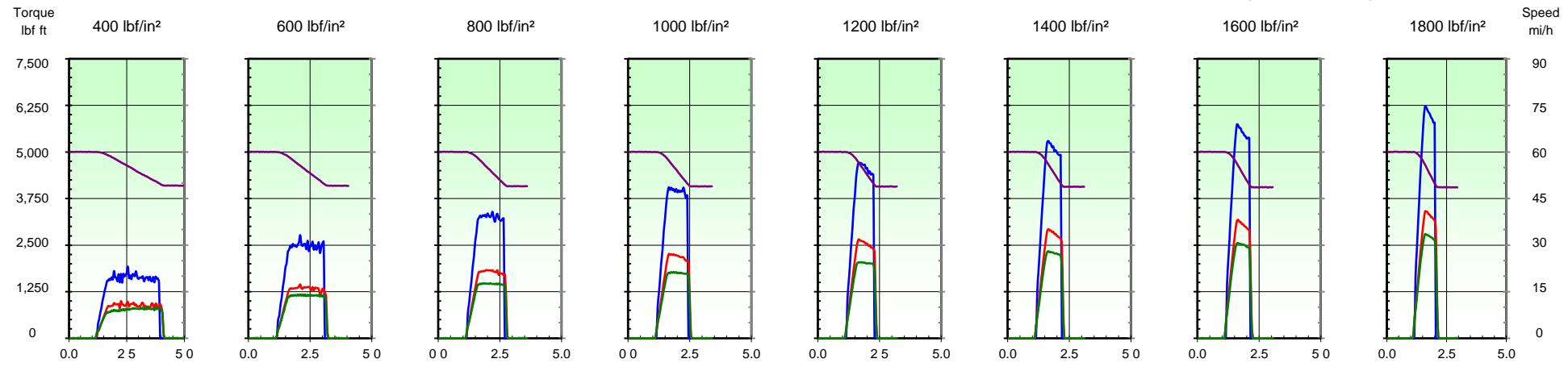
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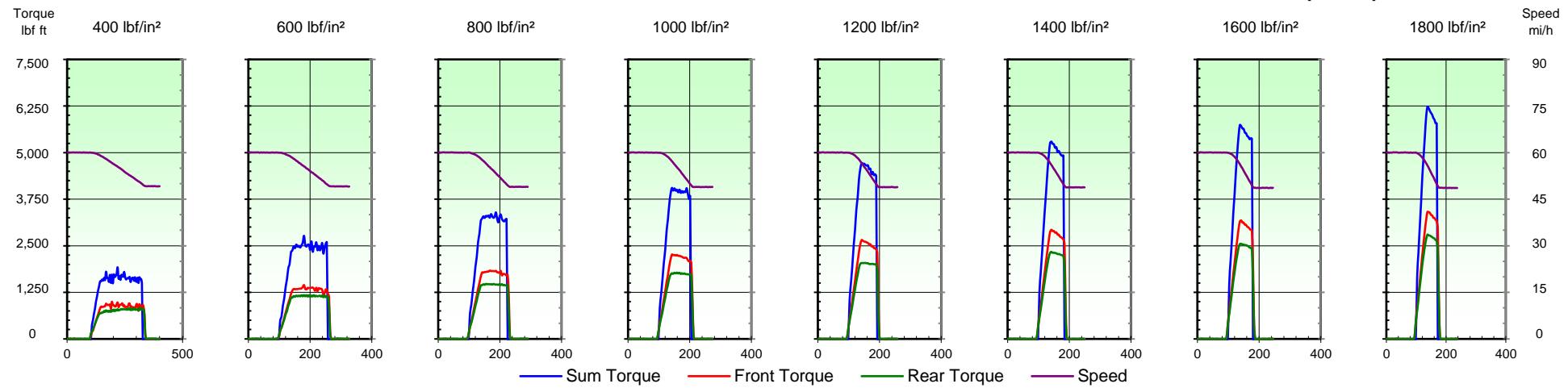
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 60-50 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 60-50 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

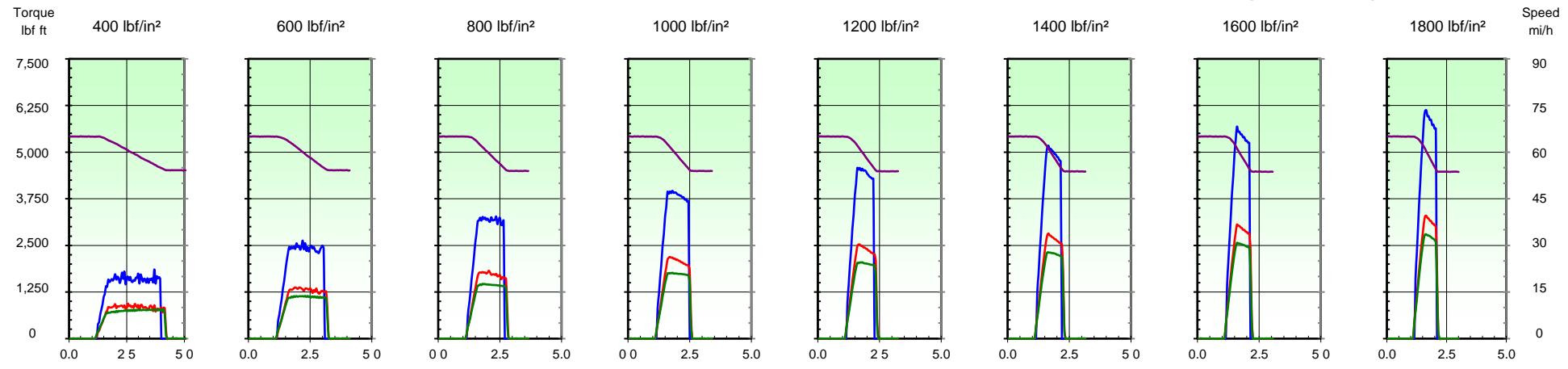
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Test Report Date: 06 March 2020

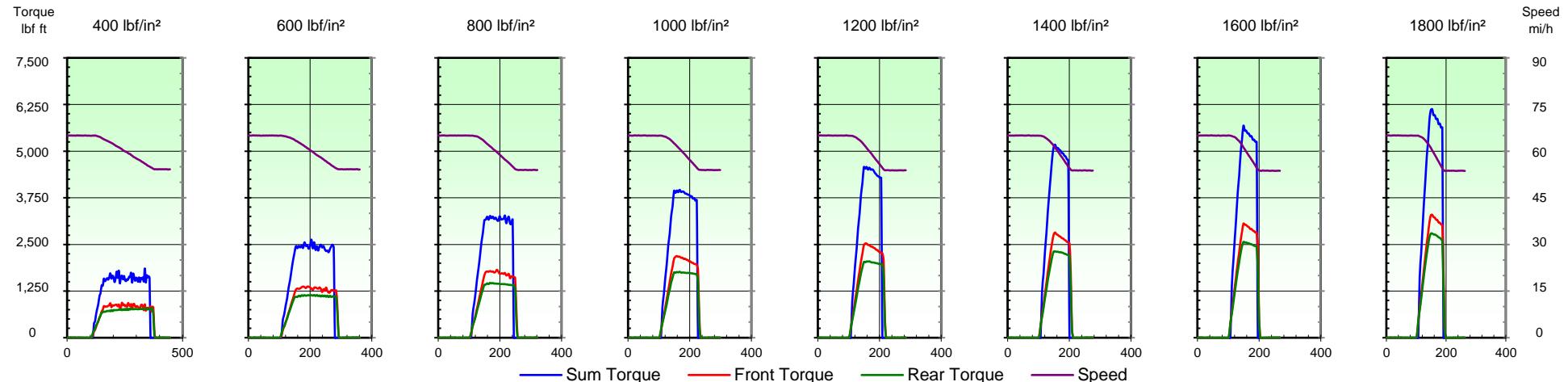
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 65-55 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 65-55 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

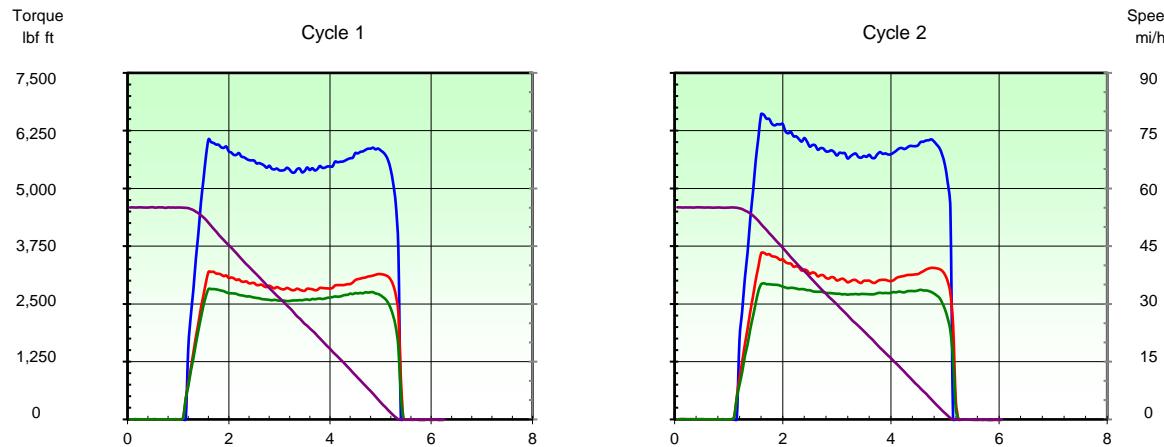
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Test Report Date: 06 March 2020

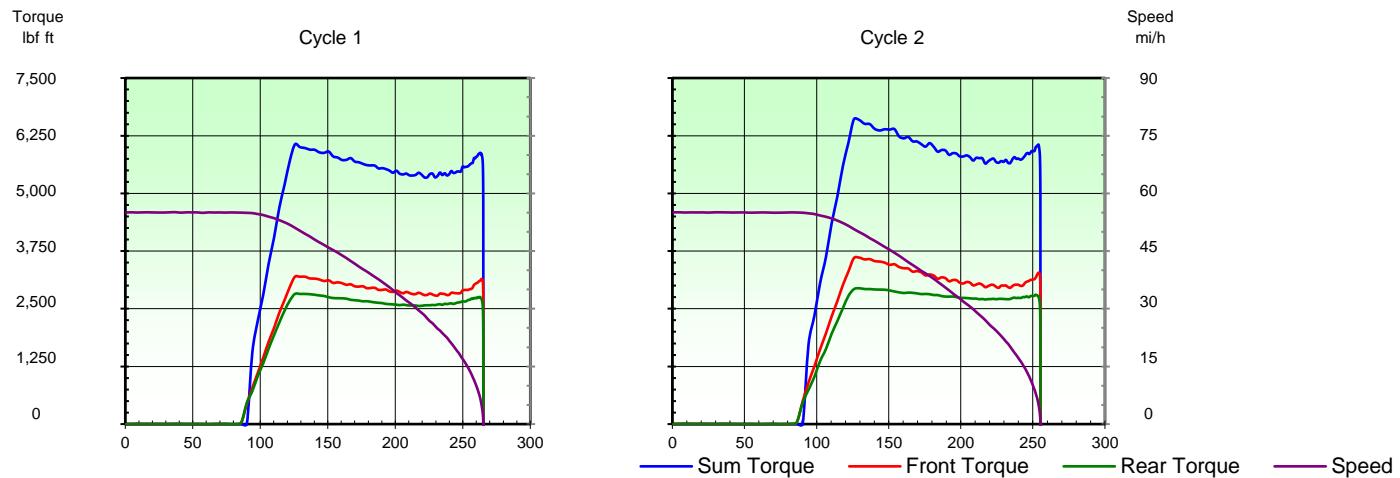
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2nd EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

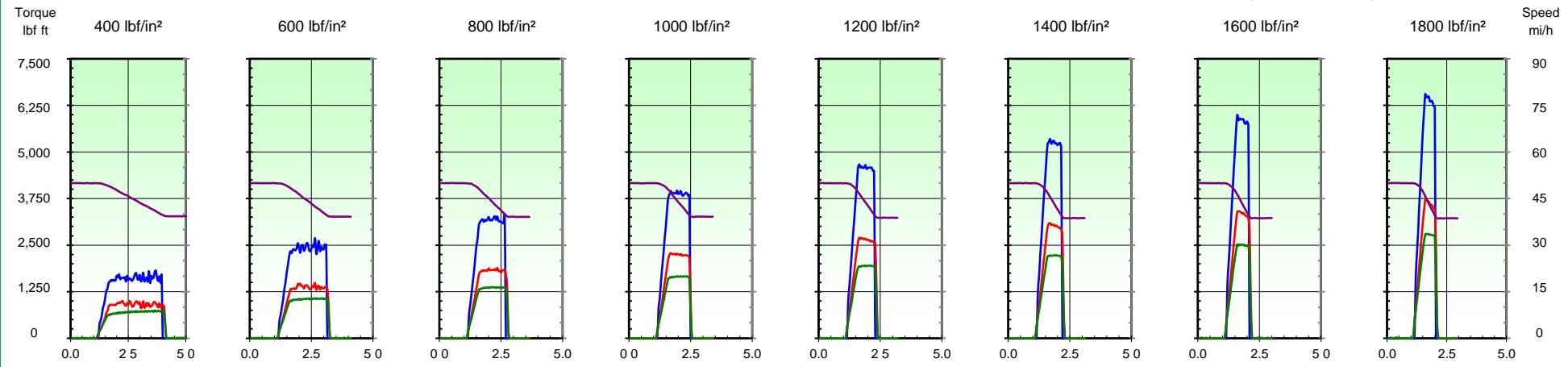
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Test Report Date: 06 March 2020

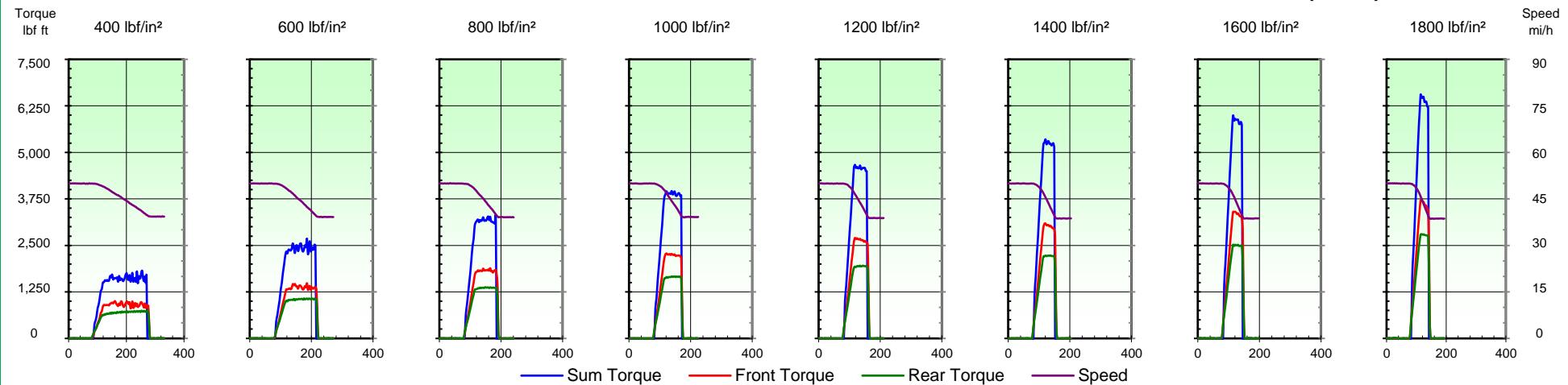
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 50-40 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 50-40 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

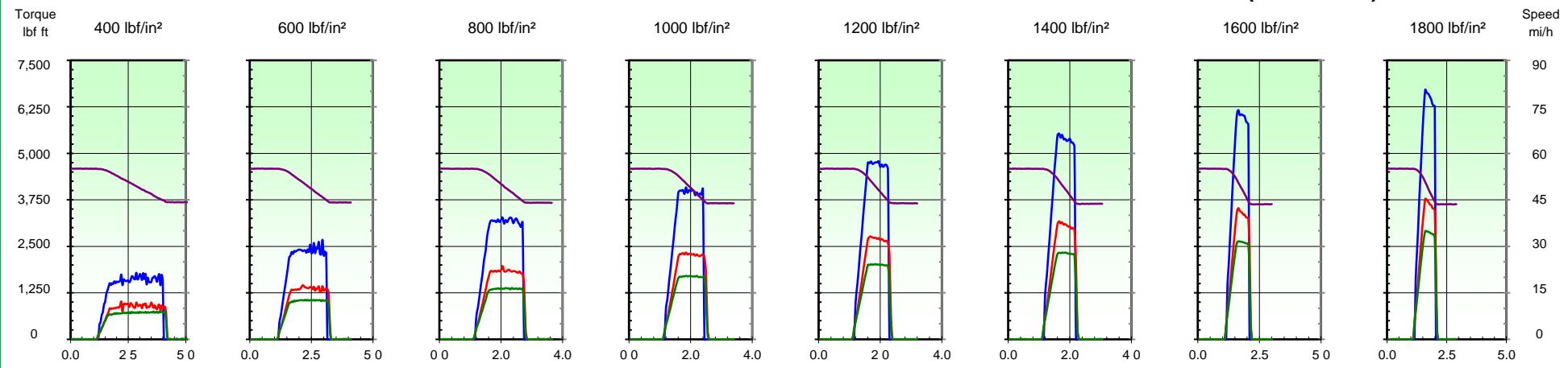
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Test Report Date: 06 March 2020

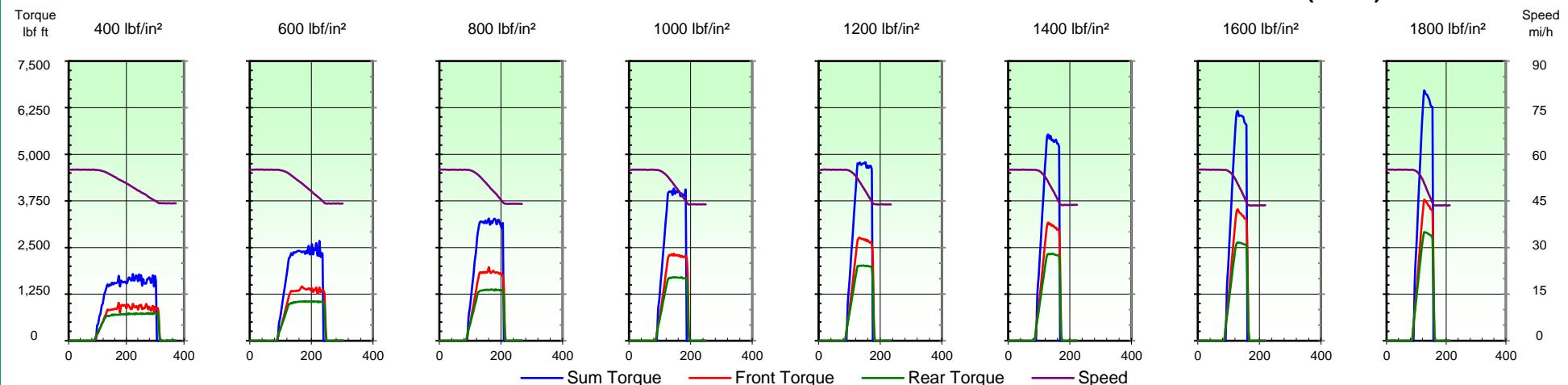
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 55-45 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 55-45 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

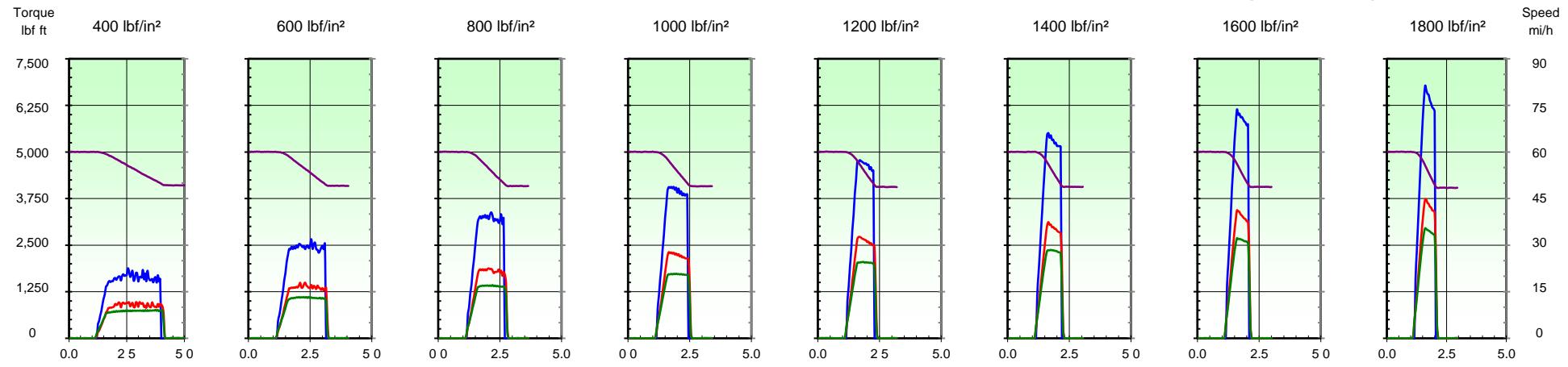
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Test Report Date: 06 March 2020

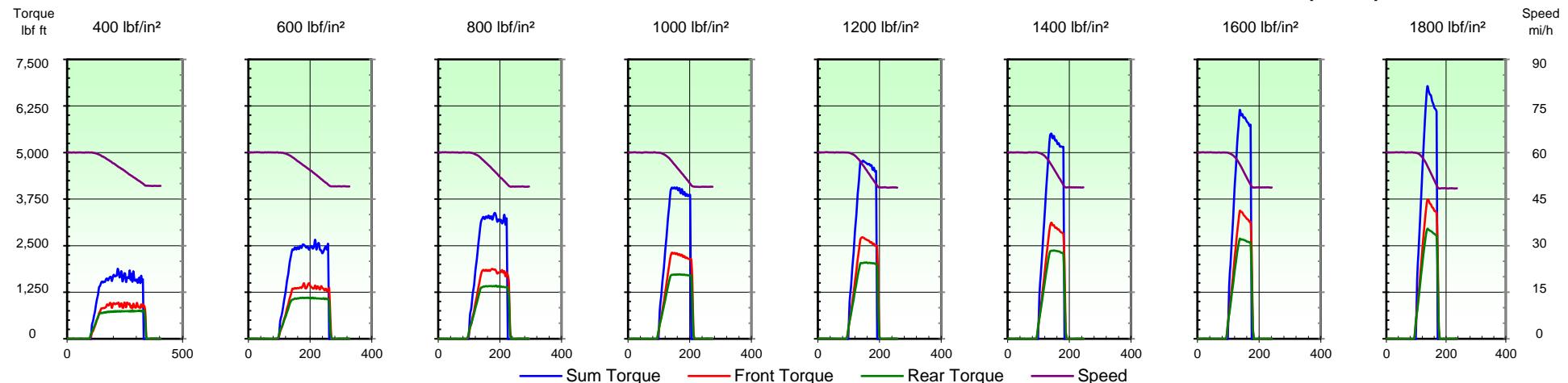
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 60-50 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 60-50 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

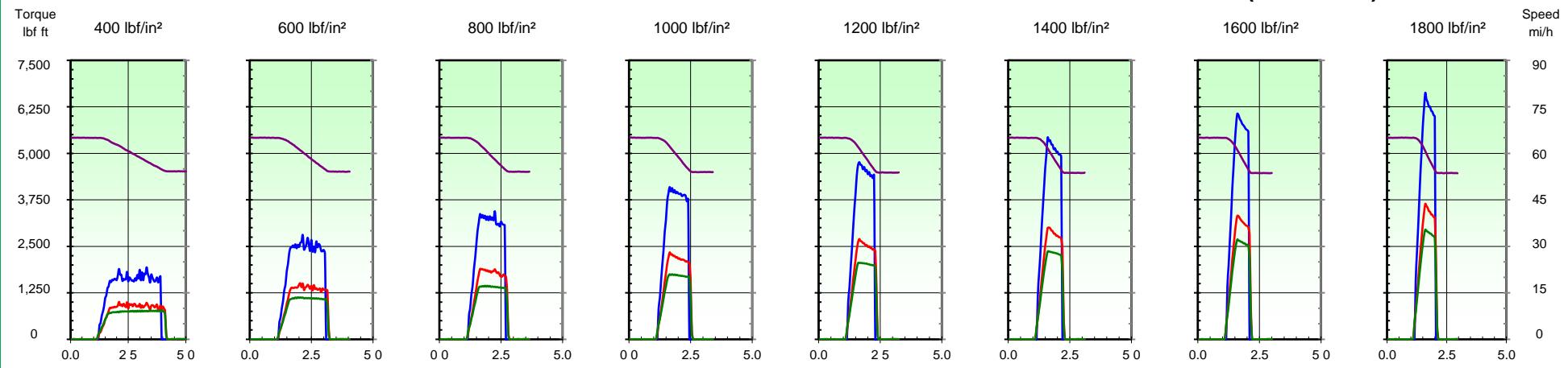
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Test Report Date: 06 March 2020

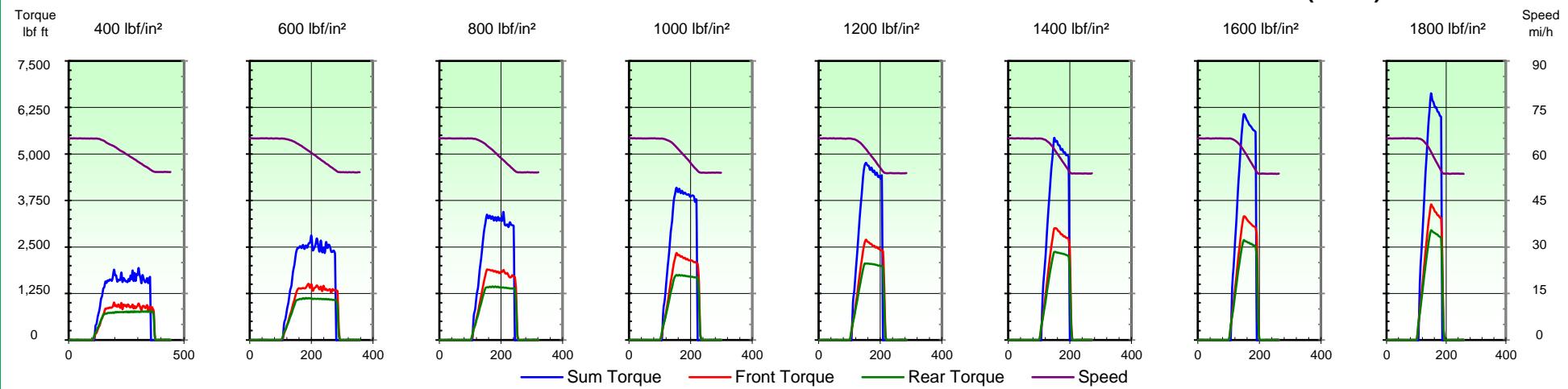
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 65-55 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 65-55 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

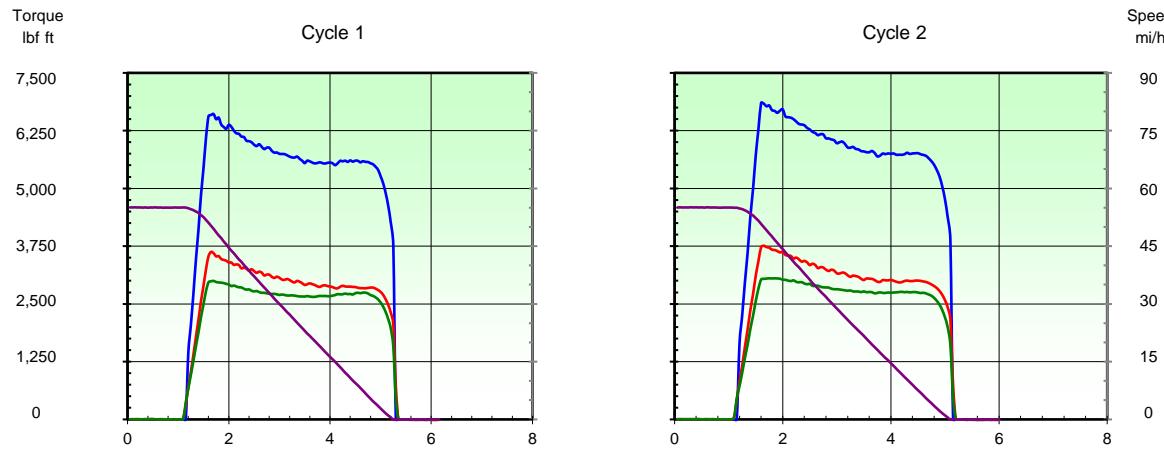
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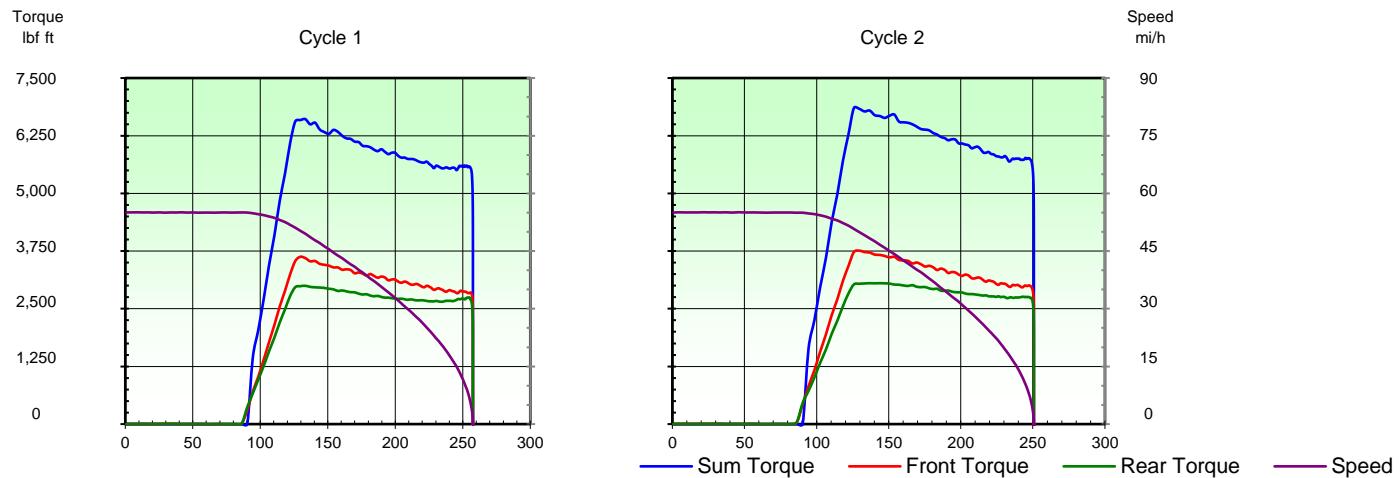
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2nd EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

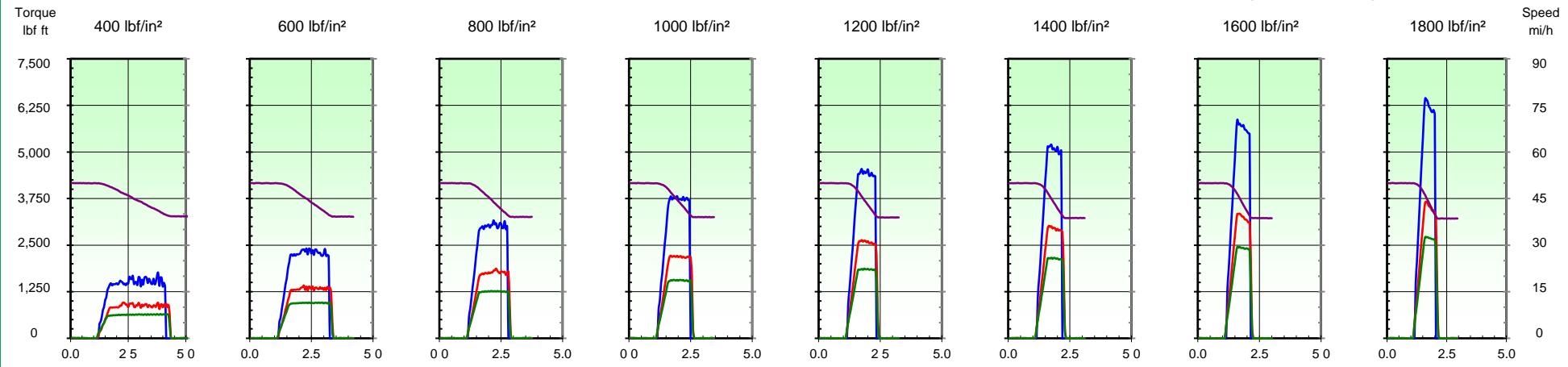
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Test Report Date: 06 March 2020

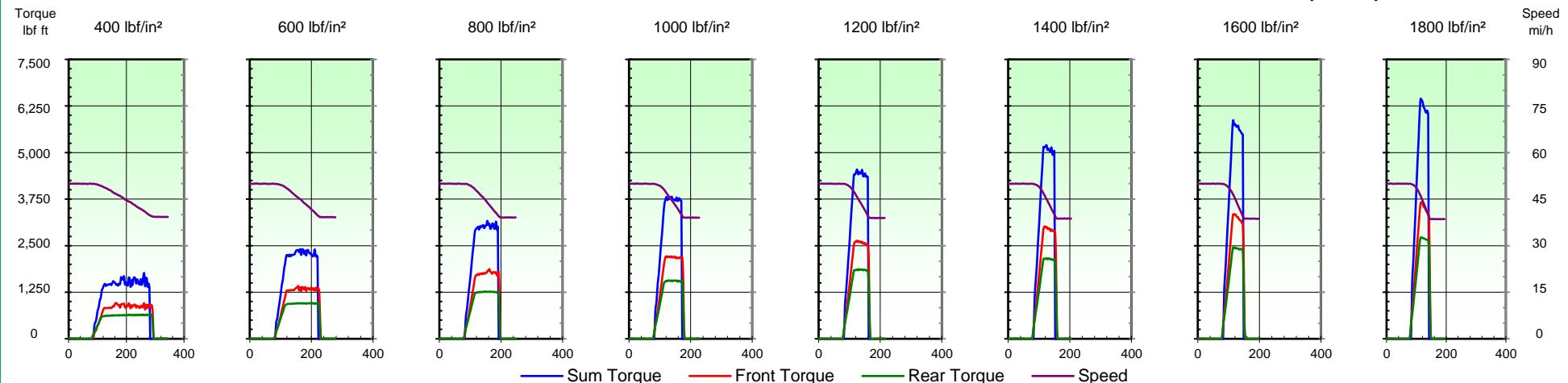
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 50-40 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 50-40 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

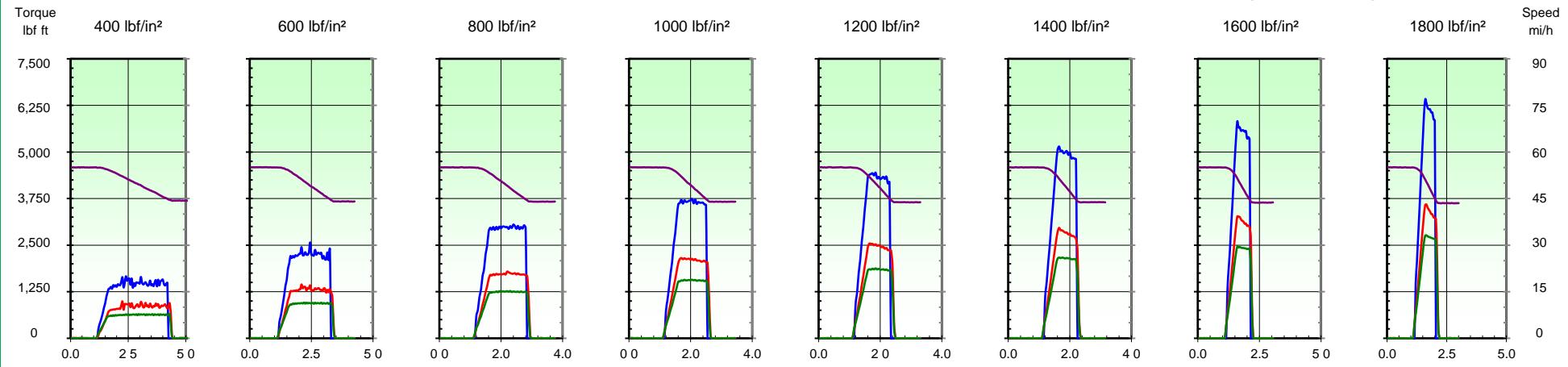
Report Number: 203145-1

Test Report Date: 06 March 2020

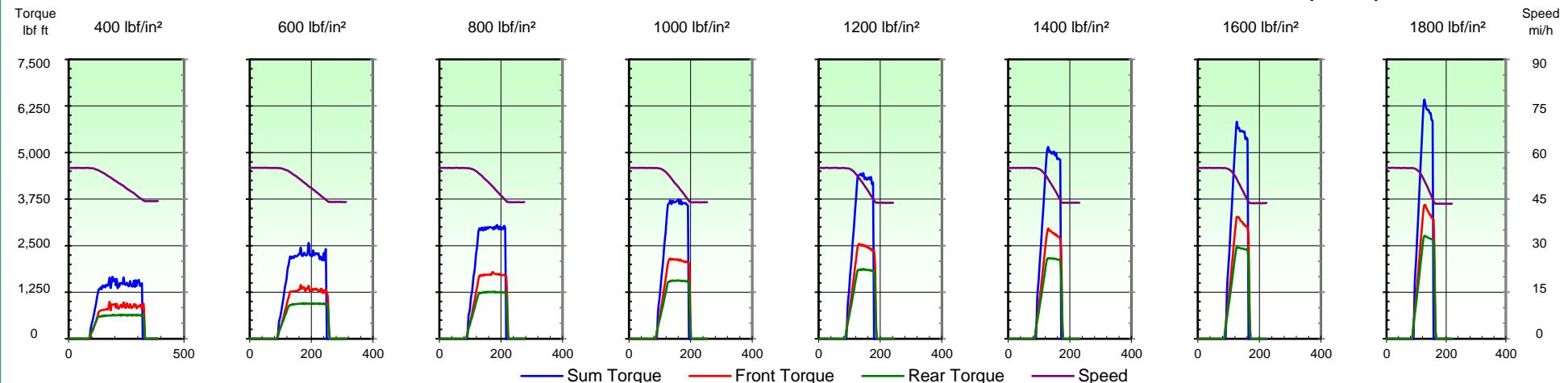
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 55-45 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 55-45 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

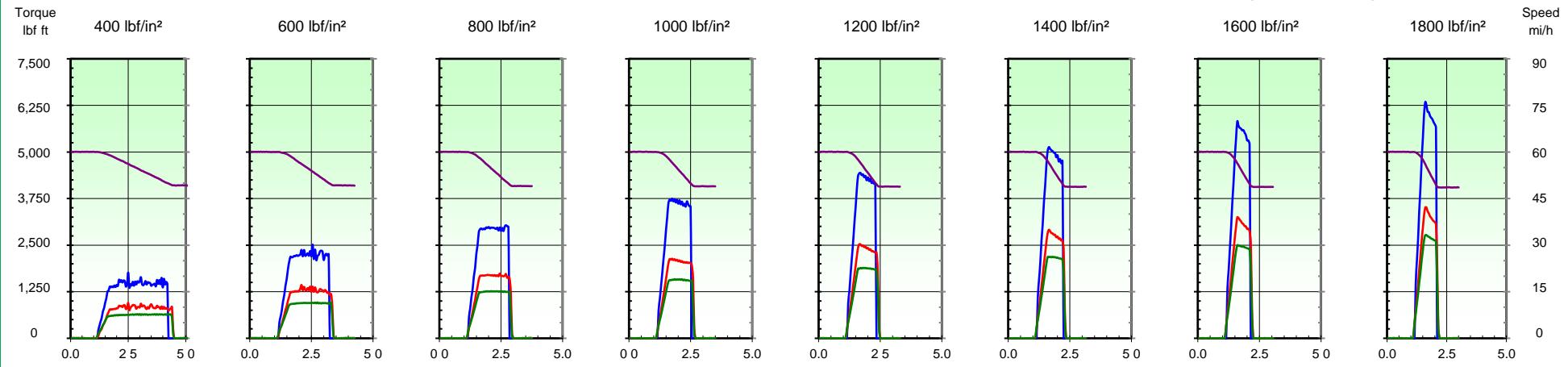
Report Number: 203145-1

Test Report Date: 06 March 2020

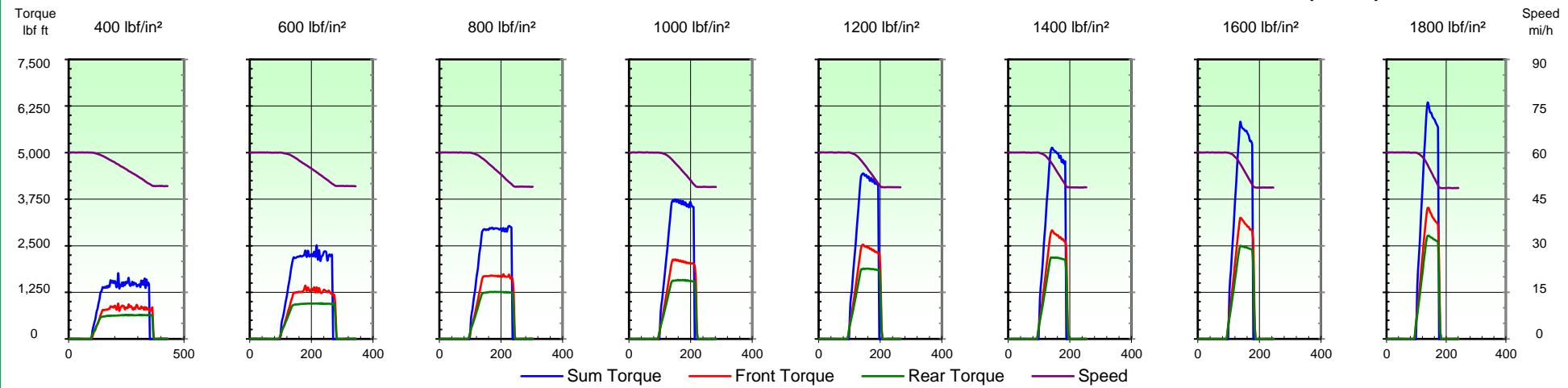
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 60-50 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 60-50 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

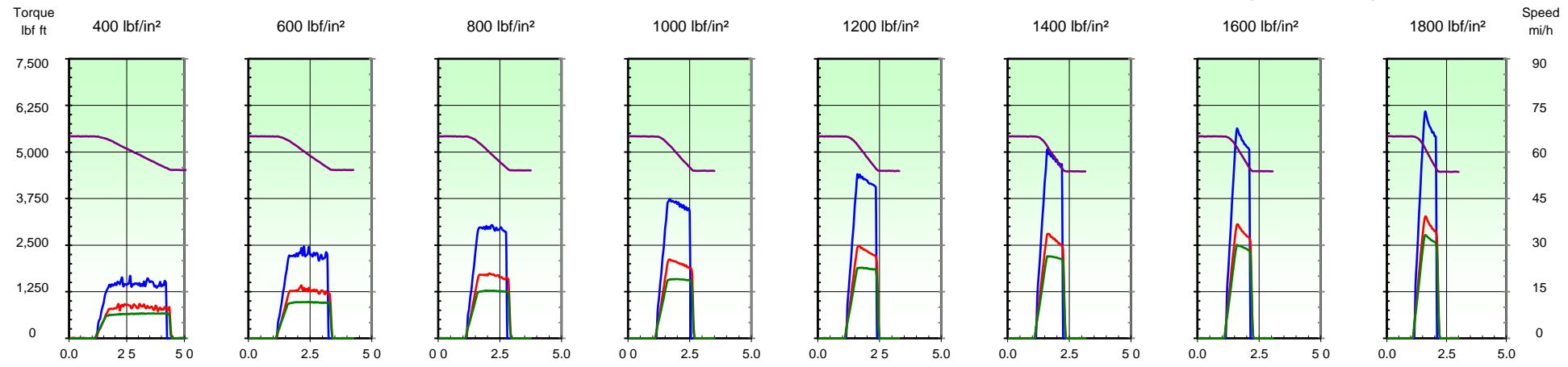
Report Number: 203145-1

Test Report Date: 06 March 2020

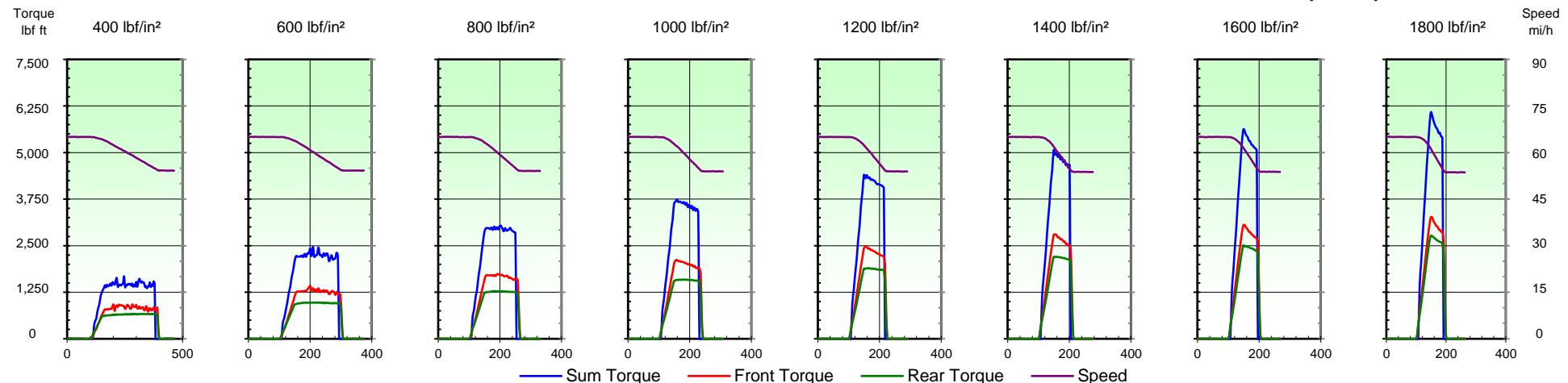
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - 65-55 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - 65-55 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

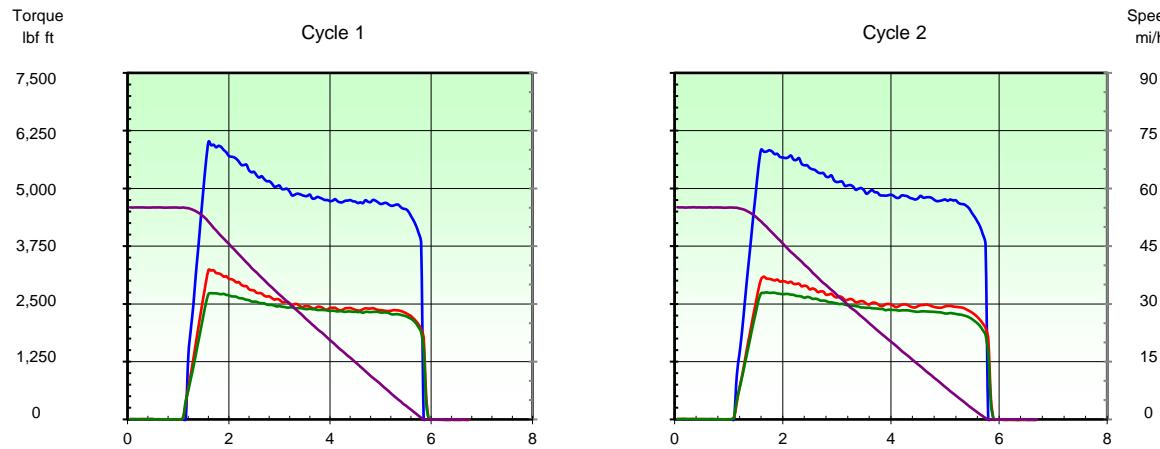
Report Number: 203145-1

Test Report Date: 06 March 2020

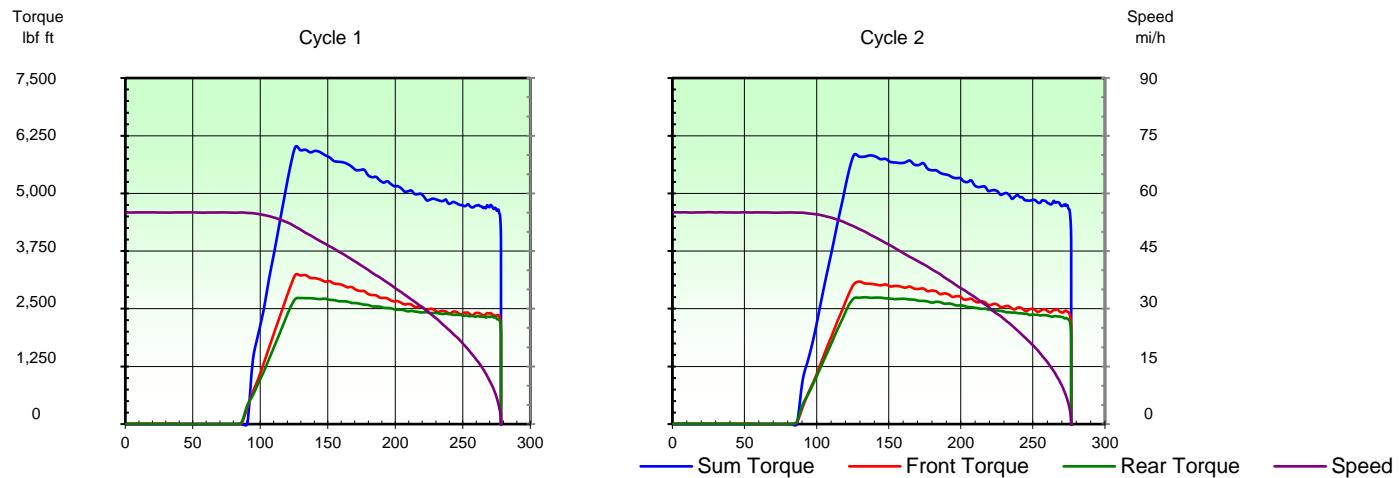
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2nd EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



2ND EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

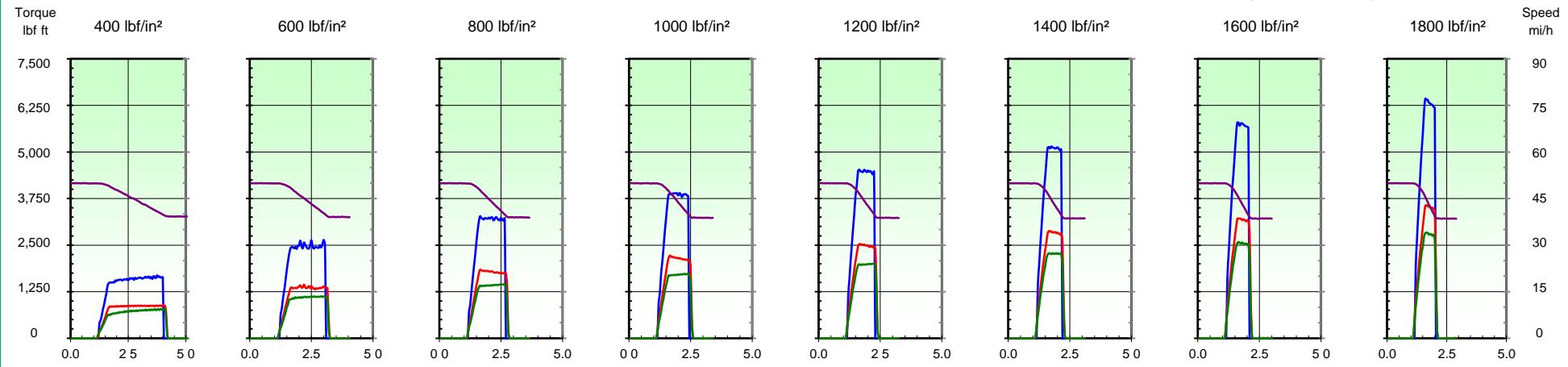
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Test Report Date: 06 March 2020

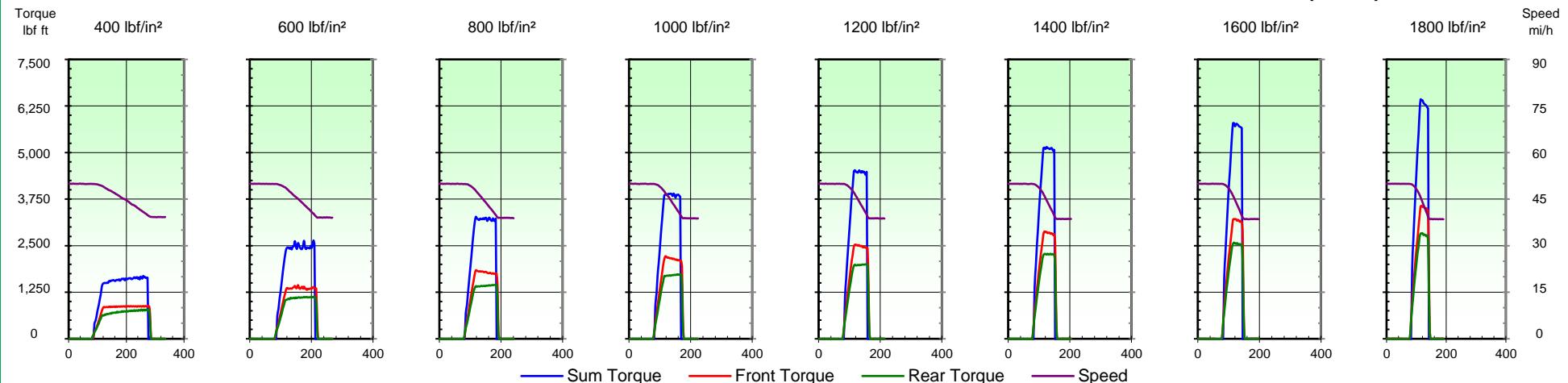
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

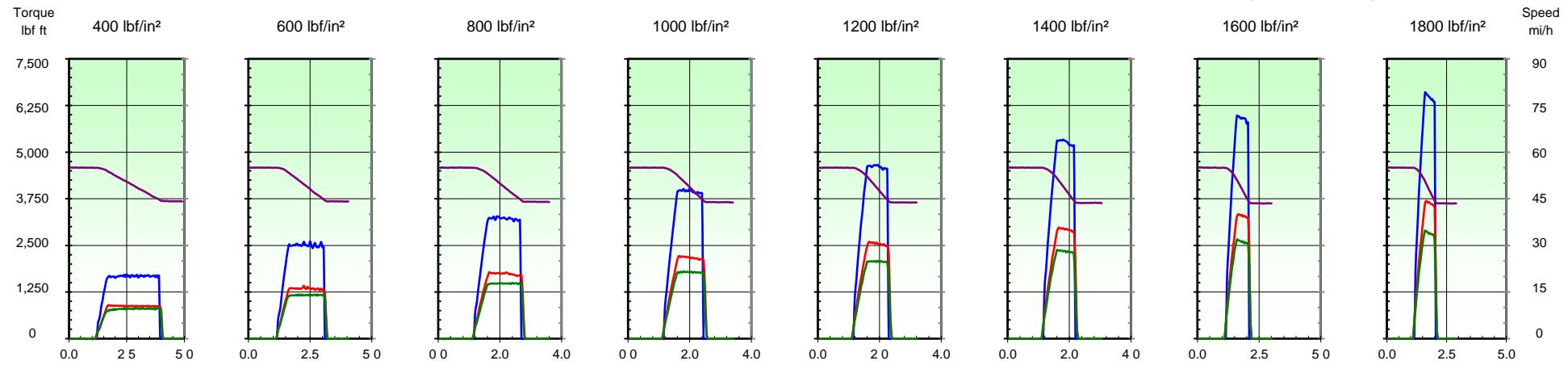
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Test Report Date: 06 March 2020

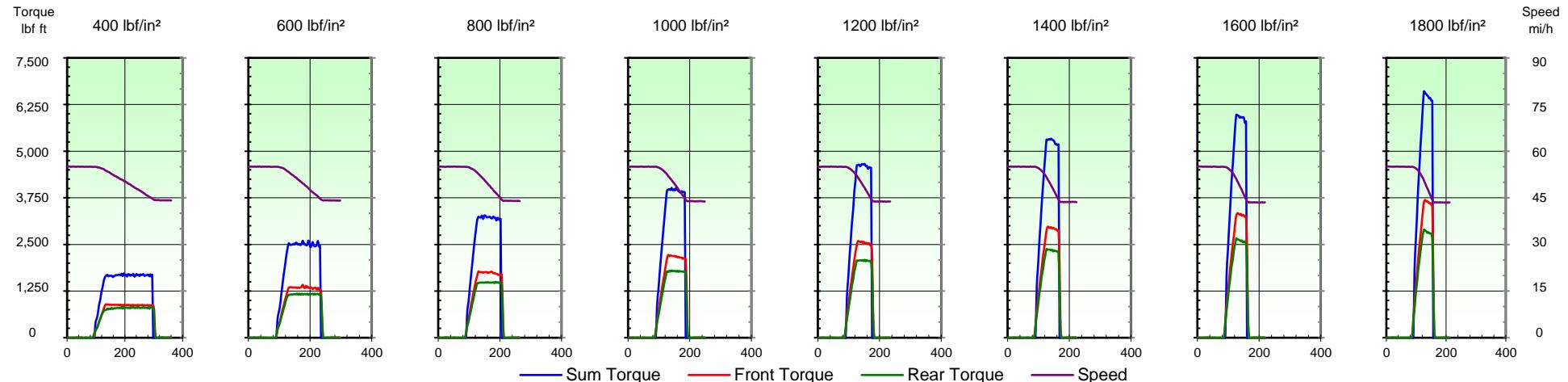
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

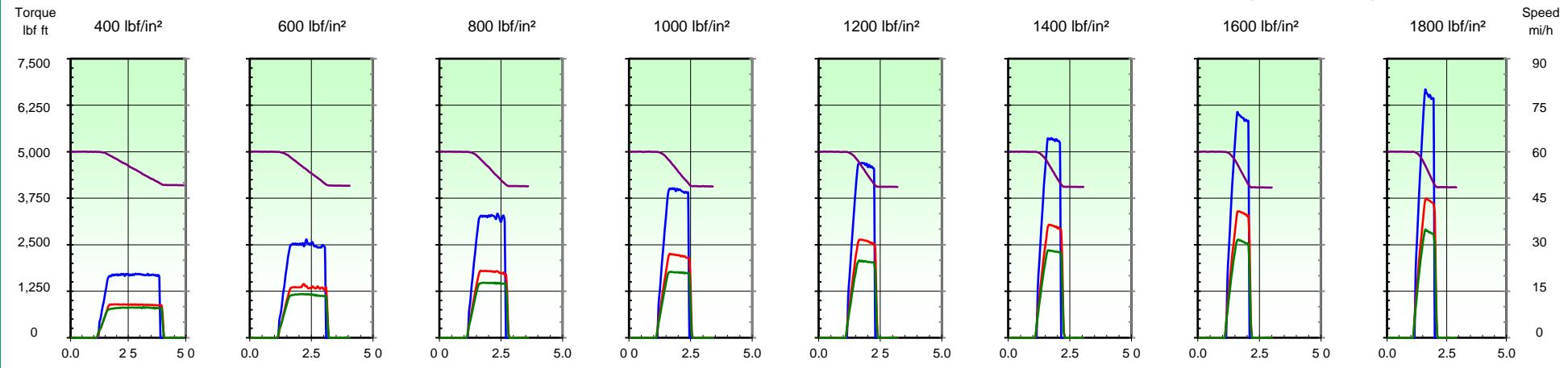
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Test Report Date: 06 March 2020

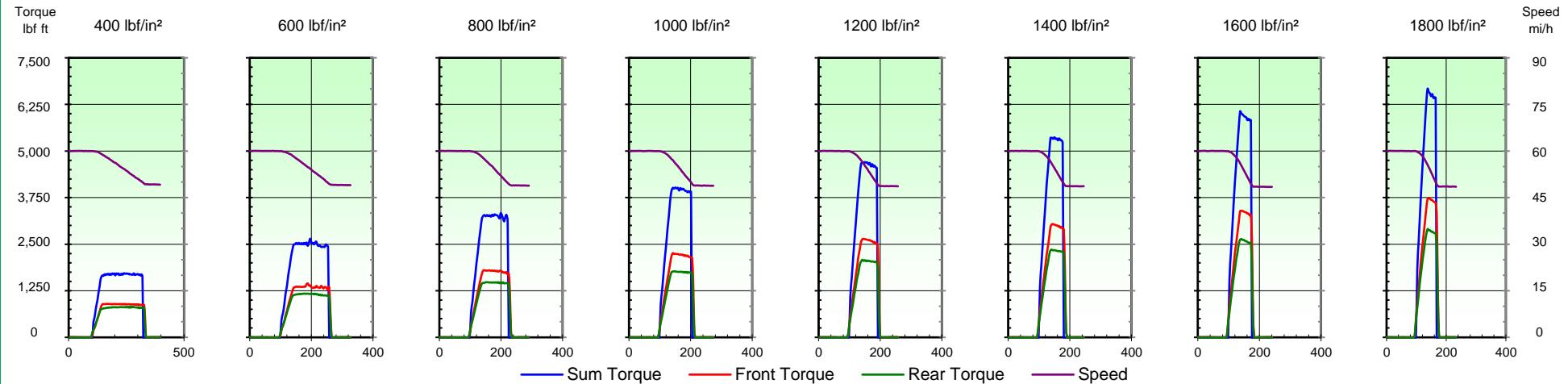
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 60-50 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 60-50 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

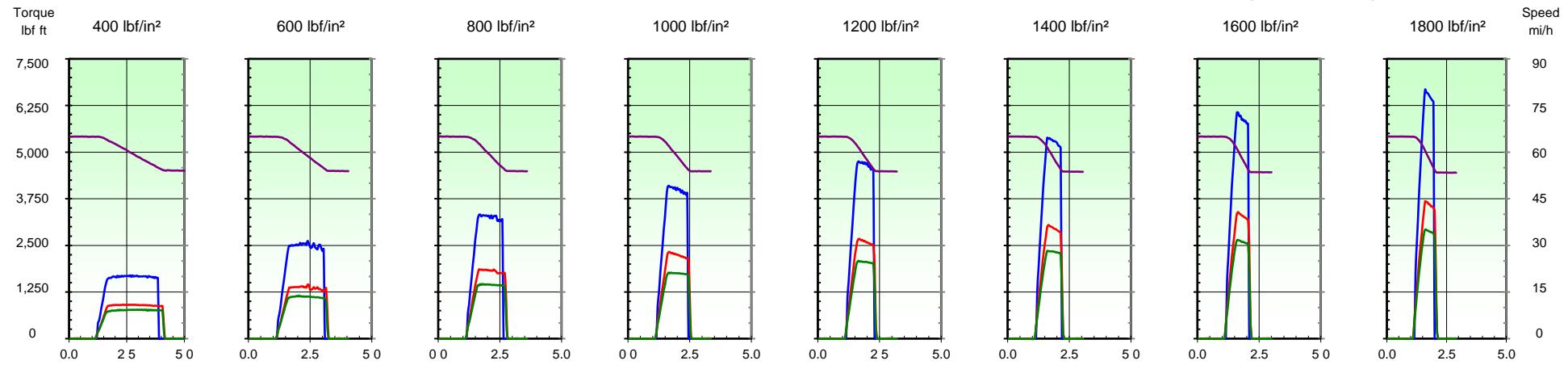
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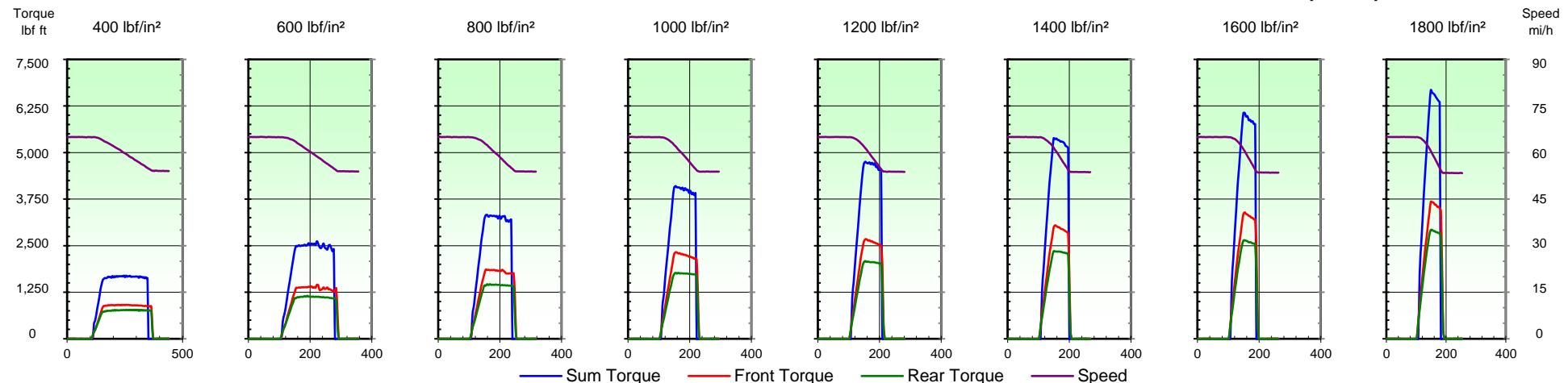
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 65-55 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 65-55 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

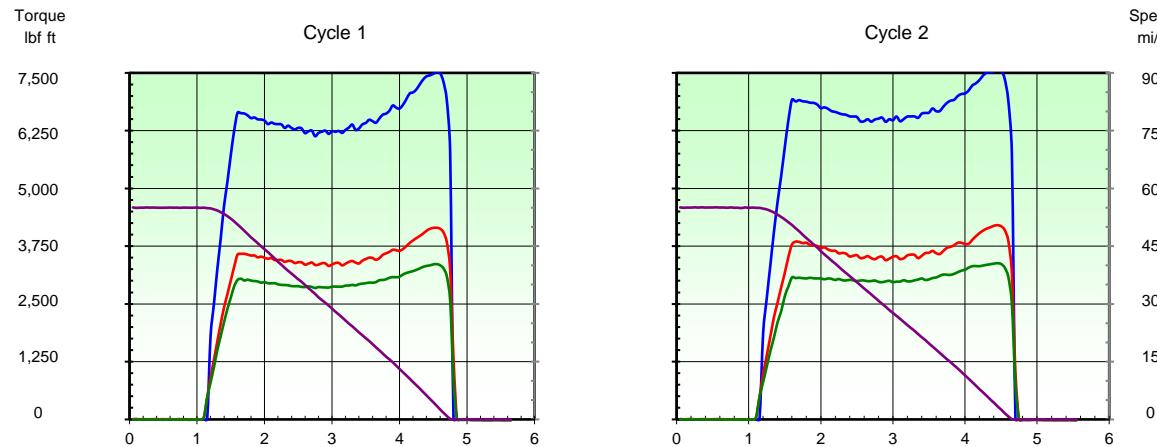
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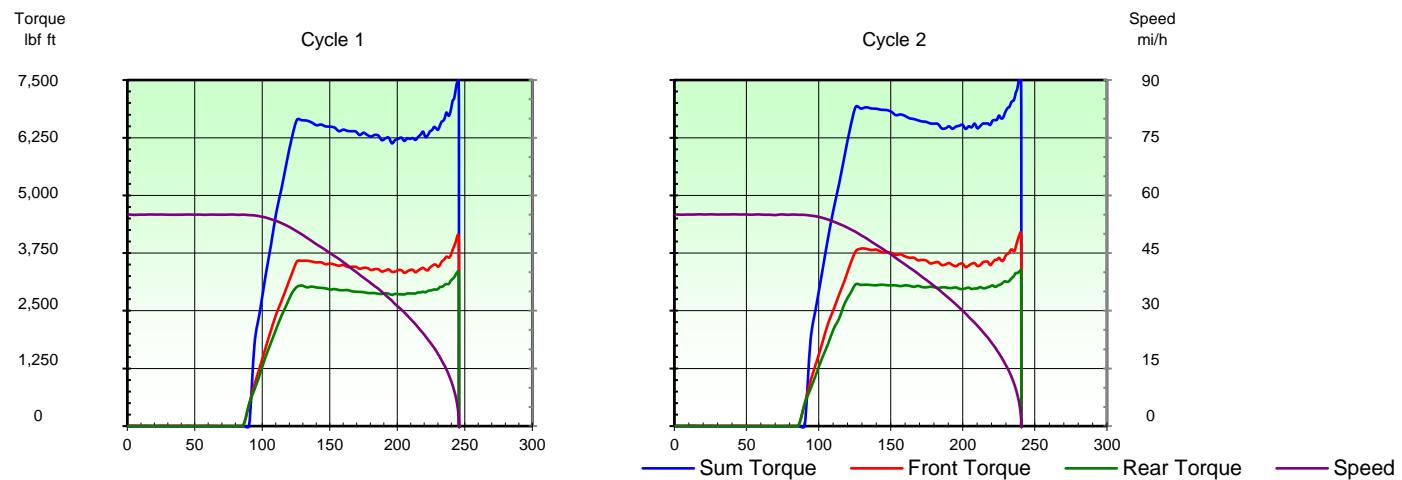
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3rd EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

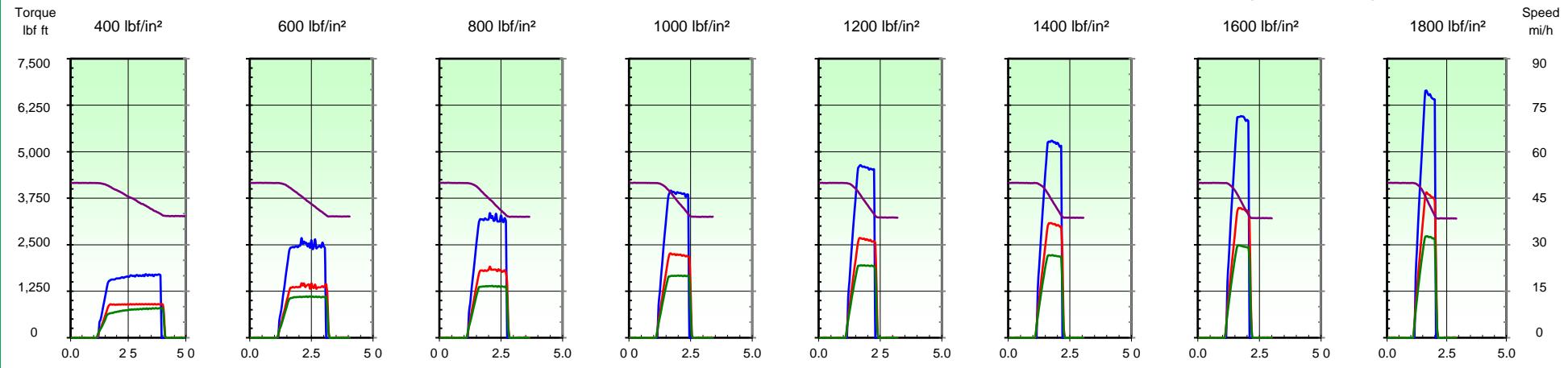
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Test Report Date: 06 March 2020

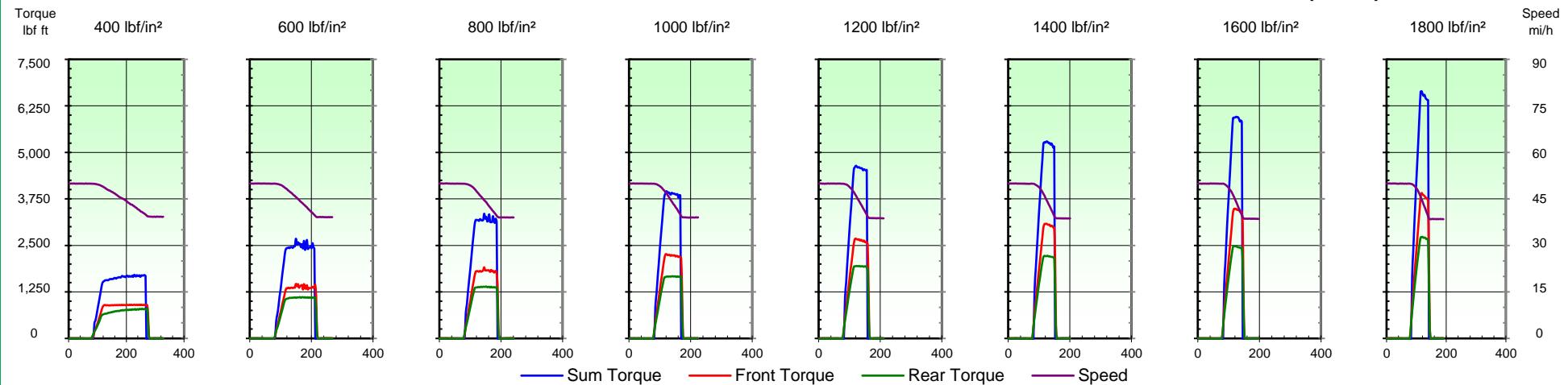
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 50-40 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 50-40 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

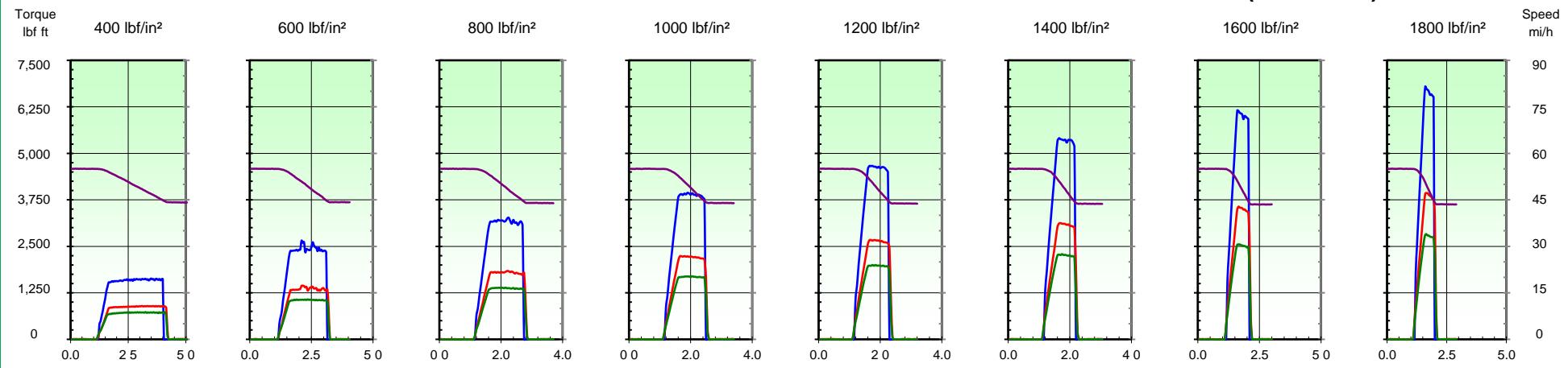
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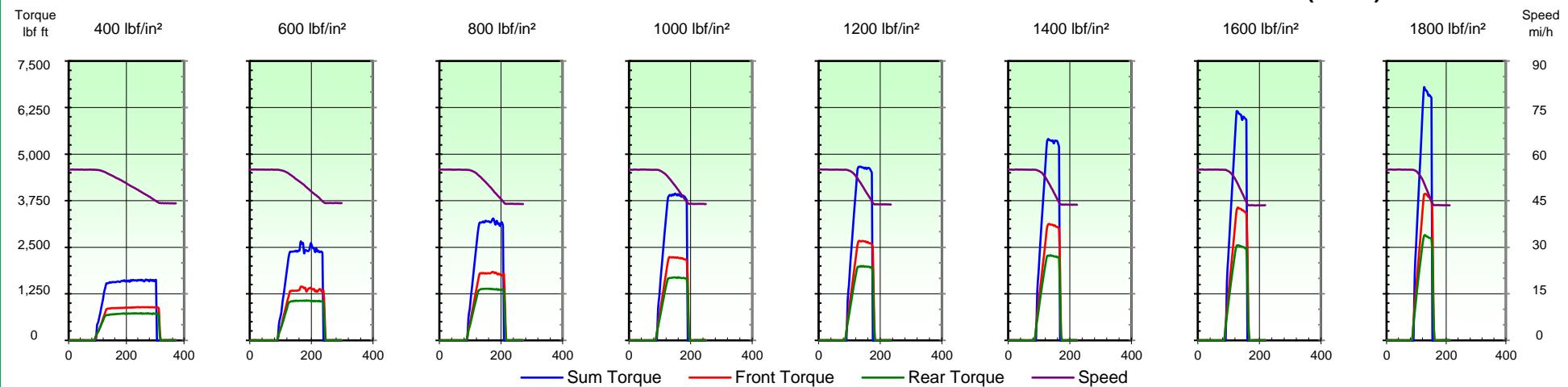
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

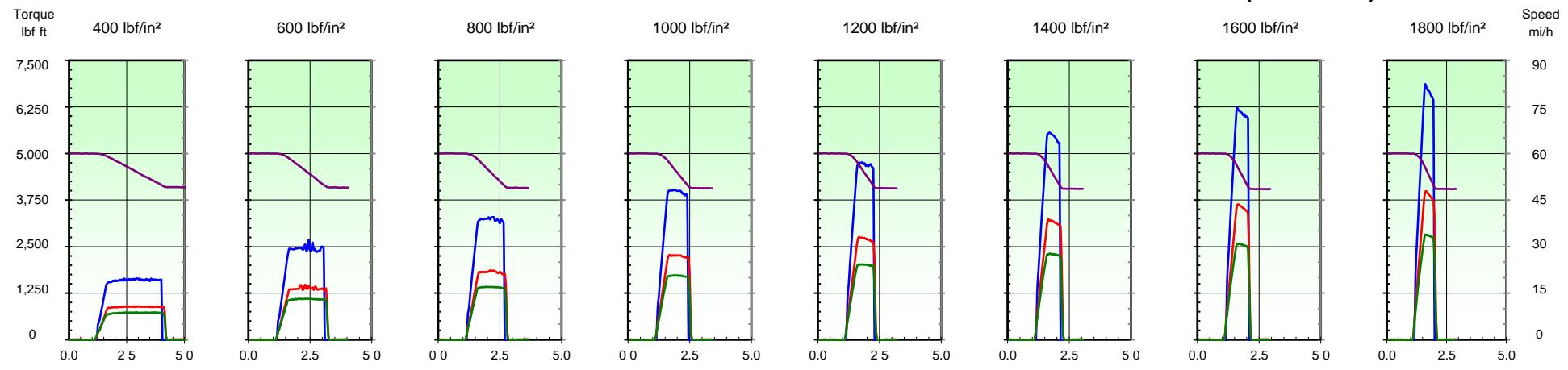
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Test Report Date: 06 March 2020

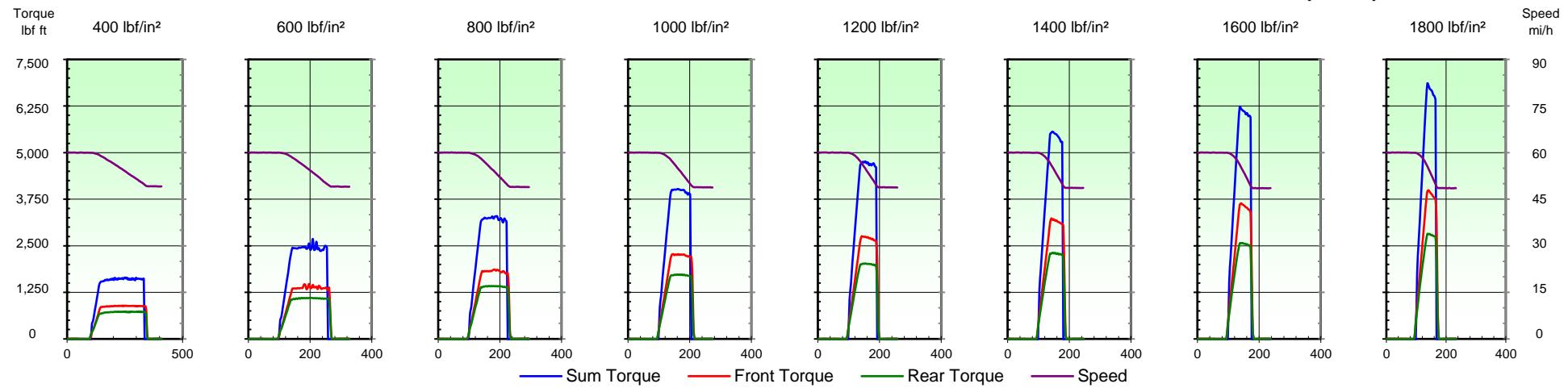
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - 60-50 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 60-50 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

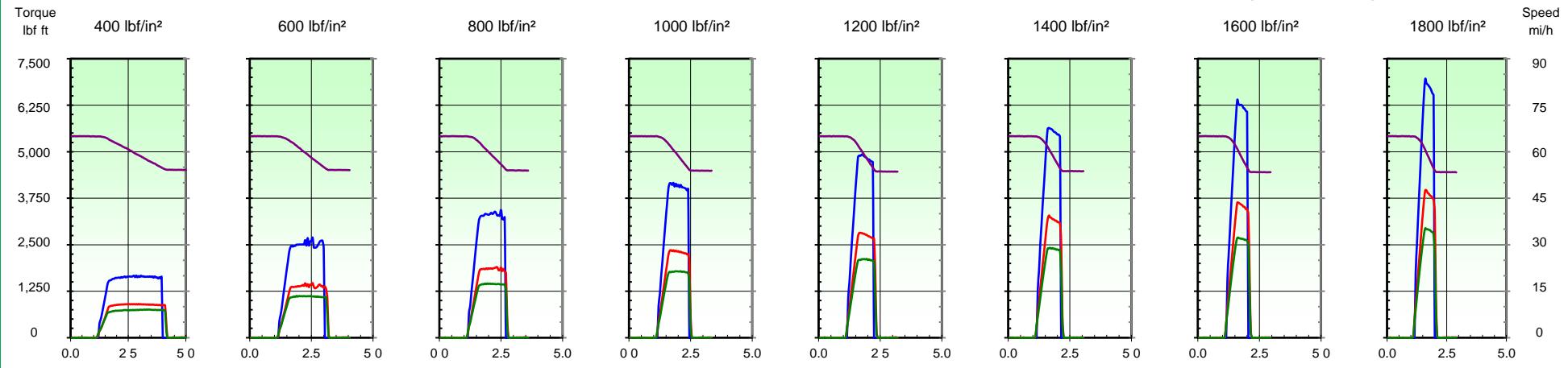
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Test Report Date: 06 March 2020

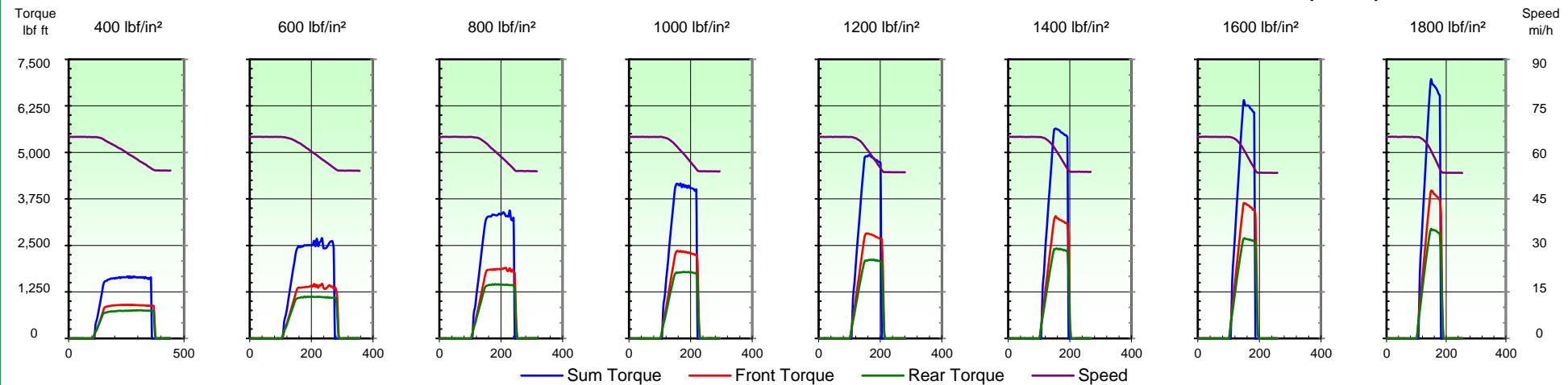
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 65-55 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 65-55 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

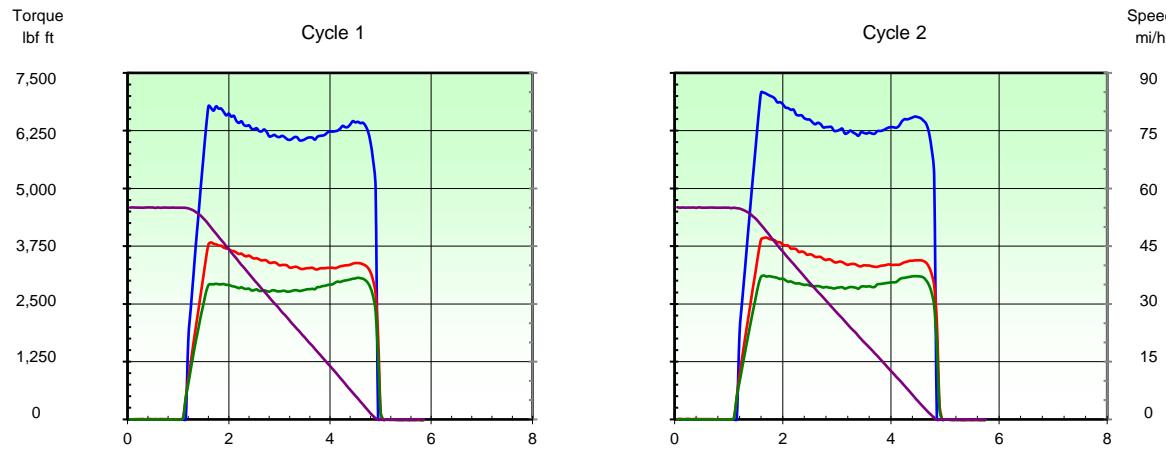
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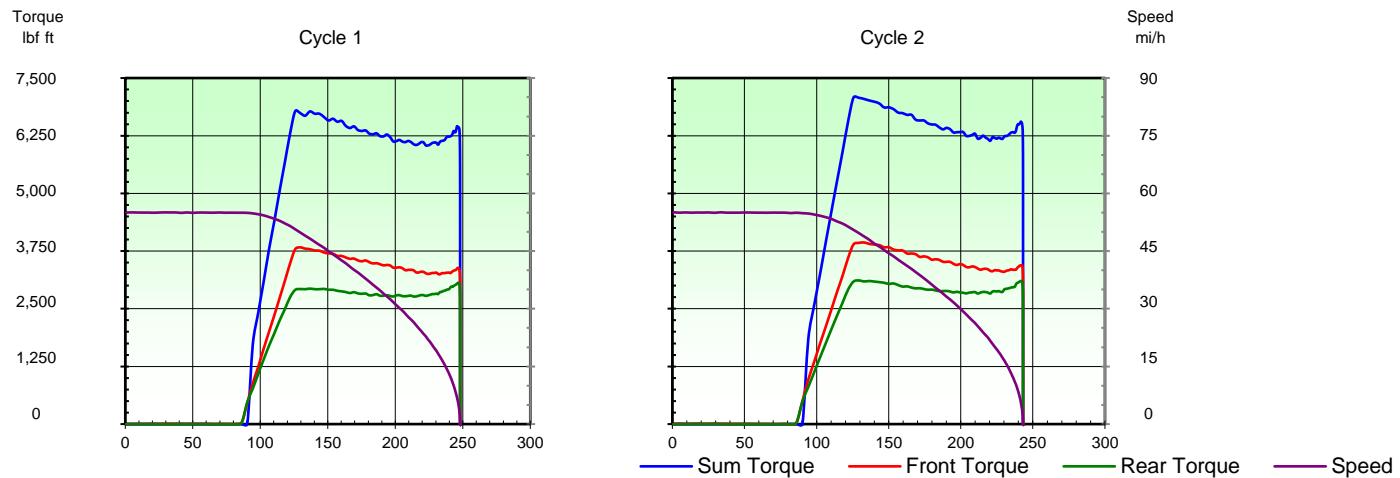
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3rd EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

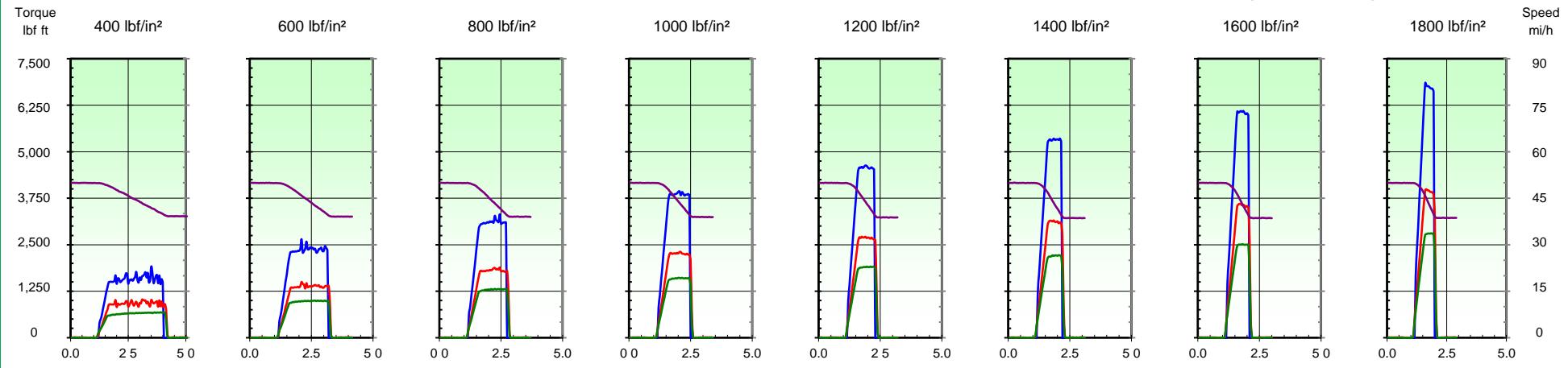
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Test Report Date: 06 March 2020

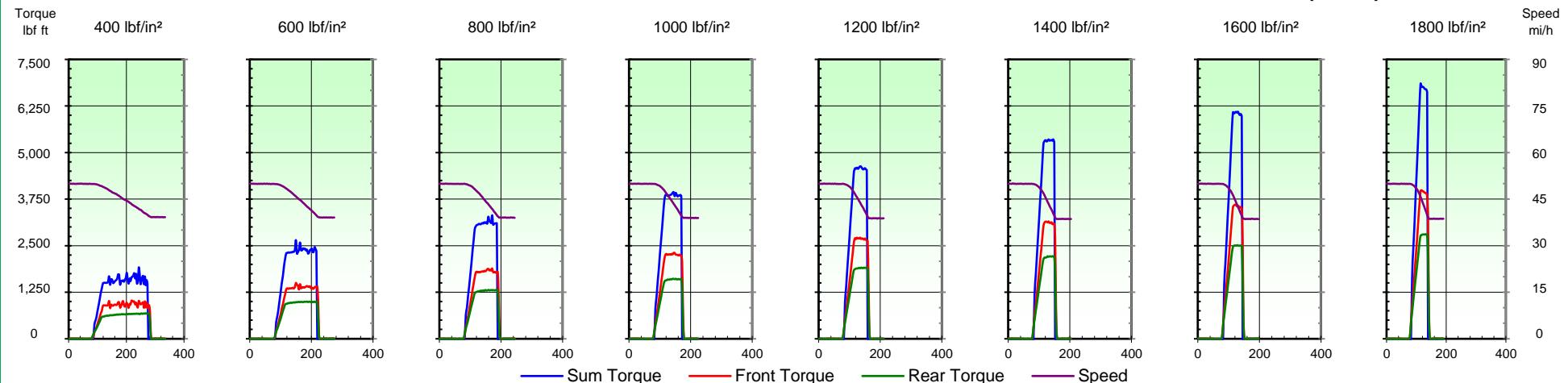
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 50-40 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 50-40 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

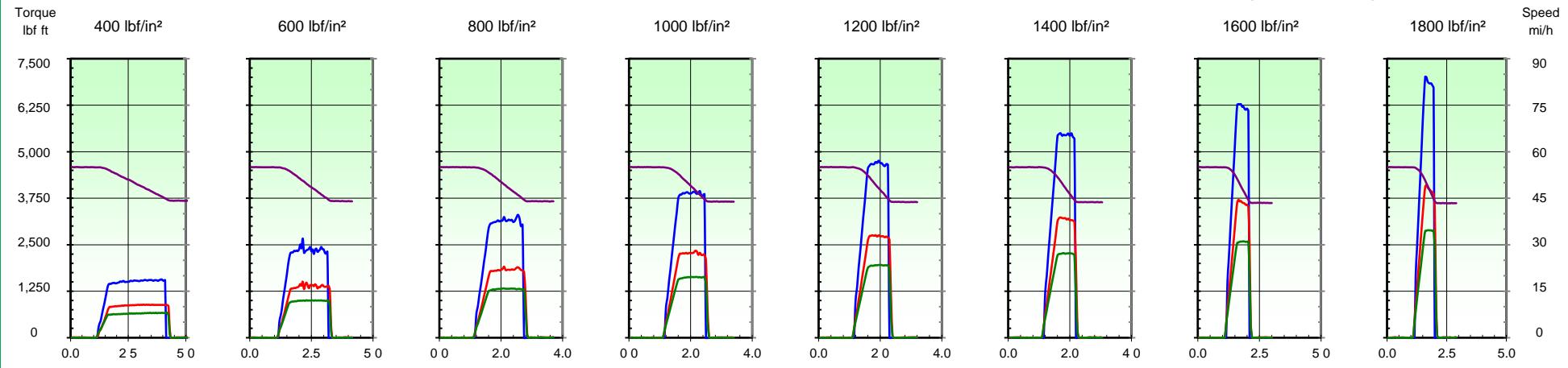
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Test Report Date: 06 March 2020

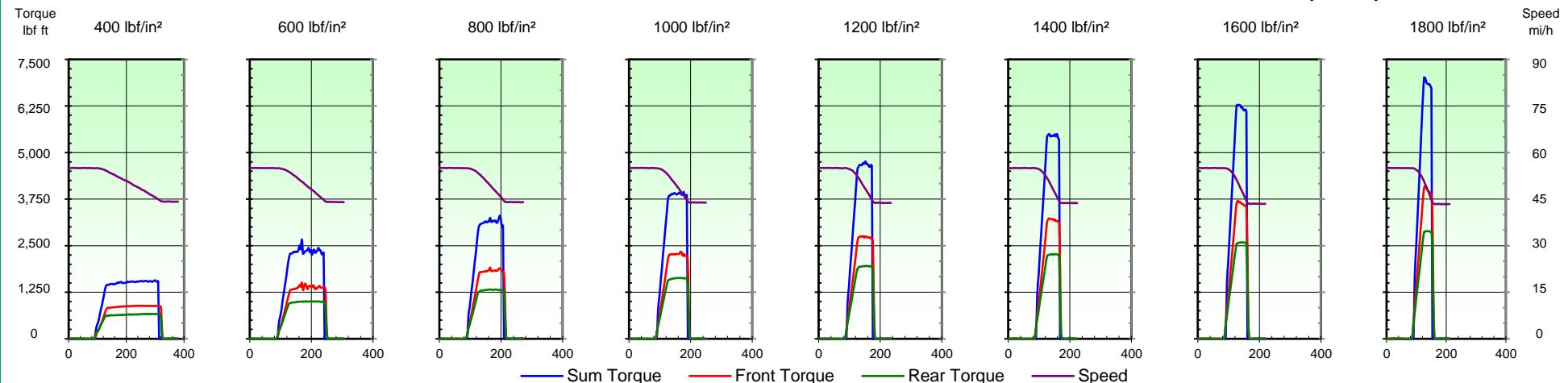
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 55-45 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 55-45 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

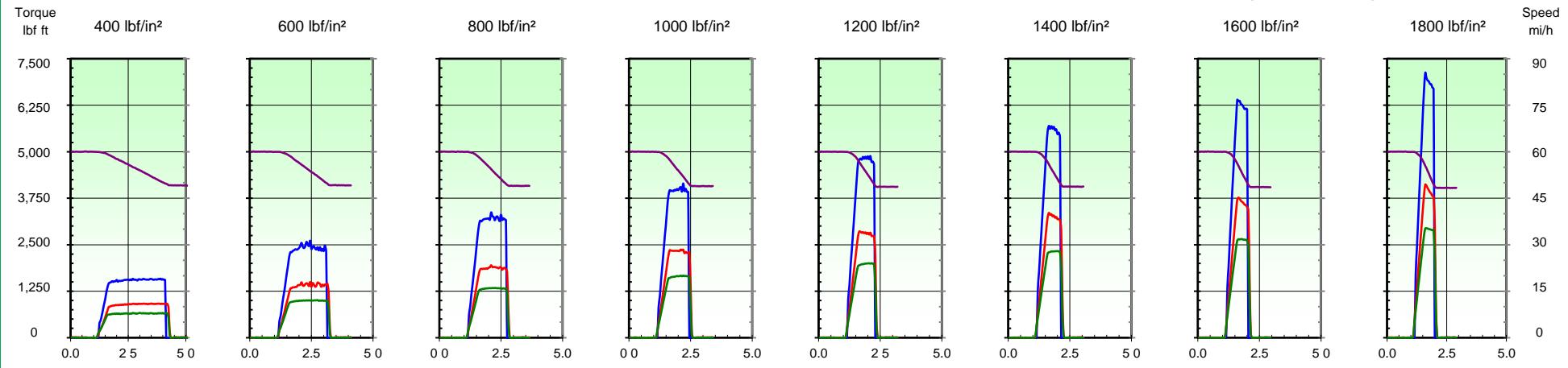
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Test Report Date: 06 March 2020

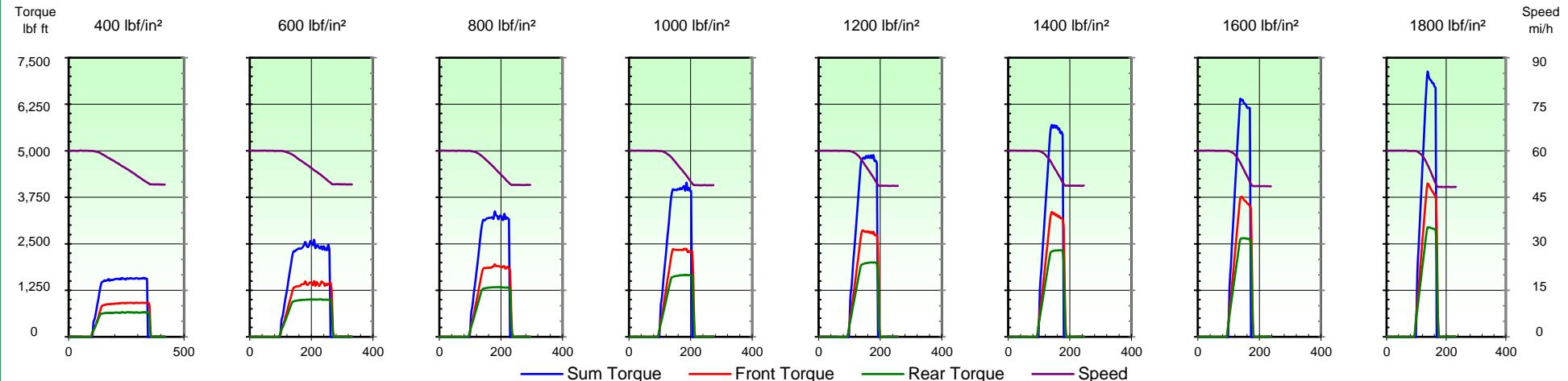
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 60-50 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 60-50 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

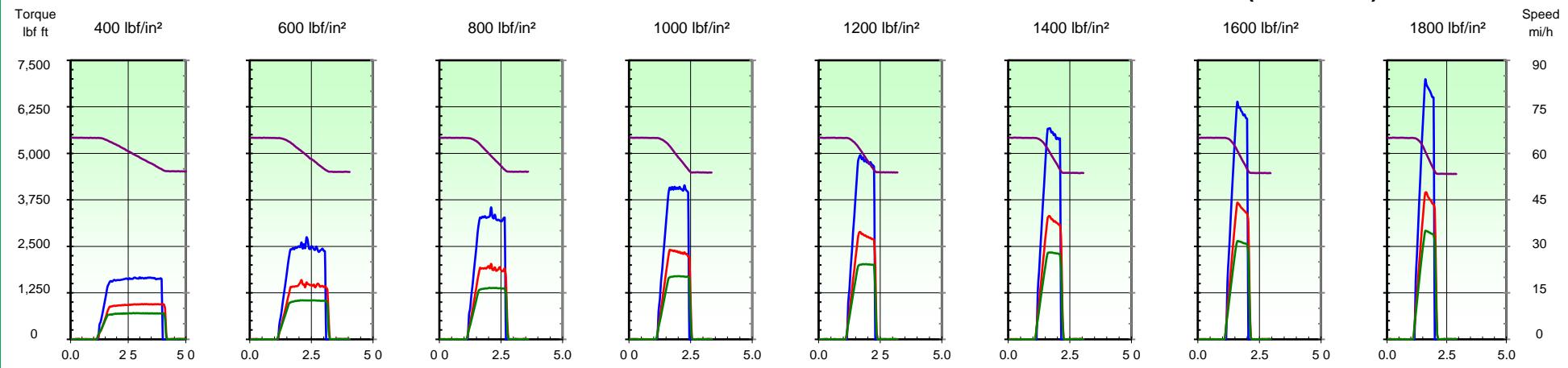
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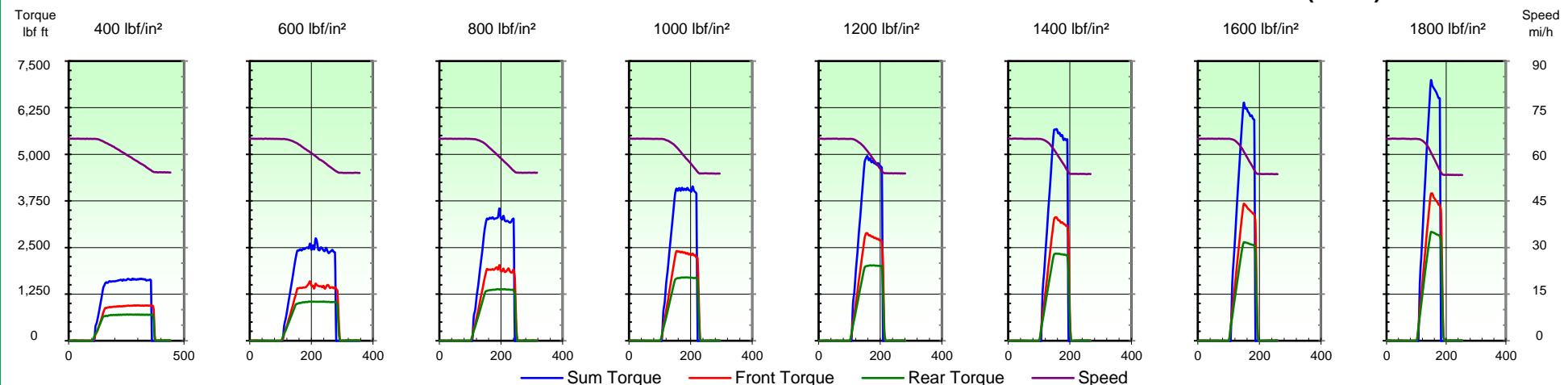
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 65-55 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 65-55 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

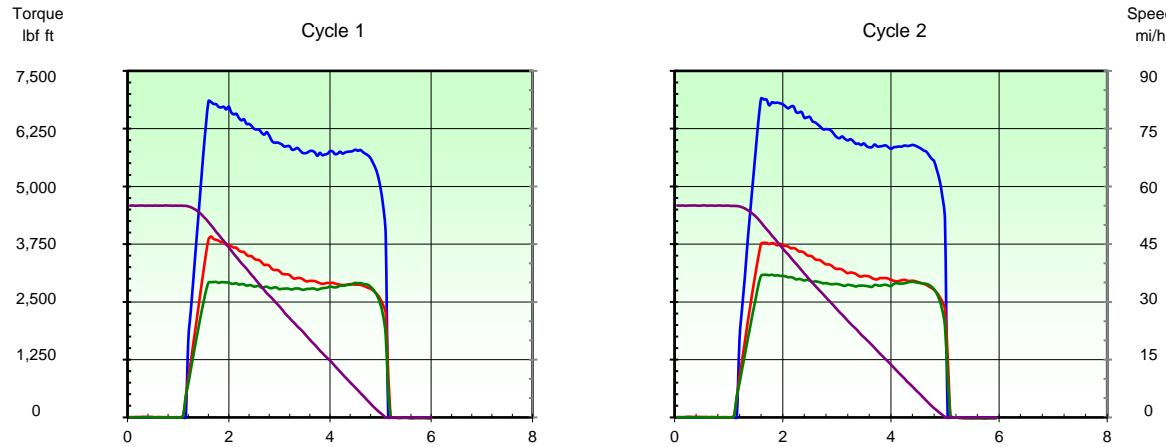
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Test Report Date: 06 March 2020

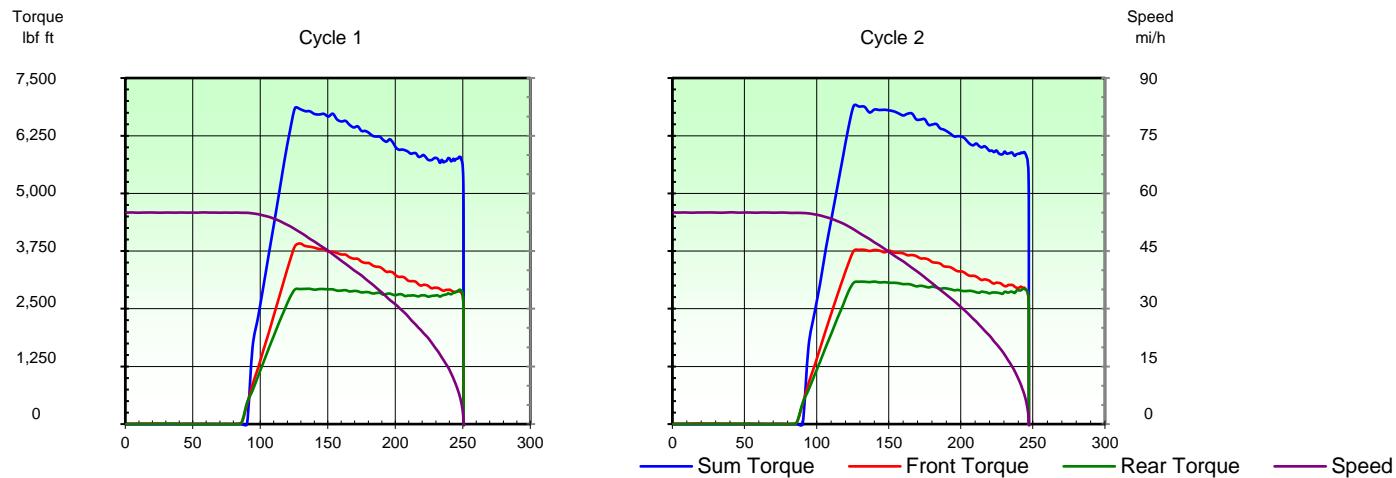
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3rd EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

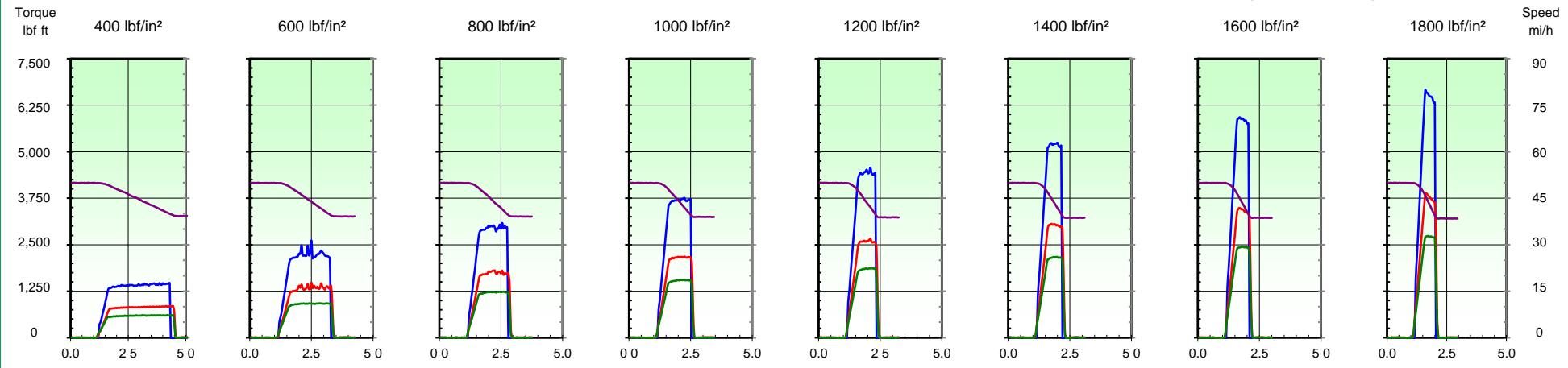
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Test Report Date: 06 March 2020

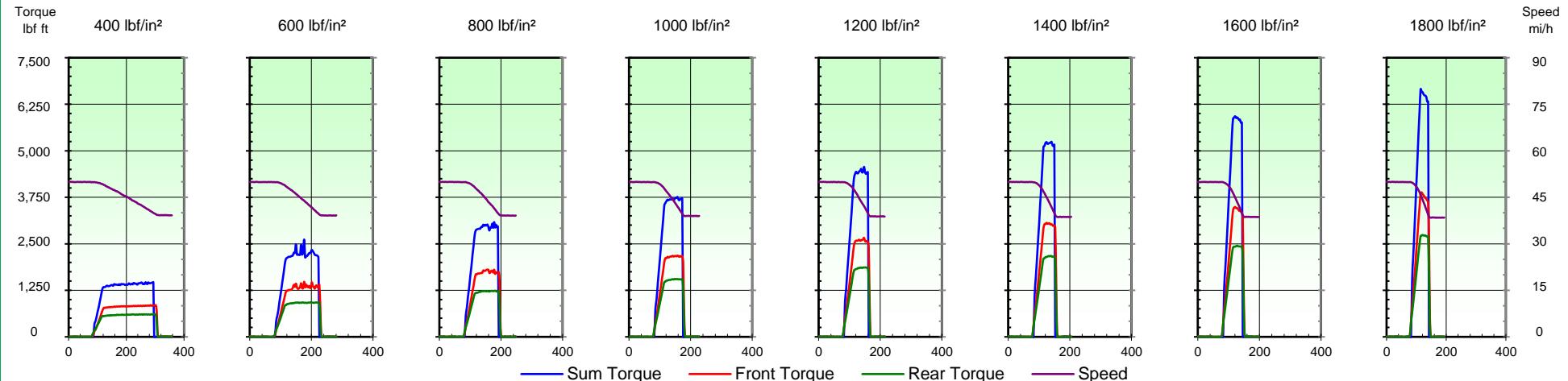
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 50-40 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 50-40 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

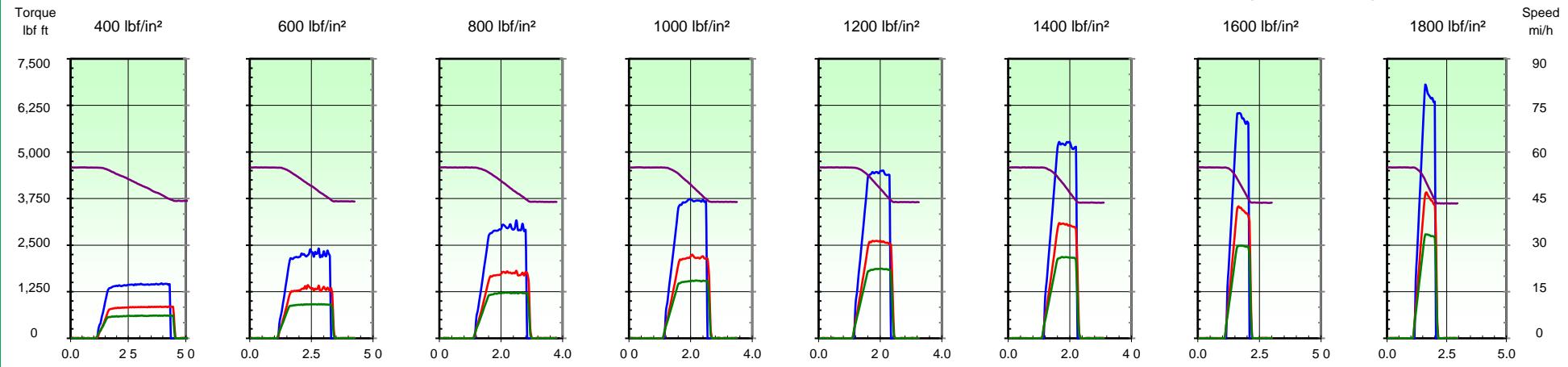
Report Number: 203145-1

Test Report Date: 06 March 2020

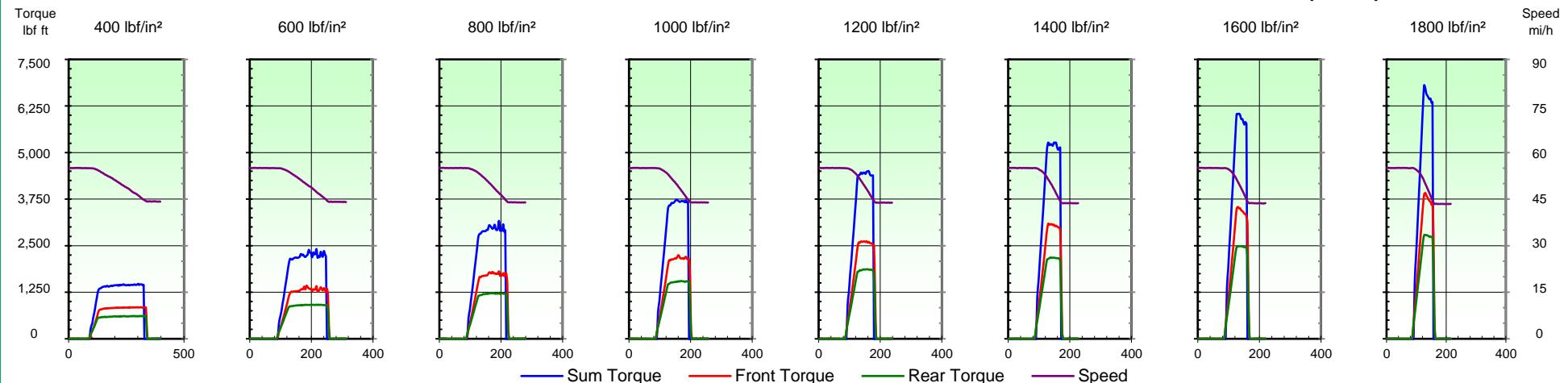
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 55-45 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 55-45 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

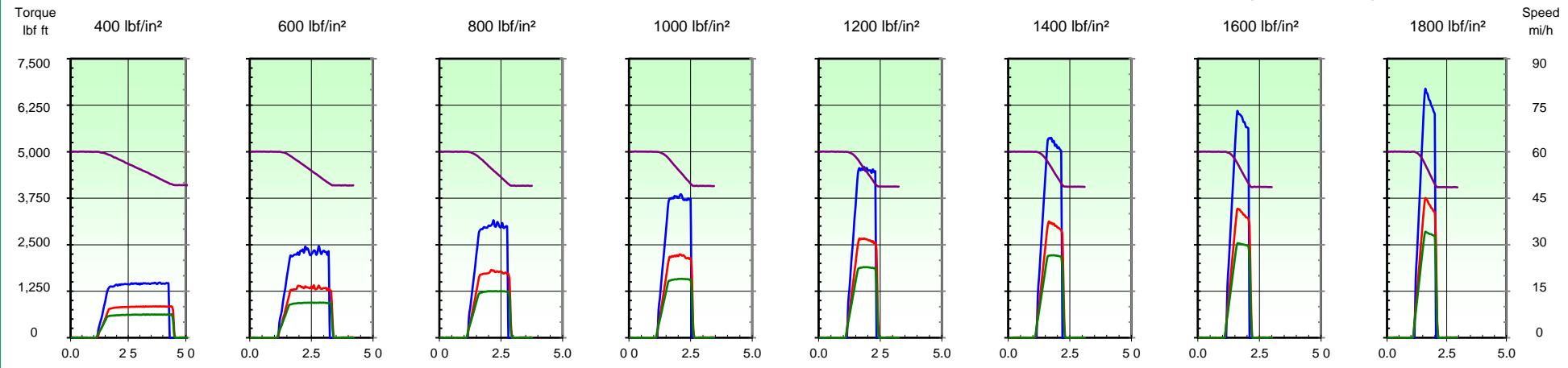
Report Number: 203145-1

Test Report Date: 06 March 2020

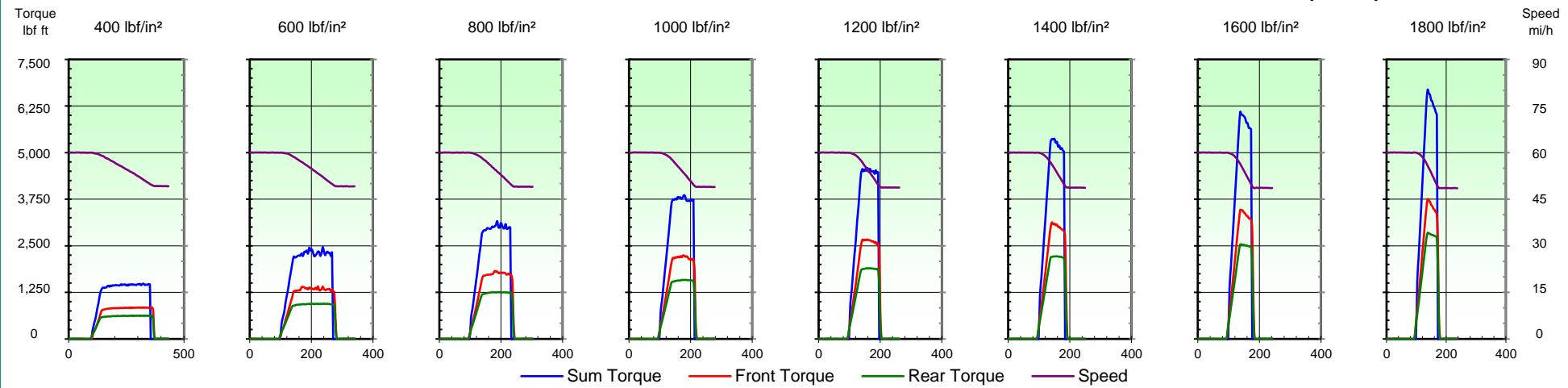
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 60-50 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 60-50 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

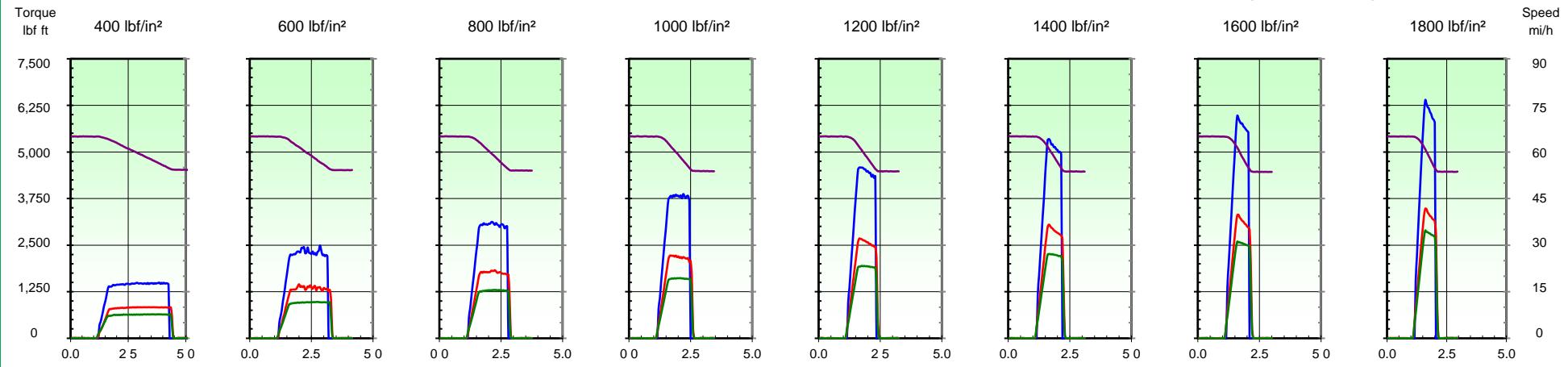
Report Number: 203145-1

Test Report Date: 06 March 2020

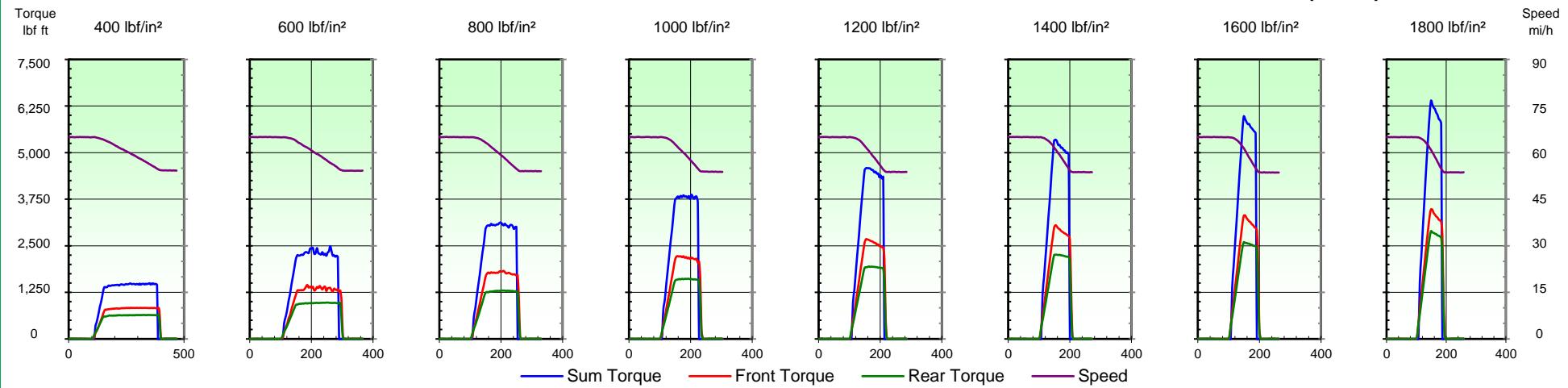
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - 65-55 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - 65-55 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

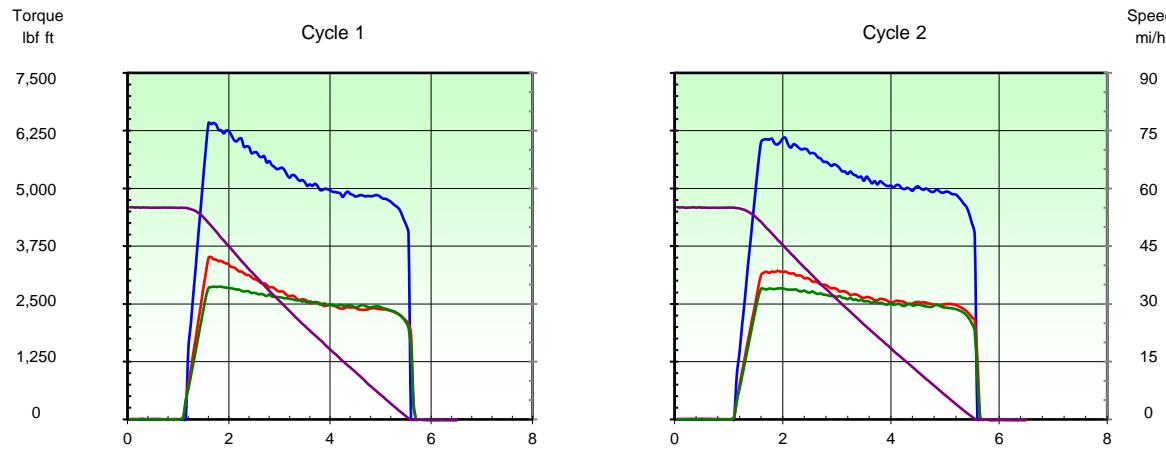
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Test Report Date: 06 March 2020

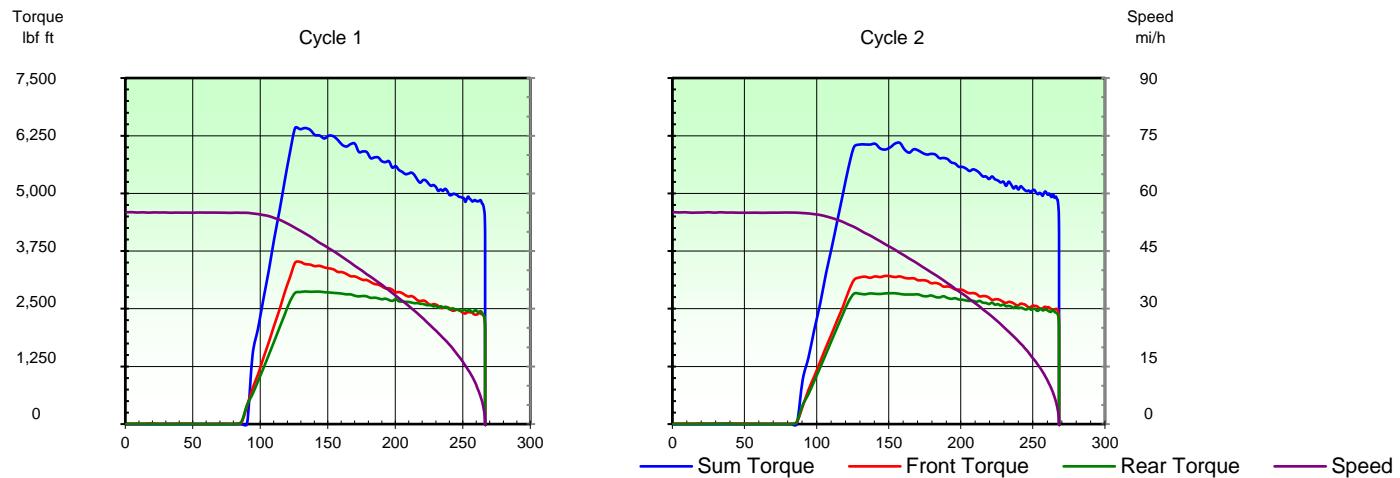
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3rd EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



3RD EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

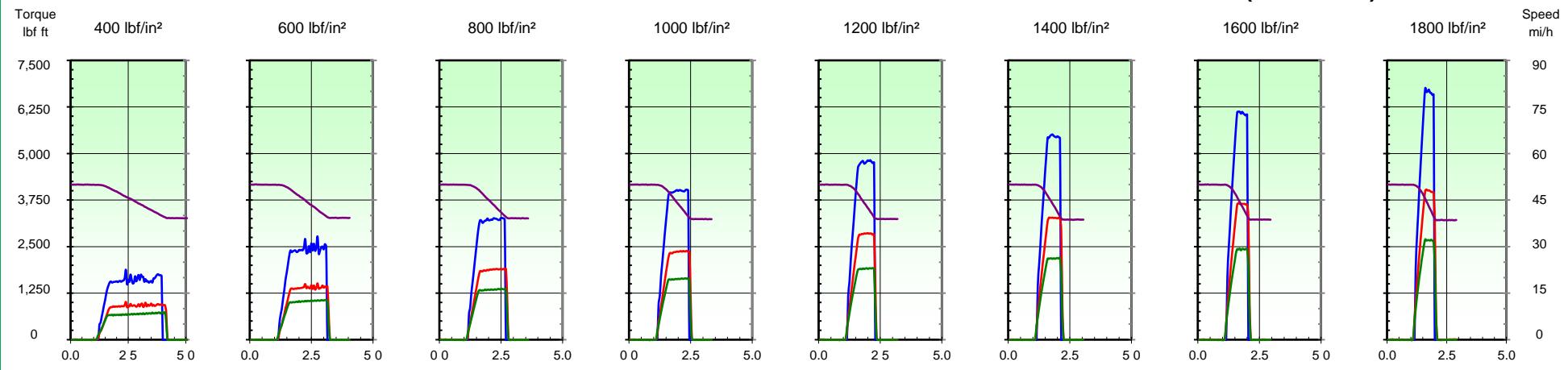
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Test Report Date: 06 March 2020

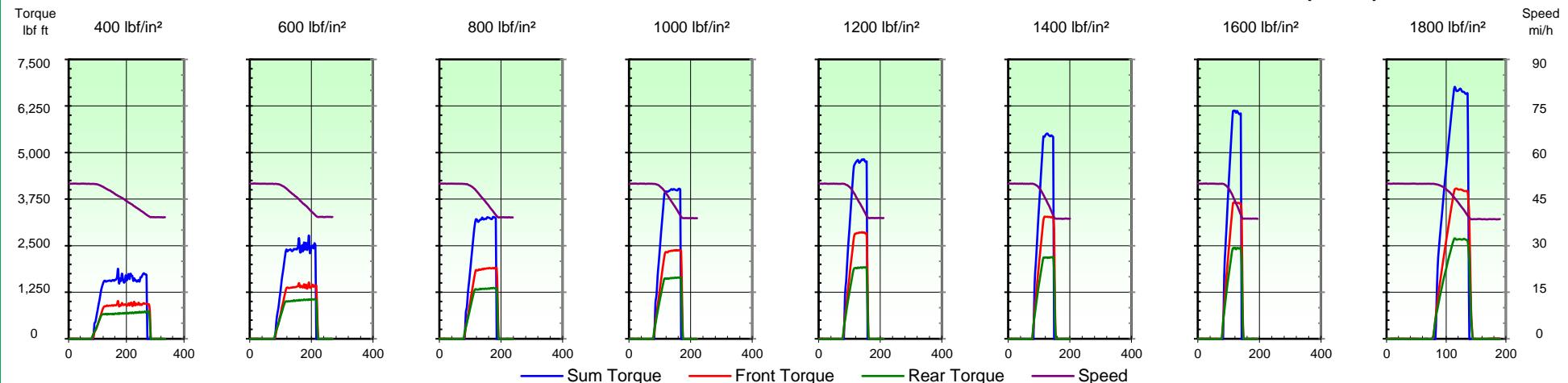
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

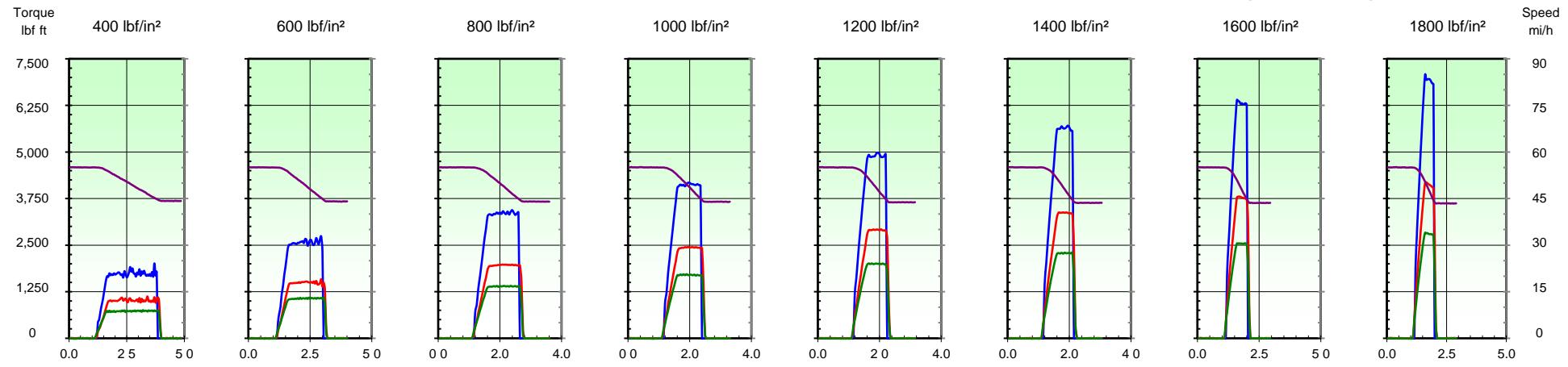
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Test Report Date: 06 March 2020

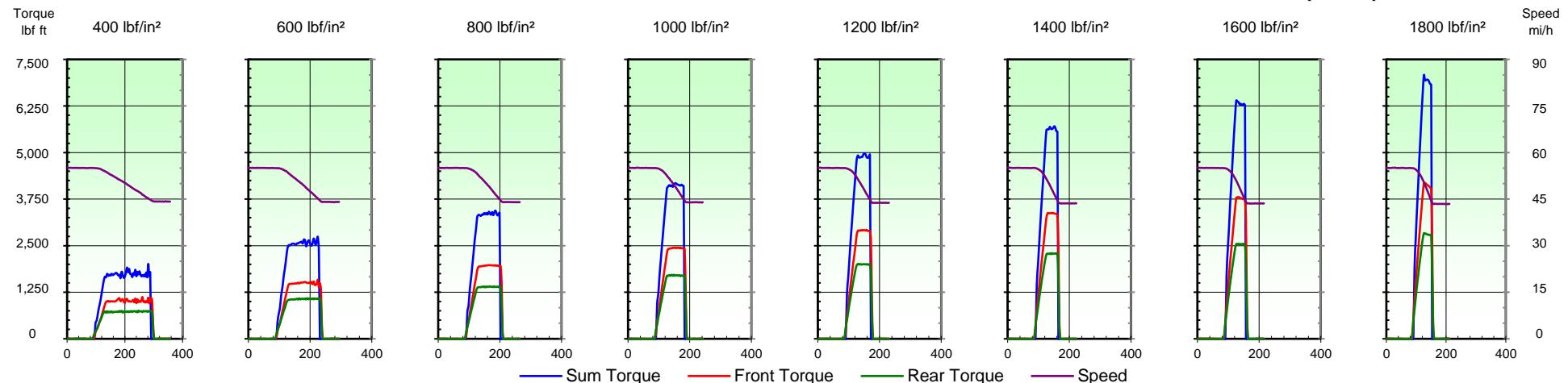
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 55-45 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

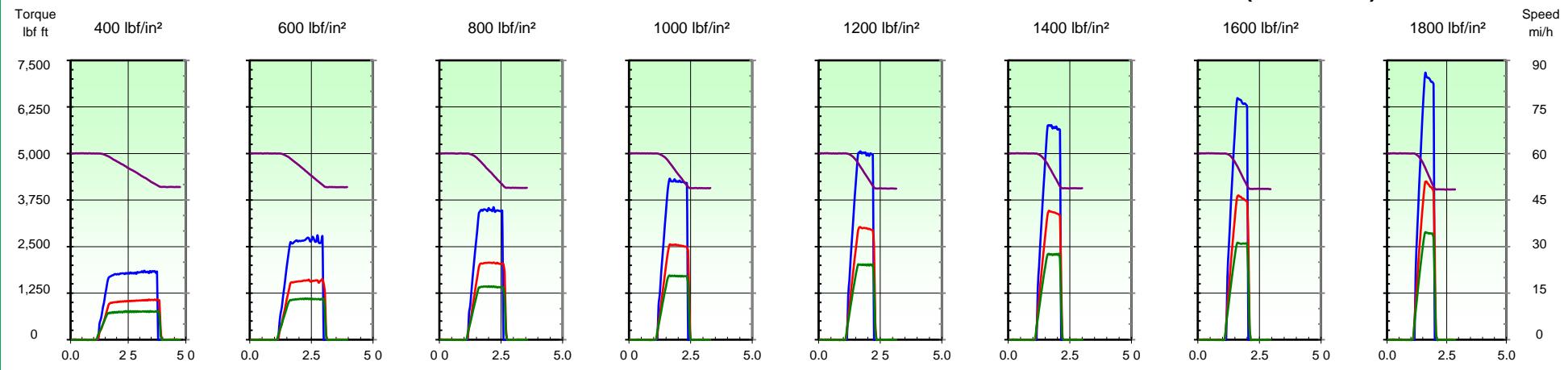
Report Number: 203145-1

Test Report Date: 06 March 2020

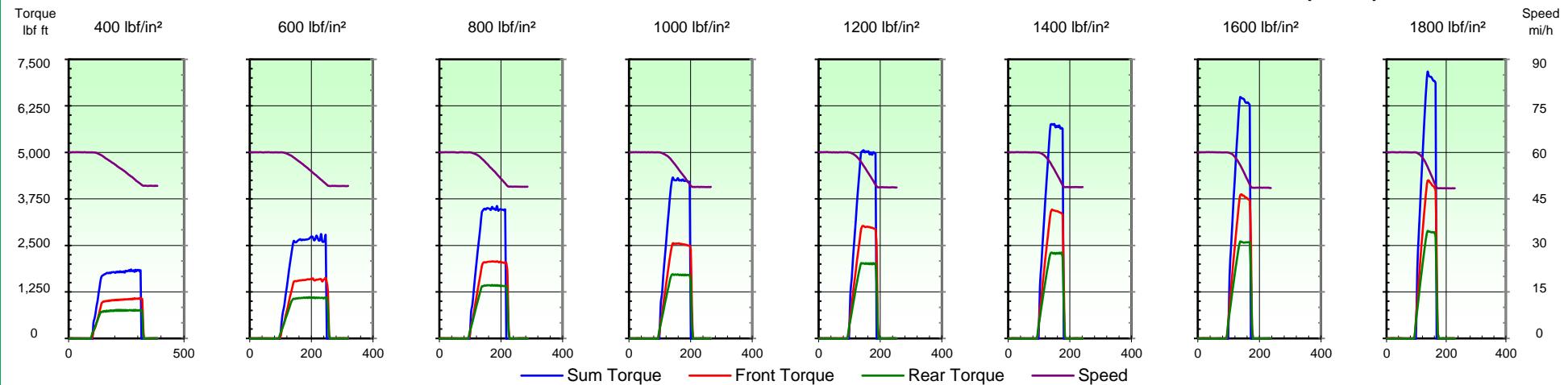
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 60-50 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

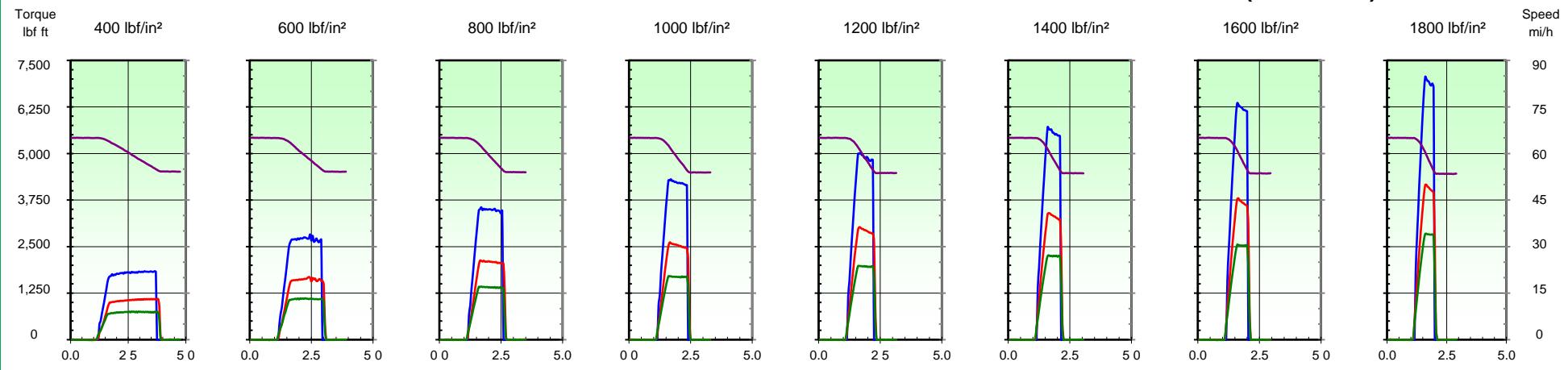
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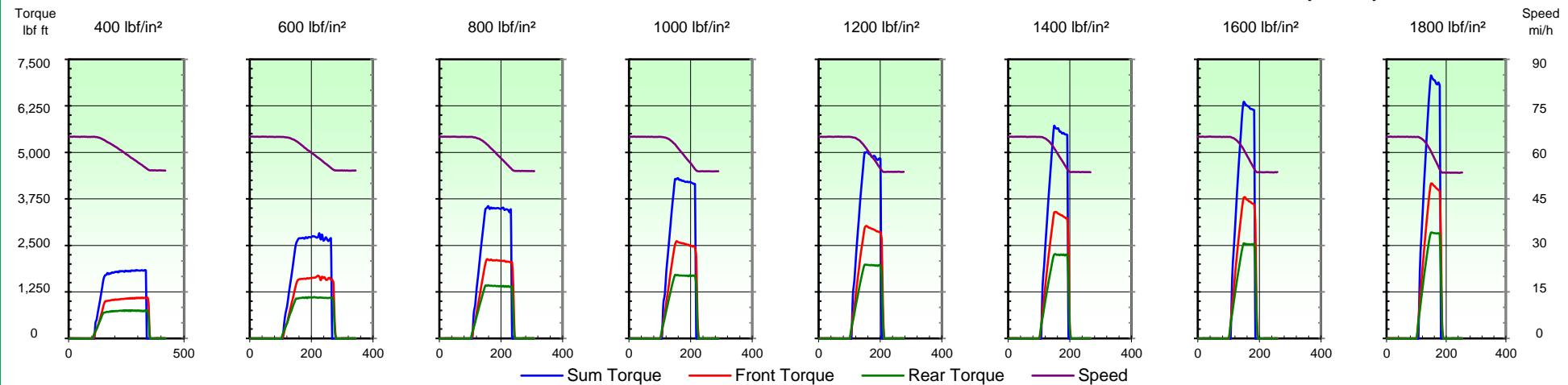
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - 65-55 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

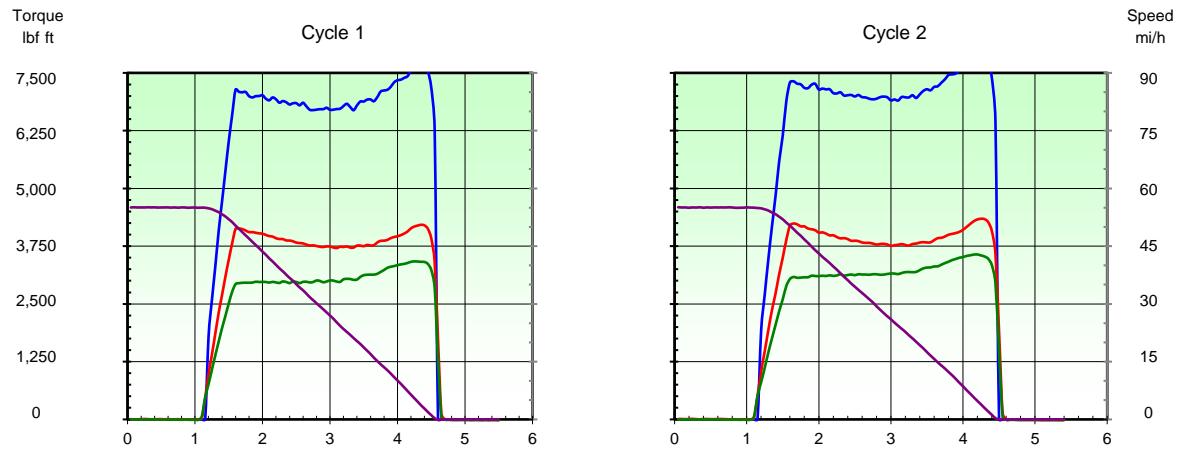
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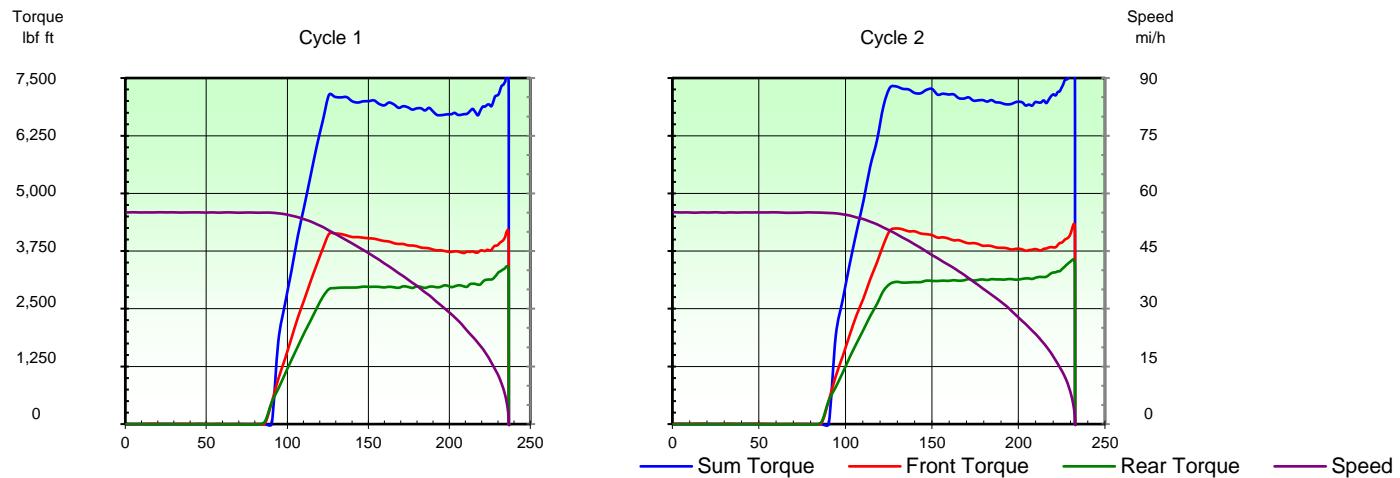
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 300°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



1ST EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 300°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

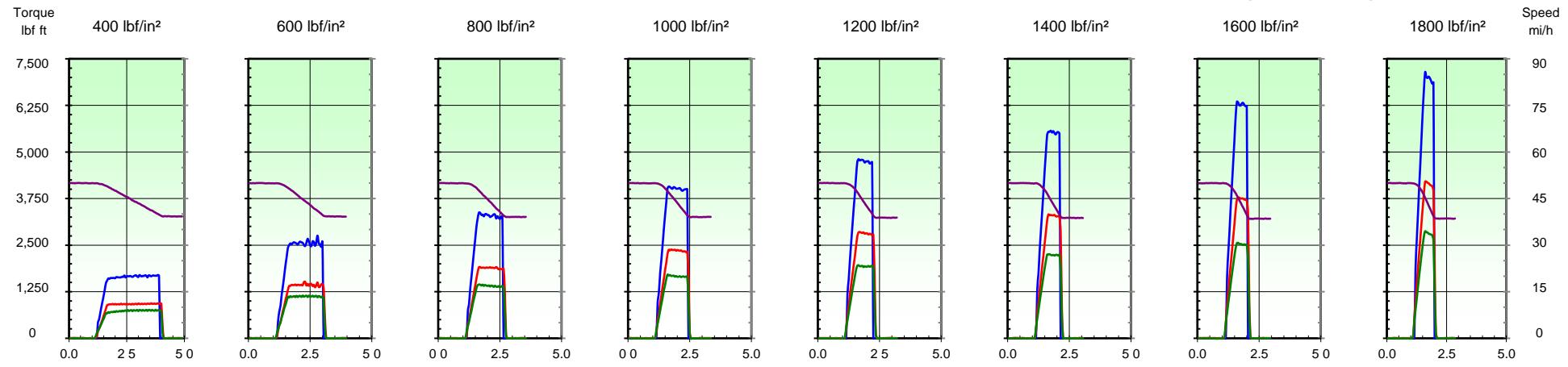
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Test Report Date: 06 March 2020

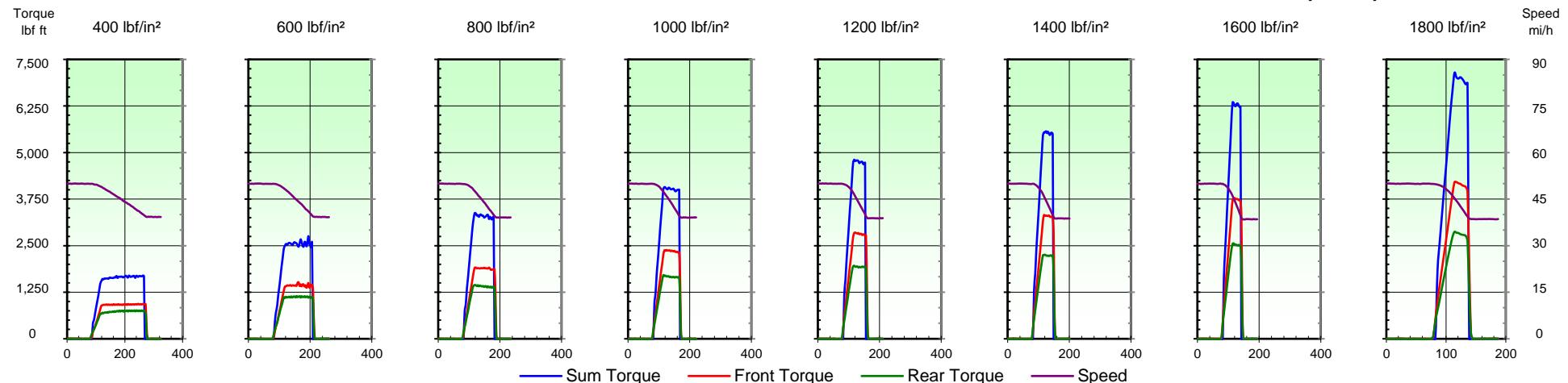
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 50-40 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

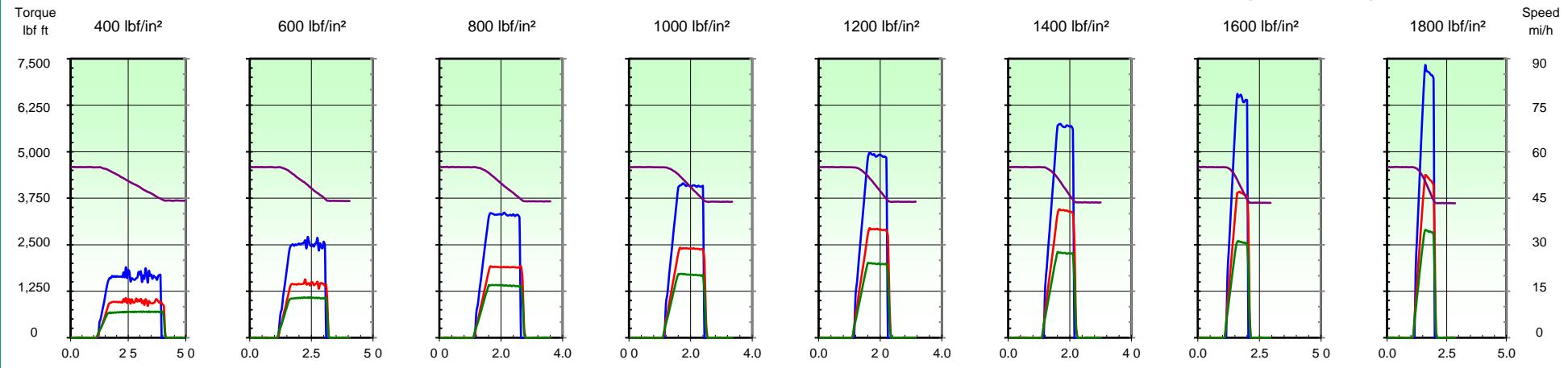
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Test Report Date: 06 March 2020

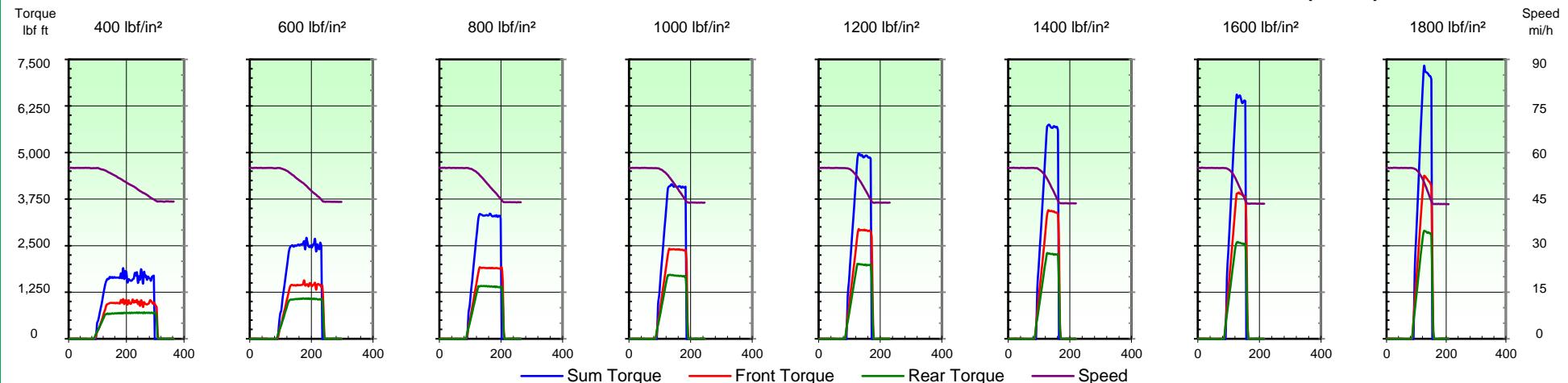
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 55-45 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 55-45 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

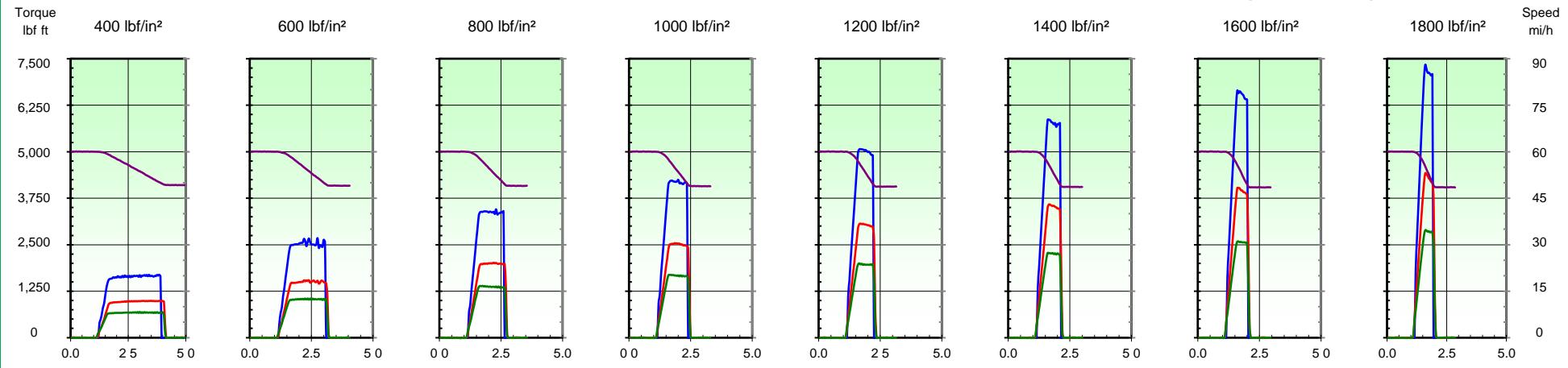
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Test Report Date: 06 March 2020

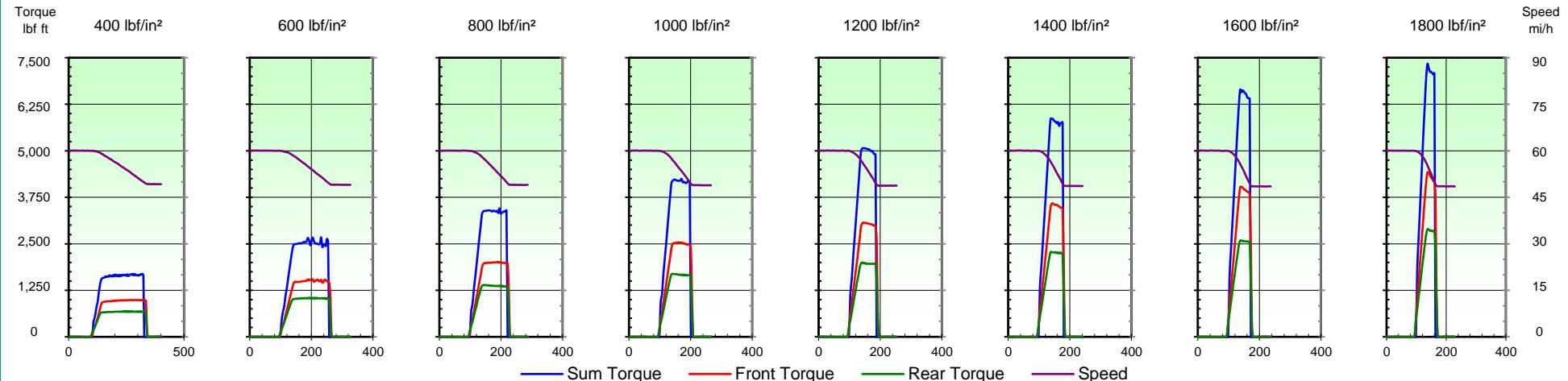
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 60-50 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 60-50 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

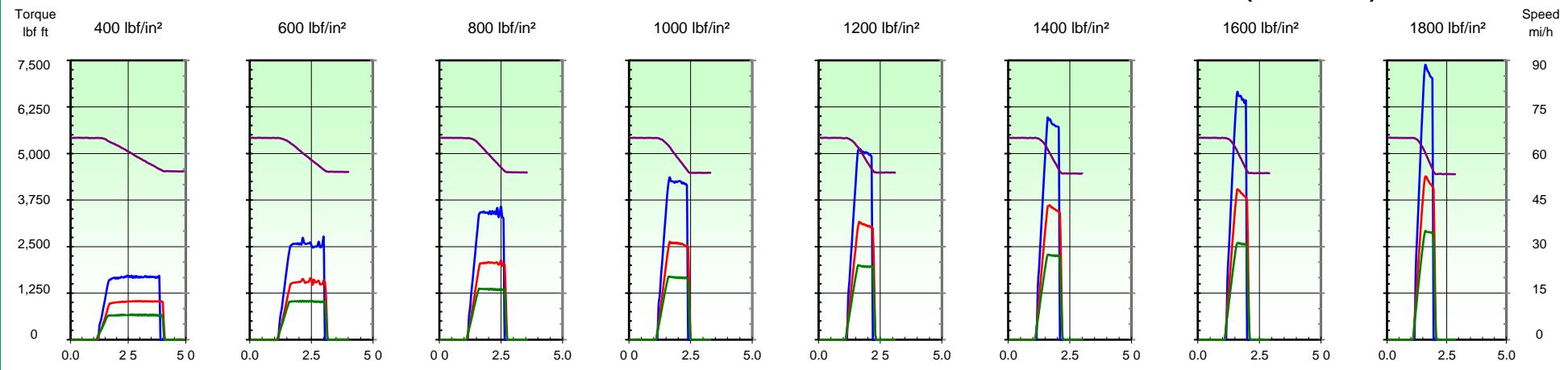
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Test Report Date: 06 March 2020

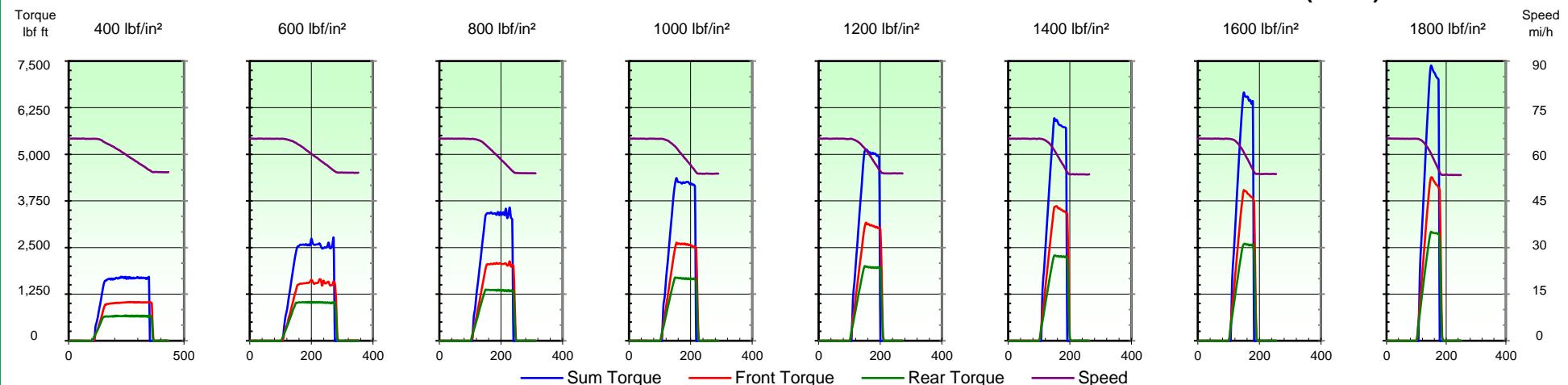
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 65-55 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 65-55 mi/h 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

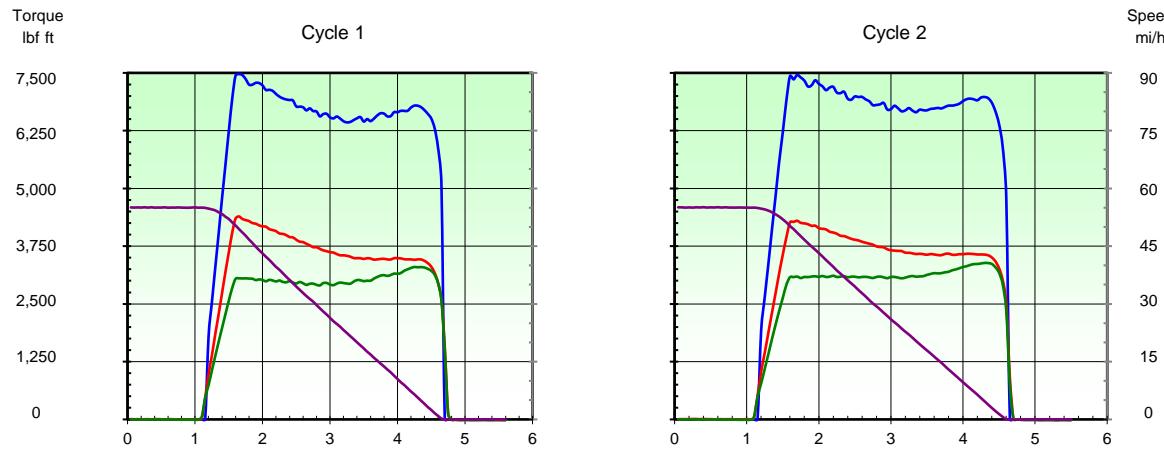
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Test Report Date: 06 March 2020

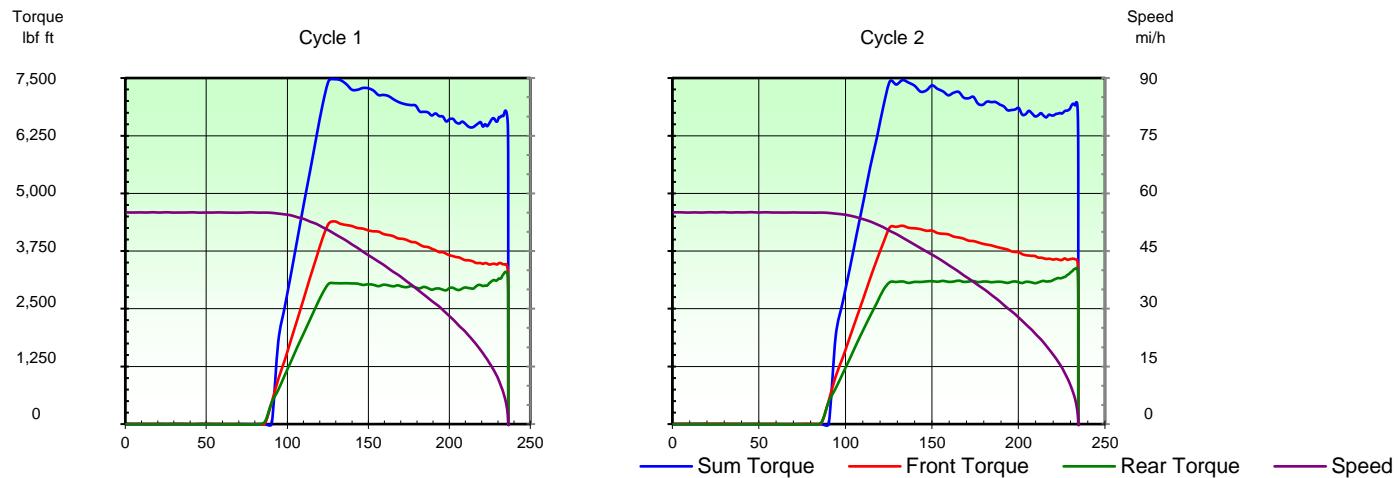
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 450°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 450°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

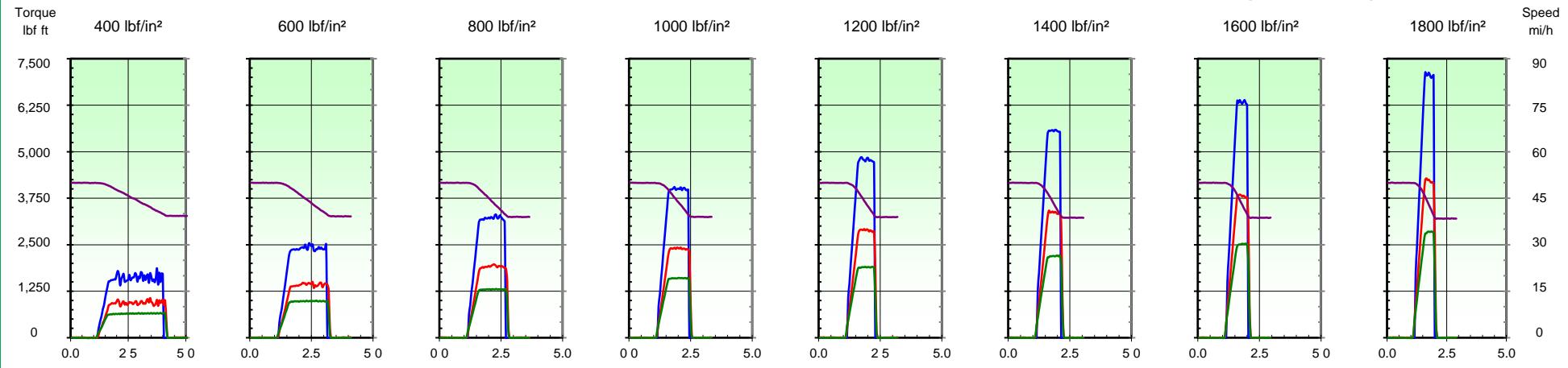
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Test Report Date: 06 March 2020

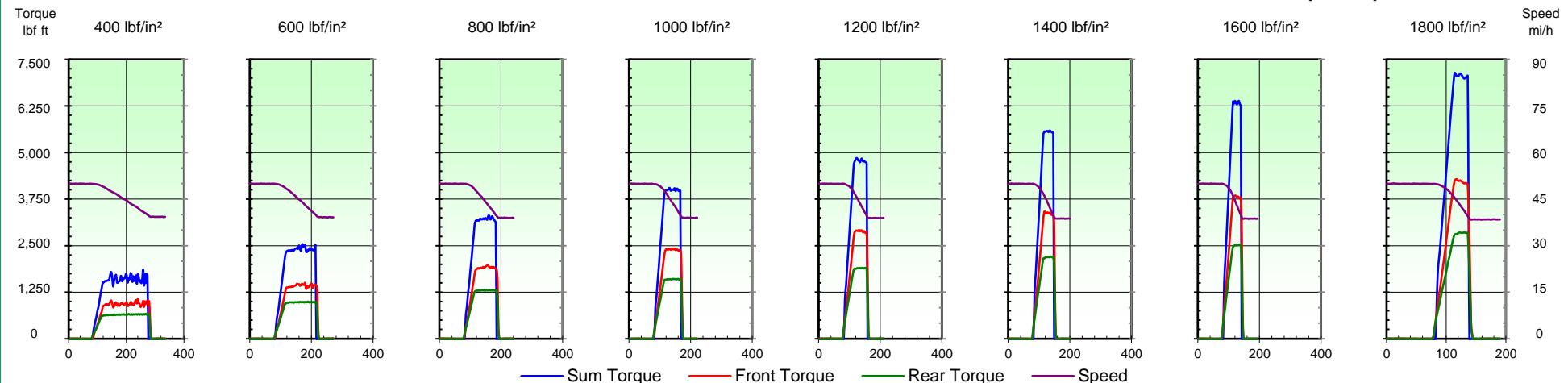
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 50-40 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

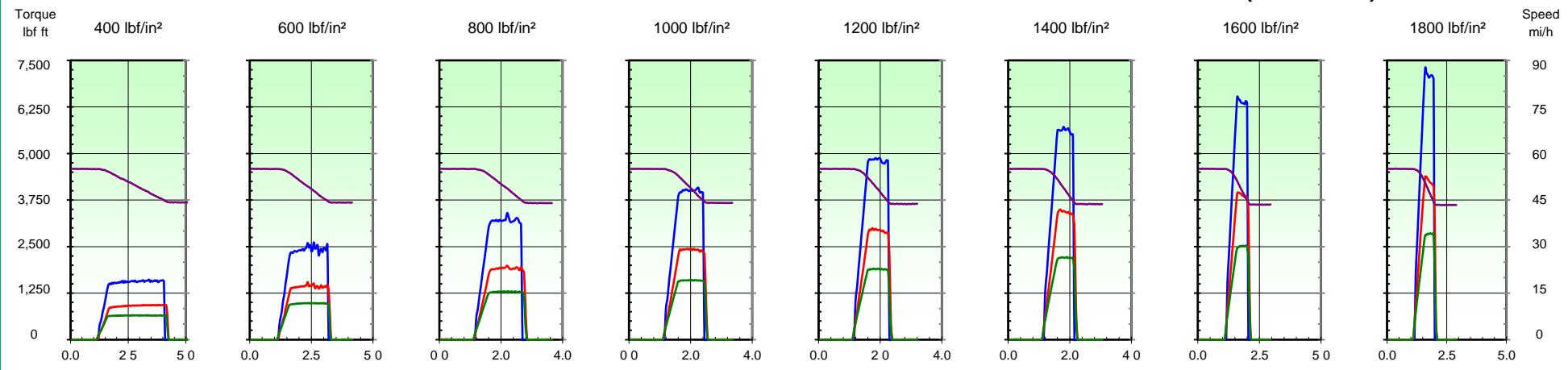
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Test Report Date: 06 March 2020

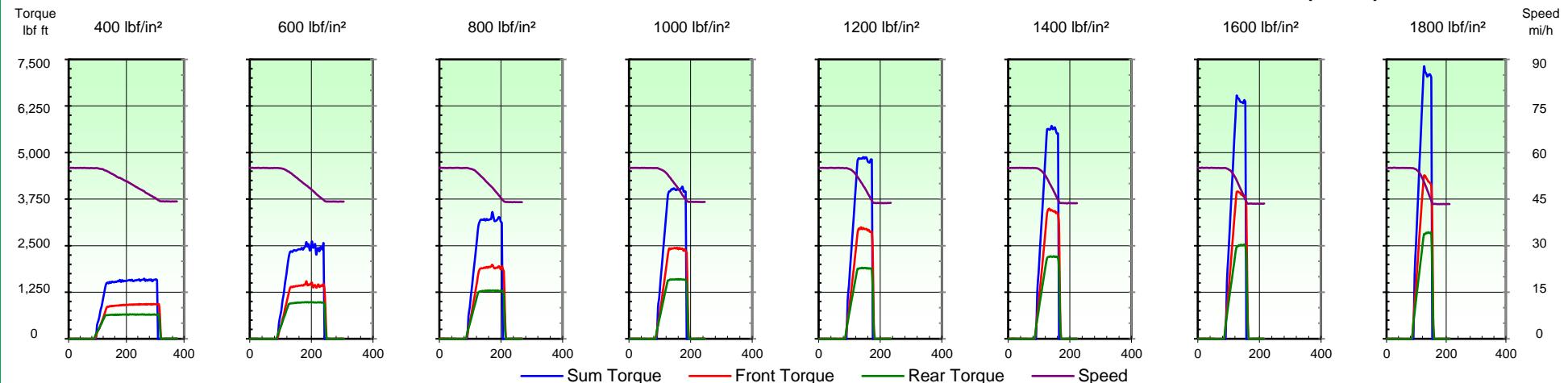
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 55-45 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 55-45 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

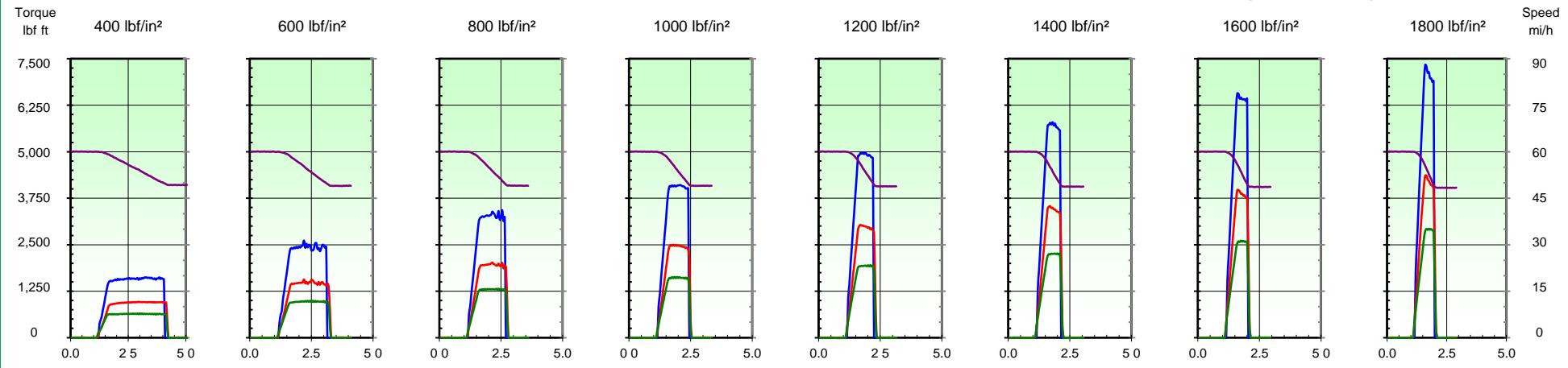
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Test Report Date: 06 March 2020

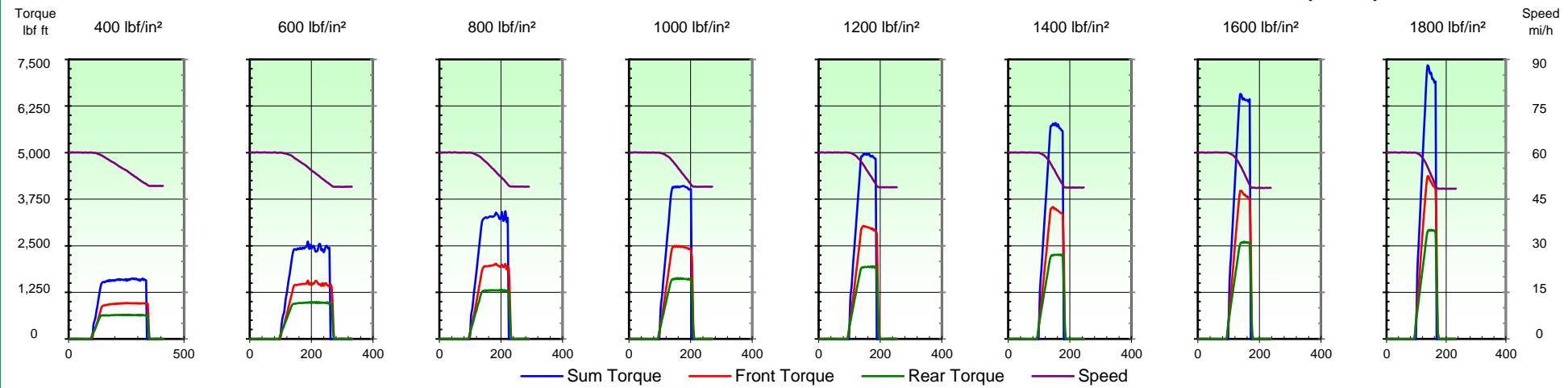
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 60-50 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 60-50 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

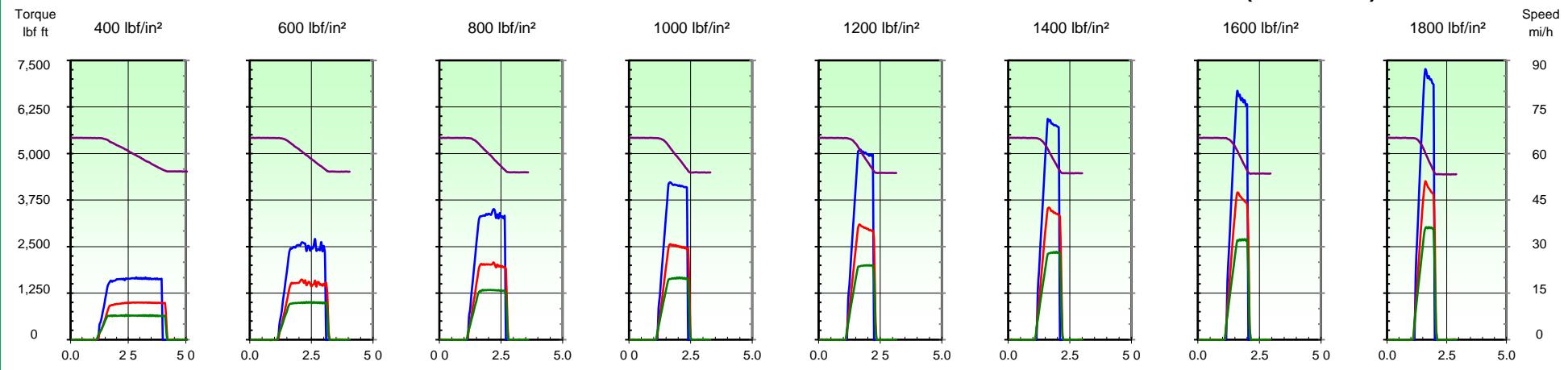
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Test Report Date: 06 March 2020

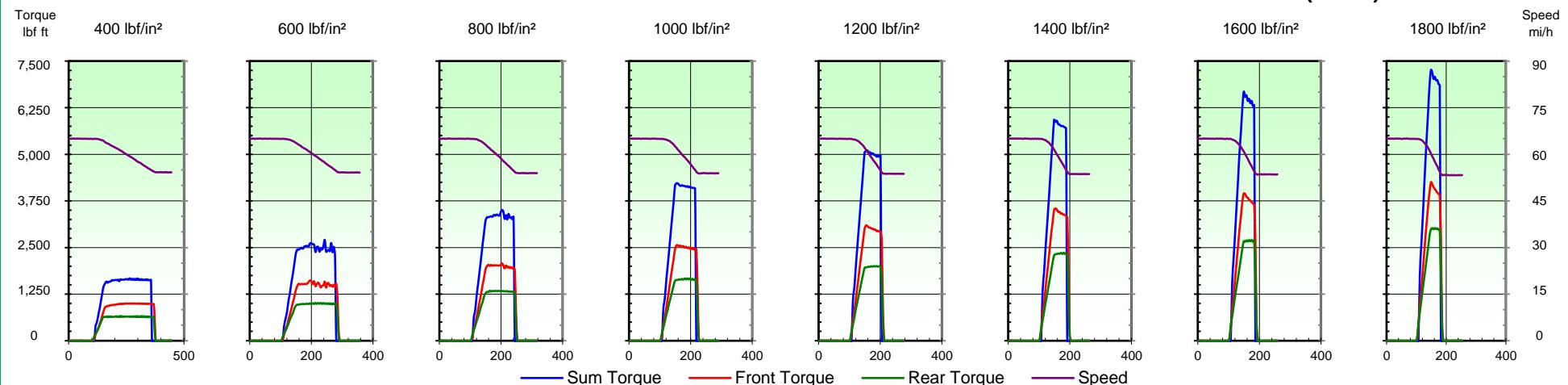
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 65-55 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 65-55 mi/h 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

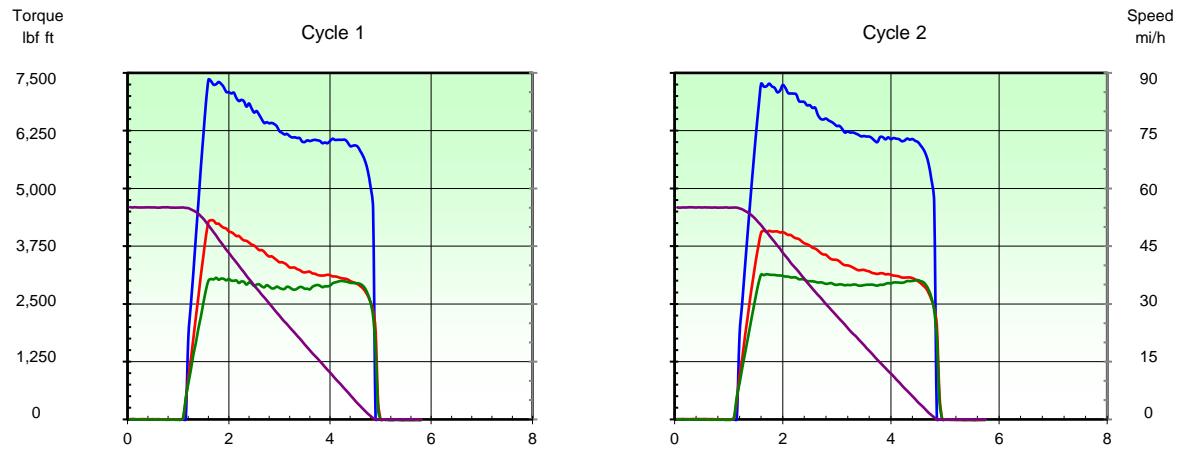
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Test Report Date: 06 March 2020

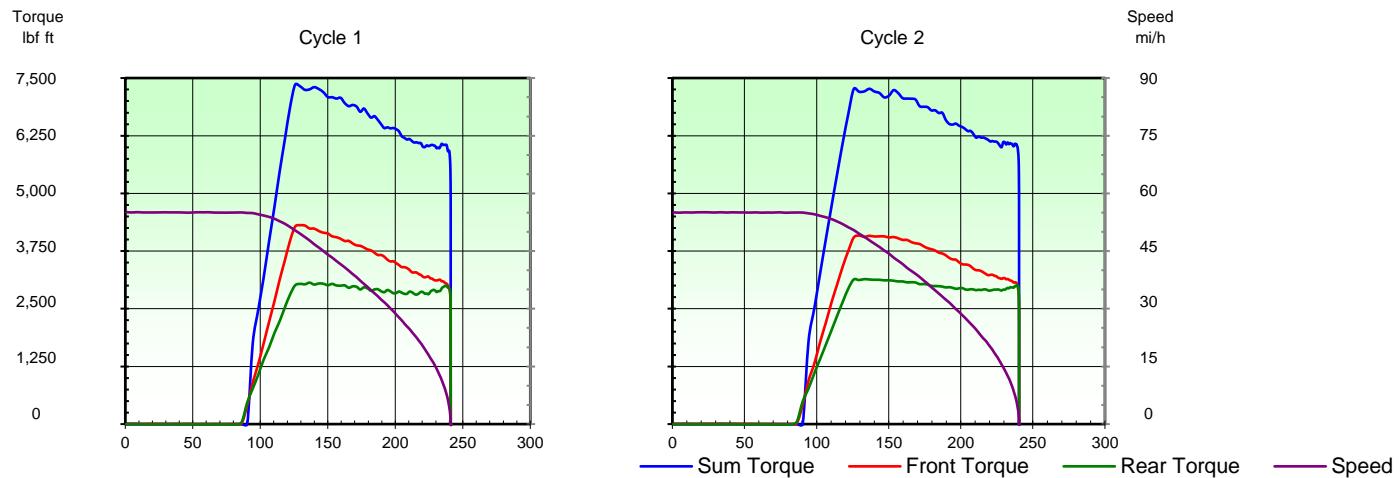
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 600°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 600°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

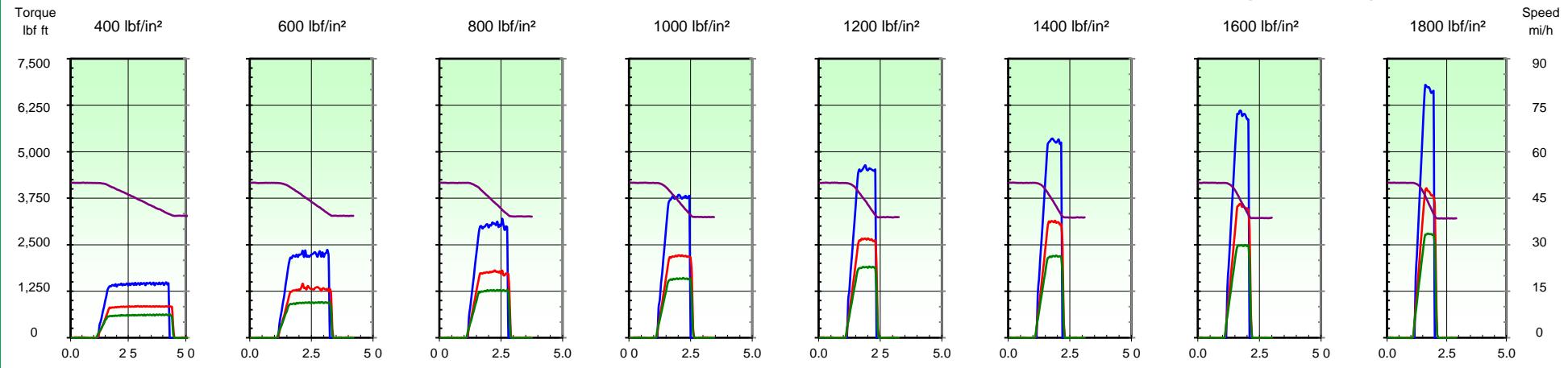
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Test Report Date: 06 March 2020

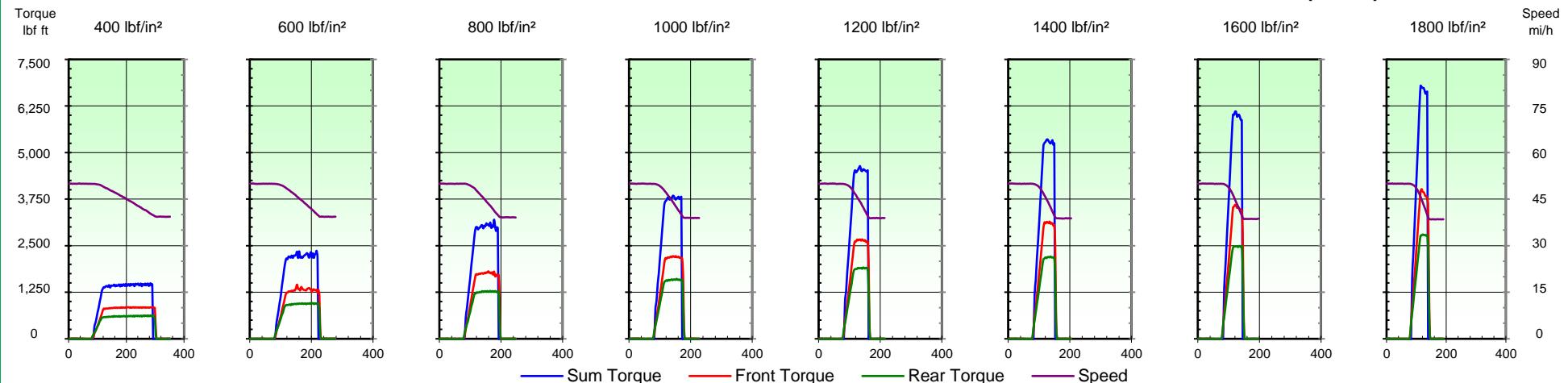
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 50-40 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

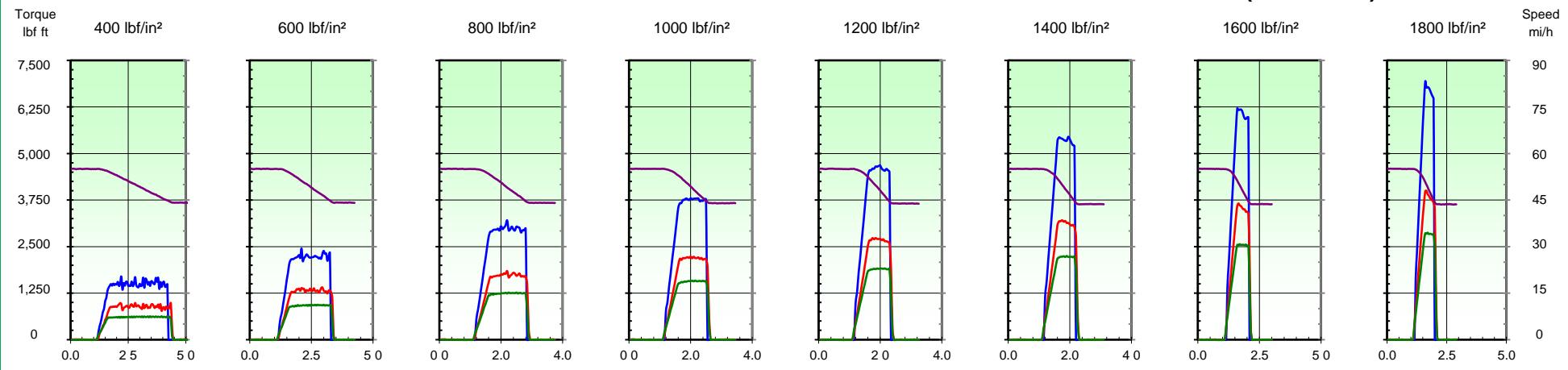
Report Number: 203145-1

Test Report Date: 06 March 2020

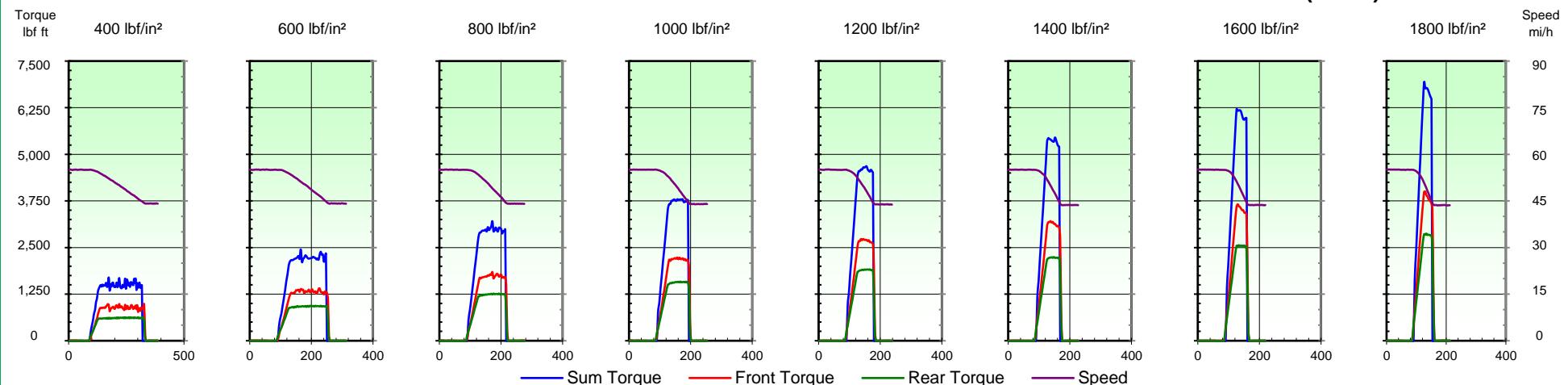
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 55-45 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 55-45 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

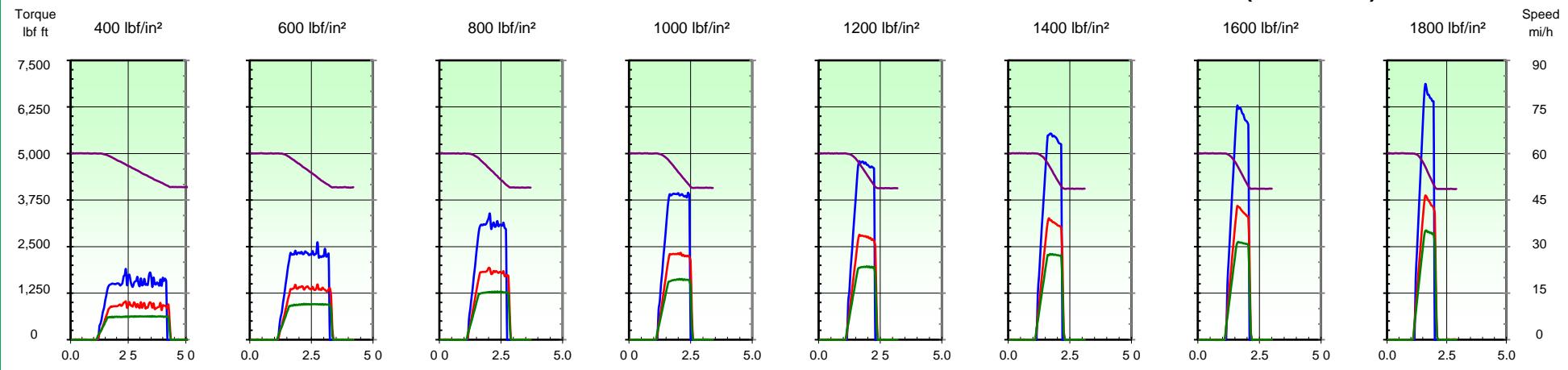
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Test Report Date: 06 March 2020

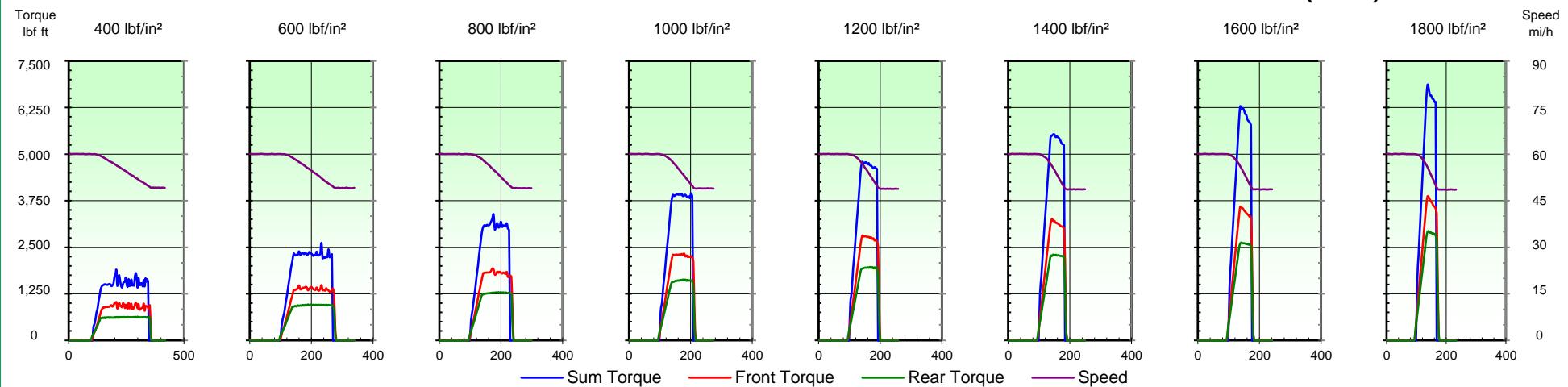
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 60-50 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 60-50 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

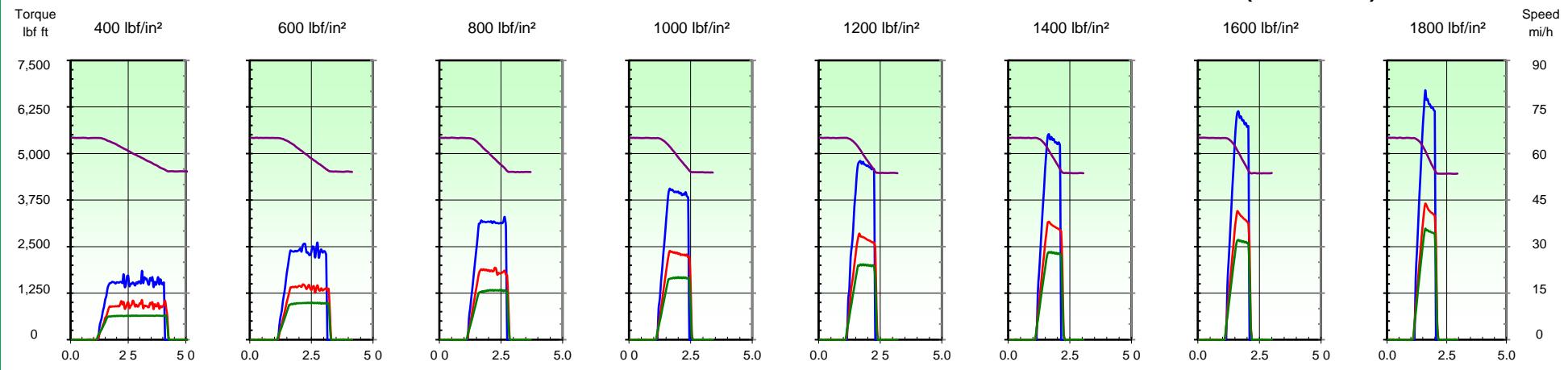
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Test Report Date: 06 March 2020

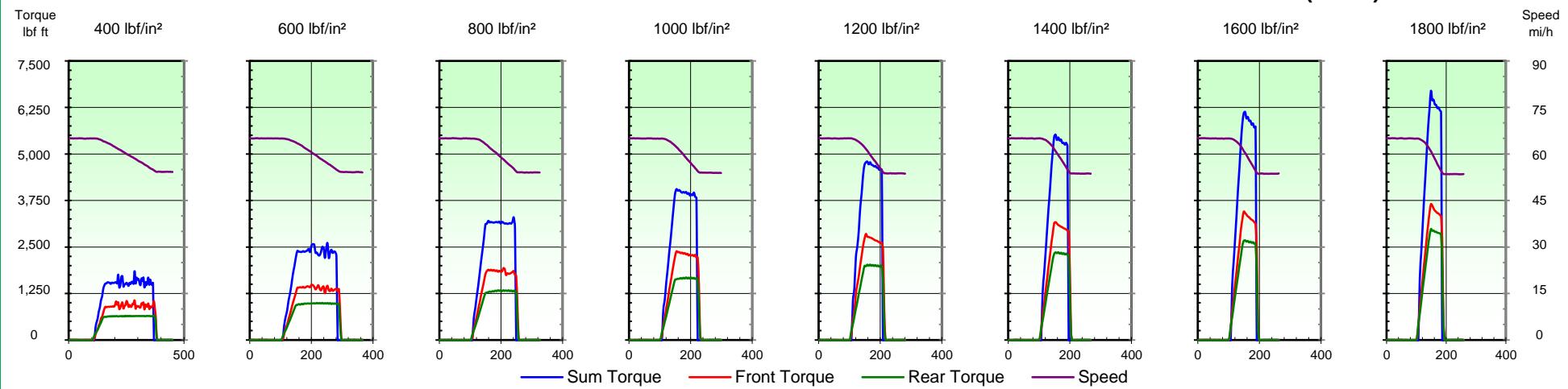
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 65-55 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 65-55 mi/h 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

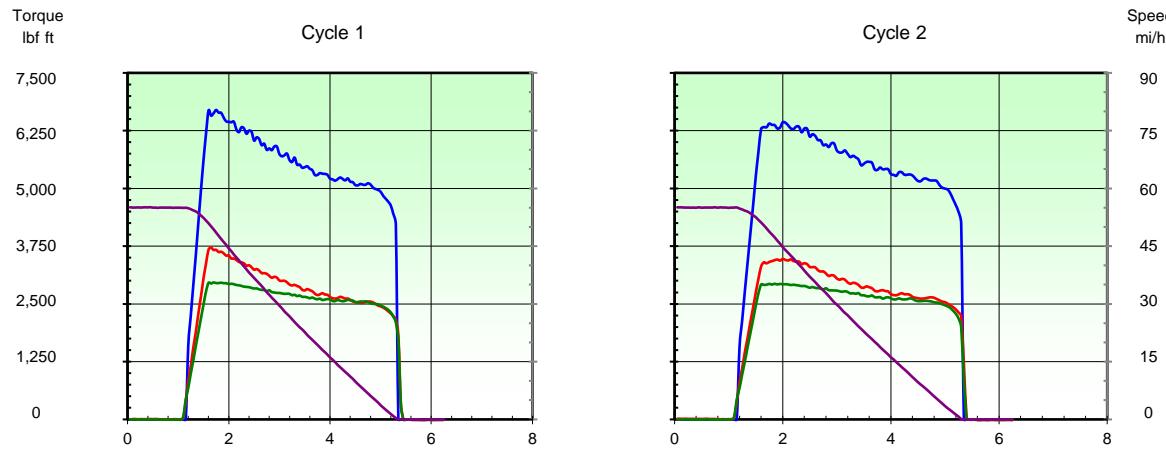
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Test Report Date: 06 March 2020

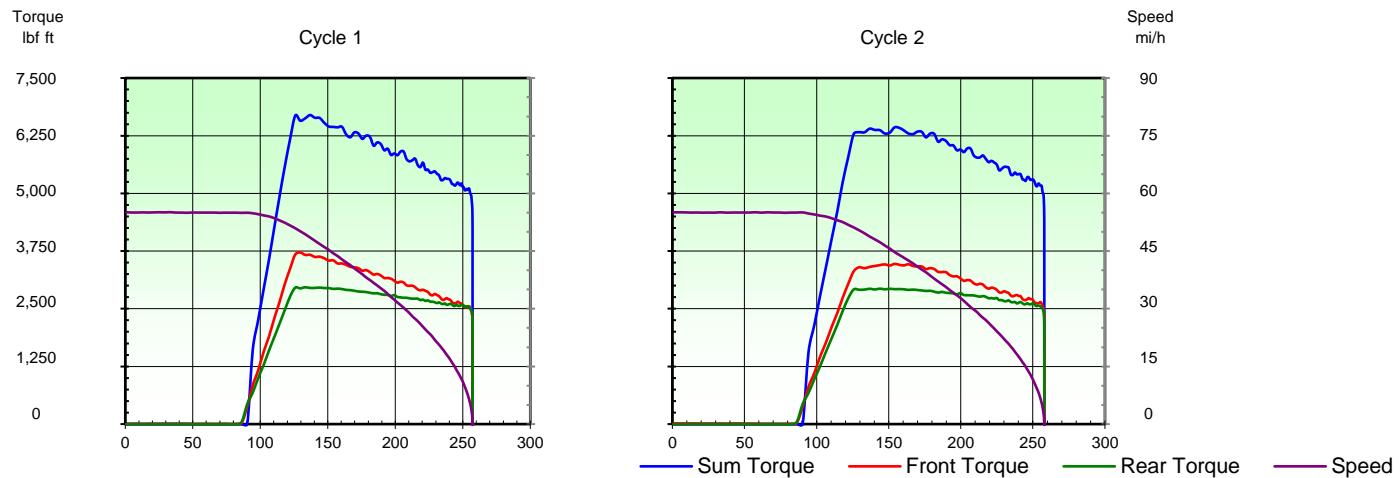
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 750°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 750°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

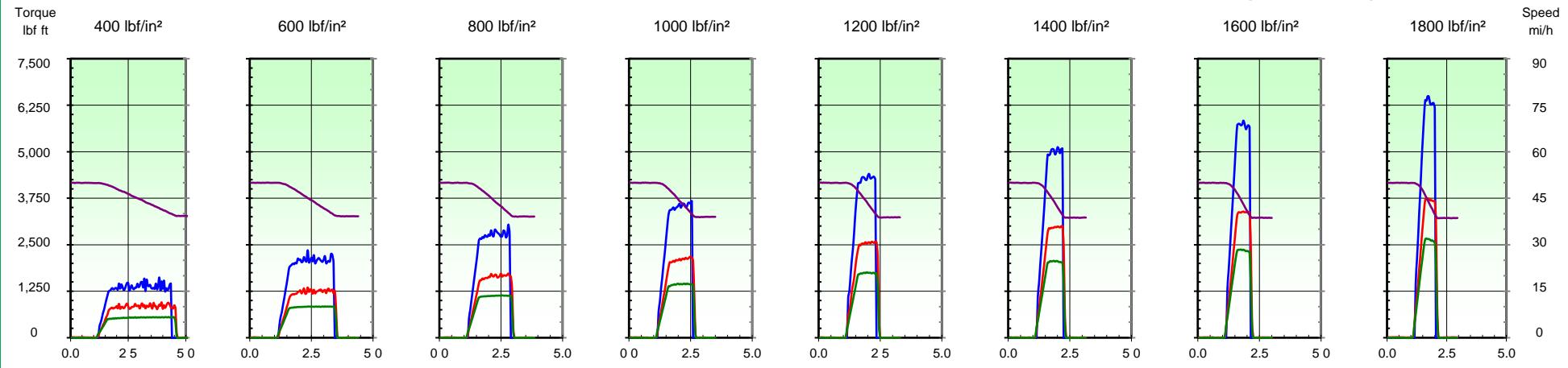
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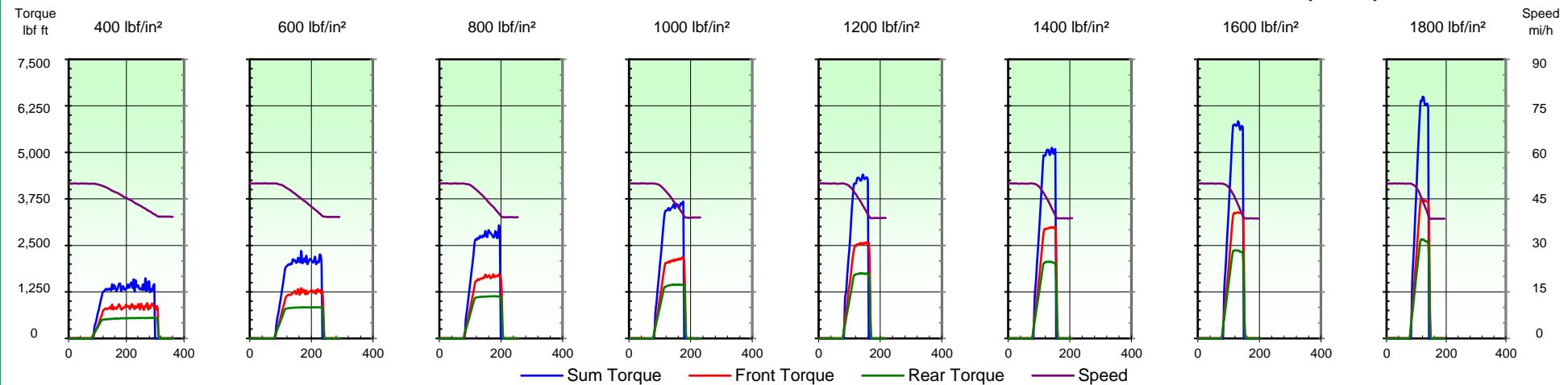
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 50-40 mi/h 900°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 50-40 mi/h 900°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

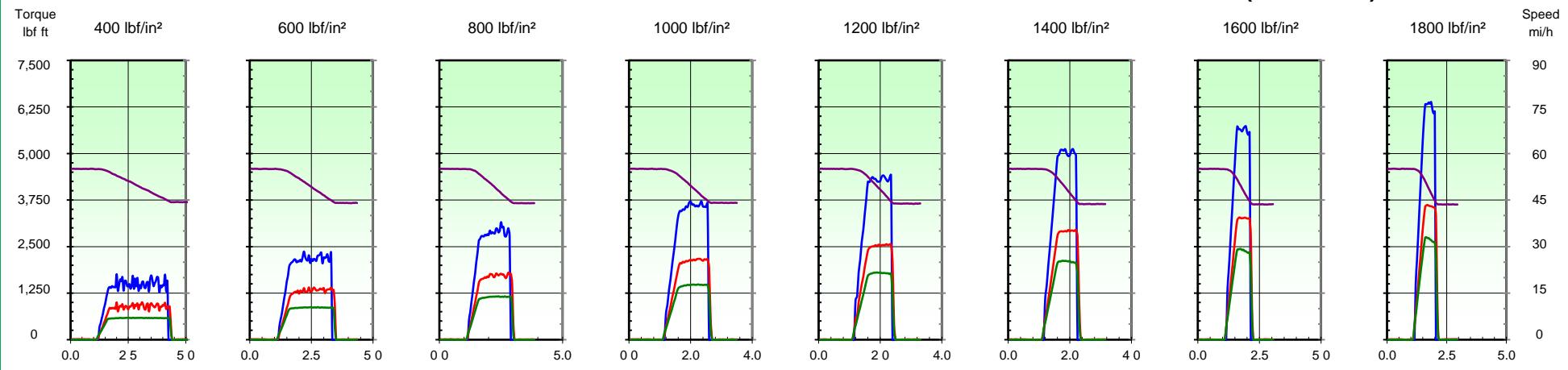
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Test Report Date: 06 March 2020

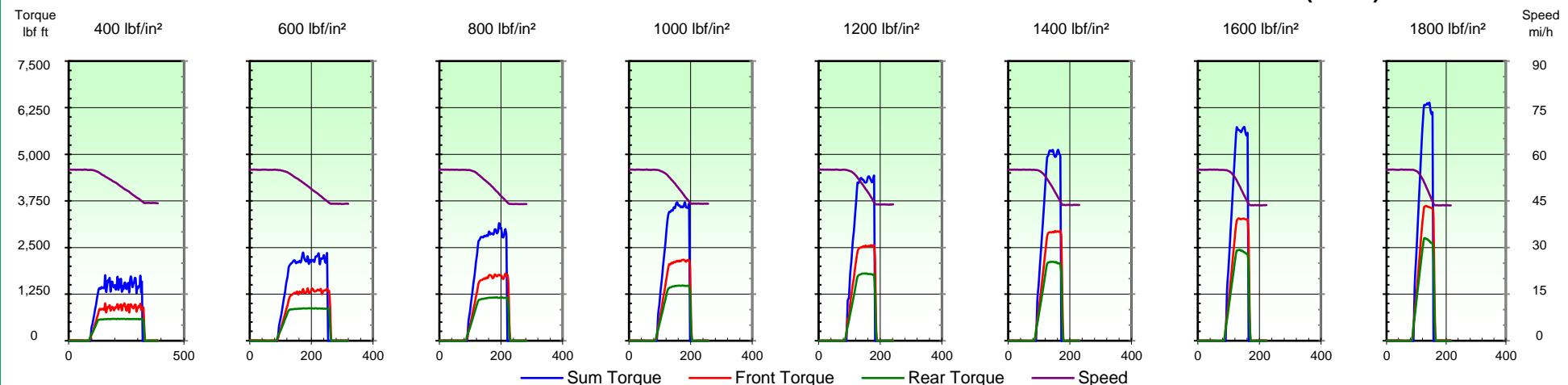
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 55-45 mi/h 900°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 55-45 mi/h 900°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

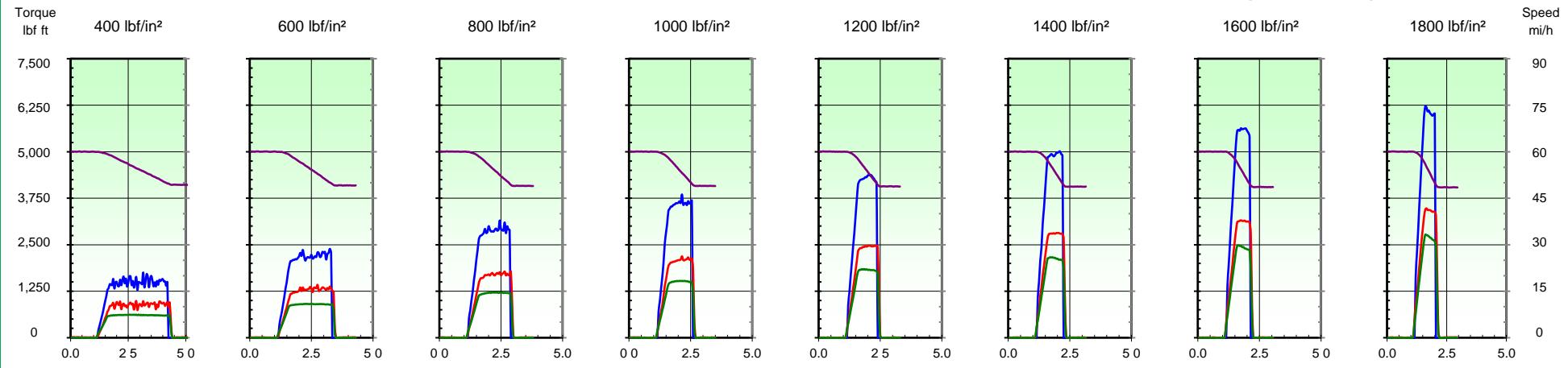
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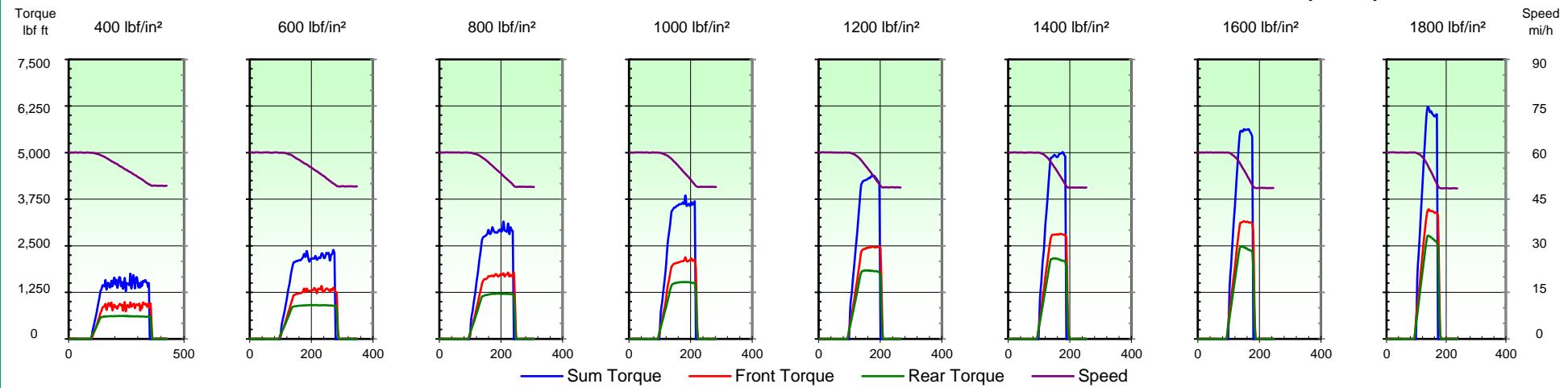
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 60-50 mi/h 900°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 60-50 mi/h 900°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

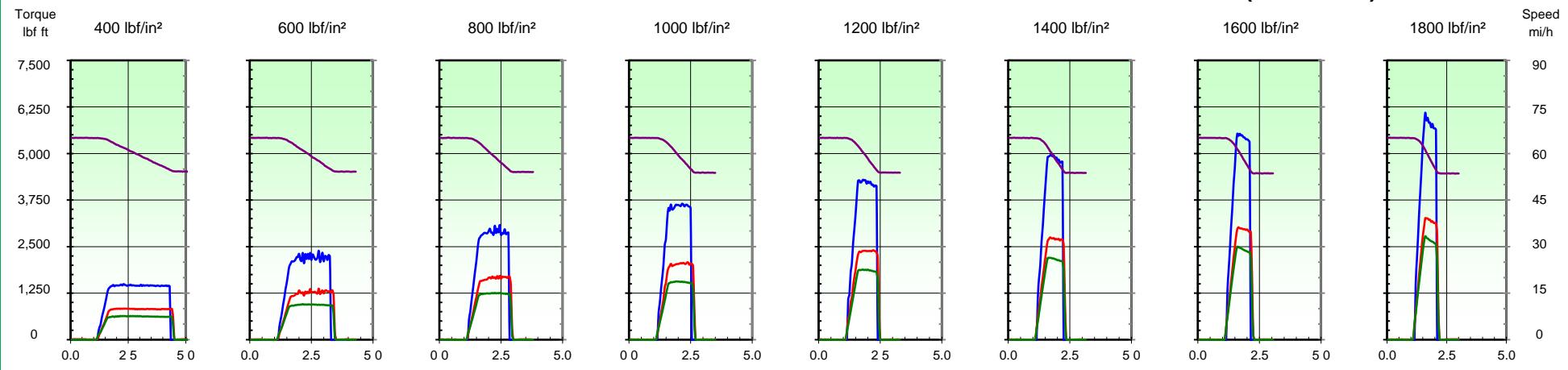
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Test Report Date: 06 March 2020

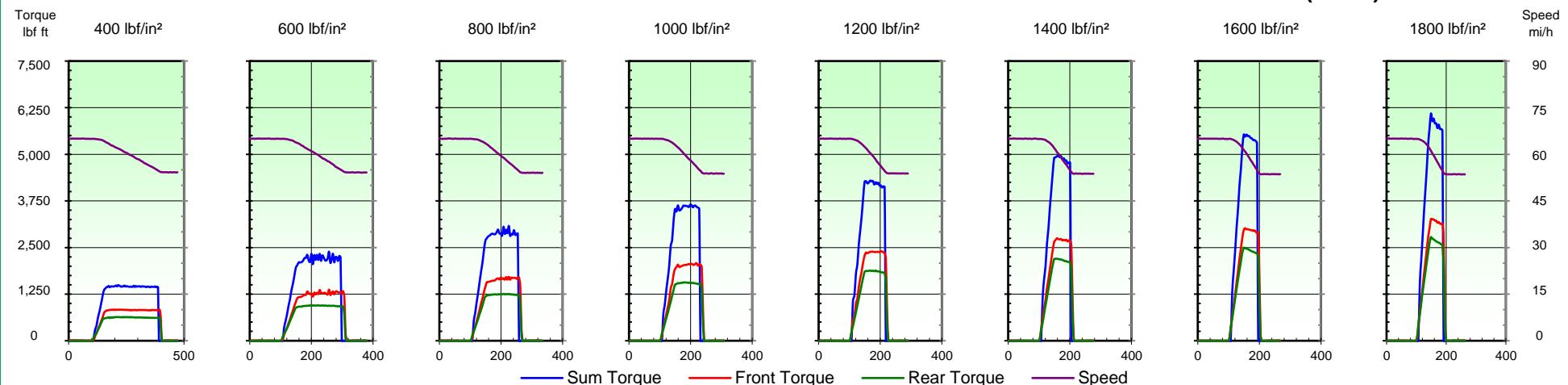
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - 65-55 mi/h 900°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - 65-55 mi/h 900°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

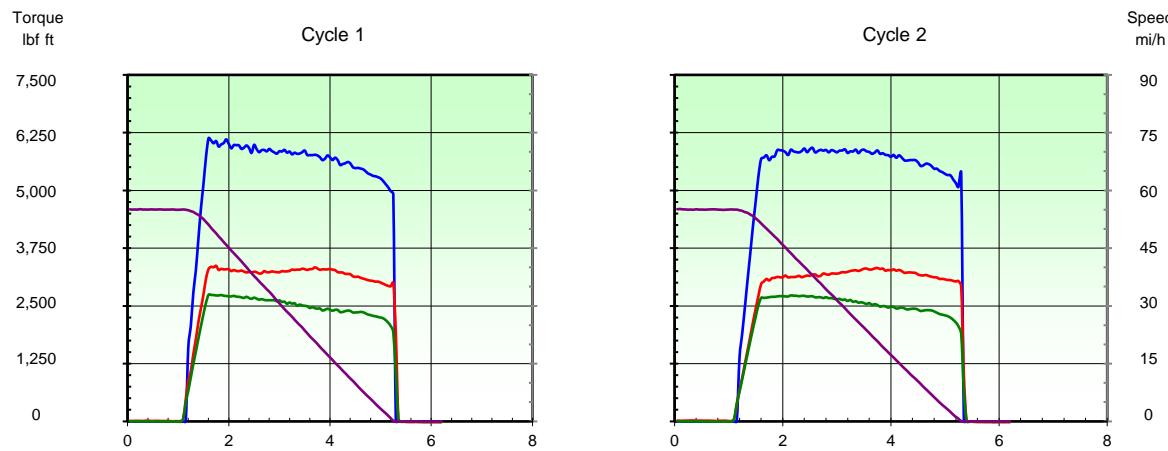
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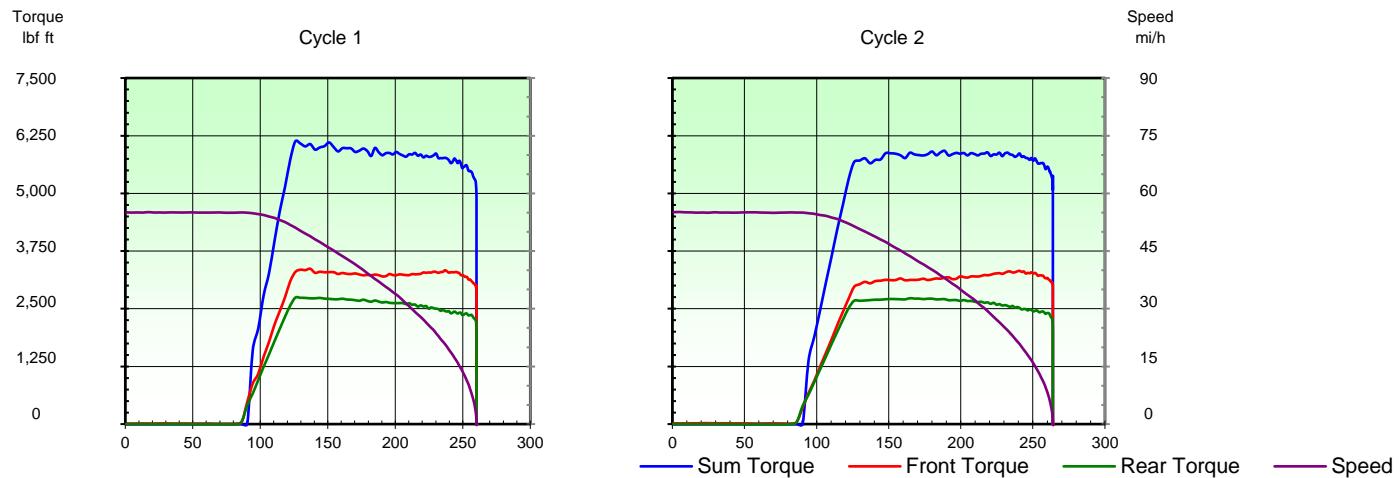
NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 900°F IN-STOP TORQUE & SPEED DATA vs. TIME (SECONDS)



4TH EFFECTIVENESS MATRIX - BEST EFFORT 1800 lbf/in² 900°F IN-STOP TORQUE & SPEED DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

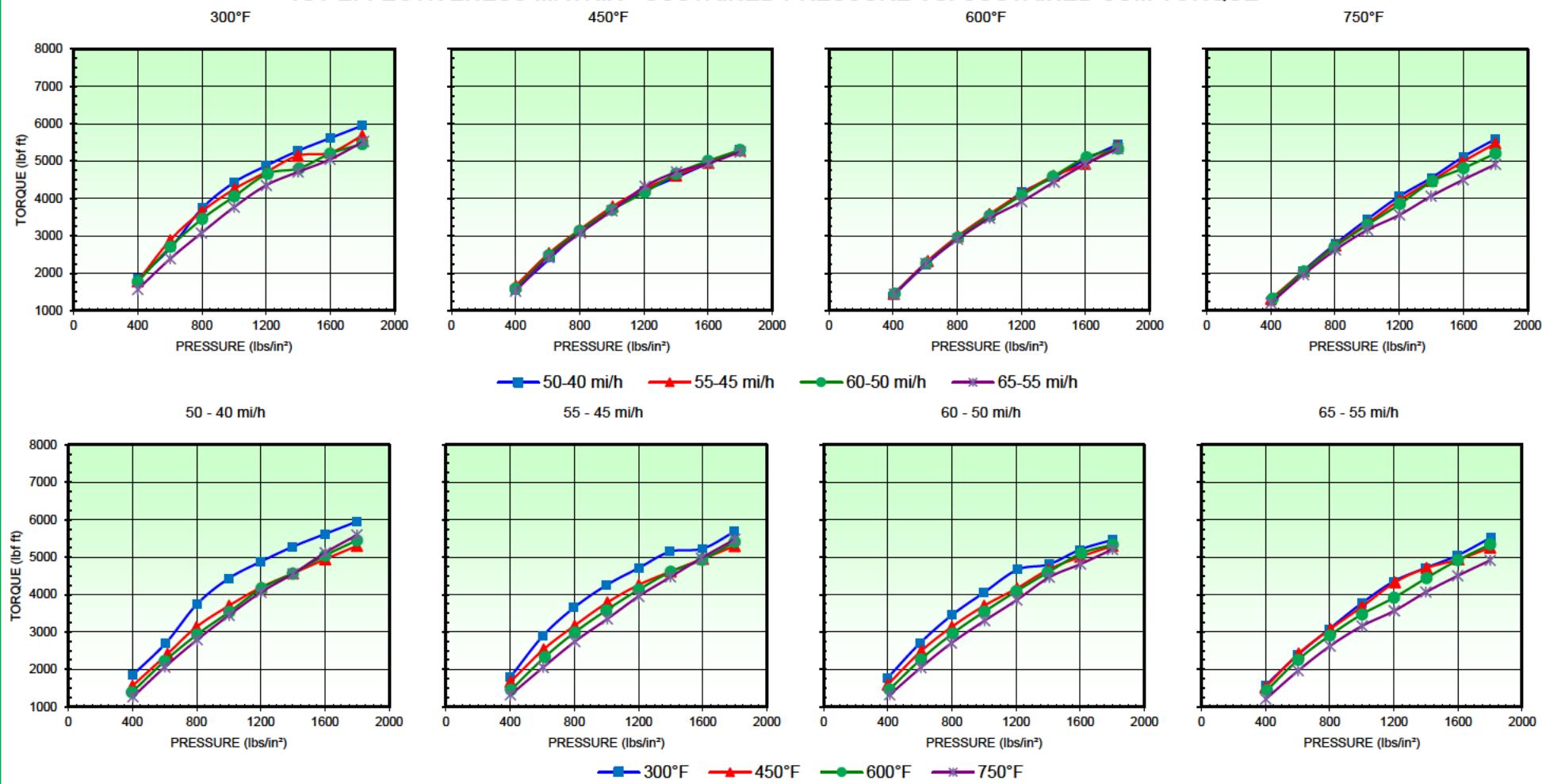
Report Number: 203145-1

Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

1ST EFFECTIVENESS MATRIX - SUSTAINED PRESSURE VS. SUSTAINED SUM TORQUE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

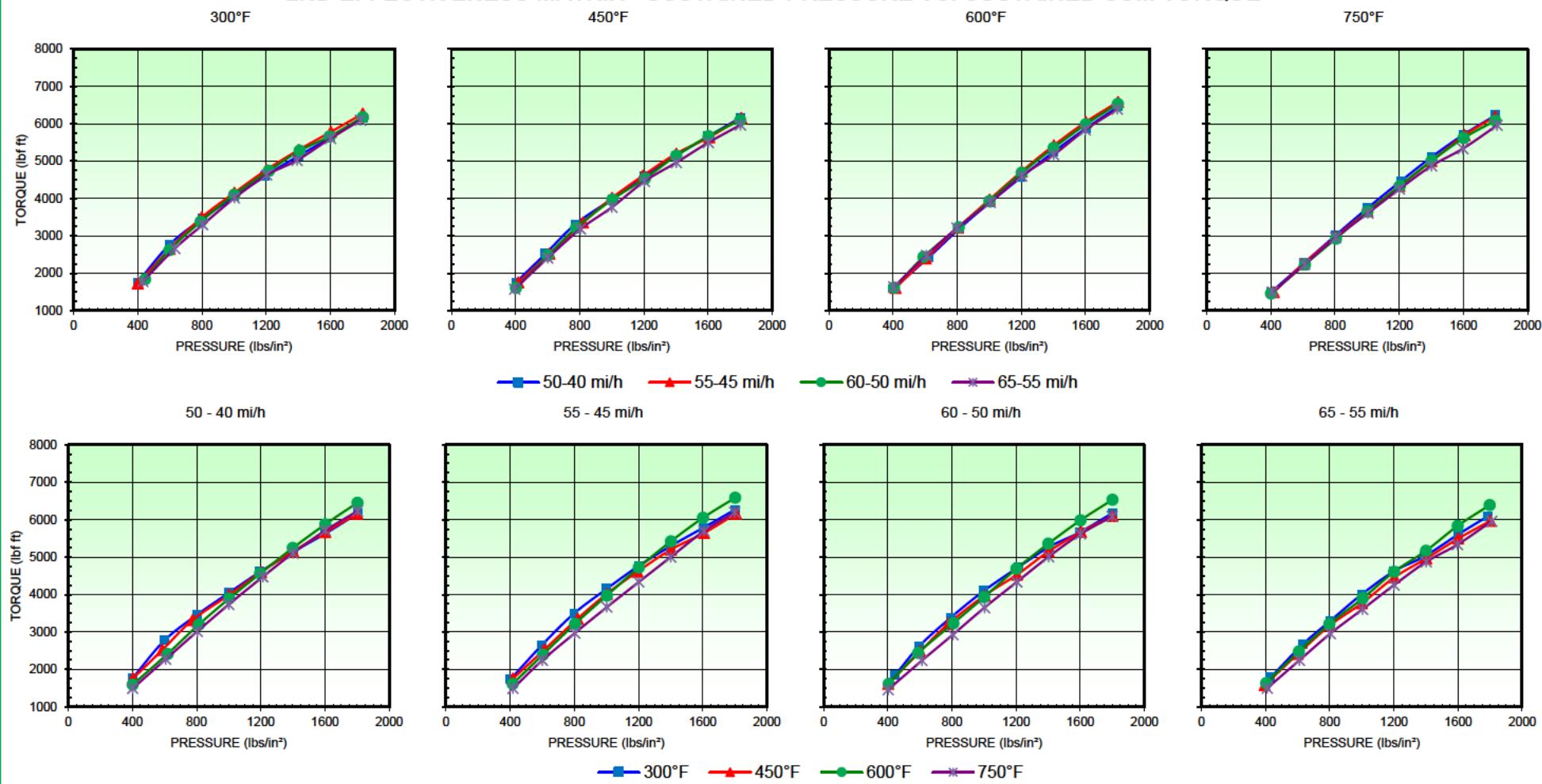
Report Number: 203145-1

Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

2ND EFFECTIVENESS MATRIX - SUSTAINED PRESSURE VS. SUSTAINED SUM TORQUE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

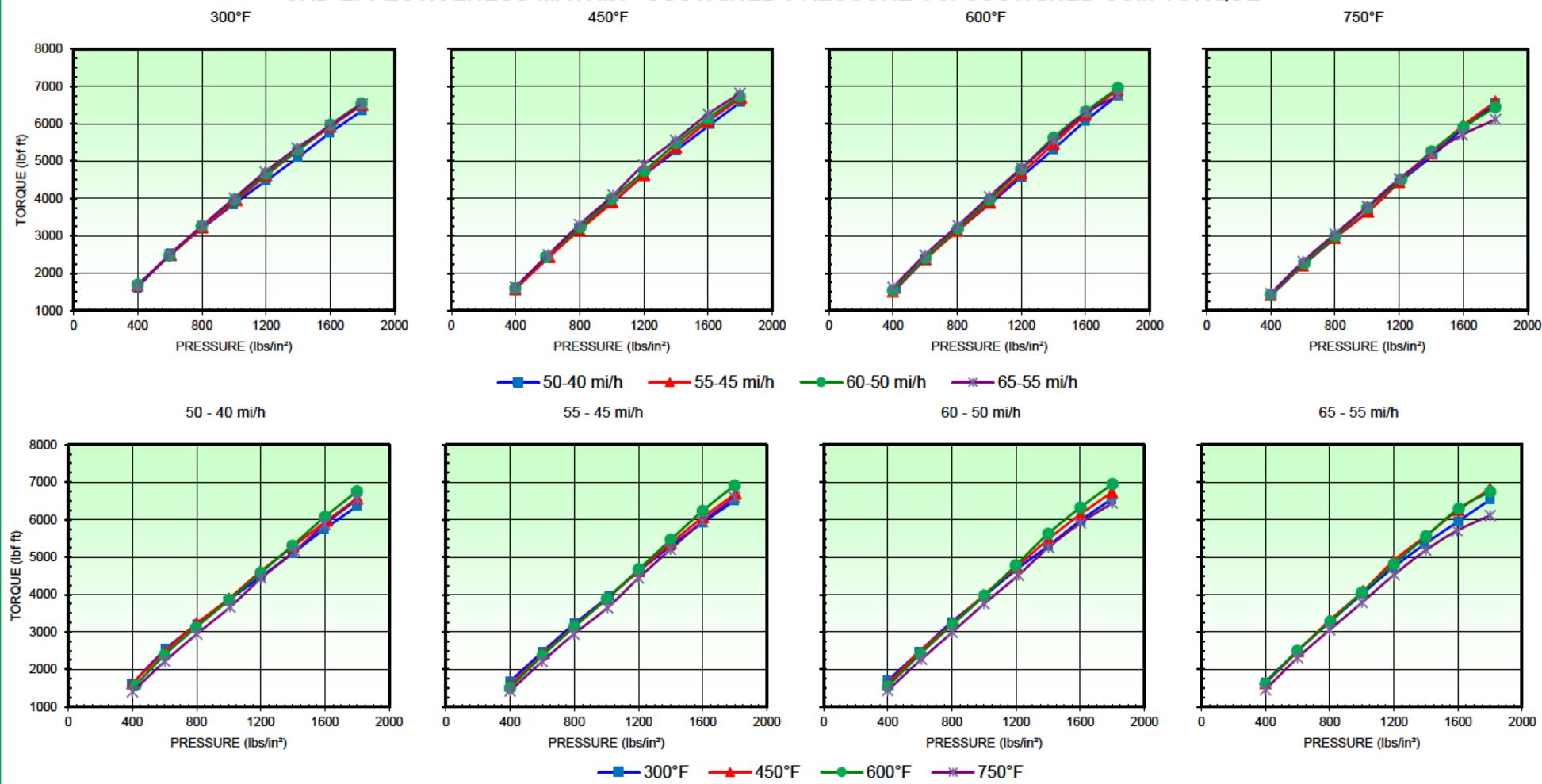
Report Number: 203145-1

Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

3RD EFFECTIVENESS MATRIX - SUSTAINED PRESSURE VS. SUSTAINED SUM TORQUE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

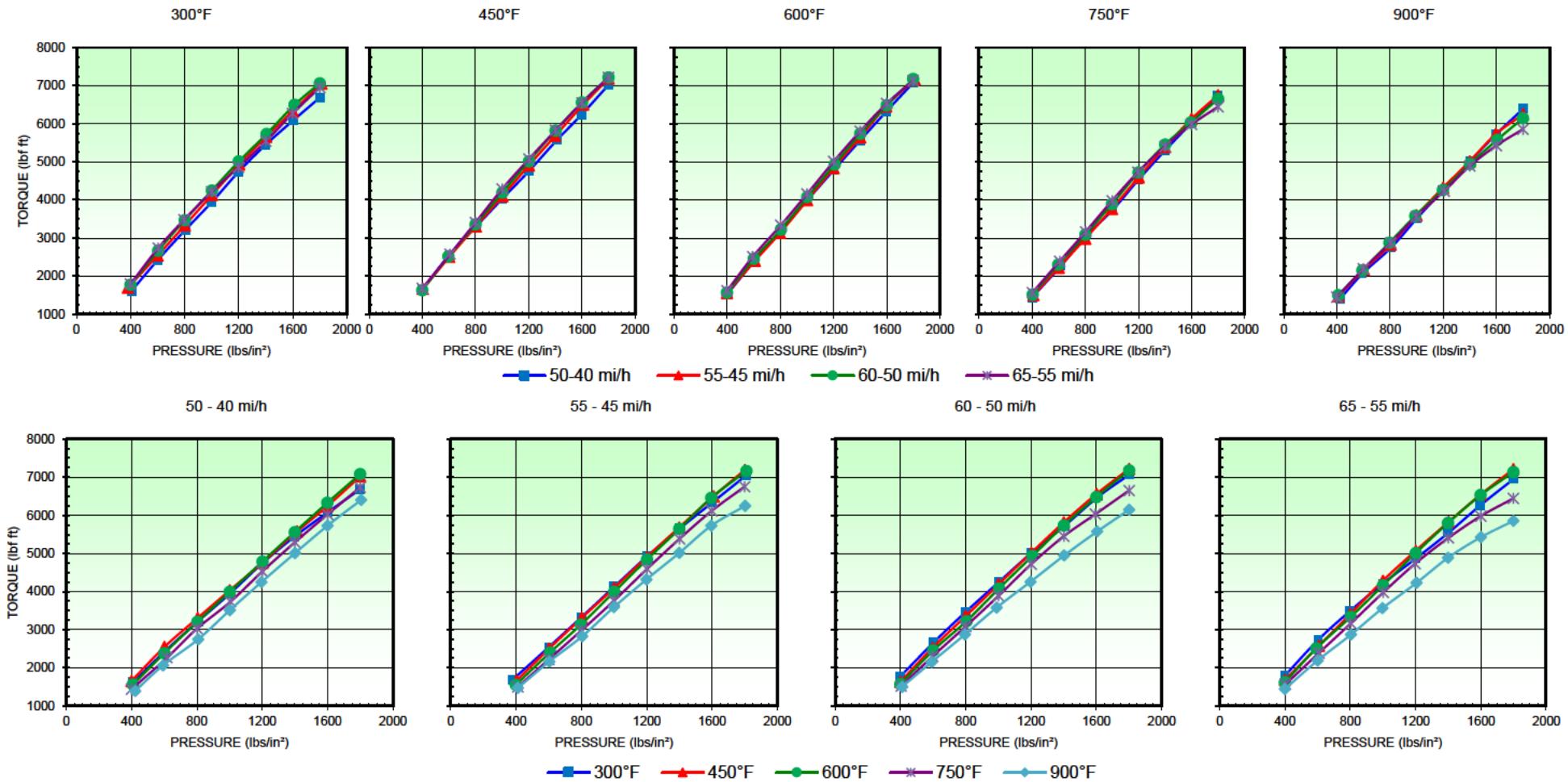
Report Number: 203145-1

Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

4TH EFFECTIVENESS MATRIX - SUSTAINED PRESSURE VS. SUSTAINED SUM TORQUE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

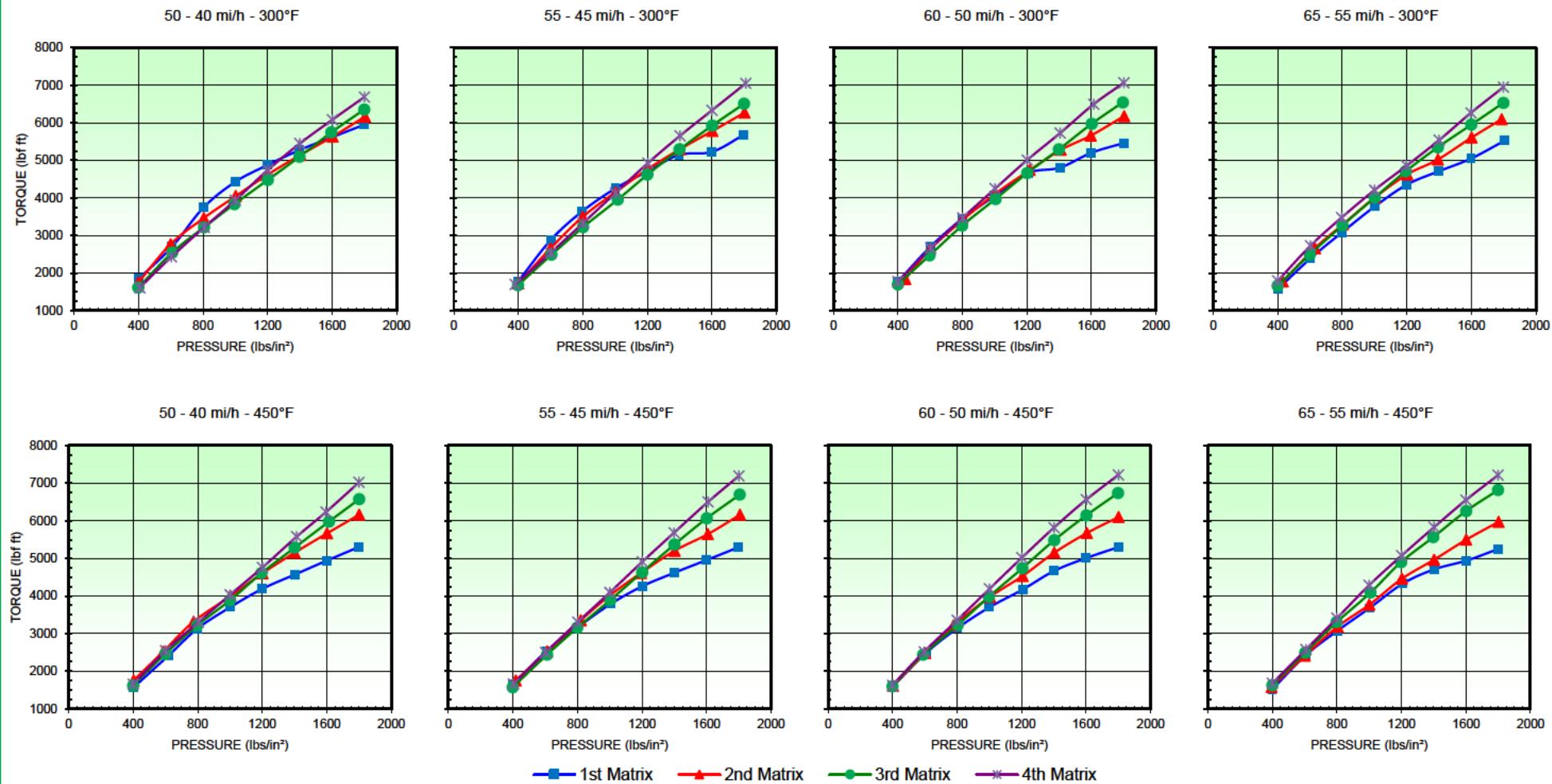
Report Number: 203145-1

Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

EFFECTIVENESS MATRIXES - SUSTAINED PRESSURE VS. SUSTAINED SUM TORQUE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

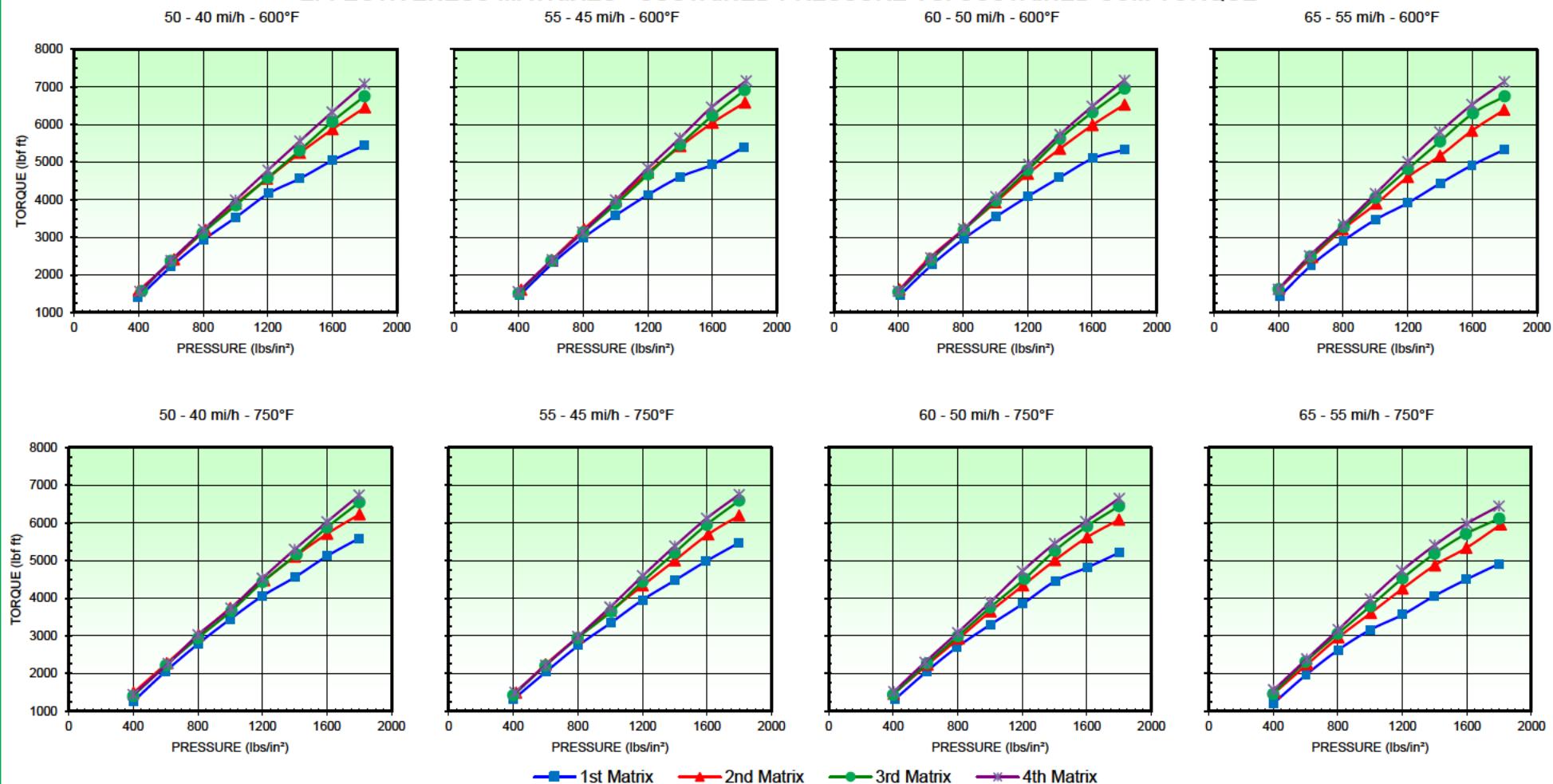
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NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

EFFECTIVENESS MATRIXES - SUSTAINED PRESSURE VS. SUSTAINED SUM TORQUE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

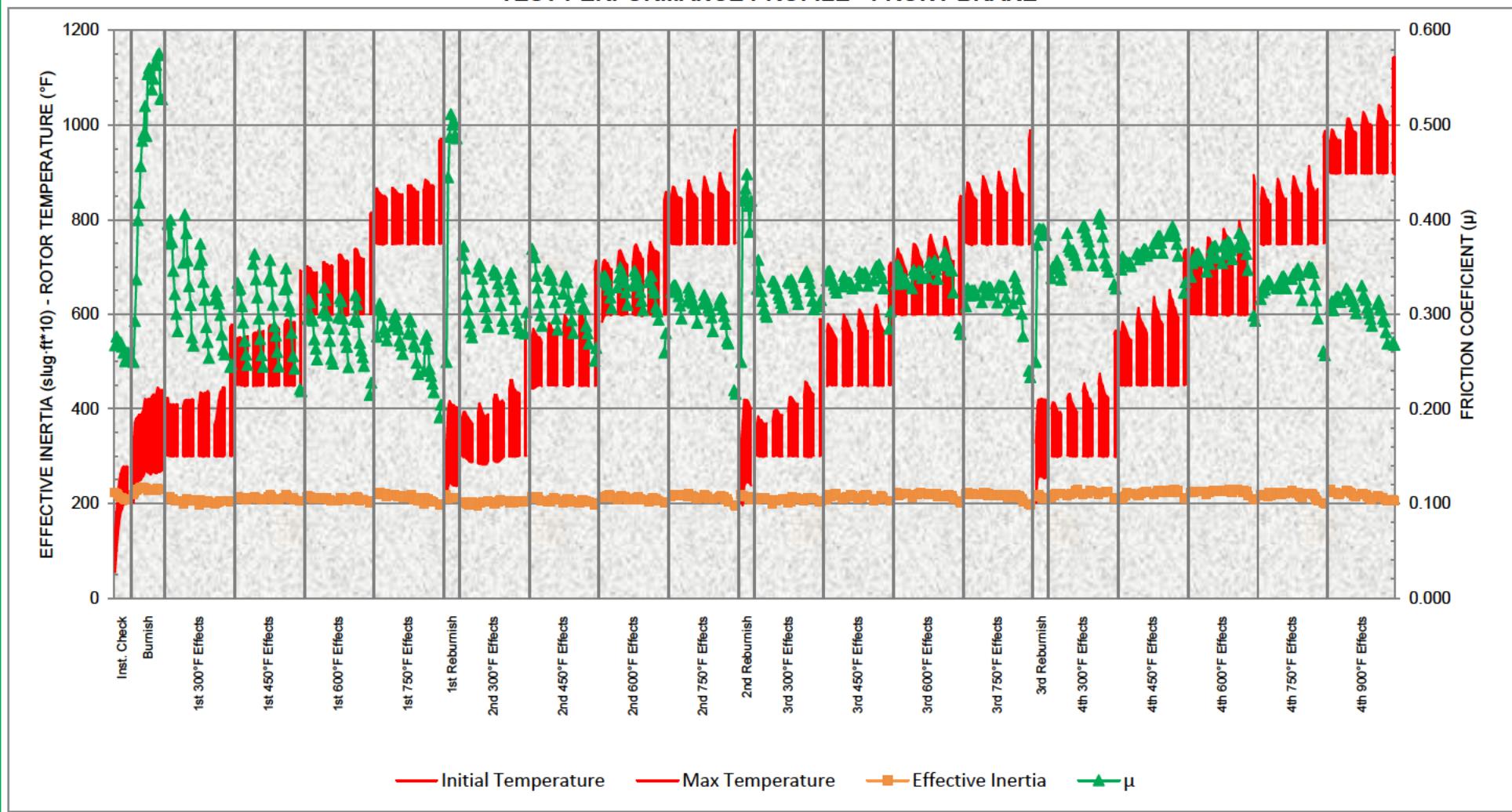
Report Number: 203145-1

Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

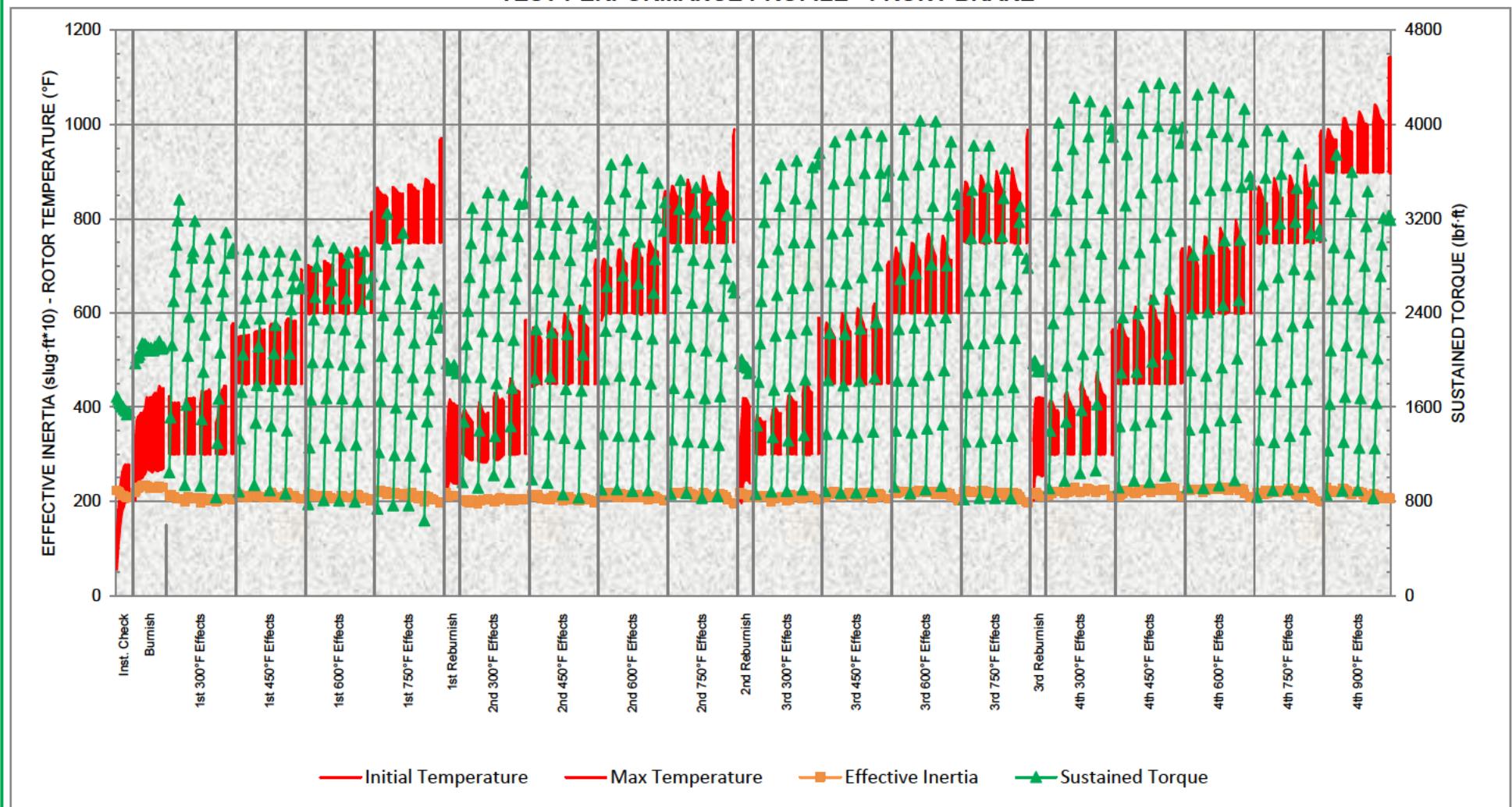
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Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

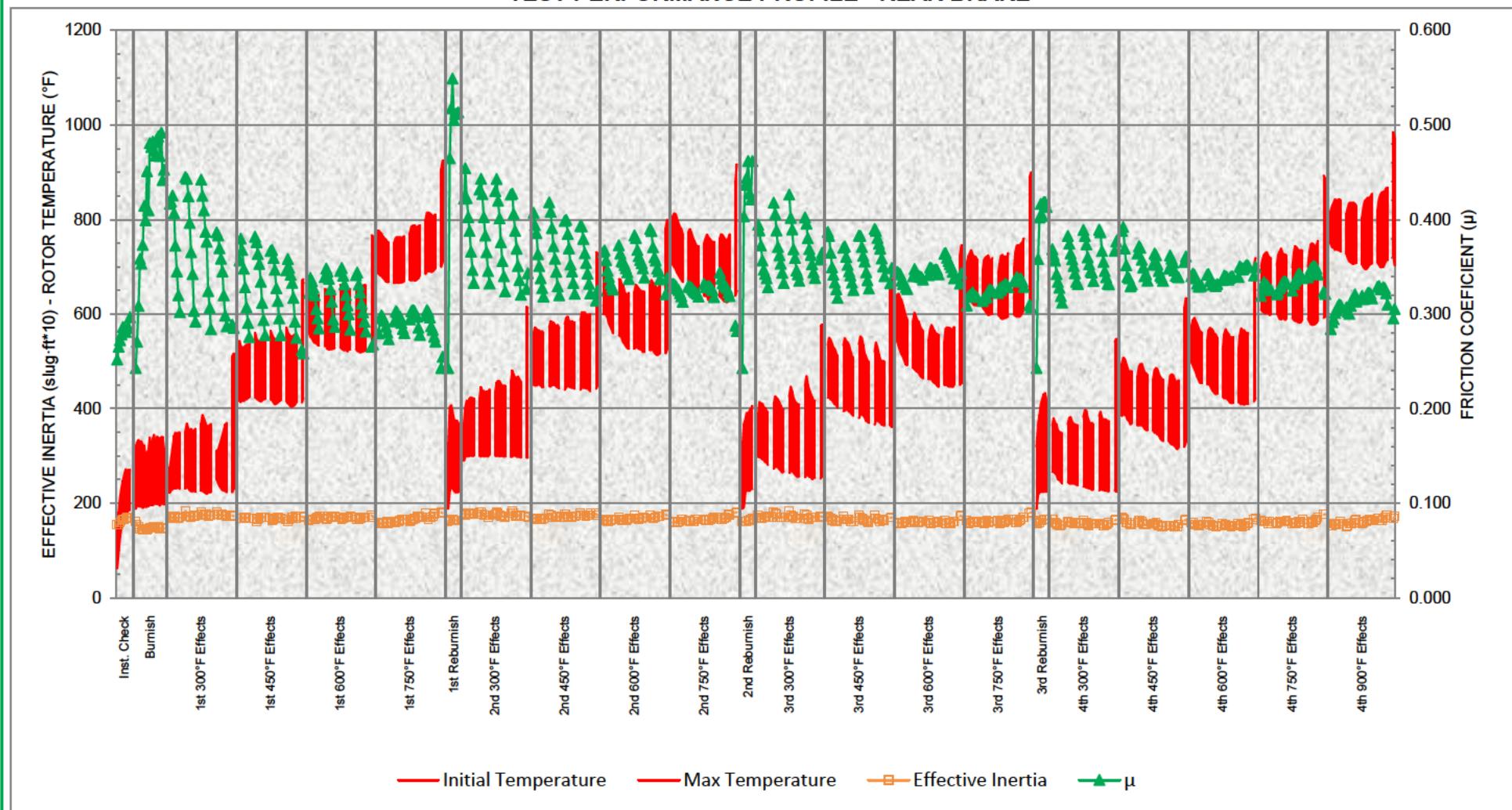
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Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

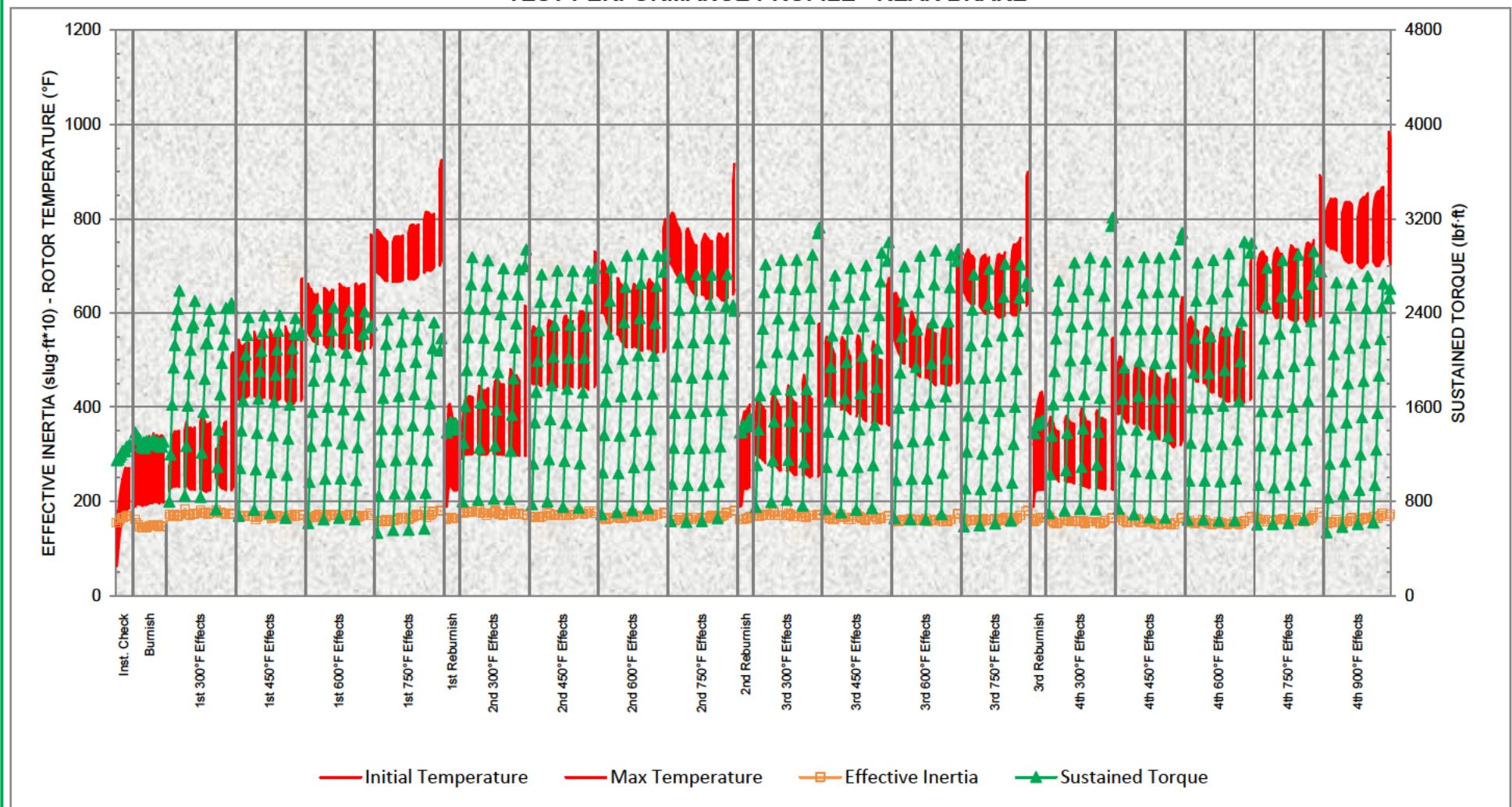
Report Number: 203145-1

Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

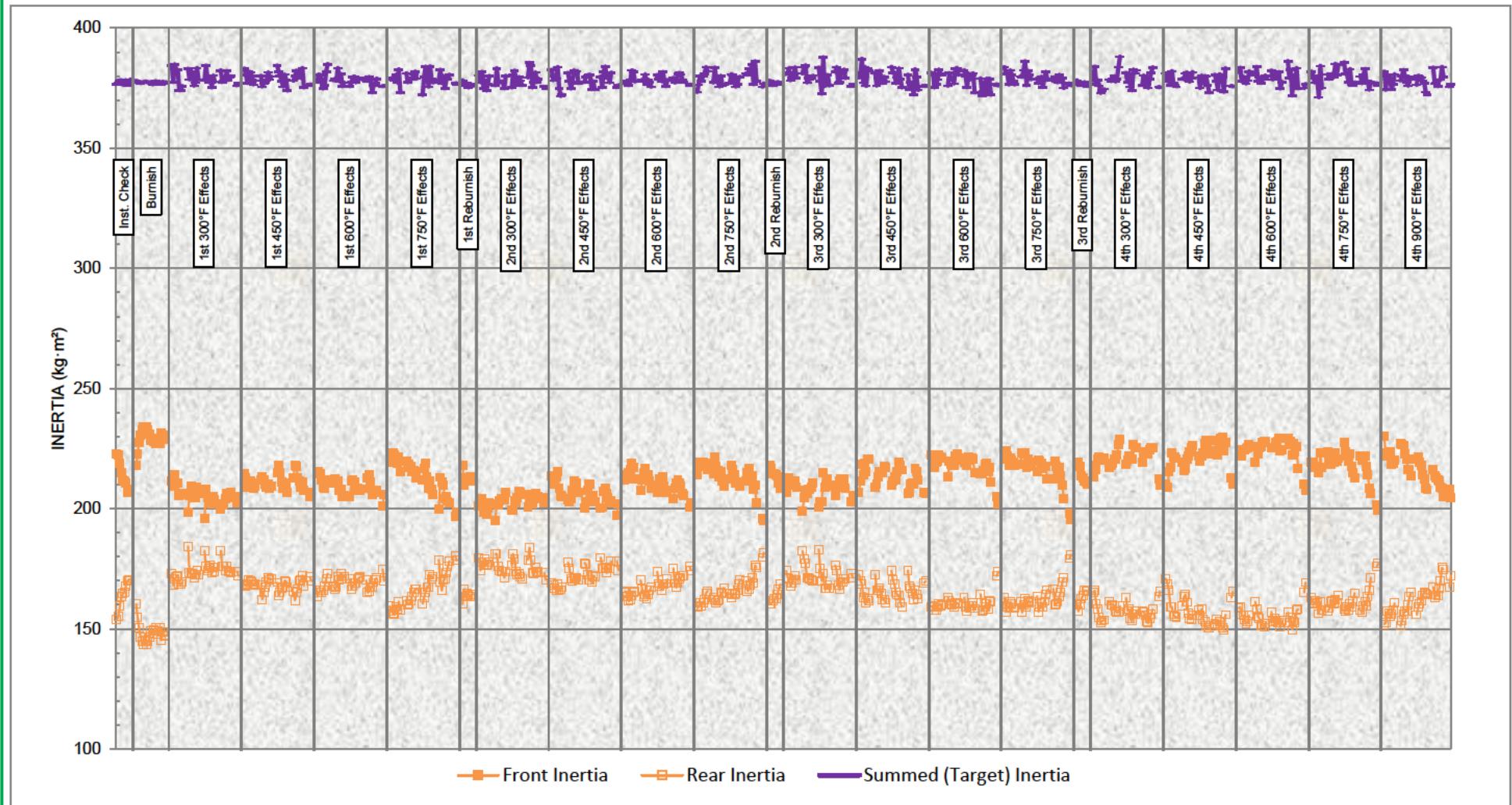
Report Number: 203145-1

Test Report Date: 06 March 2020

NTSB - PERFORMANCE MATRIX

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - FMSI® NUMBERS: 7625-D756 FRONT / 7626-D757 REAR

INERTIA DISTRIBUTION



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-063-23 / M20-064-06

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

Report Number: 203145-1

Test Report Date: 06 March 2020

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECCEL		PRESSURE						TORQUE						TEMPERATURE						FLUID		FRICTION		INERTIA	
	TO	Avg	STOP	Avg	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Front	Rear	Front	Rear	Rotor	I/B	Front	O/B	Front	I/B	O/B	Front	Rear	Displace.	Sustained	Front	Rear	Front	Rear
	INIT	FNL	STOP	REPT	ft	ft/s ²	ft	ft/s ²	lb/in ²	Int	Max	Int	Max	Int	Max	Int	Max	in ³	μ	slug ft ²												

INSTRUMENT CHECK

30 mi/h - 0.31g Deceleration Rate - 200°F Initial Rotor Temperature

1	29.9	0.5	4.64	0.0	111	8.62	920	929	954	959	1058	1085	2420	1430	990	2836	1688	1148	1720	1192	55	140	57	207	56	165	62	139	56	140	57	163	0.58	0.49	0.27	0.25	222.5	154.1
2	29.9	0.5	4.61	57.7	110	8.73	875	885	910	918	950	982	2454	1446	1008	2824	1667	1157	1717	1192	104	183	103	268	88	208	98	182	90	180	92	203	0.53	0.44	0.28	0.27	222.2	155.0
3	29.9	0.5	4.60	60.0	110	8.78	767	781	908	911	920	937	2477	1433	1044	2813	1635	1178	1667	1219	134	222	159	304	119	243	128	211	114	210	114	232	0.52	0.43	0.27	0.27	218.9	159.4
4	29.9	0.5	4.60	60.1	110	8.76	882	890	901	906	931	962	2471	1405	1067	2806	1608	1198	1670	1260	164	247	178	301	143	267	150	232	138	231	134	267	0.52	0.44	0.27	0.28	215.0	163.3
5	30.0	0.5	4.60	60.1	110	8.80	884	890	899	903	932	957	2468	1390	1079	2836	1608	1228	1626	1293	182	264	197	311	162	282	165	248	152	248	150	268	0.51	0.43	0.27	0.29	211.9	164.5
6	30.0	0.5	4.60	60.1	110	8.80	880	886	900	904	930	935	2470	1387	1083	2810	1585	1225	1632	1275	189	274	208	321	176	290	177	260	165	257	163	278	0.51	0.43	0.27	0.29	211.6	165.2
7	29.9	0.5	4.60	60.6	111	8.71	875	885	913	920	946	958	2456	1368	1088	2798	1570	1228	1620	1304	201	279	216	332	184	292	185	272	174	265	172	288	0.51	0.44	0.26	0.28	210.7	167.6
8	30.0	0.5	4.61	72.7	111	8.75	798	814	928	935	963	974	2453	1347	1106	2806	1540	1266	1594	1331	199	276	214	331	185	291	182	267	177	267	174	284	0.52	0.44	0.25	0.29	206.6	169.7
9	29.9	0.5	4.61	69.3	111	8.71	908	915	925	931	979	1002	2450	1342	1108	2815	1552	1263	1588	1340	199	279	216	334	188	291	186	271	177	268	177	287	0.51	0.44	0.25	0.29	206.6	170.5
10	30.0	0.5	4.64	69.7	111	8.70	862	872	904	909	968	988	2454	1349	1106	2836	1555	1281	1599	1334	202	277	214	336	190	289	185	271	182	271	179	287	0.51	0.44	0.26	0.30	208.0	170.5

BURNISH

40 mi/h - 0.37g Deceleration Rate - 200°F Initial Rotor Temperature or 1 Mile Distance

1	39.9	0.5	5.22	69.3	168	10.18	1002	1024	1192	1199	1314	1325	2869	1653	1216	3355	1971	1384	2045	1493	202	327	218	435	189	348	188	319	183	315	181	349	0.61	0.50	0.25	0.24	217.9	160.3
10	39.9	0.5	5.19	101.6	165	10.37	923	945	1042	1054	1147	1173	2920	1723	1196	3376	2021	1355	2101	1493	238	371	253	459	233	390	196	328	191	323	193	365	0.54	0.46	0.29	0.27	222.9	154.7
20	39.9	0.5	5.15	101.5	163	10.51	759	775	908	916	984	992	2959	1783	1177	3370	2027	1343	2095	1478	244	380	255	471	240	401	194	334	193	321	193	376	0.51	0.44	0.34	0.31	227.5	150.2
30	39.9	0.5	5.12	101.5	161	10.63	758	766	773	778	918	959	2986	1826	1160	3370	2045	1325	2136	1425	247	383	259	487	241	403	193	329	190	320	192	376	0.50	0.43	0.40	0.36	230.5	146.4
40	39.9	0.5	5.09	101.4	160	10.69	736	749	752	762	883	901	3007	1853	1155	3361	2083	1278	2157	1419	248	388	262	508	243	406	194	331	191	321	192	415	0.49	0.42	0.42	0.35	232.5	144.9
50	39.9	0.5	5.09	101.4	160	10.71	702	710	708	711	834	847	3013	1867	1145	3402	2142	1260	2172	1402	250	387	268	519	247	411	190	323	189	311	191	396	0.48	0.41	0.46	0.37	234.0	143.5
60	39.9	0.5	5.07	101.3	159	10.75	647	655	661	681	820	820	3026	1862	1165	3399	2098	1301	2163	1408	256	391	270	526	250	414	196	323	192	316	191	378	0.48	0.41	0.48	0.41	232.3	145.4
70	39.9	0.5	5.08	101.3	159	10.77	646	651	658	660	799	804	3032	1879	1153	3387	2136	1251	2207	1363	258	398	274	547	254	456	192	296	192	322	190	351	0.48	0.41	0.49	0.40	234.1	143.7
80	39.9	0.5	5.07	101.3	159	10.79	563	581	608	613	765	775	3035	1872	1163	3408	2095	1313	2186	1446	268	421	279	554	261	485	193	306	192	320	193	407	0.49	0.40	0.52	0.45	232.7	144.6
90	39.9	0.5	5.06	101.3	159	10.75	637	646	651	657	773	795	3025	1852	1173	3385	2107	1278	2184	1446	270	419	282	522	182	213	194	314	191	334	190	497	0.51	0.41	0.49	0.41	231.0	146.4
100	39.9	0.5	5.05	101.2	158	10.83	559	564	567	570	748	758	3046	1844	1202	3381	2080	1301	2172	1422	266	420	282	545	179	218	197	339	197	341	195	486	0.50	0.40	0.55	0.48	228.5	149.0
110	39.9	0.5	5.06	101.2	159	10.82	561	567	571	785	882	882	3037	1844	1192	3397	2104	1293	2313	1700	265	422	279	539	165	192	196	307	198	352	195	366	0.52	0.42	0.56	0.48	228.7	147.9
120	39.9	0.5	5.06	101.1	159	10.79	561	568	572	757	791	804	3035	1832	1203	3396	2086	1310	2163	1508	261	419	279	485	164	181	196	336	197	345	194	536	0.49	0.41	0.55	0.48	227.8	149.6
130	39.9	0.5	5.05	101.1	159	10.76	578	584	585	589	744	750	3031	1823	1208	3405	2083	1322	2160	1431	266	426	277	469	166	179	198	345	200	347	195	517	0.49	0.41	0.54	0.47	227.3	150.6
140	39.9	0.5	5.05	101.2	159	10.79	575	581	581	586	764	784	3032	1845																								

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

SPEED				TIME				DIST.		DECCEL		PRESSURE								TORQUE								TEMPERATURE								FLUID		FRICTION		INERTIA	
CYCLE NO.	INIT	FNL	STOP	REPT	TO STOP	Avg	Average	Sustained	Maximum	Average				Sustained				Maximum				Rotor		I/B	O/B	Rotor	I/B	O/B	Front		Rear		Displace.		Coeff.		Inertia				
	mi/h	s	ft	ft/s ²	ft	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	in ³	Front	Rear	slug ft ²								
FIRST EFFECTIVENESS MATRIX - 300°F																																									
300°F Initial Rotor Temperature																																									
50 - 40 mi/h																																									
1	49.9	39.9	2.56	137.4	175	5.48	353	373	400	403	404	407	1571	864	707	1845	1048	797	1119	829	301	424	316	660	217	228	222	276	223	290	220	381	0.40	0.35	0.40	0.42	211.4	173.1			
2	49.9	39.9	1.67	70.2	115	8.35	575	573	609	602	648	609	2350	1304	1046	2709	1511	1198	1850	1266	301	400	312	503	216	226	228	294	228	324	225	359	0.48	0.38	0.37	0.42	209.5	168.0			
3	49.8	39.9	1.32	71.4	91	10.49	666	675	803	802	853	812	3010	1675	1335	3747	2127	1620	2322	1664	300	410	313	741	211	229	230	318	229	342	229	390	0.54	0.42	0.40	0.43	214.2	170.7			
4	49.9	39.9	1.14	71.9	79	12.18	567	595	1002	1002	1037	1012	3473	1914	1559	4435	2499	1936	2549	2024	300	405	313	626	209	239	232	342	231	348	229	541	0.58	0.46	0.38	0.41	210.8	171.7			
5	49.9	39.9	1.05	72.4	72	13.31	857	878	1201	1203	1232	1212	3795	2088	1707	4880	2753	2127	2797	2278	299	410	315	710	206	226	231	349	230	355	230	608	0.63	0.48	0.35	0.37	210.5	172.1			
6	49.9	39.9	0.96	75.2	66	14.50	1062	1079	1400	1403	1438	1414	4043	2220	1822	5279	2980	2299	3072	2434	302	405	314	676	207	244	232	346	233	357	232	620	0.68	0.51	0.32	0.35	205.5	168.7			
7	49.9	39.9	0.91	74.6	62	15.46	1184	1203	1600	1603	1625	1629	4311	2370	1940	5618	3184	2434	3281	2567	300	410	317	728	205	234	233	349	232	355	232	630	0.74	0.54	0.30	0.32	205.7	168.4			
8	49.9	39.9	0.86	79.2	59	16.27	1306	1327	1800	1804	1824	1816	4558	2503	2055	5952	3364	2588	3482	2720	300	409	316	722	205	239	230	352	230	625	0.79	0.57	0.28	0.30	206.4	169.4					
55 - 45 mi/h																																									
1	55.0	44.9	2.54	78.7	193	5.59	386	390	400	401	403	406	1597	828	769	1786	939	847	1027	880	300	407	316	488	201	216	231	352	231	373	230	509	0.35	0.32	0.35	0.44	198.7	184.4			
2	55.0	44.9	1.69	81.9	129	8.39	545	556	602	603	687	609	2368	1285	1084	2886	1617	1269	1838	1301	299	418	315	632	201	216	234	369	232	379	232	565	0.45	0.36	0.41	0.44	205.4	173.2			
3	55.0	44.9	1.36	84.4	105	10.27	744	752	797	799	832	808	2925	1602	1233	3647	2036	1611	2086	1653	301	419	316	689	199	219	232	357	234	372	232	568	0.48	0.40	0.39	0.42	209.3	172.7			
4	55.0	44.9	1.18	86.3	91	11.92	926	938	1002	1002	1022	1011	3376	1840	1536	4255	2369	1886	2428	1998	300	418	317	718	201	216	226	353	233	370	228	601	0.54	0.43	0.36	0.40	207.0	172.8			
5	54.9	44.9	1.07	86.0	81	13.26	1017	1031	1201	1202	1238	1217	3716	2023	1693	4709	2623	2086	2729	2228	301	419	316	704	201	245	225	357	232	369	227	641	0.61	0.47	0.33	0.37	204.6	171.3			
6	55.0	44.9	1.00	87.3	77	14.09	1296	1304	1397	1401	1428	1416	3963	2150	1813	5146	2868	2278	2945	2411	300	416	320	746	202	229	225	352	230	369	226	670	0.67	0.50	0.31	0.34	204.7	172.6			
7	54.9	44.9	0.95	86.5	73	14.82	1181	1195	1601	1600	1630	1616	4234	2308	1926	5229	2924	2305	3160	2517	300	421	321	730	209	239	226	353	231	370	227	672	0.73	0.54	0.28	0.30	209.0	174.3			
8	54.9	44.9	0.89	88.8	68	15.72	1027	1052	1799	1804	1827	1820	4438	2416	2022	5683	3181	2502	3337	2656	300	419	320	741	215	234	224	358	231	365	225	671	0.79	0.57	0.27	0.29	206.1	172.5			
60 - 50 mi/h																																									
1	59.9	49.9	2.56	89.4	212	5.56	370	380	399	399	403	409	1570	813	757	1771	933	838	1015	862	300	410	320	488	204	214	226	369	229	385	223	530	0.34	0.33	0.35	0.44	196.0	182.4			
2	59.9	49.9	1.75	91.8	147	8.03	501	519	603	601	674	610	2301	1247	1055	2709	1496	1213	1685	1245	301	435	320	617	212	215	227	387	232	393	226	630	0.44	0.37	0.37	0.43	208.2	176.1			
3	59.9	49.9	1.41	96.2	118	10.05	480	501	802	801	854	810	2838	1533	1305	3458	1900	1558	2001	1620	300	433	322	779	215	220	224	379	231	389	224	644	0.49	0.40	0.36	0.41	204.5	174.2			
4	59.9	49.9	1.22	95.8	102	11.55	819	841	1001	1002	1042	1014	3249	1743	1506	4057	2216	1841	2290	1965	299	428	322	752	209	230	222	370	227	387	222	635	0.55	0.44	0.33	0.39	202.5	174.9			
5	60.0	49.9	1.11	95.1	93	12.79	1074	1072	1209	1196	1232	1217	3615	1933	1682	4665	2526	2139	2567	2219	300	434	324	756	208	215	220	363	228	387	221	675	0.60	0.48	0.32	0.38	202.8	176.4			
6	60.0	49.9	1.03	96.5	86	13.75	1001	1005	1405	1391	1433	1425	3847	2071	1775	4809	2667	2142	2815	2375	301	432	321	768	214	220	223	363	228	388	221	696	0.67	0.51	0.29	0.32	202.1	173.2			
7	59.9	49.9	0.97	93.6	81	14.51	1139	1163	1599	1603	1626	1618	4112	2216	1896	5202	2868	2334	3004	2493	301	438	320	791	206	223	223	365	229	398	223	675	0.73	0.54	0.27	0.31	204.9	175.4			
8	59.9	49.9	0.92	97.5	77	15.33	1243	1278	1799	1805	1827	1828	4316	2328	1988	5461	3027	2434	3175	2594	299	433	321	769	207	209	223	368	228	408	222	709	0.78	0.58	0.25	0.28	203.7	173.9			
65 - 55 mi/h																																									
1	64.9	55.0	2.83	0.0	256	5.01	387	389	399	399	408	403	1428	746	681	1567	835	732	874	791	301	367	316	707	219	240	251	312	253	314	247	297	0.34	0.32	0.32	0.39	199.9	182.5			
2	64.9	55.0	1.91	98.1	172	7.45	556	564	602	600	673	605	2095	1119	977	2388	1296	1092	1467	1127	299	378	319	880	205	235	242	312	249	341	243	315	0.44	0.36	0.32	0.38	201.5	176.0			
3	65.0	55.0	1.52																																						

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

SPEED				TIME		DIST.		DECCEL		PRESSURE								TORQUE								TEMPERATURE								FLUID		FRICTION		INERTIA																																			
CYCLE NO.	INIT	FNL	STOP	REPT	TO STOP	AVG DIST	AVERAGE		SUSTAINED		MAXIMUM		AVERAGE				SUSTAINED				MAXIMUM		ROTOR		I/B		O/B		ROTOR		I/B		O/B		MAXIMUM		DISPLACED.		COEFF.		SUSTAINED																																
							FRONT	REAR	FRONT	REAR	FRONT	REAR	FRONT	REAR	FRONT	REAR	FRONT	REAR	FRONT	REAR	FRONT	REAR	INT	MAX	INT	MAX	INT	MAX	INT	MAX	FRONT	REAR	FRONT	REAR	FRONT	REAR																																					
				mi/h	s	ft	ft/s ²																									in ³	μ																																								
FIRST EFFECTIVENESS MATRIX - 450°F																																																																									
450°F Initial Rotor Temperature																																																																									
50 - 40 mi/h																																																																									
1	49.9	39.9	2.84	121.4	193	4.97	352	360	400	399	404	408	1419	795	625	1559	883	676	947	747	450	550	441	475	379	399	416	544	419	496	403	561	0.33	0.31	0.33	0.36	214.5	168.6																																			
2	49.9	39.9	1.88	48.1	129	7.43	548	548	618	599	677	608	2105	1177	928	2414	1334	1080	1570	1110	452	550	450	485	388	403	414	532	422	521	405	589	0.43	0.35	0.33	0.38	212.7	167.7																																			
3	49.9	39.9	1.52	45.7	104	9.28	729	739	798	803	839	810	2608	1445	1163	3131	1729	1402	1889	1422	451	552	456	491	393	404	419	530	427	537	410	624	0.47	0.39	0.33	0.37	209.0	168.1																																			
4	49.9	39.9	1.32	48.2	91	10.60	814	832	1002	1002	1037	1012	3017	1671	1346	3703	2048	1655	2195	1694	449	547	459	492	395	405	416	529	430	546	413	640	0.54	0.43	0.31	0.35	211.4	170.4																																			
5	49.9	39.9	1.17	46.2	81	11.84	1077	1086	1202	1202	1230	1215	3368	1867	1500	4193	2319	1874	2484	1939	451	548	463	495	401	408	420	532	433	558	417	677	0.60	0.47	0.29	0.33	211.6	170.1																																			
6	49.8	39.9	1.08	47.7	75	12.76	1021	1037	1401	1402	1441	1420	3614	2002	1612	4568	2523	2045	2703	2163	448	553	467	497	402	409	420	536	435	566	420	697	0.67	0.51	0.27	0.31	210.5	169.5																																			
7	49.9	39.9	1.01	49.6	70	13.84	1208	1225	1601	1603	1632	1616	3882	2147	1735	4942	2729	2213	2900	2310	449	550	467	501	402	411	423	534	438	600	422	731	0.73	0.56	0.26	0.29	208.2	168.2																																			
8	49.9	39.9	0.95	49.2	66	14.61	1332	1351	1800	1804	1828	1820	4118	2281	1837	5303	2939	2364	3075	2484	449	554	467	501	405	414	424	538	441	707	424	748	0.80	0.60	0.25	0.28	209.5	168.6																																			
55 - 45 mi/h																																																																									
1	54.9	44.9	2.70	52.0	204	5.26	381	386	401	402	406	409	1490	831	659	1668	939	729	1001	773	448	558	468	512	406	423	424	561	438	556	424	625	0.31	0.33	0.35	0.38	212.0	168.1																																			
2	55.0	44.9	1.86	53.6	140	7.69	568	565	609	600	680	610	2152	1222	930	2538	1467	1071	1635	1116	450	561	469	514	407	421	422	548	439	570	423	658	0.41	0.37	0.36	0.38	213.3	163.2																																			
3	55.0	44.9	1.52	55.2	115	9.35	726	732	801	800	845	813	2627	1476	1151	3169	1788	1381	1906	1408	449	562	469	509	409	422	419	544	436	577	422	680	0.46	0.41	0.34	0.36	211.8	165.2																																			
4	55.0	44.9	1.29	55.6	99	10.90	795	802	1005	996	1033	1014	3067	1708	1360	3786	2116	1670	2201	1714	449	558	471	510	410	421	417	540	434	604	419	704	0.53	0.45	0.32	0.35	210.2	167.4																																			
5	54.9	44.9	1.17	53.8	89	12.04	984	1005	1201	1201	1237	1213	3394	1874	1520	4258	2352	1906	2502	1965	451	567	470	510	412	424	415	542	436	603	421	727	0.59	0.49	0.30	0.33	208.9	169.4																																			
6	54.9	44.9	1.09	56.4	83	12.91	1089	1104	1401	1402	1439	1416	3673	2024	1649	4618	2541	2077	2732	2181	449	563	469	509	411	421	417	541	436	702	420	729	0.66	0.52	0.27	0.31	210.3	171.3																																			
7	54.9	44.9	1.01	54.5	78	13.77	1327	1351	1601	1603	1626	1614	3887	2137	1750	4957	2723	2234	2924	2340	450	558	470	508	412	422	420	541	436	718	422	762	0.72	0.57	0.26	0.29	208.2	170.4																																			
8	55.0	44.9	0.96	53.5	74	14.53	1238	1270	1800	1803	1831	1822	4115	2266	1849	5296	2918	2378	3083	2490	450	565	470	506	412	427	421	545	438	782	423	801	0.78	0.61	0.24	0.28	209.2	170.7																																			
60 - 50 mi/h																																																																									
1	59.9	49.9	2.82	55.0	234	5.06	381	386	400	402	409	410	1448	811	638	1594	894	700	971	744	448	570	470	528	415	431	420	565	440	587	425	624	0.31	0.34	0.34	0.37	215.1	169.2																																			
2	59.9	49.9	1.89	58.1	158	7.50	486	492	608	600	689	613	2136	1220	916	2488	1440	1048	1664	1092	450	577	472	524	413	433	418	556	439	599	424	659	0.42	0.38	0.36	0.37	218.2	163.8																																			
3	59.9	49.9	1.51	60.8	127	9.35	726	730	800	797	832	815	2650	1499	1151	3139	1779	1360	1903	1414	449	576	469	518	413	430	413	550	434	610	419	696	0.46	0.42	0.34	0.36	215.0	165.1																																			
4	59.9	49.9	1.31	60.6	109	10.87	862	877	1001	998	1031	1015	3061	1708	1353	3701	2057	1644	2254	1706	448	575	471	516	413	431	409	547	432	667	417	726	0.53	0.46	0.31	0.35	210.9	167.0																																			
5	59.9	49.9	1.17	59.2	98	12.10	977	991	1206	1206	1238	1215	3389	1881	1508	4170	2296	1874	2511	1959	450	573	469	516	416	433	411	547	431	781	414	724	0.59	0.50	0.29	0.33	208.4	167.2																																			
6	59.9	49.9	1.09	59.4	91	12.99	1092	1106	1401	1402	1436	1420	3687	2040	1646	4665	2576	2089	2774	2169	449	575	470	511	414	439	413	547	433	800	405	643	0.66	0.54	0.28	0.31	210.7	170.0																																			
7	59.9	49.9	1.01	61.8	100	12.88	1237	1237	1404	1395	1437	1417	3640	2005	1635	4709	2608	2101	2732	2163	450	582	473	523	417	450	406	554	428	869	391	672	0.66	0.54	0.28	0.32	208.8	170.3																																			
8	64.9	55.0	1.01	62.5	94	13.51	1346	1355	1604	1602	1626	1617	3859	2126	1733	4942	2720	2222	2903	2346	449	583	475	520	418	435	408	557	430	891	390	656	0.73	0.58																																							

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

SPEED				TIME		DIST.		DECCEL		PRESSURE								TORQUE								TEMPERATURE								FLUID		FRICTION		INERTIA			
CYCLE NO.	INIT	FNL	STOP	REPT	TO STOP	Avg	Average	Sustained	Maximum	AVERAGE				SUSTAINED				MAXIMUM				ROTOR		I/B		O/B		ROTOR		I/B		O/B		MAXIMUM		DISPLAC.		COEFF.		SUSTAINED	
	mi/h		s		ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	in ³	μ	slug ft ²	Front	Rear						
FIRST EFFECTIVENESS MATRIX - 750°F																																									
750°F Initial Rotor Temperature																																									
50 - 40 mi/h																																									
1	49.9	39.9	3.43	104.5	231	4.14	385	385	403	400	519	408	1170	678	492	1269	738	531	1065	582	749	867	784	833	701	727	686	777	707	800	500	530	0.44	0.38	0.28	0.28	219.3	159.3			
2	49.9	39.9	2.19	35.1	149	6.43	561	566	602	603	744	612	1816	1062	755	2063	1216	847	1626	885	749	859	786	826	702	721	682	773	706	832	499	531	0.53	0.42	0.30	0.30	221.5	157.5			
3	49.9	39.9	1.70	33.1	116	8.30	642	648	803	801	869	815	2347	1379	967	2791	1655	1136	1809	1172	748	856	785	825	703	717	681	770	704	861	500	521	0.56	0.47	0.31	0.30	223.0	156.4			
4	49.9	39.9	1.41	34.1	97	9.88	883	890	1002	1004	1031	1022	2785	1636	1149	3447	2033	1414	2101	1461	749	852	787	820	703	717	677	764	702	880	500	513	0.63	0.51	0.31	0.30	222.2	156.1			
5	49.9	39.9	1.24	35.2	85	11.29	1042	1054	1201	1206	1234	1227	3203	1864	1339	4060	2381	1679	2476	1729	747	849	788	816	703	717	674	760	697	919	496	507	0.70	0.56	0.30	0.29	221.5	159.1			
6	49.9	39.9	1.11	35.0	77	12.47	1203	1212	1401	1404	1427	1426	3508	2036	1472	4556	2644	1912	2782	1953	748	851	786	816	703	719	669	758	694	971	488	505	0.78	0.60	0.28	0.29	219.0	158.3			
7	49.9	39.9	1.03	36.1	71	13.47	1262	1286	1601	1603	1628	1628	3843	2223	1619	5119	2983	2136	3066	2186	750	848	785	814	702	724	668	753	689	1008	486	502	0.85	0.64	0.28	0.28	221.5	161.3			
8	49.9	39.9	0.95	35.4	66	14.57	1335	1353	1800	1804	1823	1832	4054	2339	1715	5592	3249	2343	3402	2393	750	844	783	814	704	726	668	752	689	1033	481	499	0.92	0.68	0.27	0.27	215.3	157.9			
55 - 45 mi/h																																									
1	54.9	44.9	3.36	34.0	252	4.29	381	382	402	400	557	412	1218	702	516	1320	765	555	1186	593	748	868	787	837	708	733	666	752	691	808	478	500	0.44	0.35	0.29	0.29	219.6	161.5			
2	54.9	44.9	2.23	37.1	167	6.43	565	565	606	601	719	613	1808	1041	767	2057	1192	865	1502	903	749	864	788	836	705	728	667	762	687	858	478	534	0.49	0.41	0.30	0.30	217.3	160.1			
3	54.9	44.9	1.73	35.7	132	8.16	691	696	803	801	874	817	2304	1329	975	2744	1596	1148	1776	1192	749	862	790	831	706	722	667	763	686	900	480	537	0.55	0.45	0.30	0.30	218.6	160.3			
4	54.9	44.9	1.45	37.7	110	9.75	880	883	1006	1002	1048	1021	2753	1579	1174	3350	1936	1414	2039	1470	749	857	788	827	706	722	666	763	685	939	482	535	0.62	0.50	0.29	0.30	217.4	161.7			
5	54.9	44.9	1.26	37.0	96	11.16	1039	1046	1201	1201	1231	1219	3152	1792	1360	3954	2260	1694	2366	1744	750	854	784	821	706	725	667	763	685	987	484	533	0.68	0.55	0.28	0.30	215.4	163.5			
6	54.9	44.9	1.14	37.1	88	12.24	1130	1147	1400	1411	1437	1427	3474	1968	1506	4471	2523	1948	2709	2007	749	854	786	821	707	731	667	761	687	1021	484	521	0.75	0.59	0.27	0.29	215.7	165.1			
7	54.9	44.9	1.04	38.0	80	13.35	1345	1356	1592	1597	1642	1625	3800	2145	1655	4975	2818	2157	3001	2222	750	852	783	819	708	733	668	763	686	1041	484	515	0.83	0.63	0.27	0.28	215.6	166.4			
8	55.0	44.9	0.98	37.1	76	14.25	1508	1520	1800	1803	1829	1834	4024	2258	1766	5476	3080	2396	3240	2458	750	854	785	817	709	730	670	765	690	1058	482	513	0.90	0.67	0.26	0.28	212.7	166.4			
60 - 50 mi/h																																									
1	60.0	49.9	3.33	37.4	275	4.33	390	381	413	399	526	412	1201	683	518	1323	765	558	1030	596	748	873	785	848	713	735	672	771	691	827	484	537	0.41	0.35	0.28	0.29	211.8	160.4			
2	59.9	49.9	2.25	39.7	187	6.34	525	529	607	599	715	614	1794	1025	770	2051	1189	862	1473	909	748	872	788	845	707	730	671	785	688	879	486	665	0.49	0.41	0.30	0.30	216.8	162.9			
3	59.9	49.9	1.77	38.5	148	8.01	648	660	797	803	899	817	2293	1306	986	2703	1543	1160	1827	1201	749	873	788	838	708	729	674	787	688	940	489	598	0.55	0.45	0.29	0.30	218.8	165.2			
4	59.9	49.9	1.49	40.1	123	9.58	893	898	1003	1001	1035	1023	2718	1523	1195	3299	1856	1443	1942	1493	750	867	786	832	708	730	671	788	689	1002	494	636	0.60	0.50	0.28	0.30	213.2	167.3			
5	59.9	49.9	1.28	40.2	108	10.97	980	990	1204	1204	1235	1224	3070	1704	1367	3854	2145	1709	2260	1765	749	866	824	825	709	733	671	784	688	1049	497	598	0.67	0.54	0.27	0.30	208.5	167.2			
6	59.9	49.9	1.17	38.9	99	11.95	1194	1201	1407	1404	1431	1426	3420	1884	1536	4462	2479	1983	2585	2024	750	861	784	821	711	740	674	784	691	1087	496	570	0.75	0.58	0.27	0.30	211.6	172.5			
7	59.9	49.9	1.08	39.3	90	13.16	1236	1252	1601	1603	1629	1624	3715	2039	1676	4813	2638	2175	2850	2254	749	859	782	820	712	737	676	786	693	1089	495	544	0.82	0.62	0.25	0.29	207.9	170.9			
8	60.0	49.9	1.01	38.9	85	13.96	1346	1362	1801	1804	1834	1822	3926	2140	1786	5208	2827	2381	3045	2452	748	859	783	819	711	734	682	788	698	1109	495	532	0.89	0.66	0.24	0.28	205.7	171.7			
65 - 55 mi/h																																									
1	64.9	55.0	3.58	39.2	322	3.94	371	380	401	400	405	412	1113	587	525	1205	638	567	676	602	749	863	783	857	712	733	685	800	703	896	495	563	0.33	0.35	0.24	0.30	199.8	178.7			
2	64.9	55.0	2.33	38.8	210	6.12	559	563	604	603	693	616	1745	971	774	1966																									

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECCEL		PRESSURE						TORQUE						TEMPERATURE						FLUID		FRICTION		INERTIA	
	TO	Avg	Average	Sustained	Maximum	Average	Sustained	Maximum	Rotor	I/B	O/B	Rotor	I/B	O/B	MAXIMUM	SUSTAINED	FRONT	REAR	FRONT	REAR	DISPLAC.	COEFF.	FRONT	REAR	FRONT	REAR	FRONT	REAR				
	INIT	FNL	STOP	REPT	STOP	DIST	Front	REar	Front	REar	Sum	Front	REar	Sum	Front	REar	Front	REar	INT	MAX	INT	MAX	INT	MAX	INT	MAX	FRONT	REAR	FRONT	REAR		
mi/h s ft ft/s ² lbf/in ² lbf ft F in ³ µ slug ft ²																																

FIRST REBURNISH

40 mi/h - 0.37g Deceleration Rate - 200°F Initial Rotor Temperature or 1 Mile Distance

1	40.0	0.5	5.20	70.3	168	10.18	1002	1024	1192	1199	1314	1325	2869	1653	1216	3355	1971	1384	2045	1493	202	327	218	435	189	348	188	319	183	315	181	349	0.61	0.50	0.25	0.24	217.9	160.3
5	39.9	0.5	5.09	101.0	160	10.68	640	643	651	651	824	858	2996	1671	1325	3355	1918	1437	2007	1588	237	400	241	377	217	294	225	403	220	412	177	453	0.49	0.43	0.44	0.46	209.8	166.4
10	39.9	0.5	5.06	101.0	159	10.80	573	581	594	598	756	797	3029	1714	1315	3388	1918	1470	2089	1608	246	417	255	395	228	324	237	407	236	481	174	460	0.47	0.42	0.49	0.52	213.0	163.5
15	39.9	0.5	5.07	101.0	159	10.78	556	559	565	566	721	743	3027	1706	1321	3391	1915	1476	2021	1558	244	411	255	398	228	328	232	394	232	504	177	463	0.46	0.40	0.51	0.55	212.4	164.5
20	40.0	0.5	5.08	101.0	159	10.80	569	576	582	587	732	791	3020	1702	1317	3338	1930	1408	2048	1655	240	408	252	393	224	337	227	378	228	537	175	445	0.46	0.42	0.50	0.51	211.5	163.7
25	39.9	0.5	5.05	101.0	158	10.83	549	559	587	588	738	816	3041	1721	1320	3387	1959	1428	2104	1661	238	408	248	393	222	341	223	371	227	527	174	365	0.46	0.42	0.50	0.51	213.1	163.5
30	40.0	0.5	5.06	101.0	159	10.80	433	461	595	602	704	738	3025	1703	1322	3394	1930	1464	2033	1629	238	403	246	390	220	343	223	375	224	531	173	373	0.45	0.41	0.49	0.51	211.6	164.3
35	40.0	0.5	5.07	101.0	159	10.82	578	576	586	582	704	758	3033	1708	1325	3305	1886	1419	2060	1664	237	404	247	385	220	347	223	370	222	553	170	317	0.45	0.41	0.49	0.51	211.7	164.3

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID		FRICTION		INERTIA	
	TO	Avg	STOP	FNL	STOP	DIST	Front	Average	Sustained	Maximum	Front	Rear	Sum	Front	Average	Sustained	Maximum	Rotor	I/B	Front	O/B	Rotor	I/B	O/B	Front	Rear	Displace.	Coeff.	Front	Rear		
	INIT	mi/h	STOP	s	REPT	ft	ft/s ²	lb/in ²	INT	MAX	INT	MAX	INT	MAX	INT	MAX	Front	Rear	in ³	μ	Front	Rear										

SECOND EFFECTIVENESS MATRIX - 300°F

300°F Initial Rotor Temperature

50 - 40 mi/h

1	49.9	39.9	2.52	126.8	171	5.58	380	388	400	399	405	413	1582	836	746	962	800	995	939	300	383	302	366	273	304	290	370	293	550	220	356	0.33	0.33	0.36	0.42	201.1	179.3	
2	49.9	39.9	1.68	56.1	115	8.38	565	571	599	601	695	618	2358	1269	1089	2772	1476	1296	1723	1357	298	394	307	364	271	315	298	402	298	665	219	414	0.45	0.37	0.37	0.45	203.1	174.3
3	49.9	39.9	1.40	56.0	96	9.99	661	671	804	801	857	825	2842	1519	1323	3464	1856	1608	1942	1670	300	394	308	360	272	329	301	417	303	741	221	434	0.50	0.41	0.35	0.42	204.0	177.7
4	49.9	39.9	1.20	62.2	83	11.59	922	924	1003	1002	1033	1025	3239	1714	1525	4051	2136	1915	2213	1977	295	385	304	353	270	319	299	412	301	756	221	501	0.56	0.45	0.32	0.40	198.3	176.5
5	49.9	39.9	1.09	61.6	74	12.89	1112	1111	1196	1190	1228	1229	3636	1914	1722	4609	2417	2192	2490	2243	293	382	303	349	269	317	300	422	302	770	221	537	0.61	0.49	0.31	0.39	199.1	179.2
6	49.9	39.9	0.98	64.3	68	14.13	1169	1188	1402	1402	1435	1431	3938	2081	1857	5143	2706	2437	2765	2476	289	377	301	340	268	307	301	424	301	775	222	605	0.68	0.52	0.29	0.37	197.6	176.4
7	49.9	39.9	0.91	64.9	63	15.24	914	930	1603	1604	1629	1635	4280	2272	2008	5633	2992	2641	3080	2703	288	373	297	343	264	306	300	422	300	771	222	633	0.74	0.56	0.28	0.35	200.0	176.7
8	49.9	39.9	0.85	64.4	60	16.05	1586	1605	1804	1818	1827	1837	4547	2420	2127	6167	3293	2874	3337	2903	287	369	297	340	266	303	300	422	301	797	222	674	0.80	0.59	0.28	0.33	202.3	177.8

55 - 45 mi/h

1	55.0	44.9	2.62	64.9	196	5.52	351	360	400	396	405	416	1547	803	745	1727	915	812	950	888	285	392	298	380	266	292	300	422	304	585	225	404	0.32	0.31	0.35	0.43	195.2	181.1
2	55.0	44.9	1.78	69.5	136	7.94	563	564	599	596	700	616	2269	1196	1073	2656	1402	1254	1647	1322	284	412	294	365	261	301	299	446	304	669	222	584	0.44	0.36	0.35	0.44	202.0	181.2
3	55.0	44.9	1.41	71.6	108	10.04	580	596	798	808	891	825	2825	1509	1316	3494	1856	1638	2024	1670	284	404	289	356	262	309	301	437	304	739	220	608	0.50	0.40	0.35	0.43	201.6	175.9
4	54.9	44.9	1.20	71.1	91	11.74	443	457	1002	1027	1039	1027	3303	1778	1525	4158	2243	1915	2340	1974	283	394	292	349	262	310	299	438	304	768	220	620	0.55	0.44	0.34	0.40	203.2	174.2
5	55.0	44.9	1.07	71.5	83	13.07	927	941	1202	1203	1231	1232	3682	1989	1693	4768	2579	2189	2635	2231	283	387	293	347	263	310	300	432	302	812	221	613	0.61	0.48	0.32	0.38	204.1	173.7
6	55.0	44.9	0.99	70.5	75	14.33	1045	1063	1403	1403	1439	1434	4031	2174	1857	5302	2868	2434	2948	2487	283	383	292	347	264	310	300	437	304	841	220	654	0.67	0.52	0.31	0.37	203.6	173.9
7	54.9	44.9	0.90	71.1	69	15.55	1111	1130	1603	1604	1638	1634	4346	2361	1985	5783	3151	2632	3237	2700	283	385	298	345	263	309	299	435	304	848	222	642	0.73	0.55	0.30	0.35	203.7	171.3
8	54.9	44.9	0.85	69.3	65	16.45	1287	1306	1802	1804	1838	1841	4661	2533	2129	6270	3423	2847	3493	2897	289	389	299	349	267	316	303	441	305	862	223	695	0.79	0.58	0.29	0.33	206.5	173.6

60 - 50 mi/h

1	59.9	49.9	2.49	72.2	210	5.64	422	391	445	402	547	416	1578	837	741	1842	1021	821	1304	897	291	420	301	398	268	301	300	436	306	599	222	430	0.38	0.31	0.35	0.43	199.2	176.2
2	59.9	49.9	1.80	74.9	150	7.88	558	568	597	605	740	619	2235	1171	1064	2624	1352	1272	1732	1313	289	430	298	385	267	309	300	455	303	725	220	576	0.46	0.35	0.34	0.44	199.3	181.2
3	60.0	49.9	1.43	74.5	121	9.84	651	665	692	792	908	823	2804	1491	1313	3382	1803	1579	1927	1670	288	430	296	370	267	323	301	459	307	790	221	503	0.49	0.40	0.34	0.42	203.4	179.0
4	59.9	49.9	1.22	77.7	101	11.65	725	732	1000	996	1035	1022	3268	1758	1510	4101	2204	1897	2316	1959	288	418	296	366	268	327	299	458	306	823	219	640	0.54	0.43	0.33	0.40	202.4	173.8
5	60.0	49.9	1.08	74.9	92	12.97	1120	1103	1218	1191	1237	1230	3644	1978	1667	4744	2617	2127	2653	2210	290	412	299	368	271	320	300	452	305	853	221	561	0.61	0.47	0.32	0.38	204.5	172.4
6	60.0	49.9	0.99	71.7	84	14.14	1239	1248	1409	1413	1430	1400	4000	2180	1820	5279	2889	2390	2962	2420	293	415	303	363	274	327	300	448	308	866	224	638	0.66	0.51	0.31	0.36	207.0	172.7
7	60.0	49.9	0.92	73.2	78	15.33	1464	1461	1595	1586	1632	1634	4321	2359	1962	5659	3098	2561	3222	2629	296	418	306	369	276	323	299	449	310	889	226							

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID DISPLACE.		FRICTION COEFF.		INERTIA							
	INIT	FNL	STOP	REPT	TO	Avg	AVERAGE	SUSTAINED	MAXIMUM	AVERAGE			SUSTAINED			MAXIMUM			ROTOR	FRONT		REAR		O/B	ROTOR	I/B		O/B	MAXIMUM	SUSTAINED	FRONT	REAR	FRONT	REAR				
	mi/h	s	ft	ft/s ²	ft	ft	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	INT	MAX	INT	MAX	INT	MAX	INT	MAX	INT	MAX	in ³	μ	slug ft ²							
SECOND EFFECTIVENESS MATRIX - 450°F																																						
450°F Initial Rotor Temperature																																						
50 - 40 mi/h																																						
1	49.9	39.9	2.57	122.3	175	5.47	384	385	403	400	511	412	1559	870	689	1759	986	773	1281	841	443	554	451	534	405	435	450	559	457	672	335	432	0.36	0.29	0.37	0.41	213.6	169.0
2	49.8	39.9	1.80	47.4	123	7.75	550	563	587	598	708	620	2184	1214	970	2524	1405	1119	1667	1219	443	570	459	534	406	442	449	572	459	815	337	517	0.44	0.34	0.36	0.39	210.2	168.0
3	49.9	39.9	1.47	48.5	101	9.48	704	731	774	803	898	826	2686	1507	1179	3317	1847	1470	2163	1514	445	562	461	527	410	450	449	569	460	879	335	516	0.51	0.38	0.36	0.39	213.2	166.9
4	49.9	39.9	1.26	48.9	87	11.13	794	806	1003	1002	1029	1029	3144	1767	1377	3992	2263	1729	2325	1785	448	557	465	525	414	455	451	565	459	915	334	492	0.54	0.42	0.34	0.36	213.1	166.0
5	49.9	39.9	1.12	49.7	77	12.45	766	772	1201	1196	1237	1229	3559	1997	1563	4603	2611	1992	2688	2051	449	551	467	523	417	458	451	566	458	928	336	474	0.61	0.46	0.33	0.35	215.3	168.4
6	49.9	39.9	1.01	50.2	70	13.80	971	989	1401	1403	1445	1431	3854	2146	1708	5151	2900	2251	2998	2305	450	552	468	525	421	462	450	560	462	927	336	470	0.67	0.50	0.31	0.34	208.7	166.1
7	49.9	39.9	0.92	53.4	64	15.06	915	951	1602	1603	1635	1634	4171	2306	1866	5665	3172	2493	3272	2564	451	547	468	521	419	460	445	564	460	923	338	448	0.73	0.54	0.30	0.33	205.5	166.2
8	49.9	39.9	0.87	52.1	60	16.11	1271	1290	1801	1803	1834	1836	4471	2460	2011	6160	3434	2726	3523	2774	448	538	472	521	422	457	446	559	455	932	341	455	0.79	0.57	0.29	0.32	204.9	167.5
55 - 45 mi/h																																						
1	54.9	44.9	2.67	50.6	201	5.33	390	381	418	403	525	413	1515	809	706	1759	959	800	1180	856	450	561	475	563	423	448	448	572	458	745	342	431	0.37	0.30	0.35	0.42	203.7	177.7
2	54.9	44.9	1.85	54.4	141	7.65	501	501	612	597	710	616	2153	1156	998	2526	1369	1157	1644	1225	450	582	472	558	418	455	447	585	460	834	352	494	0.44	0.35	0.34	0.41	202.8	175.1
3	54.9	44.9	1.47	55.4	111	9.67	740	734	821	806	875	828	2700	1471	1229	3358	1862	1496	1950	1540	450	576	470	547	418	461	451	583	460	882	347	484	0.50	0.39	0.34	0.39	204.1	170.6
4	55.0	44.9	1.25	54.8	96	11.26	809	826	1002	1011	1030	1030	3171	1744	1427	4019	2234	1875	2281	1832	450	568	470	536	419	461	450	582	462	891	347	488	0.55	0.43	0.34	0.37	207.7	170.0
5	55.0	44.9	1.12	56.3	86	12.54	818	838	1194	1192	1230	1231	3574	1976	1598	4612	2582	2030	2659	2101	450	566	473	535	423	470	451	577	463	916	344	462	0.61	0.47	0.33	0.36	211.4	171.0
6	55.0	44.9	1.02	56.6	78	13.85	1055	1070	1402	1402	1431	1436	3936	2175	1761	5202	2906	2296	2986	2361	450	565	473	530	424	469	447	574	457	915	347	467	0.67	0.50	0.31	0.34	210.7	170.6
7	55.0	44.9	0.94	57.9	73	14.84	1414	1413	1608	1596	1633	1640	4226	2329	1897	5644	3148	2496	3293	2594	449	560	473	529	422	466	445	577	455	949	347	467	0.73	0.54	0.30	0.33	210.6	171.5
8	55.0	44.9	0.87	59.2	68	15.98	1496	1514	1807	1829	1843	1844	4493	2464	2029	6158	3399	2759	3535	2818	451	556	472	525	427	462	443	570	456	974	346	469	0.80	0.57	0.28	0.32	206.8	170.3
60 - 50 mi/h																																						
1	60.0	49.9	2.74	58.7	226	5.29	352	355	403	398	525	414	1488	789	699	1612	859	753	1169	856	450	568	474	565	425	451	440	579	456	755	347	449	0.38	0.31	0.32	0.40	200.2	177.4
2	59.9	49.9	1.89	58.0	158	7.50	552	557	602	602	616	616	2122	1134	988	2479	1337	1142	1582	1219	450	598	475	564	423	463	445	592	457	837	353	504	0.44	0.35	0.34	0.40	203.0	176.7
3	59.9	49.9	1.50	59.0	126	9.40	706	731	778	803	896	821	2665	1455	1210	3220	1753	1467	1998	1523	449	592	474	555	423	472	450	595	461	892	348	503	0.51	0.39	0.34	0.38	207.7	172.7
4	59.9	49.9	1.26	62.0	106	11.12	885	903	1004	1001	1055	1023	3153	1741	1412	3975	2219	1756	2284	1818	448	587	474	540	424	476	447	586	458	917	349	492	0.56	0.43	0.33	0.37	210.1	170.4
5	59.9	49.9	1.13	62.0	95	12.50	977	991	1206	1208	1232	1221	3545	1959	1585	4532	2511	2021	2688	2066	448	583	474	540	424	474	445	583	457	928	347	494	0.61	0.46	0.31	0.35	210.3	170.2
6	59.9	49.9	1.02	62.6	85	13.93	999	1014	1402	1403	1440	1432	3886	2129	1757	5149	2850	2299	2965	2369	451	574	473	533	428	477	444	585	458	966	351	487	0.67	0.50	0.31	0.35	205.1	169.3
7	59.9	49.9	0.94	63.7	79	14.94	1401	1416	1604	1613	1638	1638	4208	2291	1917	5671	3122	2549	3219	2582	451	565	473	533	428	469	444	581	454	983	350	478	0.73	0.54	0.29	0.33	205.7	172.1
8	59.9	49.9	0.87	63.2	74	15.87	1297	1318	1801	1805	1821	1821	4430	2400	2030	6099	3343	2756	3452	2841	452	559	472	529	429	470	442	583	456	1008	350	470	0.79					

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

SPEED				TIME		DIST.		DECCEL		PRESSURE								TORQUE								TEMPERATURE								FLUID		FRICTION		INERTIA	
CYCLE NO.	INIT	FNL	STOP	REPT	TO STOP	Avg	Average	Sustained	Maximum	Average				Sustained				Maximum				Rotor		I/B	O/B	Rotor	I/B	O/B	Front	Rear	Displace.	Coeff.	Front	Rear					
	mi/h	s	ft	ft/s ²	ft	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	in ³	μ	Front	Rear						
SECOND EFFECTIVENESS MATRIX - 600°F																																							
600°F Initial Rotor Temperature																																							
50 - 40 mi/h																																							
1	49.9	39.9	2.75	117.0	187	5.14	376	378	401	398	516	412	1443	811	632	1591	900	691	1175	773	584	687	606	684	551	578	600	704	612	794	448	570	0.38	0.30	0.34	0.37	211.7	165.2	
2	49.9	39.9	1.92	38.9	131	7.34	534	526	619	599	725	613	2067	1161	906	2417	1372	1045	1706	1107	591	711	618	689	552	588	600	712	614	862	450	642	0.46	0.35	0.33	0.37	212.3	165.5	
3	49.8	39.9	1.51	37.7	104	9.19	577	587	814	804	899	823	2585	1467	1119	3201	1838	1363	2086	1419	598	715	626	688	560	596	599	708	616	943	451	634	0.53	0.39	0.34	0.36	214.2	163.3	
4	49.9	39.9	1.30	42.8	88	10.85	568	580	1003	1002	1044	1029	3043	1737	1306	3895	2248	1647	2307	1709	599	708	627	681	564	602	592	697	608	996	453	623	0.57	0.43	0.34	0.35	214.8	161.4	
5	49.9	39.9	1.12	45.2	79	12.25	1019	1031	1196	1201	1234	1229	3457	1976	1481	4562	2626	1936	2715	2004	599	709	627	681	565	604	580	689	602	1034	460	625	0.62	0.47	0.33	0.34	216.3	162.2	
6	49.8	39.9	1.01	46.5	71	13.49	810	832	1400	1407	1427	1429	3847	2199	1648	5246	3024	2222	3104	2269	601	700	627	680	567	607	574	677	593	1046	458	622	0.69	0.51	0.33	0.33	218.7	163.8	
7	49.8	39.9	0.93	47.1	65	14.80	1159	1176	1602	1603	1624	1628	4215	2394	1821	5877	3372	2505	3479	2570	598	695	630	678	570	606	666	588	1062	456	613	0.76	0.54	0.32	0.33	216.9	165.1		
8	49.9	39.9	0.87	46.5	60	16.04	1249	1273	1802	1803	1825	1829	4517	2540	1977	6453	3662	2791	3765	2812	599	696	631	677	568	605	559	584	1081	456	598	0.82	0.57	0.31	0.33	212.5	165.4		
55 - 45 mi/h																																							
1	54.9	44.9	2.81	47.3	211	5.07	388	379	415	400	563	411	1428	785	643	1611	903	708	1272	770	600	699	631	714	572	601	555	674	578	880	453	602	0.40	0.30	0.33	0.37	207.7	170.2	
2	55.0	44.9	1.95	46.7	149	7.26	468	477	604	601	713	614	2046	1146	900	2396	1357	1039	1608	1098	601	733	632	721	567	606	554	674	578	975	451	726	0.46	0.35	0.34	0.36	212.0	166.4	
3	55.0	44.9	1.52	47.6	117	9.25	709	714	805	803	926	818	2607	1481	1126	3222	1865	1357	2169	1419	599	736	633	705	568	609	550	663	570	1063	449	606	0.53	0.39	0.35	0.36	214.9	163.4	
4	55.0	44.9	1.27	50.7	98	10.96	577	584	1002	1002	1040	1025	3110	1769	1341	3975	2284	1691	2378	1735	598	728	628	697	569	612	541	661	565	1092	441	577	0.56	0.43	0.34	0.36	216.6	164.2	
5	55.0	44.9	1.10	51.4	85	12.72	936	950	1202	1202	1234	1230	3570	2028	1542	4727	2718	2009	2791	2068	599	720	629	688	569	611	537	647	559	1094	441	602	0.63	0.47	0.34	0.35	213.9	162.7	
6	54.9	44.9	0.99	50.9	76	14.11	818	840	1402	1403	1428	1434	3982	2252	1729	5423	3101	2322	3213	2375	599	712	628	679	570	610	532	642	552	1121	436	604	0.69	0.51	0.33	0.35	214.2	164.4	
7	54.9	44.9	0.90	49.8	69	15.50	1166	1183	1602	1603	1632	1634	4360	2444	1915	6051	3431	2620	3561	2664	601	707	628	678	573	614	528	642	554	1116	438	568	0.76	0.54	0.32	0.34	211.6	165.8	
8	55.0	44.9	0.84	50.7	66	16.47	1278	1299	1802	1803	1827	1827	4609	2556	2053	6586	3700	2886	3847	2933	600	704	631	680	573	613	527	645	550	1126	437	556	0.82	0.58	0.31	0.34	208.3	167.3	
60 - 50 mi/h																																							
1	59.9	49.9	2.78	49.7	231	5.11	378	376	406	399	516	413	1450	787	662	1614	888	726	1186	782	600	711	634	717	575	613	527	647	554	1021	428	542	0.38	0.30	0.33	0.38	206.6	173.8	
2	59.9	49.9	1.91	49.4	159	7.44	516	532	590	603	726	614	2100	1164	936	2441	1352	1089	1712	1130	599	743	635	716	571	615	530	662	553	1049	428	677	0.46	0.35	0.35	0.38	209.9	168.9	
3	59.9	49.9	1.52	50.9	128	9.22	726	725	809	801	875	818	2612	1459	1153	3234	1835	1399	1992	1443	598	748	636	707	571	623	530	658	552	1061	428	602	0.51	0.39	0.34	0.37	212.2	167.7	
4	59.9	49.9	1.27	52.2	106	11.12	800	811	1001	998	1025	1020	3132	1755	1377	3934	2222	1712	2349	1759	600	741	635	695	573	621	527	654	551	1045	430	603	0.56	0.43	0.34	0.36	211.7	166.1	
5	59.9	49.9	1.11	54.6	94	12.52	939	952	1202	1202	1237	1220	3563	1991	1573	4689	2650	2039	2782	2077	600	731	632	693	572	621	526	650	545	1060	421	629	0.63	0.47	0.33	0.36	213.3	168.5	
6	60.0	49.9	1.00	52.7	84	14.09	1050	1066	1401	1402	1433	1428	3969	2199	1771	5359	3004	2355	3163	2411	601	729	632	685	572	612	525	649	546	1076	431	609	0.69	0.51	0.32	0.35	209.4	168.6	
7	59.9	49.9	0.90	54.9	77	15.34	1118	1145	1602	1603	1630	1626	4297	2366	1931	5987	3334	2653	3493	2700	596	717	632	687	573	618	520	648	544	1085	432	569	0.76	0.54	0.31	0.35	206.9	168.9	
8	59.9	49.9	0.85	52.0	72	16.38	1265	1285	1800	1803	1827	1834	4617	2535	2083	6532	3632	2900	3803	2992	597	717	633	686	576	616	520	648	544	1110	427	543	0.82	0.58	0.30	0.34	207.6	170.6	
65 - 55 mi/h																																							
1	64.9	55.0	2.72	52.2	247	5.18	382	380	404	400	527	414	1464	788	676	1635	894	741	1175	806	601	726	635	722	574	617	523	664	548	1040	421	557	0.39	0.30	0.33	0.39	204.2	175.1	
2	64.9	55.0	1.87	54.3	170	7.51	545	548	609	603	709	618	2111	1166	945	2482	1372	1110	1691	1160	599	753	634	722	569	615	525	672	549	1042	429	632	0.46	0.35	0.34	0.39	208.4	168.9	
3	64.9	55.0	1.50	53.7	136	9.37	693</td																																

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

SPEED				TIME				DIST.		DECCEL		PRESSURE								TORQUE								TEMPERATURE								FLUID		FRICTION		INERTIA	
CYCLE NO.	INIT	FNL	STOP	REPT	TO STOP	Avg	Average	Sustained	Maximum	Average				Sustained				Maximum				Rотор		I/B	O/B	Rotor	I/B	O/B	Front	Rear	Displace.	Coeff.	Front	Rear	Front	Rear	slug ft ²				
	mi/h	s	ft	ft/s ²	ft	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	in ³	μ	Front	Rear	slug ft ²							
SECOND EFFECTIVENESS MATRIX - 750°F																																									
750°F Initial Rotor Temperature																																									
50 - 40 mi/h																																									
1	49.8	39.9	2.93	101.8	197	4.86	351	361	402	401	507	410	1352	775	577	1494	862	632	1116	676	749	851	775	854	704	737	705	807	726	956	541	766	0.39	0.31	0.32	0.33	214.0	159.5			
2	49.9	39.9	2.04	35.0	139	6.92	559	560	607	602	695	611	1942	1122	821	2272	1325	947	1570	980	748	870	784	856	706	746	700	813	725	996	539	845	0.47	0.35	0.33	0.33	217.4	159.0			
3	49.8	39.9	1.60	35.7	109	8.72	680	687	804	801	912	819	2472	1426	1046	3016	1762	1254	2071	1298	750	868	785	847	707	749	695	811	719	1026	537	943	0.55	0.40	0.33	0.33	219.4	160.9			
4	49.9	39.9	1.32	36.0	92	10.43	752	762	1001	997	1062	1025	2939	1698	1241	3738	2189	1549	2290	1608	748	858	785	839	708	753	688	802	714	1065	538	968	0.60	0.44	0.33	0.33	218.3	159.6			
5	49.8	39.9	1.15	36.0	80	11.91	1041	1044	1212	1205	1241	1227	3375	1948	1427	4473	2611	1862	2656	1912	748	849	784	837	713	754	683	792	709	1111	538	933	0.66	0.48	0.33	0.33	219.4	160.7			
6	49.8	39.9	1.04	36.5	72	13.30	993	1015	1401	1402	1439	1426	3776	2171	1605	5107	2962	2145	3075	2198	748	846	784	832	713	754	677	784	706	1147	543	912	0.73	0.51	0.32	0.32	219.0	161.9			
7	49.8	39.9	0.94	36.3	67	14.35	1036	1055	1602	1604	1634	1631	4104	2342	1763	5712	3284	2439	3393	2508	747	847	787	832	717	755	673	781	701	1160	547	897	0.79	0.55	0.31	0.32	219.0	164.9			
8	49.9	39.9	0.89	37.2	62	15.49	1489	1510	1803	1819	1826	1834	4410	2497	1913	6232	3529	2703	3712	2744	749	844	785	828	718	754	668	769	699	1166	552	908	0.86	0.59	0.30	0.31	216.3	165.7			
55 - 45 mi/h																																									
1	54.9	44.9	3.04	37.0	227	4.73	393	382	418	400	568	412	1330	756	574	1494	868	626	1216	679	748	855	787	872	717	760	666	774	695	1028	527	896	0.42	0.31	0.31	0.33	214.6	162.8			
2	54.9	44.9	2.07	37.3	158	6.77	543	550	601	602	713	613	1935	1116	818	2246	1307	939	1623	986	750	883	791	874	712	768	665	780	694	1094	526	915	0.49	0.35	0.33	0.33	221.3	162.2			
3	55.0	44.9	1.63	38.1	124	8.69	683	689	803	801	873	819	2449	1407	1042	2971	1723	1248	1909	1293	748	874	791	862	713	768	659	773	689	1118	527	966	0.53	0.40	0.32	0.33	217.3	160.9			
4	55.0	44.9	1.36	38.9	104	10.40	821	829	1003	1002	1082	1020	2927	1673	1254	3665	2113	1552	2228	1591	749	862	790	847	716	767	652	763	684	1138	541	977	0.61	0.43	0.32	0.33	215.8	161.7			
5	55.0	44.9	1.19	38.5	91	11.89	944	957	1202	1201	1235	1227	3329	1891	1438	4337	2487	1850	2570	1903	748	855	790	846	716	765	647	756	680	1152	551	996	0.66	0.47	0.31	0.32	213.3	162.3			
6	54.9	44.9	1.06	38.2	82	13.05	1068	1084	1401	1402	1436	1433	3697	2093	1605	5004	2853	2151	2986	2216	751	854	788	840	718	760	643	749	678	1161	558	1022	0.73	0.51	0.31	0.32	215.2	165.0			
7	55.0	44.9	0.96	39.6	75	14.51	1344	1349	1608	1601	1625	1634	4068	2289	1780	5697	3254	2443	3340	2505	749	848	787	838	717	759	639	743	676	1159	566	1037	0.80	0.55	0.31	0.32	211.7	164.6			
8	54.9	44.9	0.90	39.2	69	15.61	1292	1310	1799	1803	1831	1837	4382	2438	1944	6193	3467	2726	3647	2797	748	845	789	836	720	758	636	744	672	1164	573	1008	0.87	0.58	0.29	0.32	209.5	167.1			
60 - 50 mi/h																																									
1	59.9	49.9	3.03	37.7	253	4.68	369	376	402	401	523	413	1317	741	575	1461	829	632	1130	673	750	857	791	896	721	767	639	749	677	1056	579	934	0.40	0.30	0.31	0.33	212.4	164.8			
2	59.9	49.9	2.05	39.7	173	6.82	566	561	613	600	740	613	1935	1107	828	2237	1301	936	1658	986	749	891	797	887	715	773	638	760	674	1102	524	935	0.50	0.36	0.32	0.33	217.9	163.0			
3	59.9	49.9	1.66	40.5	137	8.60	722	725	806	803	907	817	2438	1385	1053	2930	1676	1254	1924	1304	751	881	793	872	717	776	639	768	671	1123	517	992	0.55	0.40	0.31	0.33	216.2	164.3			
4	59.9	49.9	1.36	41.5	114	10.36	778	793	1003	1001	1060	1018	2923	1654	1269	3650	2083	1567	2166	1614	748	872	792	862	717	776	630	763	665	1124	527	1032	0.61	0.43	0.31	0.33	214.2	164.2			
5	60.0	49.9	1.19	40.9	100	11.89	992	1002	1205	1206	1228	1222	3329	1868	1461	4338	2455	1883	2546	1915	751	858	789	857	718	774	631	759	666	1111	532	1047	0.67	0.48	0.31	0.33	210.7	164.9			
6	60.0	49.9	1.06	39.9	89	13.30	1174	1187	1403	1407	1426	1423	3734	2087	1647	5010	2824	2186	2930	2222	750	856	789	850	720	770	630	755	664	1114	538	1073	0.73	0.51	0.30	0.33	210.5	166.1			
7	59.9	49.9	0.96	40.5	81	14.58	1333	1339	1602	1596	1628	1627	4123	2293	1829	5618	3151	2467	3328	2552	748	855	790	847	723	771	631	752	663	1117	537	1058	0.81	0.55	0.30	0.33	211.1	168.4			
8	60.0	49.9	0.91	40.8	77	15.48	1278	1306	1799	1804	1828	1826	4380	2413	1967	6084	3361	2723	3579	2779	749	853	792	849	724	771	632	753	665	1130	534	1067	0.87	0.58	0.28	0.32	209.2	170.5			
65 - 55 mi/h																																									
1	64.9	55.0	3.00	40.9	272	4.71	381	378	411	401	539	413	1339	742	596	1499	844	655	1151	703	748	867	793	919	723	771	637	760	666	1065	525	941	0.41	0.30	0.31	0.34	211.4	169.9			
2	64.9	55.0	2.03	41.5	187	6.82	548	550	611	602	722	611	1936	1094	842	2243	1278	965	1602	1006	749	899	797	900	718	784	635	769	668	1083	525	997	0.49	0.35	0.32	0.34	215.0	165.6			
3	64.9	55.0	1.63	41.5	149	8.58	608	617	804																																

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID		FRICTION		INERTIA	
	TO	Avg	Average	Sustained	Maximum	Average	Sustained	Maximum	Rotor	Front		Rear		O/B	I/B	O/B	I/B	O/B	I/B	Front	Re	Displace.	Coeff.	Front	Re	Front	Re	Front	Re			
	INIT	FNL	STOP	REPT	STOP	DIST	FRONT	REAR	FRONT	REAR	SUM	FRONT	REAR	SUM	FRONT	REAR	FRONT	REAR	INT	MAX	INT	MAX	INT	MAX	INT	MAX	Front	Re	in³	μ	slug ft²	
mi/h s ft ft/s² lbf/in² lbf ft																																

SECOND REBURNISH

40 mi/h - 0.37g Deceleration Rate - 200°F Initial Rotor Temperature or 1 Mile Distance

1	39.8	0.5	5.17	0.0	168	10.18	1002	1024	1192	1199	1314	1325	2869	1653	1216	3355	1971	1384	2045	1493	202	327	218	435	189	348	188	319	183	315	181	349	0.61	0.50	0.25	0.24	217.9	160.3
5	39.9	0.5	5.12	28.6	162	10.53	709	717	720	726	914	944	2959	1701	1259	3394	2004	1390	2101	1523	196	371	200	401	171	305	192	367	171	568	132	595	0.54	0.42	0.42	0.40	216.7	160.4
10	39.9	0.5	5.10	101.6	162	10.62	621	636	694	696	854	886	2978	1699	1279	3393	1950	1443	2071	1508	237	420	241	417	215	356	223	377	214	602	181	599	0.52	0.42	0.42	0.44	214.7	161.6
15	39.9	0.5	5.09	101.6	161	10.64	576	593	681	680	837	876	2989	1701	1287	3387	1953	1434	2051	1546	243	418	247	412	219	355	229	391	224	540	189	653	0.52	0.42	0.43	0.44	214.6	162.3
20	39.9	0.5	5.11	101.5	161	10.64	645	648	655	655	834	870	2988	1698	1290	3382	1945	1437	2036	1520	246	419	247	401	221	363	226	389	221	513	201	656	0.52	0.42	0.45	0.46	214.2	162.7
25	39.9	0.5	5.10	101.4	161	10.63	693	702	704	712	837	868	2992	1692	1301	3379	1933	1446	2051	1552	245	414	249	389	220	362	226	396	221	524	202	668	0.52	0.42	0.41	0.43	213.4	164.1
30	39.9	0.5	5.09	101.4	161	10.67	721	731	737	745	834	870	3000	1676	1324	3379	1889	1490	2030	1573	243	406	244	372	220	355	231	400	225	555	199	676	0.52	0.42	0.39	0.42	210.8	166.5
35	40.0	0.5	5.08	101.4	161	10.66	672	680	682	686	836	876	2993	1654	1339	3402	1897	1505	2030	1623	238	400	240	352	215	351	230	406	227	575	205	659	0.52	0.42	0.42	0.46	208.2	168.5

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID DISPLACE.		FRICTION COEFF.		INERTIA							
	INIT	FNL	STOP	REPT	TO	Avg	AVERAGE	SUSTAINED	MAXIMUM	AVERAGE			SUSTAINED			MAXIMUM			ROTOR	FRONT		REAR		O/B	ROTOR	I/B		O/B	MAXIMUM	SUSTAINED	FRONT	REAR	FRONT	REAR				
	mi/h	s	ft	ft/s ²	STOP	DIST	FRONT	REAR	FRONT	REAR	SUM	FRONT	REAR	SUM	FRONT	REAR	FRONT	REAR	INT	MAX	INT	MAX	INT	MAX	INT	MAX	INT	MAX	FRONT	REAR	in ³	μ	slug ft ²					
THIRD EFFECTIVENESS MATRIX - 300°F																																						
300°F Initial Rotor Temperature																																						
50 - 40 mi/h																																						
1	49.9	39.9	2.79	132.5	191	5.05	329	348	398	402	403	410	1433	778	655	1615	862	753	900	812	301	366	294	358	266	291	298	385	293	563	269	578	0.36	0.33	0.33	0.39	206.6	174.1
2	49.9	39.9	1.90	58.9	129	7.43	576	571	609	600	684	613	2113	1164	948	2550	1443	1107	1573	1148	301	385	303	363	267	324	298	414	294	599	260	741	0.47	0.36	0.36	0.39	210.2	171.3
3	49.9	39.9	1.50	61.4	103	9.28	613	617	806	796	842	812	2652	1472	1180	3220	1812	1408	1868	1476	299	374	303	369	267	343	296	411	291	639	265	751	0.52	0.39	0.34	0.37	212.8	170.6
4	49.9	39.9	1.27	61.8	87	11.06	932	943	995	1004	1033	1020	3118	1735	1383	3839	2139	1700	2231	1747	301	377	304	375	271	338	293	411	289	670	260	761	0.58	0.43	0.32	0.36	210.5	167.7
5	49.9	39.9	1.12	63.3	77	12.44	690	707	1201	1202	1239	1225	3514	1948	1566	4479	2499	1980	2549	2042	299	371	304	373	272	333	292	403	289	696	257	759	0.65	0.47	0.31	0.35	210.1	169.0
6	49.8	39.9	1.00	64.9	69	13.85	1299	1301	1397	1393	1427	1423	3923	2166	1757	5096	2830	2266	2900	2310	299	369	306	375	271	329	287	402	287	723	260	764	0.71	0.51	0.31	0.34	209.9	170.2
7	49.8	39.9	0.92	66.9	64	15.00	1479	1492	1596	1606	1625	1624	4289	2364	1924	5748	3172	2576	3257	2617	302	367	306	374	271	328	286	395	285	730	258	752	0.77	0.54	0.30	0.34	211.5	172.2
8	49.8	39.9	0.85	68.0	59	16.15	976	1017	1799	1803	1829	1816	4566	2515	2050	6356	3544	2812	3623	2862	300	370	309	375	272	327	281	393	279	742	255	732	0.83	0.57	0.30	0.33	209.0	170.3
55 - 45 mi/h																																						
1	54.9	44.9	2.69	77.1	203	5.28	384	389	398	400	403	411	1499	782	717	1677	883	794	906	847	300	373	307	380	270	304	273	409	276	698	256	616	0.35	0.31	0.33	0.42	198.8	182.3
2	54.9	44.9	1.88	70.3	143	7.54	577	571	606	596	689	613	2157	1150	1007	2491	1343	1148	1555	1216	300	395	308	386	266	326	278	426	279	747	262	756	0.46	0.35	0.33	0.41	204.6	179.1
3	54.9	44.9	1.50	73.0	114	9.35	571	588	802	801	864	813	2680	1446	1234	3225	1747	1478	1868	1520	301	397	306	389	268	335	277	423	278	776	263	769	0.53	0.39	0.33	0.39	207.5	177.1
4	55.0	44.9	1.25	74.4	96	11.24	946	932	1017	995	1042	1017	3162	1728	1433	3960	2207	1753	2231	1830	302	398	306	390	270	338	276	419	280	796	254	768	0.58	0.43	0.33	0.37	206.2	171.1
5	54.9	44.9	1.10	81.3	84	12.75	849	861	1200	1202	1241	1224	3603	1977	1626	4620	2552	2068	2620	2127	301	393	303	388	267	339	272	413	273	800	257	775	0.64	0.46	0.32	0.36	208.1	171.1
6	54.9	44.9	0.98	78.2	76	14.10	981	997	1400	1402	1429	1430	3980	2187	1793	5294	2942	2352	2995	2428	299	387	305	383	270	336	269	406	273	820	250	771	0.71	0.50	0.32	0.35	208.1	170.6
7	54.9	44.9	0.90	81.0	69	15.49	1164	1184	1601	1603	1625	1636	4380	2412	1968	5925	3308	2617	3355	2685	300	387	303	384	269	335	265	399	270	850	251	767	0.78	0.54	0.31	0.34	208.8	170.5
8	55.0	44.9	0.84	79.6	65	16.66	1498	1541	1800	1803	1830	1835	4722	2613	2108	6509	3659	2850	3727	2957	300	387	305	383	271	333	267	398	270	865	254	789	0.83	0.57	0.31	0.33	210.5	169.8
60 - 50 mi/h																																						
1	59.9	49.9	2.68	86.2	222	5.32	378	384	400	401	404	411	1520	794	725	1700	888	812	912	847	300	394	304	394	268	304	264	425	267	807	252	596	0.35	0.30	0.34	0.43	200.5	183.1
2	59.9	49.9	1.86	78.2	155	7.64	495	515	596	605	690	613	2151	1155	996	2470	1316	1154	1558	1210	301	425	305	402	266	332	268	447	272	815	255	729	0.47	0.35	0.33	0.40	202.9	175.0
3	60.0	49.9	1.48	82.6	124	9.62	744	751	798	802	877	812	2673	1455	1218	3263	1779	1484	1889	1523	301	425	305	408	266	345	268	436	271	852	256	731	0.53	0.38	0.34	0.39	202.9	169.8
4	59.9	49.9	1.27	86.4	107	11.02	926	927	1005	998	1034	1013	3184	1765	1419	3975	2228	1747	2284	1809	300	422	305	405	266	350	265	423	270	868	259	800	0.58	0.42	0.33	0.37	214.9	172.8
5	59.9	49.9	1.09	89.0	92	12.93	1006	1029	1201	1202	1236	1222	3624	2014	1610	4662	2611	2051	2679	2107	300	416	306	406	266	350	261	415	268	882	260	821	0.64	0.46	0.33	0.36	208.9	167.1
6	59.9	49.9	0.99	87.1	83	14.26	1281	1286	1398	1397	1423	1428	3998	2227	1771	5294	2998	2296	3075	2378	301	412	307	397	268	348	257	412	265	878	258	826	0.71	0.49	0.32	0.35	209.6	166.6
7	59.9	49.9	0.90	90.7	76	15.53	1167	1186	1601	1602	1628	1631	4404	2458	1946	5974	3372	2602	3449	2659	301	411	305	396	269	343	257	409	266	880	255	813	0.77	0.53	0.32	0.34	212.4	168.1
8	60.0	49.9	0.83	91.6	70	16.90	1558	1567	1794	1792	1830	1838	4739	2638	2101	6547	3694	2853	3759	2936	299	411	306	395	269	343	257	409										

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID		FRICTION		INERTIA	
	INIT	FNL	STOP	REPT	TO	Avg	AVERAGE	SUSTAINED	MAXIMUM	AVERAGE			SUSTAINED			MAXIMUM			ROTOR	FRONT		REAR		DISPLAC.		COEFF.		INERTIA				
		mi/h	s		ft	ft/s ²	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	INT	MAX	INT	MAX	INT	MAX	INT	MAX	Front	Rear	Front	Rear		

THIRD EFFECTIVENESS MATRIX - 450°F

450°F Initial Rotor Temperature

50 - 40 mi/h

1	49.9	39.9	2.72	121.6	185	5.19	379	385	399	400	402	407	1469	801	668	1623	888	735	921	818	448	563	461	586	398	434	423	535	426	875	363	715	0.34	0.33	0.34	0.39	206.9	172.6
2	49.8	39.9	1.88	51.1	128	7.44	553	559	600	601	698	611	2116	1173	943	2464	1372	1092	1632	1133	450	580	465	583	398	455	425	550	431	923	358	787	0.47	0.34	0.35	0.38	211.7	170.0
3	49.9	39.9	1.53	52.2	105	9.10	727	736	797	802	896	812	2626	1481	1145	3217	1827	1390	2051	1411	452	574	467	581	403	474	420	546	435	950	361	776	0.53	0.38	0.35	0.37	218.4	168.8
4	49.9	39.9	1.28	55.6	87	11.01	806	818	1001	1001	1039	1022	3096	1759	1337	3889	2228	1661	2281	1694	451	570	465	573	405	481	418	537	431	945	361	777	0.58	0.42	0.34	0.35	214.3	163.0
5	49.9	39.9	1.12	55.9	78	12.31	845	855	1196	1197	1233	1224	3521	2008	1513	4609	2667	1942	2700	1968	449	565	470	568	409	487	414	530	426	959	357	803	0.65	0.45	0.34	0.34	218.8	164.9
6	49.9	39.9	1.00	57.8	69	13.96	1183	1190	1401	1396	1422	1426	3912	2241	1671	5285	3075	2210	3098	2237	451	558	471	564	410	481	409	526	422	964	357	854	0.71	0.49	0.33	0.33	215.4	160.6
7	49.9	39.9	0.91	60.5	64	15.01	1425	1423	1614	1600	1632	1630	4286	2467	1819	5978	3499	2479	3526	2499	450	553	470	567	413	486	408	516	418	973	353	863	0.77	0.52	0.33	0.33	220.5	162.5
8	49.9	39.9	0.84	60.2	59	16.26	879	896	1801	1805	1832	1833	4633	2673	1960	6574	3856	2718	3939	2759	450	547	468	561	415	485	402	512	417	982	355	902	0.84	0.56	0.32	0.32	220.6	161.7

55 - 45 mi/h

1	55.0	44.9	2.82	59.2	214	5.04	379	385	399	401	401	410	1433	784	648	1576	871	705	909	759	450	568	471	609	415	457	395	534	413	928	353	746	0.34	0.29	0.33	0.37	208.8	172.6
2	55.0	44.9	1.92	60.4	147	7.39	561	558	611	601	681	611	2070	1156	914	2438	1378	1060	1585	1095	448	600	470	600	409	481	396	549	415	950	350	883	0.47	0.34	0.34	0.37	210.0	165.9
3	55.0	44.9	1.53	60.6	117	9.23	715	727	799	802	850	814	2608	1467	1141	3157	1785	1372	1912	1408	450	592	470	594	413	494	399	543	413	970	347	926	0.53	0.38	0.34	0.36	213.2	165.9
4	54.9	44.9	1.29	62.8	98	10.91	727	741	1004	1002	1042	1022	3108	1750	1357	3895	2219	1676	2257	1723	449	587	469	589	415	498	398	540	412	987	346	958	0.59	0.42	0.33	0.35	215.3	166.9
5	54.9	44.9	1.11	64.7	86	12.53	959	977	1201	1209	1228	1225	3543	2006	1537	4633	2650	1983	2703	2024	448	579	471	581	413	499	394	534	408	1001	347	944	0.65	0.45	0.33	0.35	214.8	164.5
6	54.9	44.9	0.99	66.8	76	14.14	1046	1061	1401	1402	1431	1432	3974	2266	1708	5367	3098	2269	3151	2310	449	572	468	569	417	497	393	523	407	1012	345	933	0.71	0.49	0.33	0.34	215.0	162.1
7	54.9	44.9	0.90	68.4	69	15.53	920	942	1601	1602	1632	1630	4396	2519	1877	6064	3529	2535	3588	2579	449	563	465	571	414	499	388	511	403	1031	344	975	0.78	0.53	0.33	0.33	217.6	162.1
8	55.0	44.9	0.82	67.8	65	16.65	1577	1579	1806	1798	1825	1833	4689	2693	1996	6694	3915	2779	3986	2847	450	560	469	571	415	494	385	508	400	1042	341	946	0.84	0.56	0.33	0.33	217.0	160.8

60 - 50 mi/h

1	59.9	49.9	2.85	70.2	234	5.03	380	386	399	401	405	410	1439	786	653	1603	874	729	912	767	449	575	468	609	417	462	380	536	395	943	336	793	0.34	0.29	0.33	0.38	209.5	174.3
2	59.9	49.9	1.91	65.2	159	7.43	501	522	590	601	706	610	2113	1171	943	2441	1349	1092	1653	1127	451	610	469	611	413	492	388	553	400	980	337	912	0.48	0.34	0.35	0.38	211.3	170.1
3	59.9	49.9	1.51	67.0	127	9.30	674	683	804	801	861	814	2644	1477	1168	3232	1821	1411	1971	1446	453	604	470	607	414	498	389	549	404	1058	337	941	0.53	0.38	0.34	0.37	213.1	168.5
4	59.9	49.9	1.27	71.1	106	11.19	891	899	998	1000	1036	1019	3145	1768	1377	3983	2266	1717	2343	1762	449	600	469	598	413	493	366	535	340	1069	338	931	0.60	0.42	0.34	0.36	211.9	165.0
5	60.0	49.9	1.10	72.6	93	12.72	832	851	1204	1204	1228	1226	3599	2043	1555	4736	2703	2033	2782	2063	451	586	470	592	416	497	382	517	400	1069	332	943	0.65	0.46	0.34	0.36	215.5	164.0
6	59.9	49.9	0.98	72.0	83	14.17	891	898	1402	1399	1421	1428	4048	2317	1731	5482	3195	2287	3252	2372	451	578	471	583	416	507	374	509	396	1068	329	926	0.71	0.49	0.34	0.34	219.4	163.9
7	59.9	49.9	0.89	75.0	75	15.76	1125	1156	1601	1603	1627	1634	4448	2561	1888	6143	3588	2555	3667	2605	450	565	470	579	418	500	373	502	390	1049	327	945	0.78	0.53	0.34	0.34	218.0	160.7
8	59.9	49.9	0.82	75.5																																		

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

SPEED				TIME		DIST.		DECCEL		PRESSURE								TORQUE								TEMPERATURE								FLUID		FRICTION		INERTIA			
CYCLE NO.	INIT	FNL	STOP	REPT	TO STOP	Avg	Average	Sustained	Maximum	AVERAGE				SUSTAINED				MAXIMUM				ROTOR		I/B		O/B		ROTOR		I/B		O/B		MAXIMUM		DISPLAC.		COEFF.		SUSTAINED	
	mi/h		s		ft	ft	ft	ft/s ²		Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear				
THIRD EFFECTIVENESS MATRIX - 600°F																																									
600°F Initial Rotor Temperature																																									
50 - 40 mi/h																																									
1	49.9	39.9	2.83	117.2	192	4.98	392	380	420	400	543	408	1417	826	592	1579	924	655	1222	697	600	712	622	741	545	588	543	642	552	860	456	793	0.41	0.30	0.33	0.34	222.3	159.3			
2	49.9	39.9	1.98	47.7	135	7.11	537	546	599	601	709	608	2015	1169	846	2379	1399	980	1670	1015	600	739	629	743	549	605	531	643	550	885	458	802	0.48	0.34	0.35	0.34	220.6	159.7			
3	50.0	39.9	1.55	49.8	107	9.07	707	715	796	798	874	814	2537	1469	1068	3120	1824	1296	2012	1340	600	728	629	735	551	614	522	634	544	895	452	844	0.54	0.38	0.35	0.34	217.3	157.9			
4	49.9	39.9	1.29	48.6	89	10.76	697	707	1002	1001	1047	1022	3020	1757	1263	3857	2263	1594	2387	1641	600	726	629	736	555	619	516	630	537	929	451	851	0.60	0.42	0.34	0.34	219.1	157.5			
5	49.9	39.9	1.13	52.2	78	12.30	929	943	1200	1202	1225	1223	3470	2014	1456	4582	2688	1894	2732	1948	598	717	628	731	560	620	510	619	531	953	443	864	0.66	0.45	0.34	0.33	219.7	158.8			
6	49.9	39.9	1.01	53.1	70	13.70	1179	1189	1397	1396	1431	1429	3909	2270	1639	5308	3107	2201	3184	2251	599	706	628	731	559	627	501	606	522	982	441	792	0.72	0.49	0.34	0.33	222.3	160.5			
7	49.8	39.9	0.91	51.8	63	15.07	1009	1035	1600	1604	1625	1631	4280	2487	1793	6078	3576	2502	3635	2558	599	698	631	731	564	630	493	595	519	1007	428	903	0.78	0.53	0.34	0.33	221.4	159.6			
8	49.9	39.9	0.84	52.0	59	16.37	970	993	1800	1803	1825	1828	4643	2694	1949	6757	3963	2794	4054	2830	599	692	633	726	566	628	492	589	513	1036	428	927	0.85	0.56	0.33	0.33	220.9	159.8			
55 - 45 mi/h																																									
1	54.9	44.9	2.95	50.4	221	4.87	347	358	400	400	402	407	1364	773	591	1514	868	646	906	688	599	705	634	756	568	610	487	585	511	922	433	694	0.34	0.30	0.33	0.34	213.2	162.8			
2	54.9	44.9	1.98	50.6	150	7.12	554	559	602	601	737	609	2023	1165	858	2376	1384	992	1720	1024	599	749	638	758	564	625	484	603	511	930	429	834	0.50	0.34	0.35	0.35	219.6	161.8			
3	54.9	44.9	1.55	53.1	118	9.08	688	699	800	801	880	816	2563	1478	1085	3134	1824	1310	2027	1346	599	748	636	750	563	631	480	596	506	939	427	893	0.54	0.38	0.34	0.34	218.3	160.2			
4	55.0	44.9	1.30	53.5	100	10.79	811	823	1003	1001	1076	1020	3051	1763	1288	3892	2275	1617	2473	1661	600	743	634	751	566	640	478	587	503	960	430	900	0.62	0.42	0.34	0.34	219.2	160.1			
5	55.0	44.9	1.13	54.5	86	12.55	968	986	1202	1202	1230	1228	3526	2040	1486	4677	2735	1942	2782	1992	600	736	634	746	569	639	476	584	499	968	426	935	0.66	0.46	0.34	0.34	218.0	158.8			
6	54.9	44.9	0.99	57.7	77	13.99	1011	1035	1401	1402	1432	1431	3993	2315	1678	5467	3207	2260	3263	2319	600	723	630	735	568	639	470	574	493	987	422	971	0.72	0.49	0.35	0.34	222.1	161.0			
7	55.0	44.9	0.90	56.3	70	15.40	1165	1185	1600	1603	1619	1633	4400	2555	1846	6238	3659	2579	3738	2641	601	717	633	740	570	644	467	568	492	1018	423	999	0.79	0.53	0.35	0.34	222.6	160.8			
8	54.9	44.9	0.83	58.1	64	16.73	1386	1410	1799	1804	1818	1837	4745	2746	1999	6916	4033	2883	4148	2927	600	711	633	737	573	640	464	564	488	1051	424	991	0.86	0.56	0.34	0.34	220.3	160.3			
60 - 50 mi/h																																									
1	59.9	49.9	2.91	57.5	241	4.89	375	381	400	399	401	407	1393	800	594	1546	900	646	930	691	599	713	635	779	573	620	462	545	486	927	420	654	0.34	0.29	0.34	0.34	219.5	162.9			
2	59.9	49.9	1.95	55.5	162	7.27	543	548	603	600	692	608	2060	1198	862	2414	1419	995	1667	1039	599	757	636	776	567	639	463	567	484	927	423	864	0.48	0.33	0.36	0.35	221.0	159.0			
3	60.0	49.9	1.53	55.8	128	9.30	653	662	804	801	867	814	2604	1512	1092	3199	1874	1325	2030	1369	599	768	636	766	570	650	462	577	483	941	423	965	0.54	0.38	0.35	0.35	218.0	157.4			
4	59.9	49.9	1.27	59.3	108	10.95	807	820	1002	1001	1051	1022	3112	1808	1304	3975	2334	1641	2467	1700	600	756	635	754	571	652	458	571	480	918	452	962	0.60	0.42	0.35	0.35	221.4	159.7			
5	59.9	49.9	1.10	58.3	93	12.80	1010	1019	1199	1198	1239	1222	3612	2100	1512	4783	2812	1971	2889	2036	599	748	634	756	570	645	456	565	478	992	416	1001	0.67	0.46	0.35	0.35	220.1	158.4			
6	59.9	49.9	0.98	59.7	82	14.37	1165	1181	1400	1407	1435	1427	4075	2367	1708	5627	3308	2319	3396	2378	600	736	634	748	574	651	453	559	475	1013	413	998	0.73	0.49	0.36	0.35	221.1	159.5			
7	59.9	49.9	0.88	60.6	75	15.73	1158	1178	1601	1604	1621	1632	4468	2586	1882	6326	3685	2641	3839	2709	601	729	632	742	574	647	449	558	474	1038	411	996	0.79	0.53	0.35	0.35	220.6	160.6			
8	59.9	49.9	0.80	62.1	69	17.16	1236	1260	1801	1803	1825	1823	4774	2747	2026	6957	4027	2930	4181	2971	599	721	633	745	572	648	446	556	470	1073	411	995	0.86	0.55	0.34	0.34	214.8	158.4			
65 - 55 mi/h																																									
1	64.9	55.0	2.76	59.1	249	5.13	337	349	399	400	403	405	1449	820	628	1621	930	691	968	735	599	732	636	781	575	645	450	541	472	926	413	709	0.34	0.29	0.35	0.36	214.7	164.4			
2	64.9	55.0	1.88	56.7	169	7.63	523	536	599	602	712	610	2114	1220</td																											

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

SPEED				TIME		DIST.		DECCEL		PRESSURE								TORQUE								TEMPERATURE								FLUID		FRICTION		INERTIA					
CYCLE NO.	INIT	FNL	STOP	REPT	TO STOP		Avg	AVERAGE		SUSTAINED		MAXIMUM		AVERAGE				SUSTAINED				MAXIMUM		ROTOR		FRONT		I/B		O/B		ROTOR		REAR		FRONT		DISPLAC.		COEFF.		INERTIA	
					Dist	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear	Front	Rear						
mi/h s ft ft/s ² lbf/in ² lbf ft F in ³ µ slug ft ²																																											
THIRD EFFECTIVENESS MATRIX - 750°F																																											
750°F Initial Rotor Temperature																																											
50 - 40 mi/h																																											
1	49.9	39.9	3.14	107.1	215	4.47	375	381	399	400	404	411	1280	736	544	1402	815	587	862	623	751	847	790	902	707	755	645	707	661	919	581	792	0.35	0.30	0.31	0.31	220.7	163.0					
2	49.8	39.9	2.08	37.4	141	6.76	483	489	602	601	726	611	1921	1130	792	2216	1307	909	1694	939	750	879	796	909	706	770	639	722	663	941	608	893	0.51	0.33	0.33	0.32	224.1	157.1					
3	49.8	39.9	1.61	38.5	111	8.56	592	602	801	803	904	818	2429	1415	1015	2945	1723	1222	2004	1257	748	876	792	904	708	774	631	729	658	964	591	925	0.57	0.37	0.32	0.32	221.8	159.1					
4	49.9	39.9	1.35	37.9	93	10.32	910	913	1009	1005	1040	1022	2897	1676	1221	3668	2139	1529	2207	1588	749	867	791	903	711	784	626	735	656	984	592	985	0.61	0.41	0.32	0.32	217.9	158.7					
5	49.8	39.9	1.17	37.8	81	11.81	1030	1043	1201	1202	1240	1225	3367	1948	1419	4432	2588	1844	2718	1903	746	858	794	903	712	786	623	726	651	1009	592	1025	0.69	0.45	0.33	0.32	221.3	161.2					
6	49.8	39.9	1.03	37.6	72	13.27	1194	1198	1412	1404	1426	1427	3764	2179	1585	5161	3036	2125	3080	2213	750	848	791	905	716	787	619	721	649	1042	594	1045	0.74	0.49	0.32	0.32	220.3	160.3					
7	49.8	39.9	0.93	37.6	65	14.73	1175	1195	1599	1602	1624	1622	4150	2407	1744	5874	3446	2482	3502	2482	749	846	793	908	719	783	619	722	648	1067	603	1051	0.81	0.52	0.33	0.32	219.2	158.8					
8	49.9	39.9	0.86	39.4	60	16.09	1248	1270	1801	1805	1827	1834	4515	2613	1902	6547	3821	2726	3942	2768	749	842	794	909	718	785	618	716	644	1092	593	1045	0.88	0.56	0.32	0.32	217.9	158.6					
55 - 45 mi/h																																											
1	54.9	44.9	3.13	38.5	236	4.56	352	362	400	400	402	411	1291	742	548	1425	829	596	862	638	750	856	796	926	718	777	614	691	640	977	592	820	0.35	0.28	0.31	0.31	218.5	161.4					
2	54.9	44.9	2.11	38.4	158	6.76	494	503	599	600	707	611	1912	1123	789	2210	1307	903	1623	936	749	892	802	939	715	794	611	714	641	988	594	940	0.50	0.33	0.33	0.32	222.9	156.7					
3	54.9	44.9	1.65	40.3	127	8.50	696	708	798	799	879	817	2422	1410	1012	2945	1741	1204	1942	1242	749	885	799	939	714	808	606	720	637	1012	588	1055	0.57	0.37	0.33	0.32	222.7	159.8					
4	54.9	44.9	1.37	39.7	105	10.18	903	895	1007	999	1065	1017	2930	1696	1235	3650	2142	1508	2343	1576	748	876	797	933	716	808	602	722	635	1053	584	1097	0.63	0.41	0.32	0.32	223.4	162.7					
5	55.0	44.9	1.17	40.0	90	12.02	950	964	1200	1202	1230	1228	3371	1945	1426	4441	2591	1850	2638	1924	746	865	797	926	718	801	598	724	632	1082	584	1134	0.68	0.45	0.33	0.32	217.0	159.2					
6	54.9	44.9	1.04	40.7	80	13.47	1177	1186	1400	1396	1435	1429	3837	2215	1622	5208	3048	2160	3107	2234	749	854	795	926	720	799	599	714	628	1085	582	1117	0.75	0.49	0.33	0.33	220.7	161.6					
7	55.0	44.9	0.93	39.8	72	14.90	1037	1058	1598	1604	1635	1632	4223	2436	1787	5952	3473	2479	3579	2552	751	852	795	928	723	796	601	714	629	1090	588	1097	0.81	0.52	0.33	0.33	219.4	161.0					
8	54.9	44.9	0.86	40.8	66	16.18	818	836	1800	1803	1822	1829	4569	2622	1946	6595	3821	2774	3968	2841	748	852	797	930	722	799	600	719	628	1107	587	1113	0.88	0.56	0.32	0.32	217.4	161.4					
60 - 50 mi/h																																											
1	59.9	49.9	3.10	42.0	256	4.63	376	380	399	399	402	411	1307	743	564	1437	826	611	865	652	749	864	798	958	721	784	598	686	625	984	578	820	0.35	0.27	0.31	0.32	215.5	163.6					
2	60.0	49.9	2.05	41.4	171	6.94	548	547	610	600	690	611	1951	1138	813	2270	1337	933	1582	971	749	902	798	964	718	807	596	708	627	1014	580	952	0.50	0.32	0.33	0.33	219.9	157.1					
3	59.9	49.9	1.61	41.6	135	8.73	639	646	802	804	869	814	2464	1428	1035	2992	1750	1242	1936	1287	748	890	799	958	718	812	591	723	625	1045	580	1071	0.56	0.37	0.33	0.33	219.6	159.2					
4	59.9	49.9	1.34	41.4	113	10.46	817	829	1001	1002	1055	1021	2962	1708	1254	3753	2186	1567	2325	1614	749	879	798	958	718	814	590	725	624	1080	579	1090	0.63	0.41	0.33	0.33	219.0	160.8					
5	60.0	49.9	1.15	41.4	97	12.28	1024	1022	1214	1194	1243	1228	3436	1982	1454	4515	2650	1865	2691	1927	748	868	799	953	725	813	591	719	624	1081	574	1077	0.68	0.45	0.33	0.33	216.5	158.9					
6	59.9	49.9	1.02	41.9	86	13.74	1056	1075	1402	1402	1428	1430	3879	2226	1653	5261	3051	2210	3151	2269	749	861	799	951	725	809	592	722	622	1092	579	1052	0.75	0.48	0.33	0.33	217.4	161.4					
7	59.9	49.9	0.93	42.6	79	15.08	1272	1292	1602	1613	1627	1639	4293	2446	1848	5913	3375	2538	3529	2594	749	858	799	951	726	808	593	718	622	1111	577	1055	0.82	0.52	0.32	0.33	217.6	164.3					
8	60.0	49.9	0.86	41.6	74	16.11	1291	1312	1799	1805	1839	1843	4543	2548	1996	6444	3629	2815	3797	2903	749	857	805	952	728	807	596	729	625	1135	586	1089	0.89	0.56	0.30	0.33	212.2	166.2					
65 - 55 mi/h																																											
1	64.9	55.0	3.06	43.8	274	4.67	369</																																				

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID		FRICTION		INERTIA	
	TO	Avg	Average	Sustained	Maximum	Average	Sustained	Maximum	Rotor	Front		Rear		O/B	I/B	O/B	I/B	O/B	I/B	Front	Re	Displace.	Coeff.	Front	Re	Front	Re	Front	Re			
	INIT	FNL	STOP	REPT	STOP	DIST	FRONT	REAR	FRONT	REAR	SUM	FRONT	REAR	SUM	FRONT	REAR	FRONT	REAR	INT	MAX	INT	MAX	INT	MAX	INT	MAX	Front	Re	Front	Re		
mi/h s ft ft/s ² lbf/in ² lbf ft F in ³ µ slug ft ²																																

THIRD REBURNISH

40 mi/h - 0.37g Deceleration Rate - 200°F Initial Rotor Temperature or 1 Mile Distance

1	39.9	0.5	5.13	88.9	168	10.18	1002	1024	1192	1199	1314	1325	2869	1653	1216	3355	1971	1384	2045	1493	202	327	218	435	189	348	188	319	183	315	181	349	0.61	0.50	0.25	0.24	217.9	160.3
5	39.9	0.5	5.13	101.2	162	10.58	768	778	805	810	856	863	2970	1730	1240	3370	1992	1378	2033	1467	249	405	249	357	222	361	218	368	213	334	212	303	0.49	0.33	0.37	0.36	219.4	157.2
10	39.9	0.5	5.11	101.3	162	10.58	627	647	755	757	844	858	2978	1716	1262	3399	1953	1446	2007	1508	260	420	262	366	231	376	223	386	219	339	218	313	0.48	0.33	0.39	0.40	217.6	160.0
15	39.9	0.5	5.12	101.2	162	10.60	726	731	738	740	853	876	2974	1688	1285	3370	1906	1464	2024	1579	257	420	262	367	231	372	224	409	220	344	220	323	0.49	0.33	0.39	0.42	213.7	162.6
20	40.0	0.5	5.11	101.2	161	10.63	649	672	753	762	841	884	2983	1685	1298	3376	1915	1461	1977	1585	257	422	261	368	232	377	224	421	222	345	221	329	0.48	0.33	0.38	0.40	212.7	163.8
25	39.9	0.5	5.11	101.2	162	10.60	688	699	736	740	845	878	2982	1671	1311	3373	1903	1470	1965	1582	256	420	260	369	230	375	224	430	222	349	221	339	0.48	0.33	0.39	0.42	211.5	165.9
30	39.9	0.5	5.12	101.1	161	10.61	659	675	741	747	850	871	2980	1668	1312	3390	1906	1484	1956	1599	253	420	260	372	229	377	226	433	219	348	223	343	0.48	0.33	0.39	0.42	210.9	165.9
35	39.9	0.5	5.10	101.2	161	10.67	593	620	752	758	850	861	2987	1671	1316	3399	1912	1487	1965	1611	255	419	260	375	230	379	224	416	221	347	219	344	0.47	0.33	0.38	0.41	210.1	165.6

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID DISPLACE.		FRICTION COEFF.		INERTIA			
	INIT	FNL	STOP	REPT	TO	Avg	AVERAGE	SUSTAINED	MAXIMUM	AVERAGE			SUSTAINED			MAXIMUM			ROTOR	FRONT		REAR		O/B	ROTOR	I/B		O/B	MAXIMUM	SUSTAINED	FRONT	REAR	FRONT	REAR
	mi/h	s	ft	ft/s ²	STOP	DIST	FRONT	REAR	FRONT	REAR	SUM	FRONT	REAR	SUM	FRONT	REAR	FRONT	REAR	INT	MAX	INT	MAX	INT	MAX	INT	MAX	INT	MAX	FRONT	REAR	in ³	μ	slug ft ²	

FOURTH EFFECTIVENESS MATRIX - 300°F

300°F Initial Rotor Temperature

50 - 40 mi/h

1	49.8	39.9	2.80	162.7	188	5.07	316	325	407	400	487	407	1430	806	624	1612	912	700	1207	744	300	405	306	368	271	317	266	364	265	356	264	312	0.36	0.24	0.34	0.37	213.1	165.1
2	49.9	39.9	1.93	66.1	132	7.25	357	389	603	599	708	610	2075	1179	896	2429	1399	1030	1714	1089	300	414	308	364	272	318	267	380	264	347	261	311	0.44	0.27	0.35	0.36	218.1	165.8
3	49.9	39.9	1.51	69.3	103	9.35	766	765	807	801	847	819	2625	1508	1116	3219	1862	1357	1939	1396	299	413	307	363	271	324	264	370	264	346	258	302	0.47	0.32	0.35	0.36	216.4	160.2
4	49.9	39.9	1.25	68.9	86	11.17	931	935	999	998	1033	1019	3149	1834	1315	3936	2313	1623	2408	1670	301	405	308	362	274	331	260	366	261	339	255	295	0.53	0.35	0.35	0.34	220.3	158.0
5	49.9	39.9	1.09	73.1	75	12.84	494	525	1201	1201	1242	1221	3597	2118	1479	4744	2838	1906	2900	1959	298	397	309	356	272	337	251	354	256	333	252	287	0.60	0.38	0.36	0.33	221.4	154.6
6	49.9	39.9	0.97	72.5	67	14.34	568	608	1400	1401	1426	1425	3987	2354	1633	5450	3269	2181	3316	2222	300	390	307	357	275	341	249	351	253	330	246	277	0.67	0.42	0.35	0.33	220.2	152.7
7	49.9	39.9	0.88	71.1	61	15.70	1487	1498	1601	1602	1637	1623	4378	2585	1793	6081	3653	2428	3724	2482	300	394	308	353	275	339	246	349	252	329	246	277	0.74	0.46	0.34	0.32	220.9	153.2
8	49.9	39.9	0.82	74.0	57	16.86	656	709	1801	1803	1829	1827	4710	2778	1932	6689	4016	2673	4083	2723	303	387	305	356	275	334	242	348	247	323	245	273	0.80	0.49	0.34	0.31	221.0	153.7

55 - 45 mi/h

1	54.9	44.9	2.60	74.9	195	5.49	368	387	381	398	499	407	1548	888	660	1697	974	723	1260	773	302	421	310	386	278	332	245	367	247	353	243	299	0.36	0.23	0.39	0.38	217.1	161.4
2	55.0	44.9	1.85	79.3	140	7.72	562	566	600	599	680	609	2174	1253	920	2541	1476	1065	1806	1113	302	431	309	378	271	336	242	381	245	346	241	301	0.44	0.28	0.37	0.37	217.9	160.0
3	55.0	44.9	1.48	77.8	112	9.67	745	748	802	799	831	814	2731	1577	1155	3334	1953	1381	2042	1440	300	432	309	376	272	343	241	382	246	341	240	298	0.48	0.31	0.37	0.36	218.7	160.1
4	55.0	44.9	1.23	81.7	94	11.51	797	812	1000	1031	1015	1040	3259	1892	1367	4131	2431	1700	2490	1744	301	415	308	371	272	346	242	372	245	335	241	289	0.55	0.35	0.37	0.36	220.6	159.4
5	55.0	44.9	1.07	80.3	82	13.19	693	720	1204	1199	1241	1219	3712	2166	1547	4931	2933	1998	2962	2042	299	410	311	361	272	346	241	368	243	332	240	283	0.61	0.39	0.37	0.35	220.3	157.4
6	54.9	44.9	0.95	80.7	73	14.72	1028	1049	1402	1402	1435	1421	4158	2438	1720	5654	3370	2284	3423	2331	300	403	311	369	272	344	241	367	242	333	241	282	0.68	0.42	0.36	0.34	222.2	156.8
7	54.9	44.9	0.87	82.4	68	15.85	1147	1172	1600	1601	1626	1627	4535	2679	1856	6332	3791	2541	3877	2588	299	398	311	369	275	343	239	365	244	332	239	279	0.74	0.45	0.36	0.33	226.7	157.1
8	54.9	44.9	0.80	84.6	63	16.90	1661	1655	1811	1795	1828	1836	4888	2881	2008	7055	4228	2827	4249	2862	301	392	314	366	269	339	238	365	241	327	241	274	0.80	0.49	0.35	0.33	228.7	159.4

60 - 50 mi/h

1	59.9	49.9	2.55	84.6	212	5.56	380	388	400	398	402	409	1579	905	674	1774	1039	735	1092	794	300	436	313	397	275	332	235	382	242	368	239	304	0.33	0.23	0.39	0.39	218.5	162.8
2	60.0	49.9	1.79	85.6	150	7.94	502	514	604	601	664	611	2235	1303	932	2668	1576	1092	1726	1139	300	454	314	386	270	350	237	397	242	359	238	303	0.43	0.28	0.39	0.38	220.1	157.5
3	59.9	49.9	1.42	86.2	119	9.91	397	421	801	800	827	811	2807	1639	1168	3470	2051	1419	2113	1458	301	441	312	382	270	360	233	396	244	354	238	298	0.49	0.31	0.39	0.37	221.9	158.2
4	59.9	49.9	1.19	87.8	101	11.76	791	807	1002	1000	1040	1015	3292	1940	1352	4247	2538	1709	2588	1747	299	435	313	381	270	368	233	381	242	354	237	293	0.55	0.35	0.38	0.36	221.3	154.2
5	59.9	49.9	1.05	89.7	88	13.51	909	927	1201	1201	1246	1220	3768	2223	1544	5010	2998	2012	3080	2054	299	422	314	379	271	360	231	372	248	348	236	285	0.62	0.39	0.38	0.35	220.7	153.3
6	59.9	49.9	0.94	87.8	80	14.76	930	952	1406	1407	1425	1418	4212	2493	1719	5730	3423	2337	3043	2623	302	429	314	380	272	357	236	368	245	347	238	284	0.68	0.42	0.37	0.35	226.6	156.2
7	60.0	49.9	0.86	94.1	74	16.12	1472	1463	1614	1592	1628	1623	4582	2708	1874	6498	3898	2600	3930	2623	300	412	313	374	270													

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID DISPLACE.		FRICTION COEFF.		INERTIA			
	INIT	FNL	STOP	REPT	TO	Avg	AVERAGE	SUSTAINED	MAXIMUM	AVERAGE			SUSTAINED			MAXIMUM			ROTOR	FRONT		REAR		O/B	ROTOR	I/B		O/B	MAXIMUM	SUSTAINED	FRONT	REAR	FRONT	REAR
	mi/h	s	ft	ft/s ²	STOP	DIST	FRONT	REAR	FRONT	REAR	SUM	FRONT	REAR	SUM	FRONT	REAR	FRONT	REAR	INT	MAX	INT	MAX	INT	MAX	INT	MAX	INT	MAX	FRONT	REAR	in ³	μ	slug ft ²	

FOURTH EFFECTIVENESS MATRIX - 450°F

450°F Initial Rotor Temperature

50 - 40 mi/h

1	49.9	39.9	2.71	135.3	184	5.21	371	378	399	399	401	405	1479	816	663	1653	918	735	944	773	449	563	461	531	398	447	384	496	396	486	370	414	0.33	0.26	0.35	0.39	210.2	170.9
2	49.9	39.9	1.84	51.8	125	7.69	550	552	601	596	697	611	2165	1198	967	2547	1437	1110	1714	1160	450	584	468	528	401	457	391	508	399	498	378	422	0.45	0.28	0.36	0.39	209.1	168.8
3	49.8	39.9	1.47	55.4	100	9.50	691	703	805	806	844	816	2699	1525	1175	3308	1894	1414	1995	1473	450	576	467	523	402	469	387	505	399	492	380	416	0.50	0.32	0.36	0.37	215.3	165.9
4	49.9	39.9	1.24	56.1	85	11.25	860	884	1001	1000	1034	1022	3154	1821	1333	4031	2361	1670	2411	1726	449	569	468	525	407	481	384	495	403	486	382	414	0.56	0.36	0.36	0.35	217.3	159.0
5	49.8	39.9	1.09	59.0	75	12.71	964	989	1201	1201	1221	1225	3618	2114	1505	4757	2821	1936	2877	1983	450	561	468	522	408	486	377	486	399	480	378	404	0.63	0.40	0.35	0.34	223.2	158.9
6	49.9	39.9	0.96	60.4	67	14.28	1245	1251	1413	1410	1435	1427	4014	2355	1659	5576	3313	2263	3367	2296	451	552	468	522	410	488	374	477	395	473	375	403	0.69	0.43	0.35	0.34	221.2	155.9
7	49.9	39.9	0.87	59.5	61	15.83	933	970	1596	1590	1633	1624	4442	2613	1829	6234	3747	2487	3827	2597	449	547	469	521	411	490	367	479	394	468	372	398	0.75	0.47	0.35	0.33	221.5	155.0
8	49.9	39.9	0.80	61.1	56	17.21	1224	1250	1800	1803	1831	1828	4819	2832	1987	7020	4184	2836	4269	2906	449	546	469	521	416	487	369	479	390	464	370	394	0.82	0.51	0.35	0.33	220.8	154.9

55 - 45 mi/h

1	55.0	44.9	2.73	62.4	205	5.26	346	354	403	398	499	405	1485	859	625	1662	974	688	1251	723	450	584	471	562	416	469	364	469	387	503	370	399	0.38	0.24	0.36	0.36	219.3	159.6	
2	55.0	44.9	1.89	60.1	143	7.57	550	552	602	597	705	608	2137	1217	921	2503	1449	1054	1756	1107	451	614	475	550	411	483	365	489	387	503	372	407	0.46	0.29	0.36	0.37	215.7	163.3	
3	54.9	44.9	1.47	64.2	113	9.49	667	686	801	799	831	812	2694	1533	1162	3305	1900	1405	1950	1443	450	593	472	541	411	494	365	494	386	406	493	368	406	0.49	0.33	0.36	0.37	216.8	164.3
4	54.9	44.9	1.23	62.8	95	11.33	796	812	1001	1000	1043	1016	3223	1864	1360	4096	2399	1697	2452	1747	449	585	472	542	413	509	365	495	386	400	370	405	0.57	0.37	0.36	0.36	220.6	161.0	
5	54.9	44.9	1.06	64.1	82	13.06	922	939	1201	1201	1229	1223	3682	2159	1523	4907	2915	1992	2965	2027	451	580	474	534	416	511	363	485	390	483	369	399	0.63	0.41	0.37	0.35	221.8	156.5	
6	54.9	44.9	0.95	67.6	73	14.69	719	759	1399	1402	1437	1427	4136	2448	1688	5683	3420	2263	3496	2334	450	573	472	534	417	509	358	477	384	479	364	393	0.69	0.44	0.37	0.34	223.5	154.2	
7	55.0	44.9	0.86	67.8	67	16.08	1406	1400	1610	1610	1634	1634	4544	2699	1845	6503	3930	2573	3983	2656	451	569	473	532	418	509	355	475	379	473	363	390	0.76	0.48	0.37	0.34	225.2	154.0	
8	54.9	44.9	0.79	70.0	62	17.33	1242	1270	1801	1804	1829	1831	4930	2921	2009	7193	4319	2874	4446	2936	450	559	471	529	419	503	354	471	379	467	362	387	0.82	0.52	0.36	0.34	226.2	155.5	

60 - 50 mi/h

1	59.9	49.9	2.74	67.8	227	5.21	375	379	397	402	408	405	1473	861	612	1629	965	664	1003	711	449	592	475	579	419	472	354	461	376	518	362	392	0.33	0.25	0.37	0.35	221.9	157.6
2	60.0	49.9	1.87	68.7	155	7.67	485	502	595	601	659	610	2144	1254	889	2517	1478	1039	1679	1074	449	637	475	561	416	493	349	482	372	509	359	397	0.44	0.29	0.37	0.36	219.5	155.6
3	59.9	49.9	1.46	70.0	123	9.63	743	745	800	796	833	812	2731	1595	1136	3355	1986	1369	2066	1414	450	618	474	550	414	512	349	486	376	502	359	397	0.50	0.33	0.37	0.36	222.1	158.2
4	59.9	49.9	1.21	71.3	101	11.64	856	875	1001	1000	1037	1017	3273	1937	1336	4190	2517	1673	2564	1723	451	611	475	547	415	529	346	484	374	490	357	393	0.57	0.38	0.38	0.35	223.3	154.0
5	59.9	49.9	1.05	73.6	89	13.25	923	939	1201	1201	1232	1219	3752	2243	1508	5016	3045	1971	3116	2021	450	605	472	540	416	526	344	474	368	481	354	387	0.63	0.41	0.38	0.35	227.2	152.8
6	59.9	49.9	0.94	76.8	79	14.87	1025	1046	1401	1401	1439	1427	4210	2532	1678	5818	3552	2266	3644	2325	450	586	469	537	416	524	337	467	365	474	348	380	0.70	0.45	0.38	0.34	228.5	151.4
7	59.9	49.9	0.85	73.9	71	16.57	793	819	1601	1602	1637	1631	4653	2791	1862	6550	3968	2582	4075	2635	450	598	470	536	416</td													

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECEL		PRESSURE						TORQUE						TEMPERATURE						FLUID DISPLACE.		FRICTION COEFF.		INERTIA		
	INIT	FNL	STOP	REPT	TO	Avg	AVERAGE	SUSTAINED	MAXIMUM	AVERAGE			SUSTAINED			MAXIMUM			ROTOR	FRONT		REAR		O/B	ROTOR	I/B	O/B	MAXIMUM	SUSTAINED	FRONT	REAR	FRONT	REAR
	mi/h		s		STOP	ft	ft/s ²	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	INT	MAX	INT	MAX	INT	MAX	INT	MAX	Front	Rear	in ³	μ	slug ft ²	

FOURTH EFFECTIVENESS MATRIX - 600°F

600°F Initial Rotor Temperature

50 - 40 mi/h

1	49.9	39.9	2.85	121.2	193	4.97	380	381	408	399	506	408	1415	828	588	1562	918	644	1254	691	600	713	620	691	553	601	499	574	516	611	488	514	0.40	0.26	0.34	0.34	223.2	158.5
2	49.9	39.9	1.97	46.8	134	7.16	546	551	600	598	682	609	2047	1197	849	2382	1408	974	1697	1018	600	741	628	690	555	622	492	587	514	608	484	511	0.47	0.29	0.35	0.34	224.4	159.2
3	49.9	39.9	1.51	48.2	103	9.26	690	697	803	799	860	815	2609	1533	1076	3208	1912	1296	2074	1328	600	736	628	684	558	635	484	592	509	598	480	506	0.53	0.34	0.36	0.34	222.0	155.8
4	49.9	39.9	1.26	48.3	87	11.05	689	706	1001	997	1025	1023	3130	1849	1280	3992	2393	1599	2449	1644	601	728	629	680	563	643	478	585	504	589	475	501	0.58	0.38	0.36	0.34	224.5	155.4
5	49.9	39.9	1.10	48.8	75	12.71	956	978	1201	1200	1231	1225	3583	2128	1456	4786	2892	1894	2945	1939	599	722	632	679	566	650	468	579	500	583	472	494	0.65	0.42	0.36	0.33	224.6	153.6
6	49.9	39.9	0.98	51.6	67	14.32	672	703	1399	1401	1430	1428	4024	2400	1624	5561	3372	2189	3461	2248	601	712	628	678	567	653	461	570	492	579	468	487	0.71	0.46	0.36	0.33	224.8	152.1
7	49.9	39.9	0.87	49.9	61	15.65	1145	1167	1599	1601	1636	1627	4411	2628	1783	6332	3827	2505	3895	2564	600	714	633	676	570	652	455	564	490	575	463	483	0.78	0.49	0.36	0.33	225.3	152.9
8	49.9	39.9	0.80	52.9	57	16.89	1245	1273	1800	1803	1832	1834	4810	2852	1958	7082	4255	2827	4328	2900	599	701	631	676	572	649	454	562	483	568	458	479	0.85	0.53	0.36	0.33	226.5	155.5

55 - 45 mi/h

1	54.9	44.9	2.90	49.6	218	4.93	372	376	399	397	402	407	1399	807	592	1556	912	644	950	679	600	712	632	713	575	616	451	543	482	606	457	486	0.34	0.26	0.35	0.34	219.5	161.2
2	54.9	44.9	1.96	49.0	150	7.14	552	552	608	599	692	609	2044	1201	843	2402	1428	974	1741	1001	599	763	635	710	568	633	453	565	480	595	456	488	0.48	0.30	0.35	0.34	225.6	158.3
3	55.0	44.9	1.53	52.0	117	9.26	699	709	797	798	871	871	2607	1537	1070	3134	1865	1269	2083	1319	599	760	633	701	567	655	449	571	487	453	485	0.53	0.34	0.35	0.33	222.8	155.1	
4	54.9	44.9	1.27	53.2	97	11.11	864	873	1001	999	1035	1017	3144	1867	1277	3993	2405	1588	2482	1623	598	750	632	691	569	666	443	569	474	575	451	481	0.60	0.38	0.36	0.33	225.5	154.1
5	54.9	44.9	1.08	52.9	84	12.87	961	984	1201	1201	1236	1223	3617	2164	1453	4839	2948	1891	3018	1927	599	739	630	693	573	677	438	566	469	575	446	477	0.66	0.42	0.37	0.33	225.6	151.5
6	55.0	44.9	0.97	53.4	75	14.46	957	983	1400	1401	1426	1431	4085	2453	1632	5644	3443	2201	3514	2260	598	730	631	687	574	668	434	558	468	568	445	473	0.72	0.46	0.37	0.33	227.6	151.5
7	55.0	44.9	0.87	53.7	68	15.87	1315	1339	1595	1612	1639	1630	4479	2698	1781	6459	3936	2523	4057	2561	600	722	633	687	578	669	431	557	465	563	444	469	0.79	0.50	0.37	0.33	228.1	150.6
8	54.9	44.9	0.81	54.7	62	17.38	1122	1137	1810	1809	1831	1834	4926	2952	1973	7164	4314	2850	4476	2895	597	722	632	682	579	669	432	550	462	559	440	463	0.85	0.53	0.36	0.33	227.9	152.3

60 - 50 mi/h

1	59.9	49.9	2.86	54.0	237	4.98	375	380	399	398	402	409	1419	836	583	1571	936	635	980	667	600	732	636	725	581	625	425	526	460	596	437	471	0.35	0.26	0.35	0.34	225.2	157.1
2	60.0	49.9	1.95	53.7	162	7.35	514	525	601	598	672	611	2074	1235	839	2455	1487	968	1700	1015	599	781	636	721	573	653	422	558	473	473	0.48	0.31	0.37	0.34	225.4	153.1		
3	59.9	49.9	1.50	55.3	125	9.44	705	710	804	797	882	811	2671	1585	1086	3223	1936	1287	2169	1337	600	771	633	710	572	674	423	568	454	576	434	471	0.55	0.35	0.36	0.34	225.4	154.4
4	59.9	49.9	1.25	54.9	105	11.26	837	848	1003	1001	1036	1017	3195	1907	1288	4078	2467	1611	2517	1653	598	766	633	703	574	685	421	562	452	567	432	469	0.60	0.39	0.37	0.34	227.3	153.5
5	59.9	49.9	1.07	56.0	91	12.97	1019	1025	1208	1198	1234	1215	3680	2204	1476	4933	3018	1915	3063	1968	597	752	633	697	575	685	418	558	559	430	462	0.67	0.43	0.38	0.34	228.0	152.7	
6	59.9	49.9	0.95	56.3	81	14.62	1044	1063	1401	1401	1429	1418	4159	2496	1663	5736	3485	2251	3585	2293	599	742	633	694	577	682	413	552	448	485	0.73	0.46	0.38	0.34	229.1	152.7		
7	59.9	49.9	0.86	56.5	72	16.42	1310	1321	1600	1601	1638	1624	4586	2744	1843	6483	3901	2582	4027	2632	600	738	630	690	579	676	412	552	446	455	0.80	0.50	0.37	0.34	224.2	150.6		
8	59.9	49.9																																				

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DIST.		DECCEL		PRESSURE						TORQUE						TEMPERATURE						FLUID DISPLACE.		FRICTION COEFF.		INERTIA	
	TO STOP	Avg mi/h	STOP	FNL s	STOP	DIST ft	AVERAGE ft/s ²	SUSTAINED FRONT REAR	MAXIMUM FRONT REAR	AVERAGE SUM	SUSTAINED FRONT REAR	MAXIMUM SUM	ROTOR INT	I/B MAX	FRONT INT	REAR MAX	O/B INT	ROTOR MAX	I/B INT	REAR MAX	O/B INT	MAXIMUM INT	FRONT MAX	REAR INT	FRONT REAR	in ³	μ	slug ft ²				

FOURTH EFFECTIVENESS MATRIX - 750°F

750°F Initial Rotor Temperature

50 - 40 mi/h

1	49.9	39.9	3.08	107.2	211	4.57	374	378	400	397	404	407	1302	747	555	1440	838	602	865	649	749	832	781	862	703	741	610	701	629	735	596	635	0.37	0.27	0.32	0.32	219.1	162.8
2	49.9	39.9	2.05	36.6	140	6.84	568	560	617	600	706	610	1937	1117	819	2264	1322	942	1582	971	748	869	790	863	705	773	606	715	632	730	593	631	0.51	0.29	0.32	0.33	219.3	160.8
3	49.9	39.9	1.60	34.9	109	8.79	686	698	801	804	894	816	2471	1421	1050	3031	1756	1275	2027	1316	746	863	792	862	710	789	604	725	632	730	593	630	0.58	0.34	0.33	0.33	216.9	160.3
4	49.9	39.9	1.33	34.7	92	10.46	875	883	1006	1004	1038	1022	2956	1696	1260	3736	2172	1564	2237	1635	749	853	793	860	713	797	601	729	633	729	592	628	0.62	0.38	0.33	0.33	217.5	161.5
5	49.9	39.9	1.14	33.9	79	12.14	779	803	1200	1200	1226	1227	3422	1968	1455	4527	2641	1886	2700	1948	750	844	797	860	723	806	602	731	634	729	593	626	0.68	0.42	0.33	0.33	217.4	160.7
6	49.9	39.9	1.01	35.8	69	13.88	1047	1067	1400	1401	1438	1432	3840	2224	1616	5294	3113	2181	3163	2254	748	842	796	856	723	803	604	723	631	728	593	624	0.75	0.46	0.34	0.33	215.0	156.3
7	49.9	39.9	0.91	37.1	64	15.00	1232	1265	1600	1601	1627	1624	4297	2494	1803	6025	3549	2476	3620	2535	749	832	795	857	722	801	598	720	633	725	591	620	0.83	0.49	0.33	0.33	223.0	161.2
8	49.9	39.9	0.83	35.1	59	16.44	1486	1504	1800	1803	1822	1828	4597	2663	1934	6736	3951	2785	4057	2833	749	833	799	856	726	803	600	718	632	724	593	621	0.89	0.53	0.33	0.33	217.3	157.8

55 - 45 mi/h

1	55.0	44.9	3.01	34.2	228	4.75	360	358	411	397	510	409	1346	790	556	1499	894	605	1234	649	749	850	802	895	733	778	601	703	635	755	596	636	0.44	0.25	0.33	0.32	223.5	157.2
2	54.9	44.9	2.08	38.4	157	6.84	510	518	600	598	688	610	1931	1124	807	2219	1301	918	1620	956	748	887	802	891	723	794	598	724	630	745	592	636	0.51	0.30	0.33	0.32	220.4	158.4
3	54.9	44.9	1.62	38.5	124	8.65	718	727	800	801	898	813	2447	1407	1040	2980	1735	1245	2054	1284	748	878	800	882	720	808	590	731	627	741	588	631	0.59	0.34	0.33	0.33	218.2	161.3
4	54.9	44.9	1.34	37.5	102	10.47	706	721	1000	997	1026	1022	2972	1710	1262	3762	2201	1561	2254	1611	748	863	800	878	723	818	589	739	626	736	587	627	0.63	0.38	0.33	0.33	219.2	161.8
5	55.0	44.9	1.14	37.1	88	12.23	1024	1033	1202	1197	1230	1224	3459	1998	1461	4594	2703	1891	2750	1953	748	855	801	875	728	817	591	730	628	732	590	627	0.70	0.42	0.34	0.33	219.2	160.3
6	54.9	44.9	1.02	38.0	78	13.73	1053	1071	1401	1401	1434	1430	3941	2282	1658	5385	3160	2225	3222	2284	749	847	801	872	729	814	591	725	623	729	588	624	0.77	0.46	0.34	0.33	223.0	162.0
7	54.9	44.9	0.90	38.0	69	15.41	896	926	1599	1601	1634	1630	4372	2525	1847	6122	3579	2543	3700	2602	748	839	803	865	732	808	588	726	625	725	587	616	0.83	0.49	0.34	0.33	219.8	160.8
8	54.9	44.9	0.84	37.5	66	16.35	1273	1300	1799	1802	1827	1841	4686	2690	1996	6751	3901	2850	4098	2900	749	845	804	866	733	813	591	723	626	726	589	622	0.90	0.53	0.33	0.33	220.8	163.8

60 - 50 mi/h

1	59.9	49.9	2.97	38.3	245	4.82	377	377	404	398	517	408	1385	818	568	1517	903	614	1251	649	748	855	806	900	734	780	592	698	627	759	592	636	0.45	0.26	0.34	0.32	227.7	158.0
2	59.9	49.9	2.03	40.1	169	7.01	548	557	597	599	714	610	1990	1168	822	2299	1355	944	1670	989	750	892	806	903	724	810	588	730	625	750	588	637	0.53	0.30	0.34	0.33	223.5	157.4
3	59.9	49.9	1.57	40.3	132	8.93	685	700	800	801	885	811	2533	1476	1057	3087	1812	1275	2127	1316	749	886	806	896	726	828	586	744	619	741	586	636	0.59	0.34	0.34	0.34	221.8	158.9
4	60.0	49.9	1.30	40.0	109	10.91	703	722	1001	1000	1039	1016	3071	1787	1283	3889	2287	1602	2381	1653	749	873	807	891	728	832	585	741	620	738	586	629	0.64	0.38	0.34	0.34	219.7	157.7
5	59.9	49.9	1.11	39.6	94	12.48	985	997	1201	1200	1237	1219	3560	2070	1490	4719	2771	1948	2841	1995	749	865	808	886	732	825	583	736	619	734	587	628	0.70	0.42	0.35	0.34	222.6	160.3
6	60.0	49.9	1.00	40.0	84	14.26	1158	1178	1401	1401	1432	1426	4003	2311	1691	5453	3172	2281	3311	2331	749	858	807	874	734	823	582	733	617	734	587	626	0.77	0.46	0.34	0.34	217.4	159.1
7	59.9	49.9	0.89	40.7	75	15.68	1096	1116	1594	1590	1621	1637	4397	2510	1887	6031	3461	2570	3650	2676	748	853	806	875	735	817	583	736	619	730	589	623	0.84	0.50	0.33	0.34	214.8	161.5
8	59.9	49.9	0.84	40.0	7																																	

Test Numbers: M20-063-23 / M20-064-06

Report Number: 203145-1

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

SPEED				TIME		DIST.		DECCEL		PRESSURE								TORQUE								TEMPERATURE								FLUID		FRICTION		INERTIA			
CYCLE NO.	INIT	FNL	STOP	REPT	TO STOP		Avg	AVERAGE		SUSTAINED		MAXIMUM		AVERAGE				SUSTAINED				MAXIMUM		ROTOR		I/B		O/B	ROTOR		I/B		O/B	MAXIMUM		DISPLAC.		COEFF.		INERTIA	
					Dist	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear						
mi/h s ft ft/s ² lbf/in ² lbf ft F in ³ µ slug ft ²																																									
FOURTH EFFECTIVENESS MATRIX - 900°F																																									
900°F Initial Rotor Temperature																																									
50 - 40 mi/h																																									
1	49.9	39.9	3.20	105.0	219	4.38	375	367	422	398	517	408	1248	751	496	1393	856	537	1124	570	899	968	949	1035	861	917	749	818	797	882	742	785	0.46	0.28	0.31	0.28	229.9	151.9			
2	50.0	39.9	2.22	30.2	151	6.42	504	518	592	601	694	612	1792	1062	730	2063	1231	832	1526	856	898	991	958	1050	866	943	741	829	798	883	737	781	0.54	0.31	0.31	0.29	221.8	152.6			
3	49.8	39.9	1.71	28.0	117	8.15	720	722	808	800	880	818	2312	1357	955	2748	1629	1119	1886	1166	898	987	962	1054	874	961	741	836	794	883	734	777	0.60	0.35	0.30	0.29	223.4	157.2			
4	49.9	39.9	1.41	27.6	97	9.96	823	834	1002	1000	1074	1024	2812	1649	1162	3514	2083	1431	2352	1484	898	977	964	1056	877	966	736	843	793	882	733	773	0.68	0.40	0.31	0.30	222.1	156.5			
5	49.9	39.9	1.19	27.4	83	11.64	843	833	1196	1201	1227	1227	3288	1941	1347	4252	2517	1735	2608	1797	897	972	965	1059	883	973	738	840	793	883	730	769	0.73	0.44	0.32	0.30	223.7	155.3			
6	49.9	39.9	1.05	27.6	73	13.21	1021	1048	1401	1401	1438	1432	3687	2151	1536	5010	2959	2051	3039	2119	898	967	967	1054	884	971	735	842	792	878	730	764	0.81	0.48	0.32	0.31	218.5	156.0			
7	49.9	39.9	0.95	27.9	65	14.66	1001	1031	1600	1601	1633	1637	4115	2389	1726	5730	3372	2358	3437	2449	898	968	966	1054	887	968	736	843	791	877	729	762	0.89	0.52	0.32	0.31	218.6	157.9			
8	49.9	39.9	0.88	30.2	61	15.62	1414	1434	1805	1811	1823	1841	4434	2564	1870	6403	3744	2659	3786	2726	900	968	962	1047	885	972	732	841	784	870	724	758	0.96	0.55	0.31	0.31	220.2	160.6			
55 - 45 mi/h																																									
1	54.9	44.9	3.03	30.9	227	4.72	358	358	411	399	526	406	1330	799	532	1473	891	582	1219	611	898	988	957	1067	880	952	728	813	778	875	722	772	0.44	0.25	0.33	0.31	227.0	151.2			
2	55.0	44.9	2.16	32.7	163	6.61	500	510	604	600	694	610	1873	1118	756	2166	1304	862	1602	894	897	1014	958	1074	876	971	719	825	767	874	712	768	0.51	0.31	0.33	0.30	226.8	153.3			
3	55.0	44.9	1.71	32.4	130	8.30	713	717	805	799	872	822	2368	1401	967	2827	1688	1139	1974	1195	899	1014	959	1074	874	982	712	835	761	871	707	763	0.58	0.36	0.32	0.30	226.4	156.2			
4	54.9	44.9	1.40	31.6	107	10.02	761	775	1000	1003	1047	1030	2838	1663	1175	3595	2125	1470	2237	1543	898	1004	960	1072	879	991	710	836	761	868	706	757	0.65	0.40	0.32	0.31	222.6	157.3			
5	55.0	44.9	1.19	31.3	92	11.81	942	938	1199	1205	1234	1236	3323	1940	1383	4320	2517	1803	2585	1880	898	994	960	1068	880	991	707	835	759	864	705	750	0.71	0.44	0.32	0.32	220.4	157.2			
6	55.0	44.9	1.07	31.2	81	13.28	1176	1186	1399	1400	1427	1440	3720	2138	1581	5013	2909	2104	2971	2201	899	987	960	1060	882	988	706	836	756	862	705	745	0.79	0.48	0.31	0.32	216.1	159.8			
7	55.0	44.9	0.96	31.0	75	14.46	1338	1365	1596	1619	1627	1644	4089	2330	1759	5730	3263	2467	3305	2529	900	986	963	1056	884	993	708	833	758	863	707	745	0.87	0.52	0.31	0.32	216.3	163.3			
8	55.0	44.9	0.89	31.9	69	15.75	1481	1483	1803	1784	1845	1847	4447	2510	1938	6250	3597	2653	3703	2812	897	984	961	1053	886	989	708	829	758	859	706	743	0.94	0.55	0.30	0.31	213.8	165.0			
60 - 50 mi/h																																									
1	60.0	49.9	3.01	32.2	249	4.77	381	380	410	399	529	407	1338	784	554	1502	897	605	1166	638	898	1000	959	1076	885	963	705	804	754	879	705	762	0.42	0.25	0.33	0.32	220.7	155.8			
2	59.9	49.9	2.13	33.2	178	6.65	546	557	591	598	725	610	1885	1097	788	2151	1254	897	1635	933	899	1028	960	1080	878	980	699	828	749	875	700	761	0.52	0.30	0.32	0.32	221.3	158.9			
3	59.9	49.9	1.69	34.0	141	8.43	680	688	795	797	879	820	2385	1378	1007	2874	1676	1198	1921	1242	897	1023	960	1076	877	992	696	839	748	875	695	758	0.58	0.36	0.32	0.32	219.5	160.3			
4	59.9	49.9	1.39	32.5	117	10.08	855	859	990	1002	1092	1031	2852	1638	1213	3582	2068	1514	2325	1576	899	1016	958	1068	881	1005	695	843	750	873	697	752	0.66	0.39	0.32	0.32	218.0	161.5			
5	59.9	49.9	1.21	32.4	102	11.64	1019	1024	1197	1190	1246	1242	3281	1858	1423	4235	2437	1821	2496	1924	897	1005	957	1070	883	1005	699	846	750	873	698	751	0.70	0.44	0.31	0.32	214.1	164.0			
6	60.0	49.9	1.06	31.6	90	13.19	1060	1071	1402	1401	1433	1446	3709	2087	1622	4945	2800	2145	2850	2248	899	1001	961	1066	887	1007	703	846	754	872	702	748	0.78	0.48	0.30	0.32	212.2	165.0			
7	60.0	49.9	0.96	31.0	81	14.66	1289	1289	1605	1599	1632	1652	4080	2279	1801	5576	3136	2440	3204	2567	897	1002	961	1071	891	1014	706	848	758	874	705	749	0.86	0.52	0.29	0.32	208.5	164.8			
8	59.9	49.9	0.89	32.7	75	15.88	1173	1177	1800	1803	1829	1856	4408	2461	1947	6146	3434	2712	3499	2821	898	997	963	1070	890	1012	707	855	757	874	708	747	0.93	0.56	0.29	0.32	207.8	164.4			
65 - 55 mi/h																																									
1	64.9	55.0	3.10</td																																						



**Brake Performance Study Attachment 3: Dynamometer Testing Report: Downhill Braking
Simulation Test– 2001 Ford Excursion with Limousine Conversion, 8600 lbs**

Schoharie, NY

HWY19H001

NATIONAL TRANSPORTATION SAFETY BOARD

SCHOHARIE, NY DOWNHILL BRAKING SIMULATION TEST

Client NTSB Acquisition and Lease Management Division
490 L'Enfant Plaza East SW
Washington, DC 20594-0003

Report Number 203145-2
(8,600 lb GVW)

Vehicle Simulated 2001 Ford Excursion with Limousine Conversion

Front Lining Edge Code MPV 2000-EE

Rear Lining Edge Code MPV 2000-EE

Test Completion Date 20 March 2020

Signature

Kevin C. Machus, Test Engineer
for Greening Testing Laboratories, Inc.

This test report issued in Adobe® Acrobat® format only.

Original retained on file at

Greening Testing Laboratories, Inc.

Complete test report in Microsoft® Excel format available upon request.



Greening Testing Laboratories, Inc.

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Test Numbers: M20-064-07

Report Number: 203145-2

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

Test Numbers	M20-064-07	
Test Program Number	3947.01.20V02 - 2001 FORD EXCURSION.TST	
Vehicle System Simulated	2001 Ford Excursion with Limousine Conversion	
Reference	Contract No. 9531BM20P0015	
Test Date(s)	20 March 2020	
Date Test Report Prepared	27 March 2020	
Test Report Prepared By	K. Machus	
Gross Vehicle Weight	8,600 lbs (per NTSB)	
Static Rolling Radius	16.1 inches (based on revolutions per mile of LT265/75R16D tires)	
Test Inertia (without loss)	240.4 slug·ft ²	
Parasitic Loss	3.0% (based on vehicle measurements)	
Test Inertia (with loss)	233.2 slug·ft ²	
Equivalent 1/2 Vehicle Weight	4,172 lbs	
	Front Disc Brake	Rear Disc Brake
Lining Edge Code	MPV 2000-EE	MPV 2000-EE
Brake Pad Part Number	Motorcraft BR1266	Motorcraft BR1275
Brake Pad FMSI® Number	7625-D756	7626-D757
Brake Configuration	dual piston, separate function caliper disc brake	dual piston, separate function caliper disc brake
Piston Diameter(s)	2 x 54 mm	2 x 46 mm
Rotor Part Number	Ford 1G3Z-1V102-AB	Ford YC3Z-2C026-BB
Brake Size (nominal)		
Rotor Diameter x Thickness	13.0 x 1.5 inches	12.8 x 1.2 inches
Rotor Mass (nominal)	20.7 kg	10.9 kg
Rotor Effective Radius	5.599 inches	5.529 inches
Wheel Rotation	right hand	left hand
Test Fixture	096622	190316
Date Parts Received	16 January 2020	16 January 2020

*NOTE: Parts were previously used on Grade Simulation shake down tests.

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

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DATA NOTES

- 1 All average and sustained values shown in this report are calculated with respect to **DISTANCE**.
- 2 The data presented in this report has been gathered as follows:

START Threshold = 50 lbf·ft of brake torque during brake apply.

AVERAGE = average value between START and STOP Threshold levels.

INITIAL Data Point = Values are taken at the point where the control level is achieved.

SUSTAINED Data = average value between the INITIAL and END data points.

END Data Point = Values are taken 0.1 seconds prior to the STOP threshold

MAXIMUM = maximum value observed in the SUSTAINED Data Interval.

STOP Threshold = brake release

FINAL temperature is the highest temperature value observed in a 4.0 second "window" beginning 1.0 seconds after brake release.

- 3 Brake application is initiated when the control temperature (rotor) reaches the desired initial brake temperature.
- 4 Cooling Air Temperature = 80°F ($\pm 5^\circ\text{F}$)
- 5 Cooling Air Velocity = 20 mi/h for front brake, 2 mi/h for rear brake as determined by cooling curves conducted on a 2001 Ford Expedition.
- 6 For all stops which show "zero" (0) or negative values for some of the computed pressure, torque or coefficient values:

These stops achieved final speed but did not achieve the torque level required for the particular stop. Since the START data and STOP data thresholds were satisfied, deceleration rate, distance, time to stop, etc., are accurate values, and can be used for data comparison purposes.

The presence of "zero" values generally is caused by lack of brake performance, resulting in a "clamp" condition. "Clamp" condition is defined by the brake calling for the maximum pressure the test section allows ("clamp" pressure) and the brake being unable to attain the deceleration rate required in the test section at that pressure.

- 7 Thermocouple locations and depths:
 - Front Rotor: Center of inboard rubbing track at a depth of 0.040 inches
 - Front Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches
 - Front Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches
 - Rear Rotor: Center of inboard rubbing track at a depth of 0.040 inches
 - Rear Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches
 - Rear Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches

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2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

COMPUTED DATA DESCRIPTIONS**SPEED**

INIT = Speed start threshold is achieved.

FNL = Brake release speed

TIME

STOP = Time elapsed between start threshold and brake release

REPT = Time elapsed between cycles

DISTANCE

STOP = Distance elapsed between start threshold and brake release

REPT = Distance elapsed between cycles

DECCEL

AVG = Average deceleration measured from start threshold to brake release

PRESSURE

AVERAGE = Average pressure from start threshold to brake release

SUSTAINED = Average pressure from point control level is achieved to brake release

MAXIMUM = Maximum pressure from start threshold to brake release

TORQUE

AVERAGE = Average torque from start threshold to brake release

SUSTAINED = Average torque from point control level is achieved to brake release

MAXIMUM = Maximum torque from start threshold to brake release

TEMPERATURE

INT = Temperature at start threshold

MAX = Maximum temperature between start threshold and 0.1 seconds after brake release

FLUID DISPLACEMENT

MAX = Maximum fluid displacement between start threshold and brake release

FRICTION COEFFICIENTSUST = Friction coefficient (μ) calculated using the following formula:

$$\mu = \frac{\text{Sustained Torque (lbf-ft) / Rotor Effective Radius (ft)}}{\text{Sustained Pressure (lbf/in}^2\text{) * Total Caliper Piston Area (in}^2\text{)}} * 0.5$$

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

TEST ROUTE - NEW AMSTERDAM TO SCHOHARIE NEW YORK

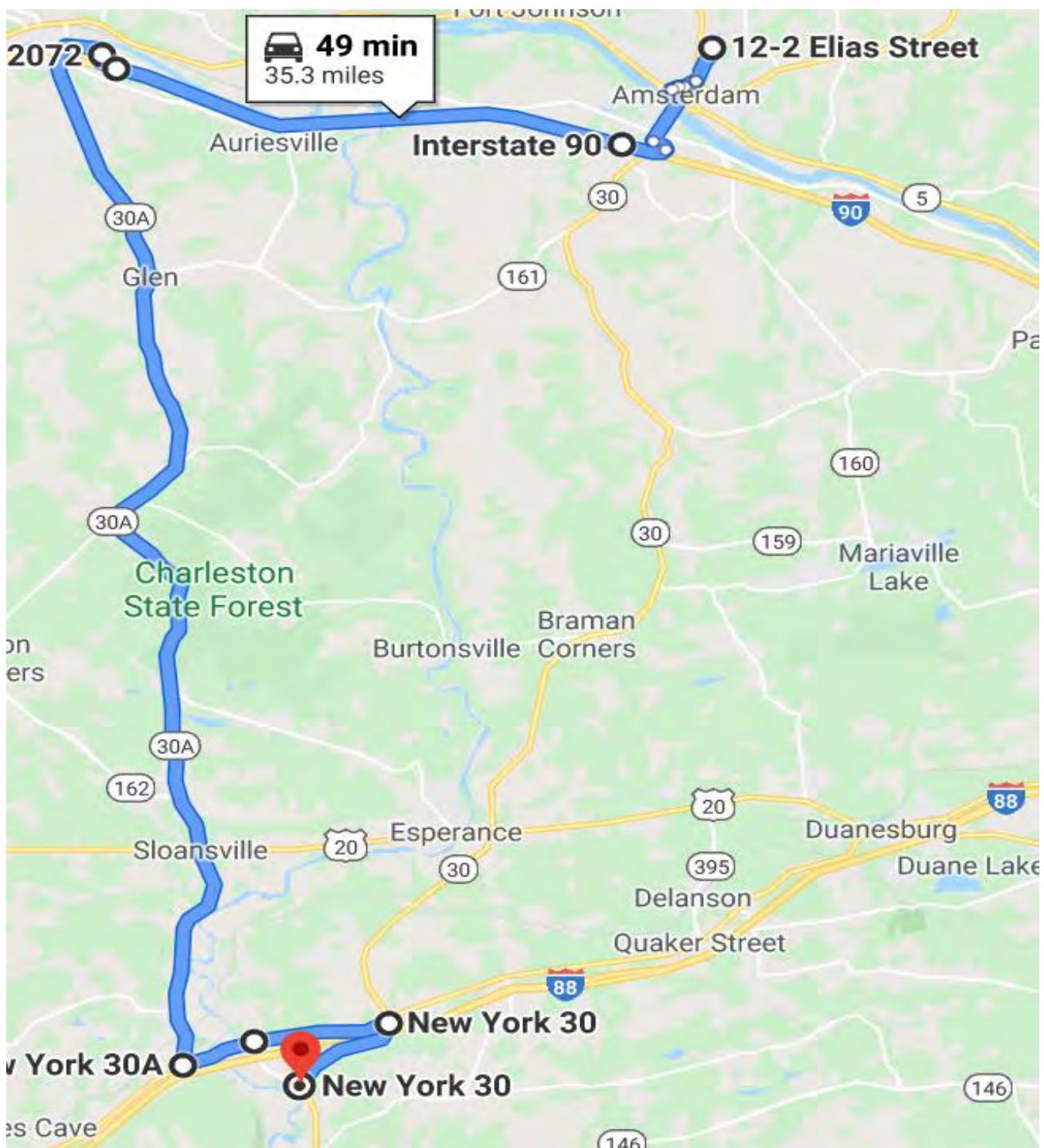
Cycle	Mile	Latitude (GPS)	Longitude (GPS)	Altitude (ft)	Grade Input (%g)	Braking Deceleration (g)	Apply Speed (mi/h)	Release Speed (mi/h)
0	0.0	42.94908	-74.18265	574.1	—	—	—	—
1	10.8	42.94409	-74.35478	293.3	-0.14%	0.2	60	30
2	11.1	42.94722	-74.35869	296.3	0.21%	0.2	30	20
3	11.2	42.94865	-74.35809	288.1	-1.69%	0.2	20	0
4	11.7	42.94957	-74.36914	287.4	0.28%	0.2	40	0
5	14.6	42.91169	-74.35237	469.5	0.40%	0.2	55	40
6	15.6	42.89860	-74.34632	647.3	5.20%	0.2	55	35
7	15.7	42.89696	-74.34592	666.0	0.80%	0.2	35	15
8	17.0	42.87979	-74.34609	802.8	0.90%	0.2	55	40
9	17.7	42.86949	-74.34253	871.7	5.27%	0.2	55	50
10	18.4	42.86000	-74.33732	1016.7	3.88%	0.2	50	40
11	20.4	42.83745	-74.35430	1200.1	1.12%	0.2	55	40
12	21.8	42.82276	-74.33815	1259.2	1.09%	0.2	55	30
13	22.6	42.81189	-74.33648	1295.6	-1.10%	0.2	55	40
14	24.5	42.78596	-74.33829	1284.1	0.19%	0.2	55	40
15	25.3	42.77450	-74.33766	1075.5	-4.69%	0.2	55	40
16	25.7	42.76815	-74.33585	955.1	-5.45%	0.2	45	0
17	26.5	42.75714	-74.33045	681.8	-10.46%	0.2	45	0
18	29.4	42.71859	-74.33721	676.2	0.59%	0.2	55	40
19	30.4	42.70533	-74.33539	633.2	2.50%	0.2	40	0
20	31.5	42.71097	-74.31464	681.4	3.31%	0.2	55	0
21	33.6	42.71540	-74.27608	1183.4	4.71%	0.2	55	0
2 MINUTE STOP - BRAKES RELEASED								
22	33.9			1078.1	-5.92%	0.2	60	55
23	34.0			1033.7	-5.92%	0.2	60	55
24	34.2			989.3	-5.92%	0.2	60	55
25	34.3			944.9	-5.92%	0.2	60	55
26	34.5			900.6	-5.92%	0.2	60	55
27	34.6			856.2	-5.92%	0.2	60	55
28	34.8			811.8	-5.92%	0.2	60	55
29	34.9			767.4	-5.92%	0.2	60	55
30	35.0			723.1	-5.92%	0.2	60	55
31	35.2	42.70259	-74.29994	678.5	-5.95%	0.2	60	55
32	35.4	42.70043	-74.30176	628.3	-5.40%	0.2	50	0

*NOTE: Test route was derived using the following criteria:

Speed limit and warning speeds were identified along the simulated route and used to control speed in the simulations. At Stop signs and controlled signalized intersections along the simulated route complete stops were modeled. At last stop before the final downhill descent a completed stop of 2 minutes was modeled. During downhill descents if the speed exceeded the posted speed limit by 5 mph braking at a maximum of 0.2 g was applied to reduce the speed to the speed limit.

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

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TEST ROUTE - OVERVIEW MAP

Test Numbers: M20-064-07

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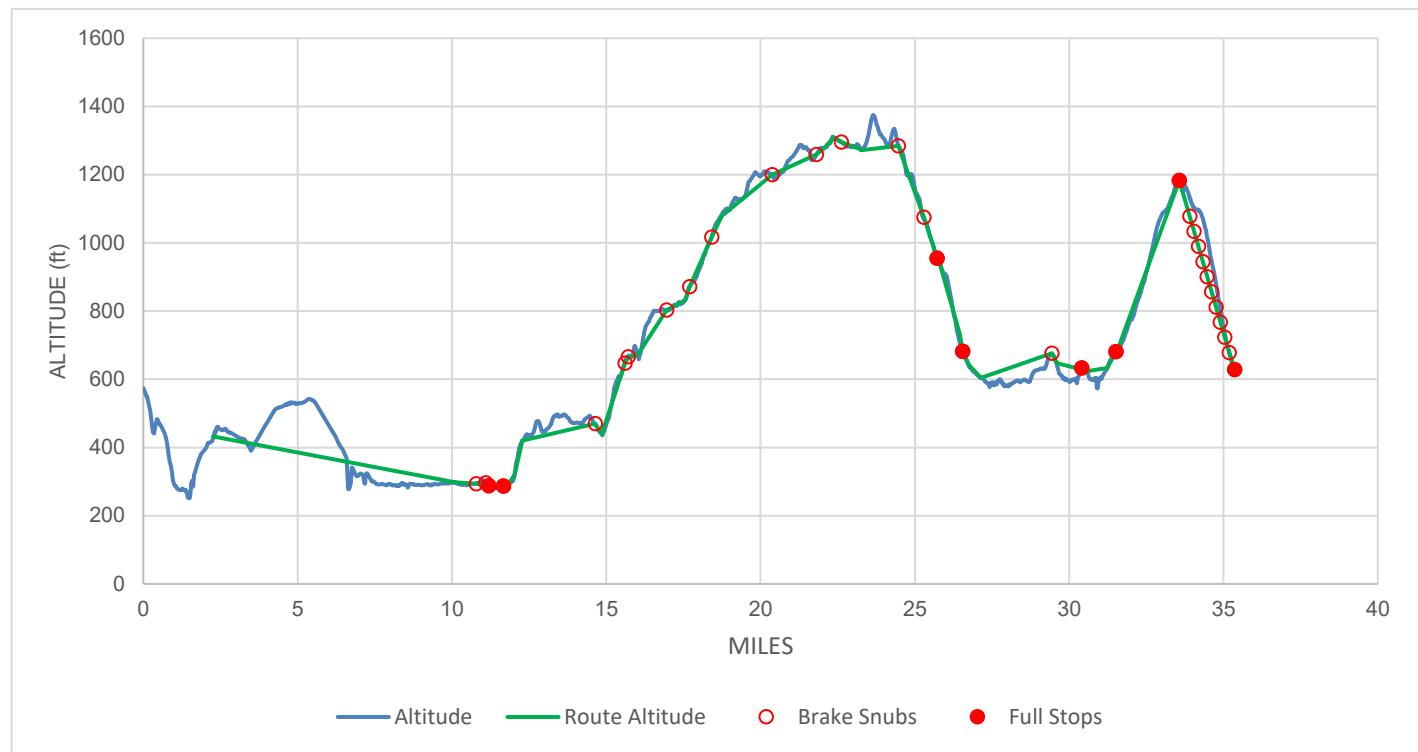
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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

TEST ROUTE - PROFILE



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2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

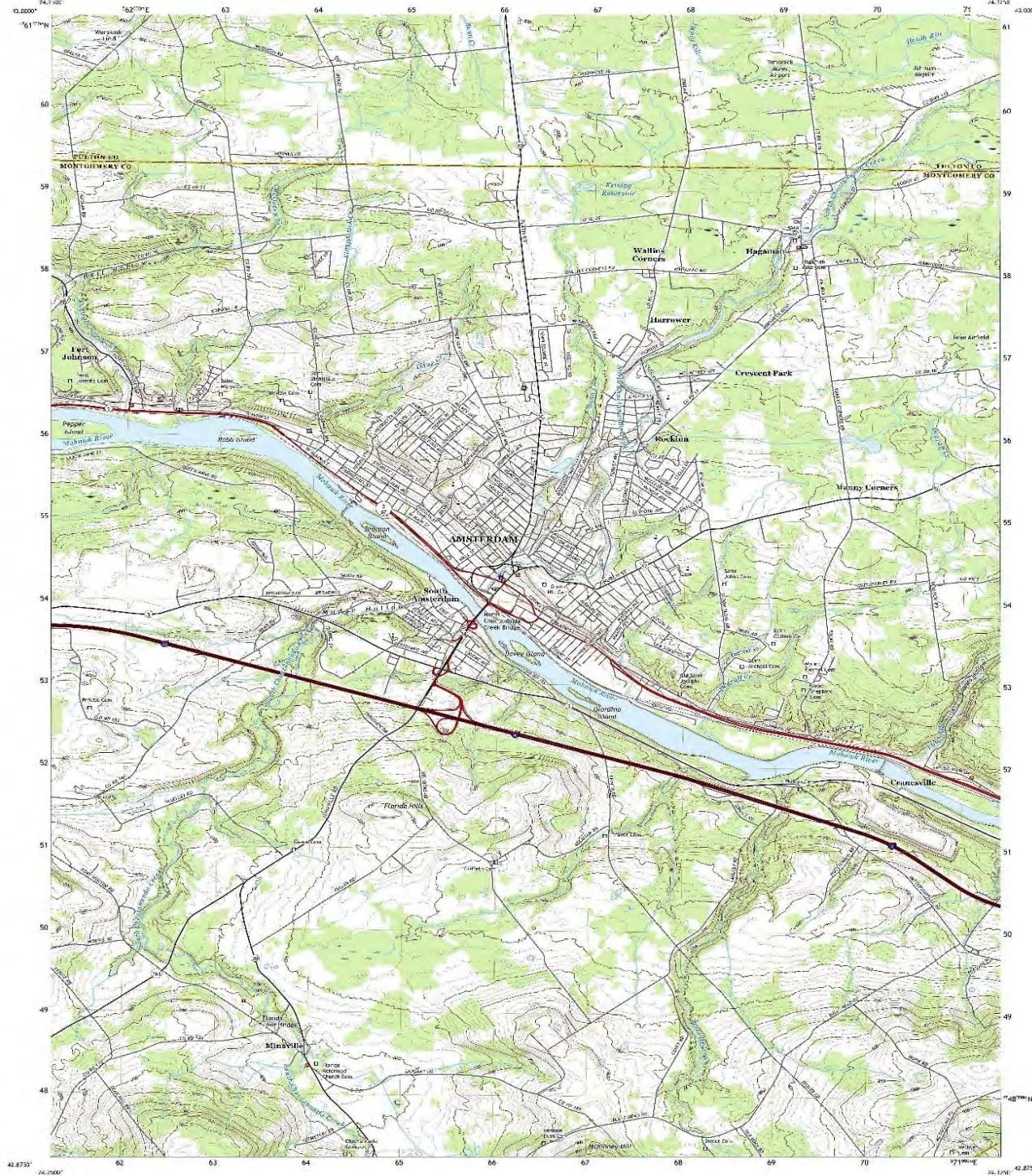
TEST ROUTE - AMSTERDAM QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



AMSTERDAM QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



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2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

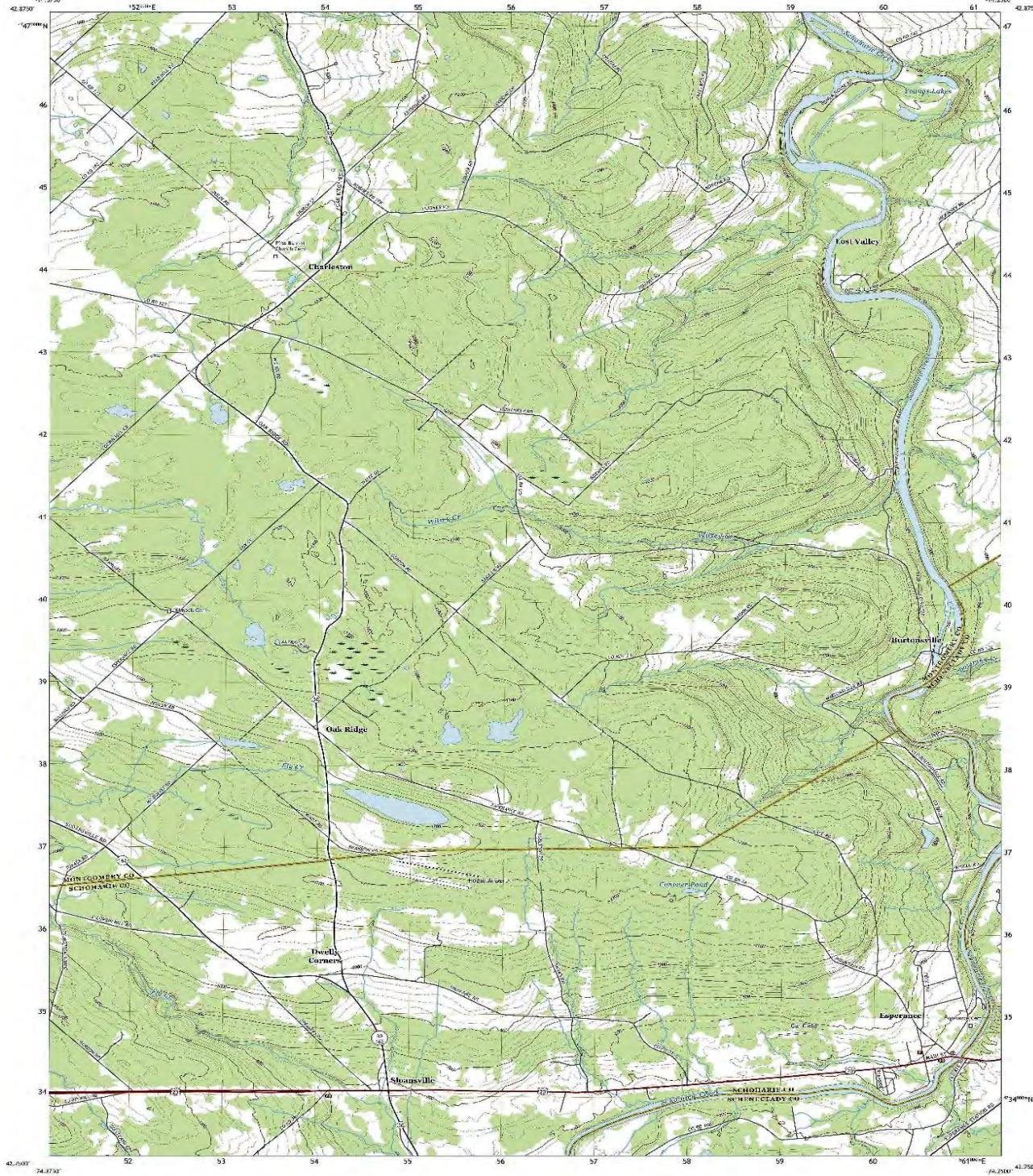
TEST ROUTE - ESPERANCE QUADRANGLE



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U.S. GEOLOGICAL SURVEY



ESPERANCE QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



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2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

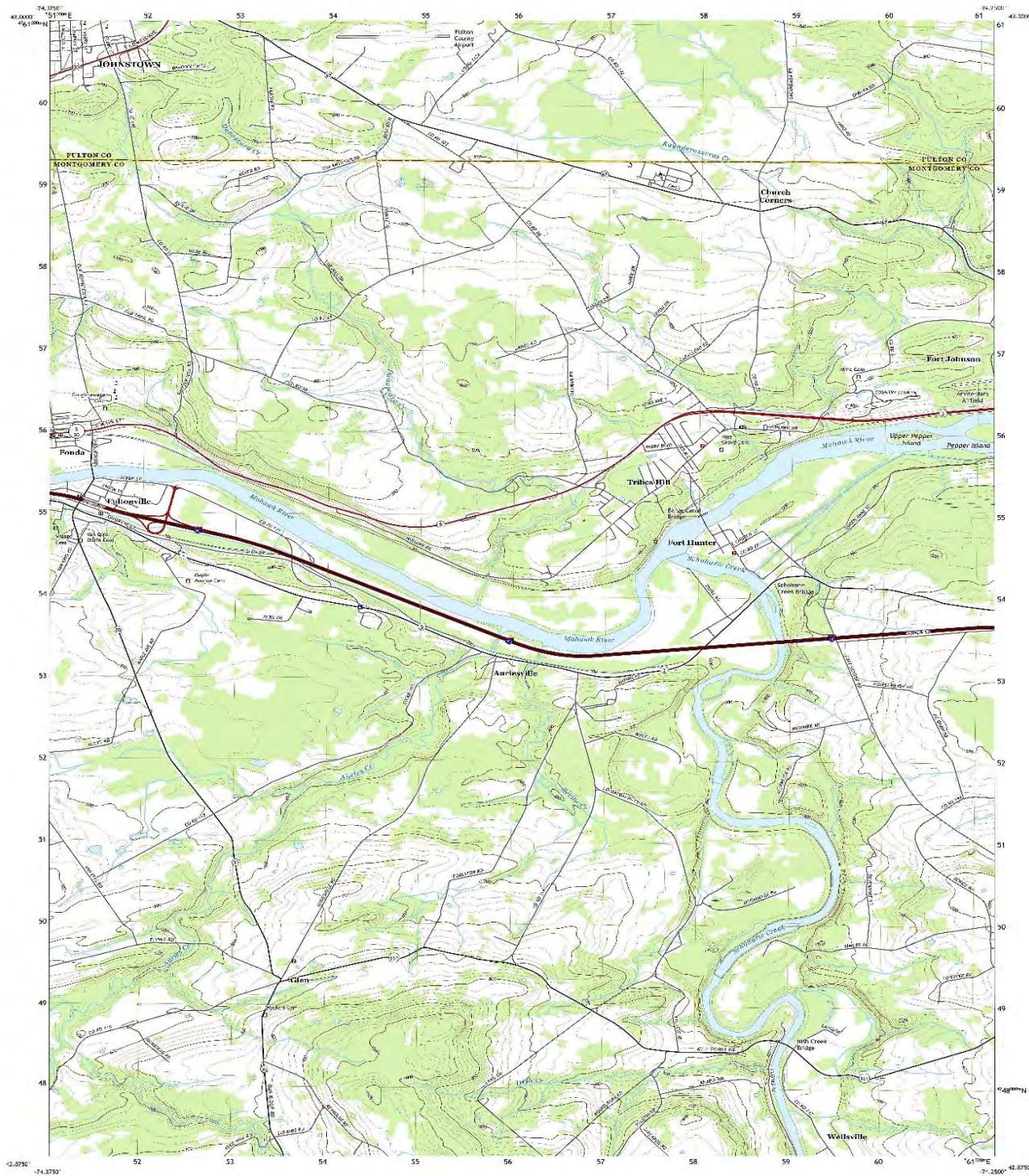
TEST ROUTE - TRIBES HILL QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



TRIBES HILL QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



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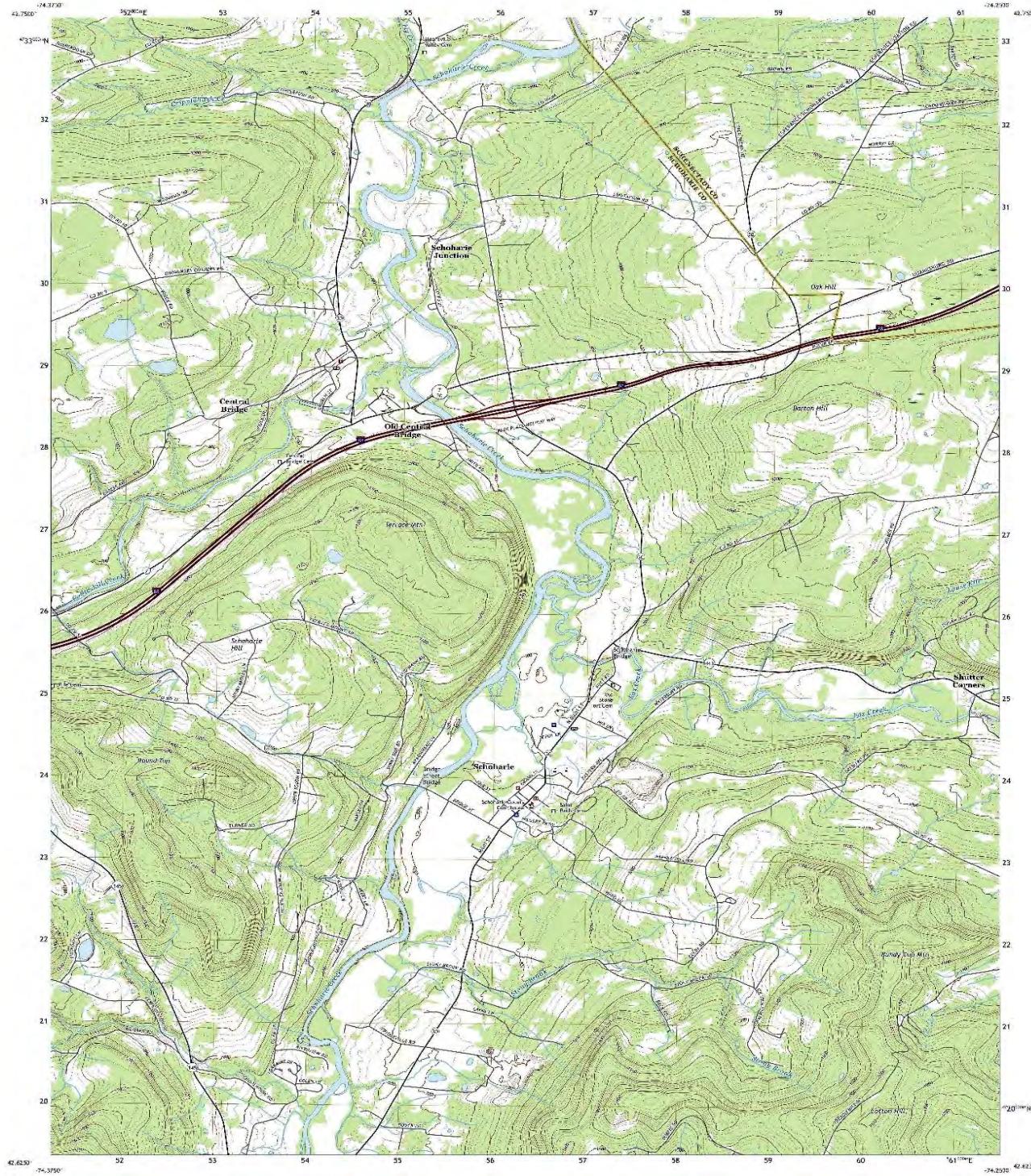
TEST ROUTE - SCHOHARIE QUADRANGLE



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SCHOHARIE QUADRANGLE
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2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

PRE TEST PHOTOGRAPHS - FRONT BRAKE



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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

PRE TEST PHOTOGRAPHS - REAR BRAKE



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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

POST TEST VISUAL INSPECTION - FRONT BRAKE

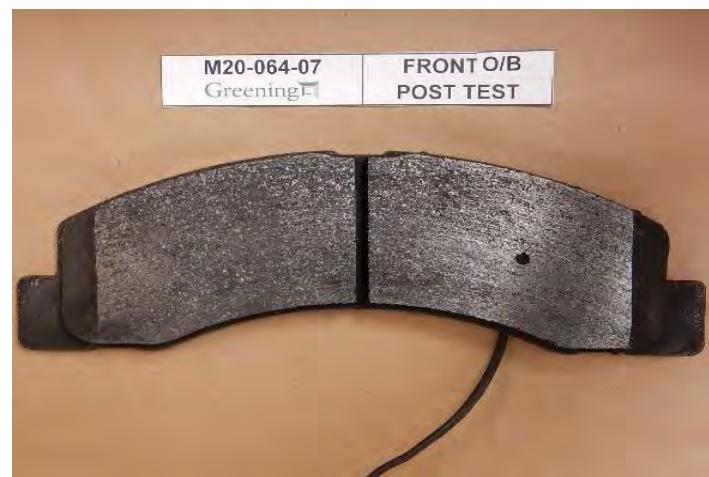
Inboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is blue/grey in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



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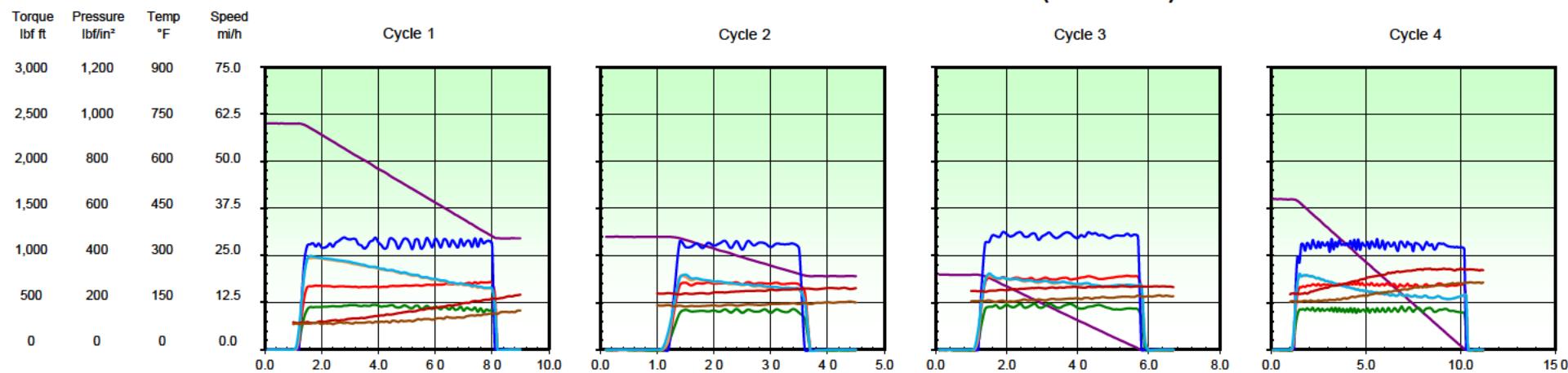
PHOTOGRAPHS



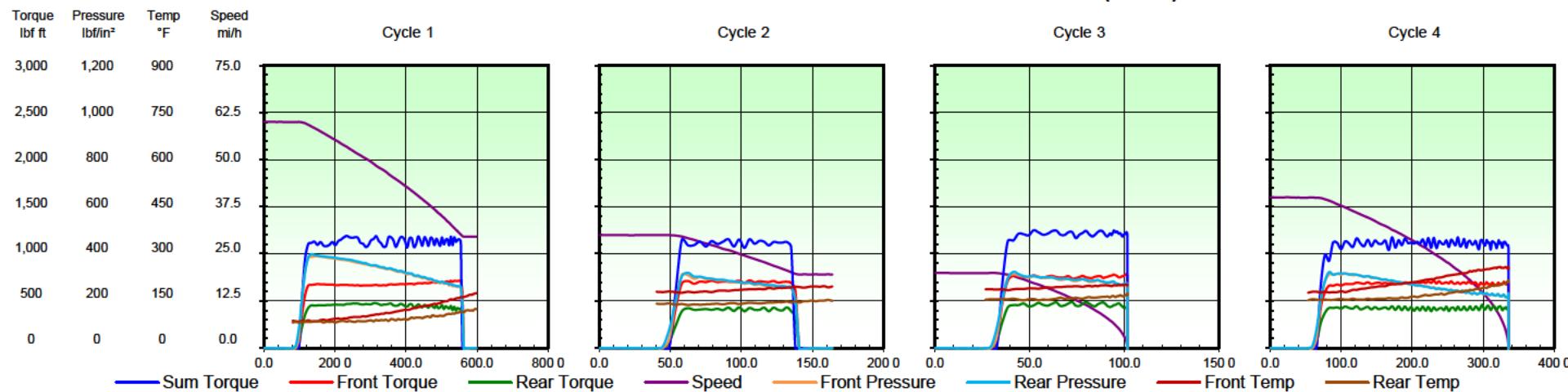
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

GRADE SIMULATION CYCLES IN-STOP DATA vs. TIME (SECONDS)



GRADE SIMULATION CYCLES IN-STOP DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-07

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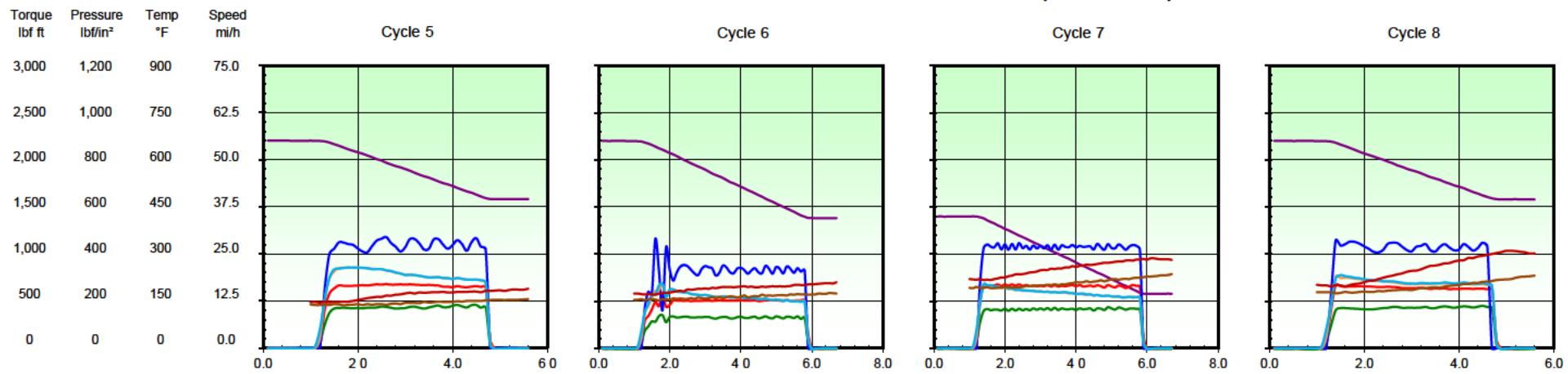
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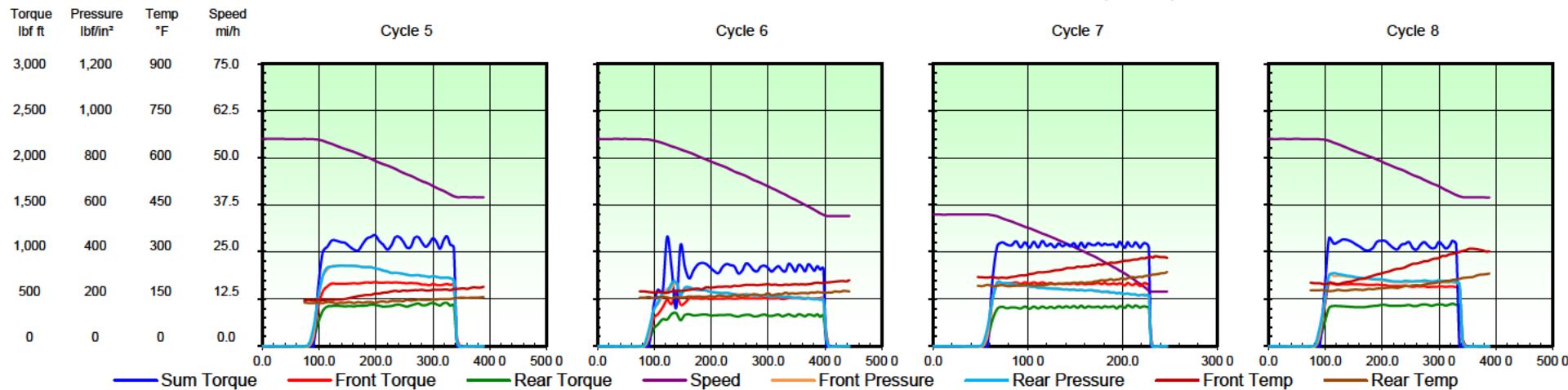
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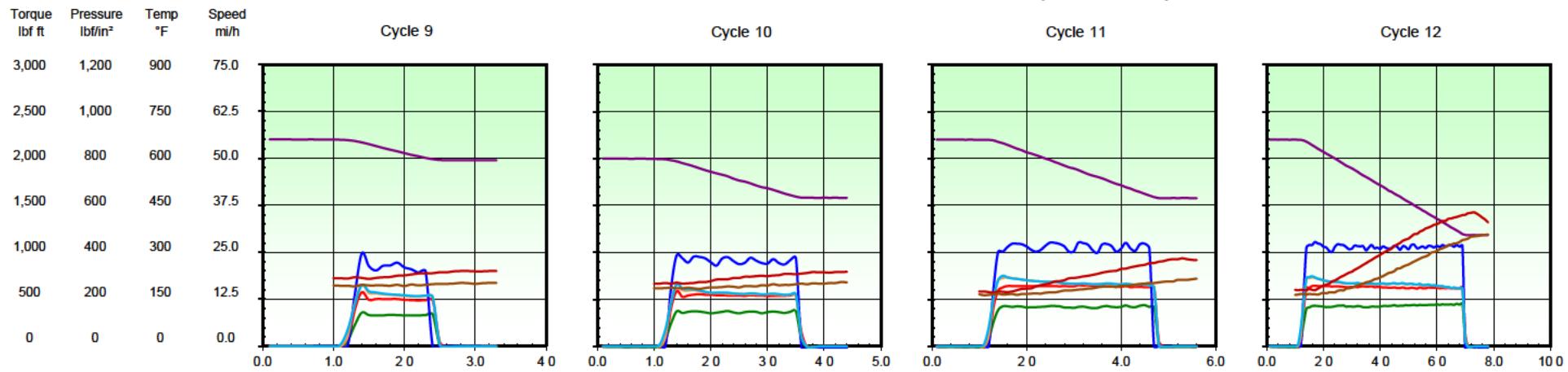
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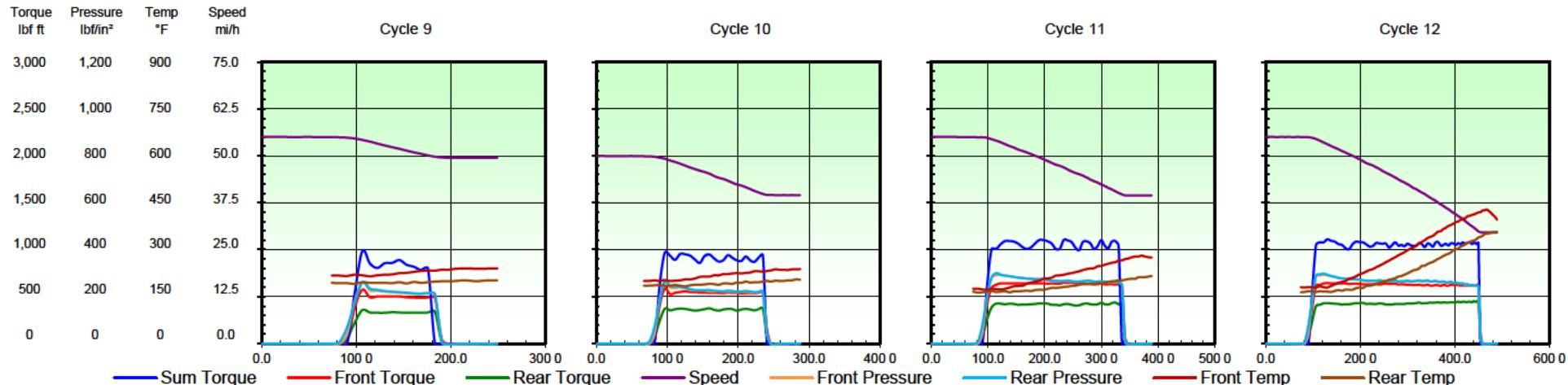
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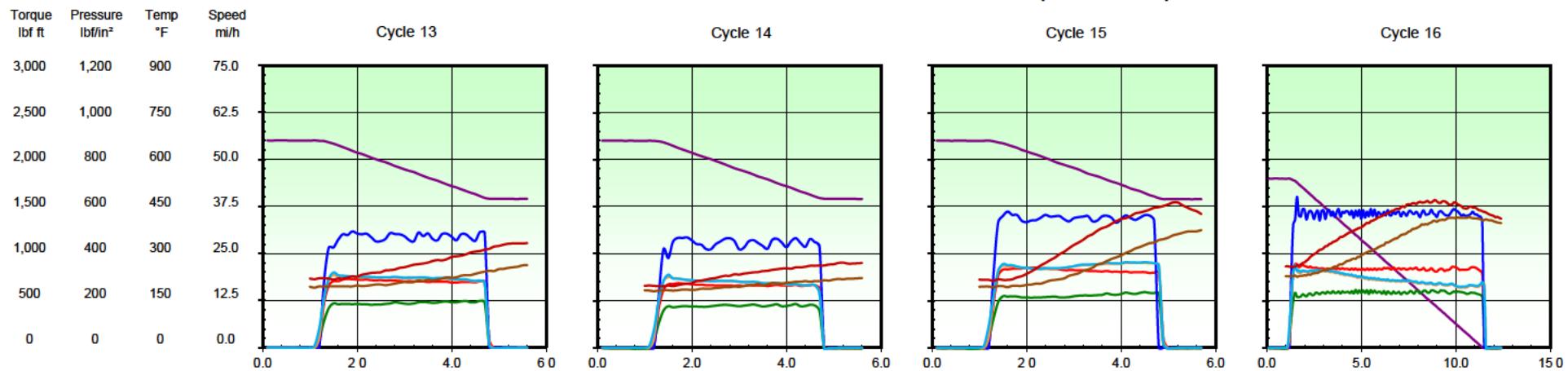
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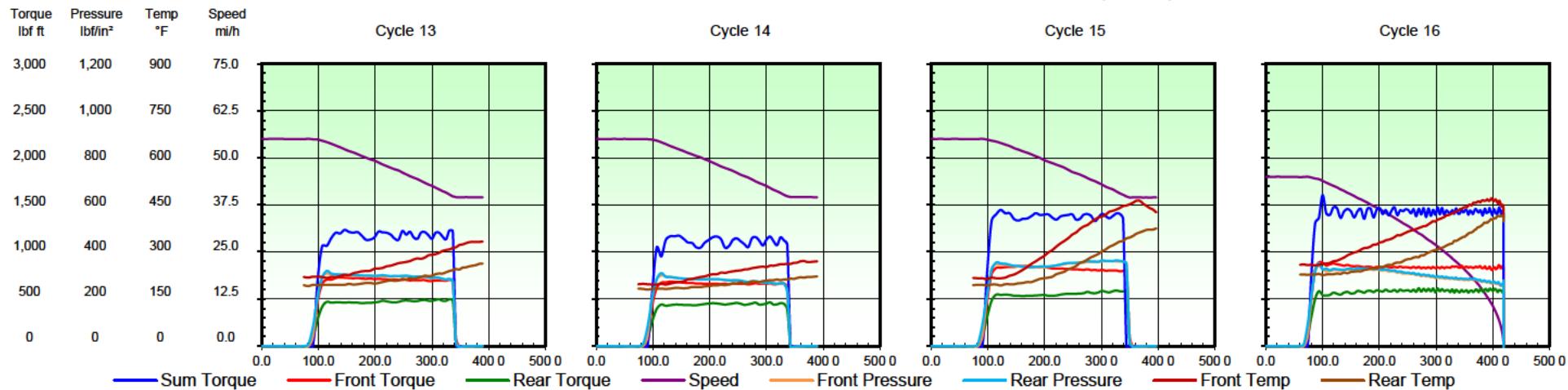
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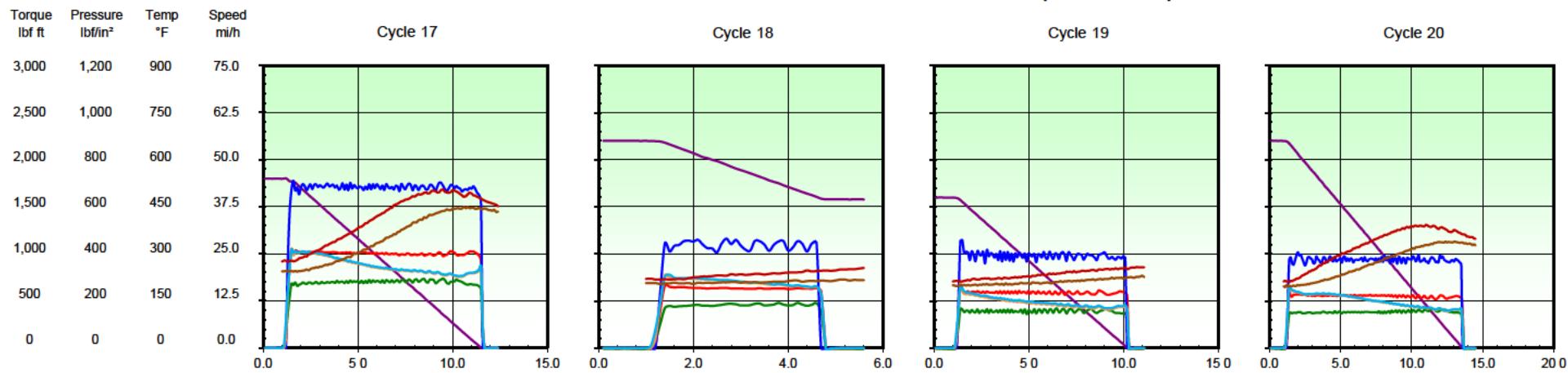
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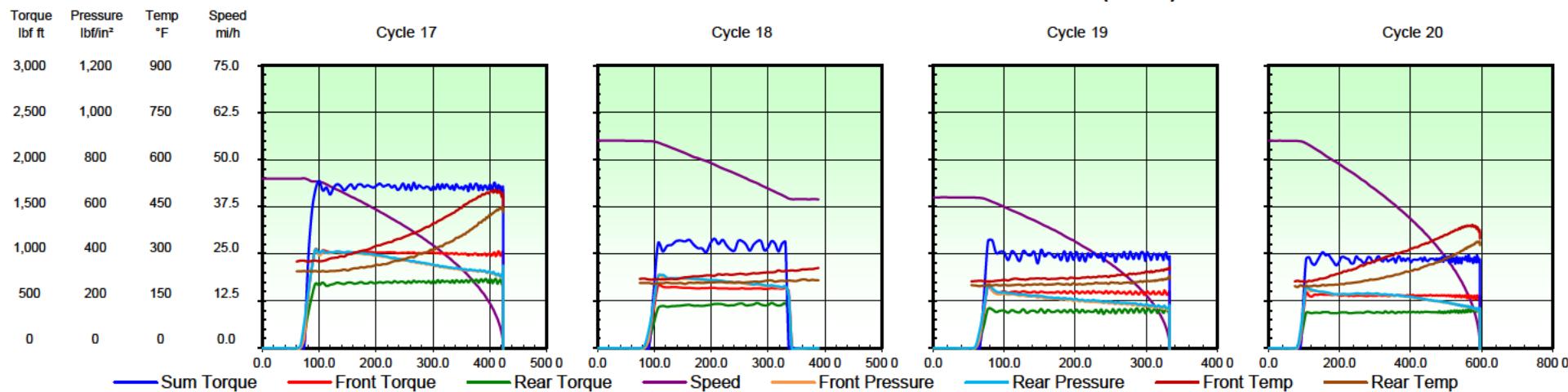
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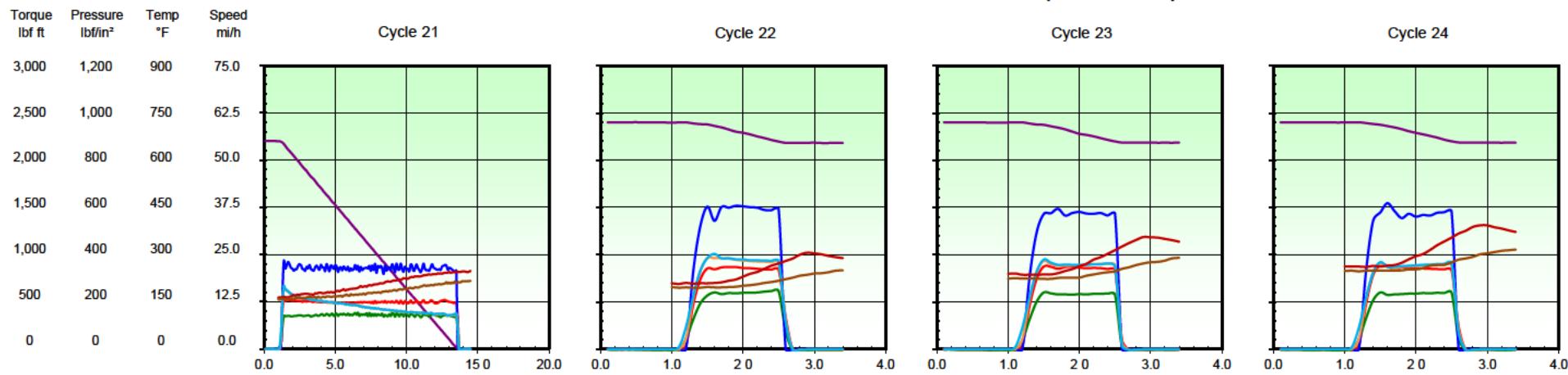
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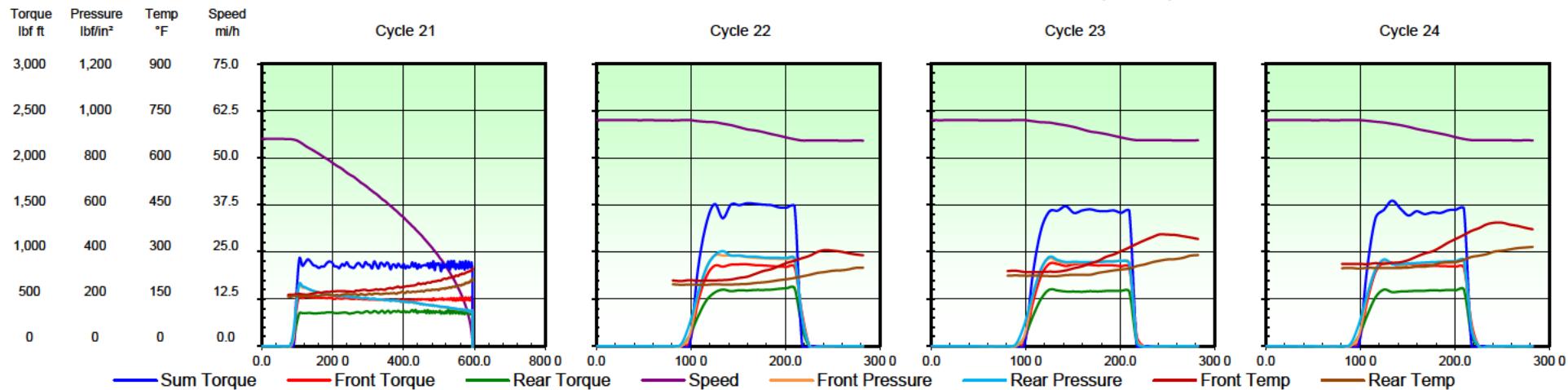
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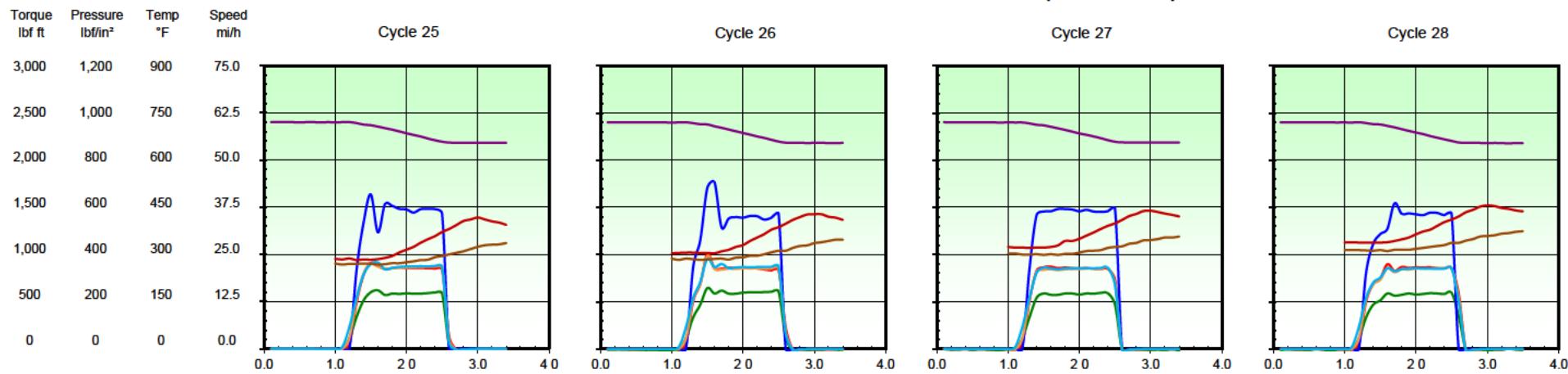
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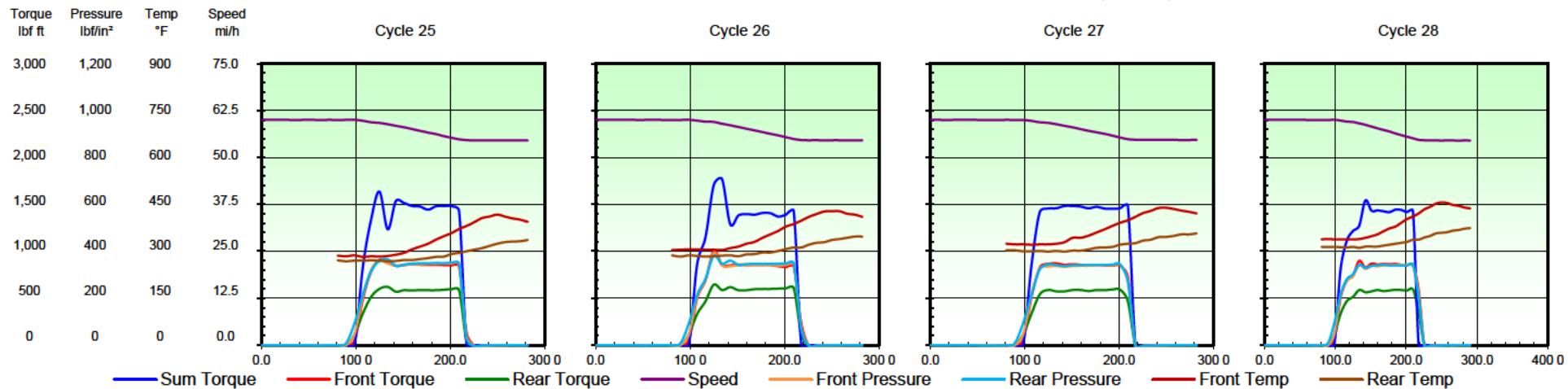
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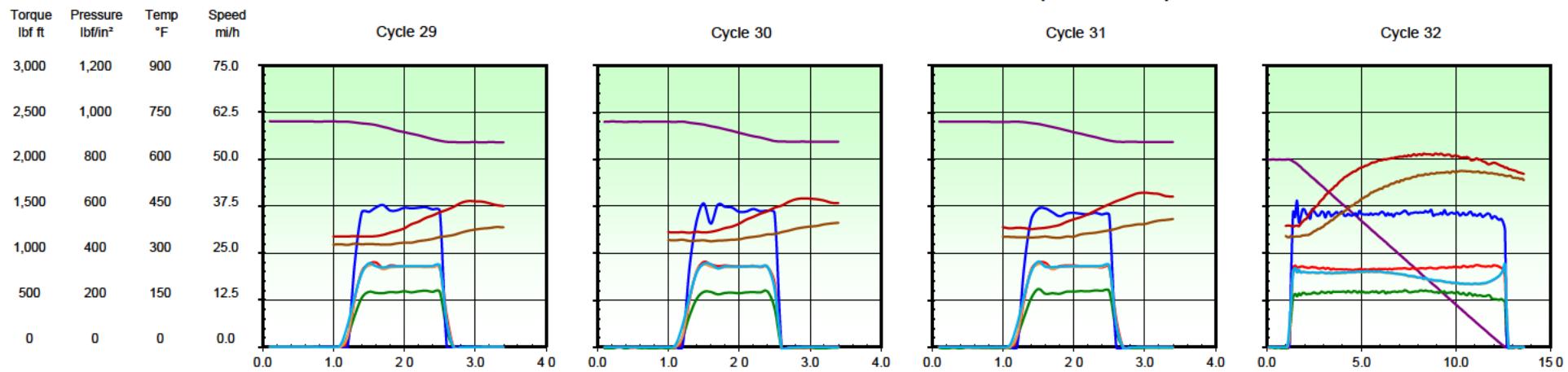
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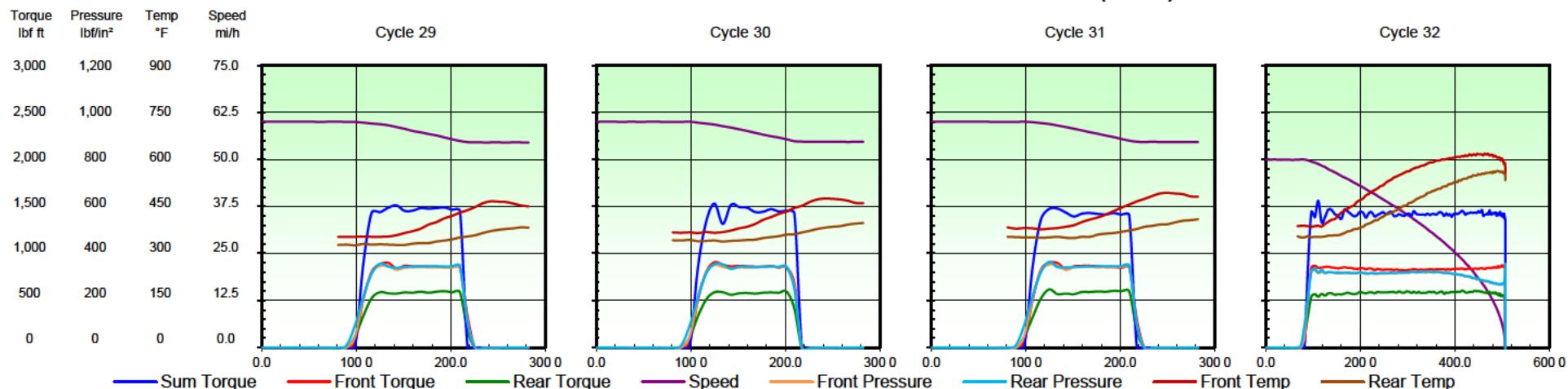
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Test Numbers: M20-064-07

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

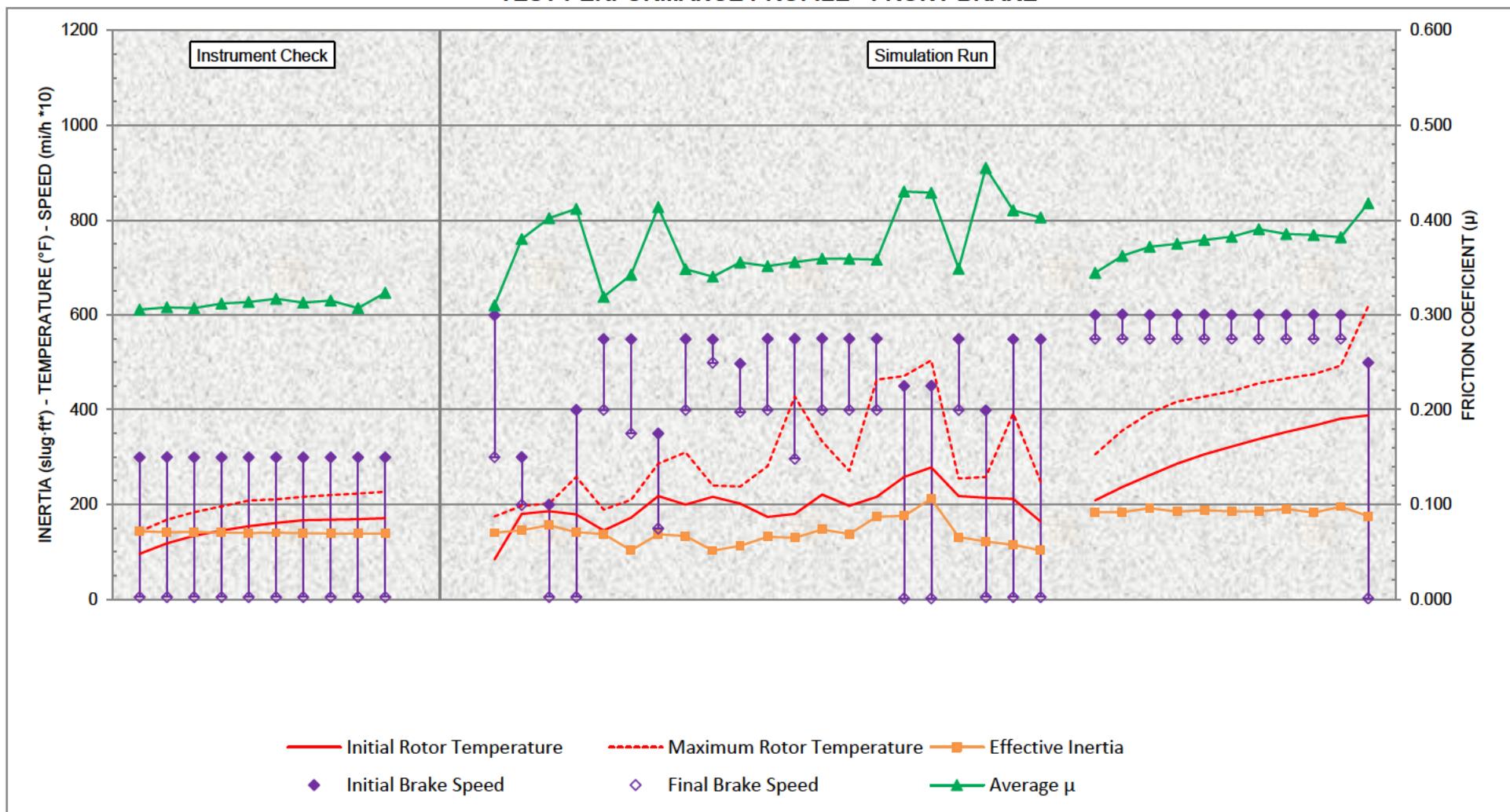
Report Number: 203145-2

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-07

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

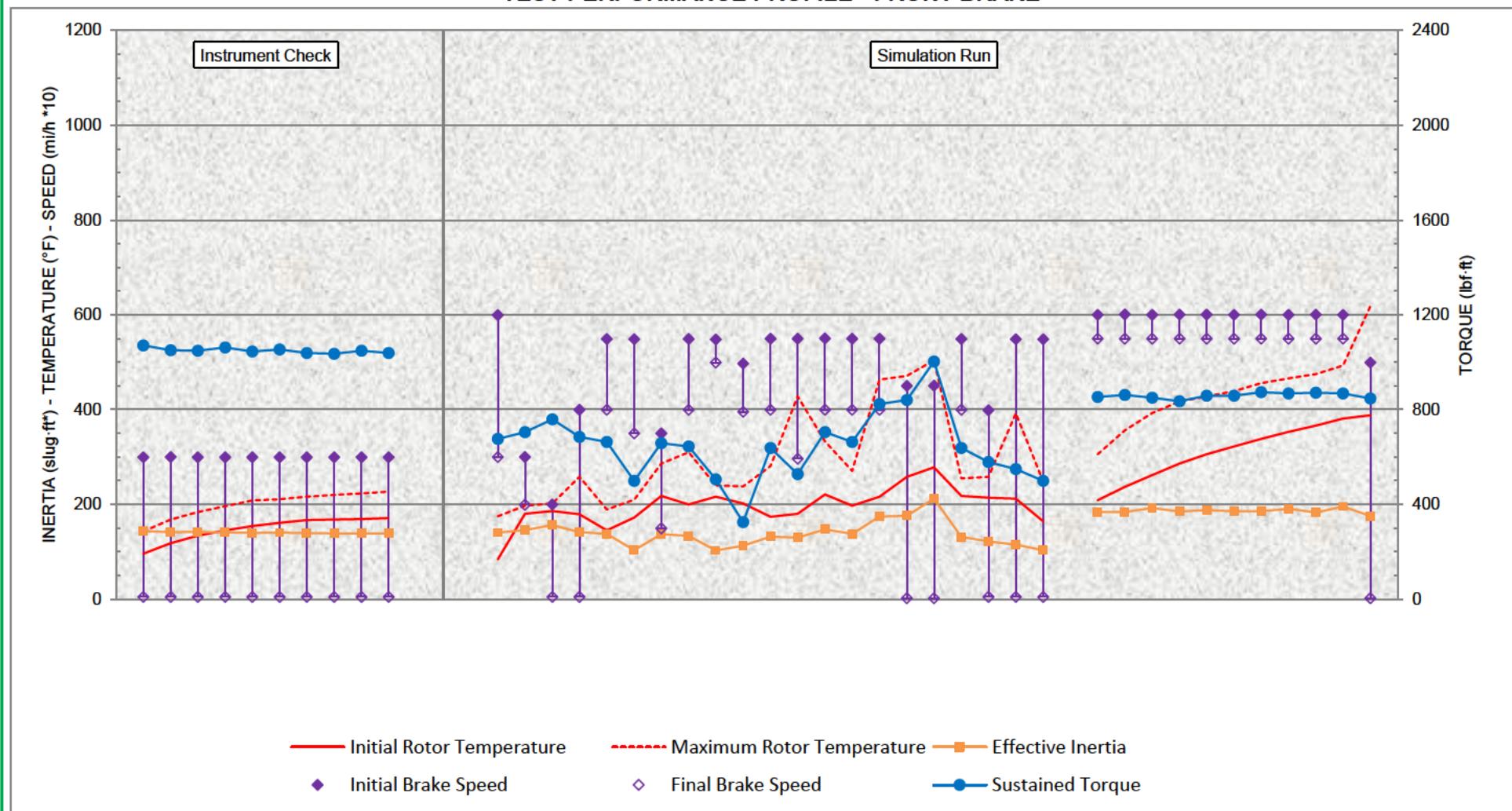
Report Number: 203145-2

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-07

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

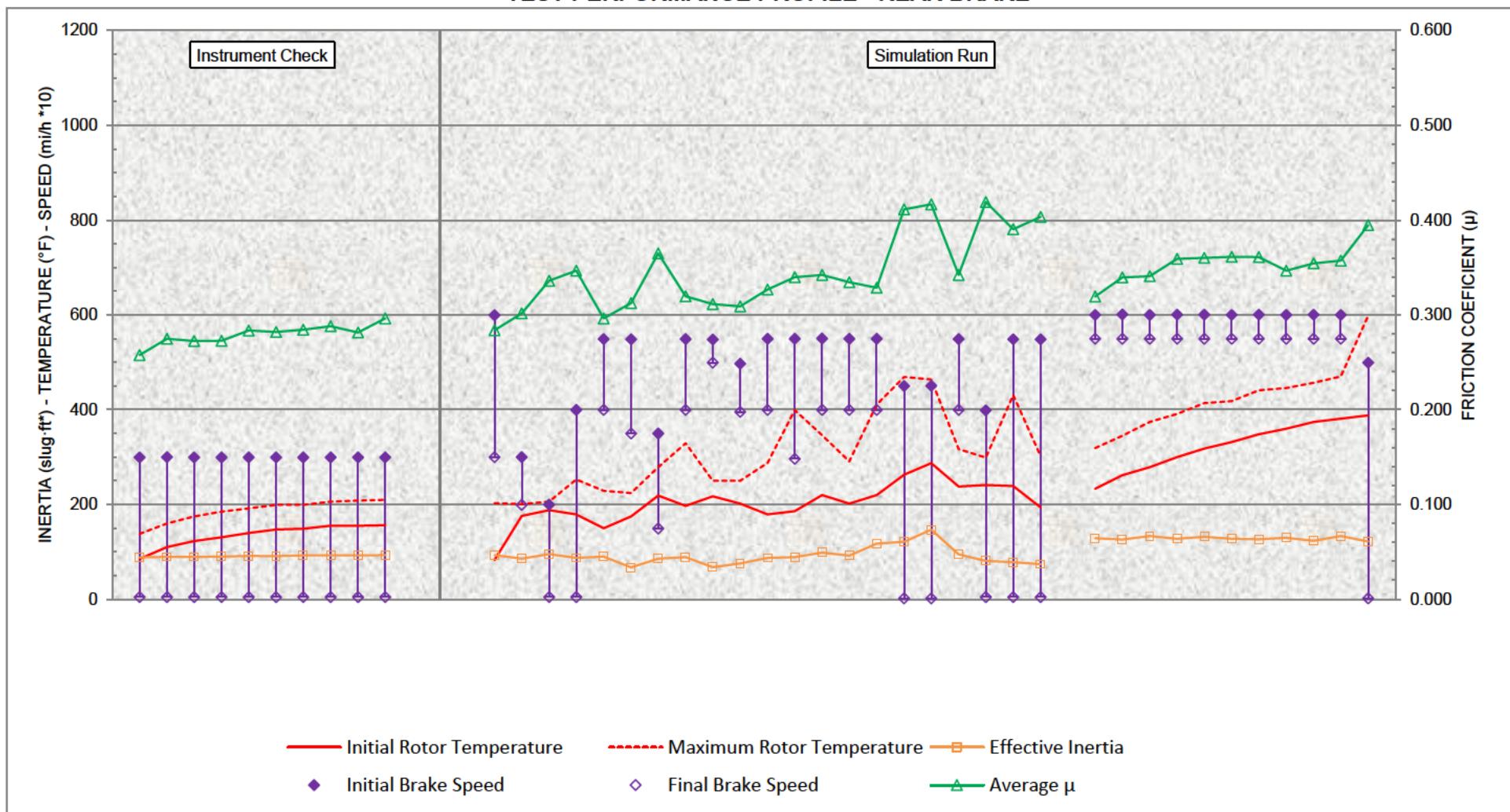
Report Number: 203145-2

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-07

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

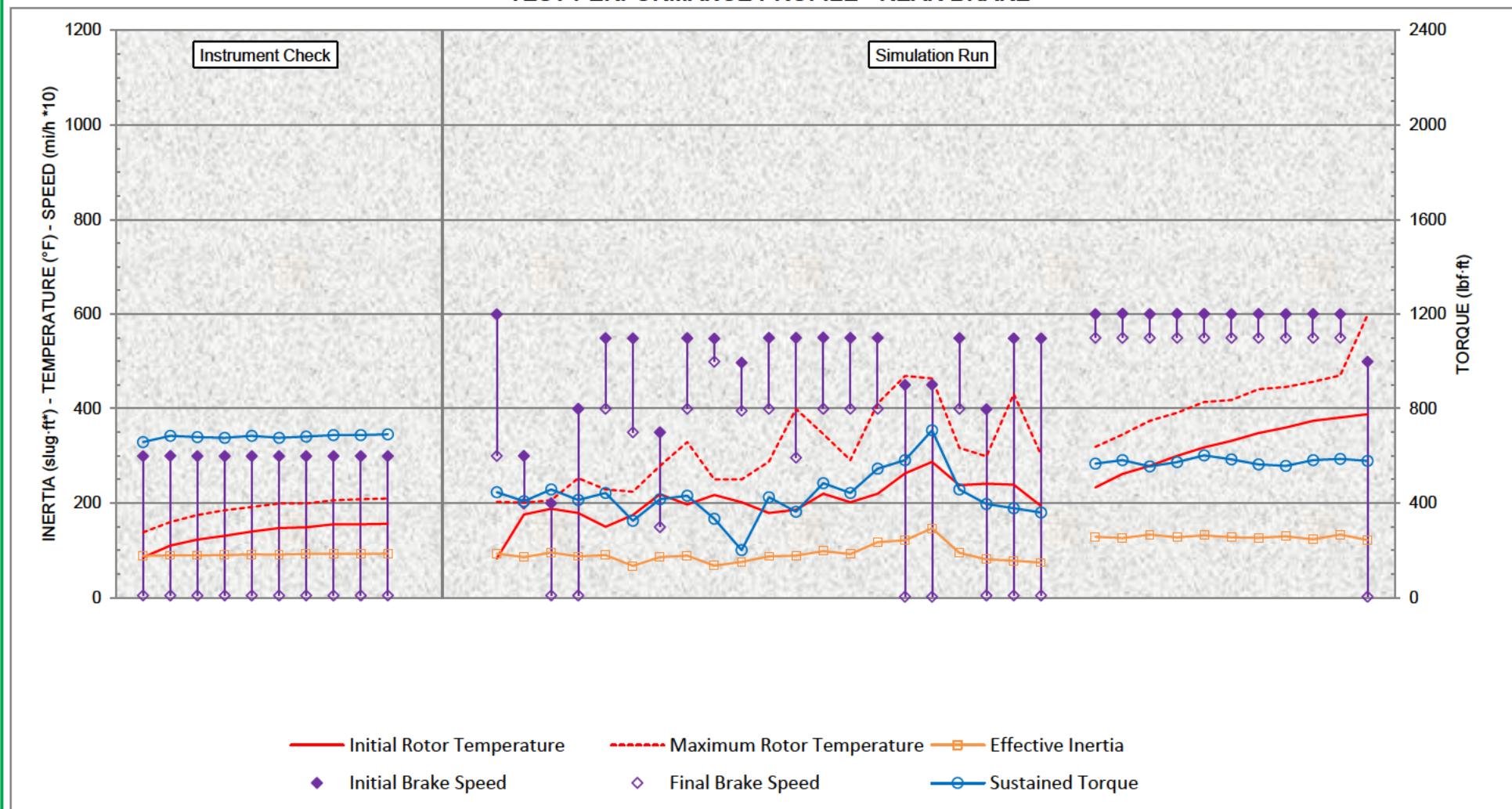
Report Number: 203145-2

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-07

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

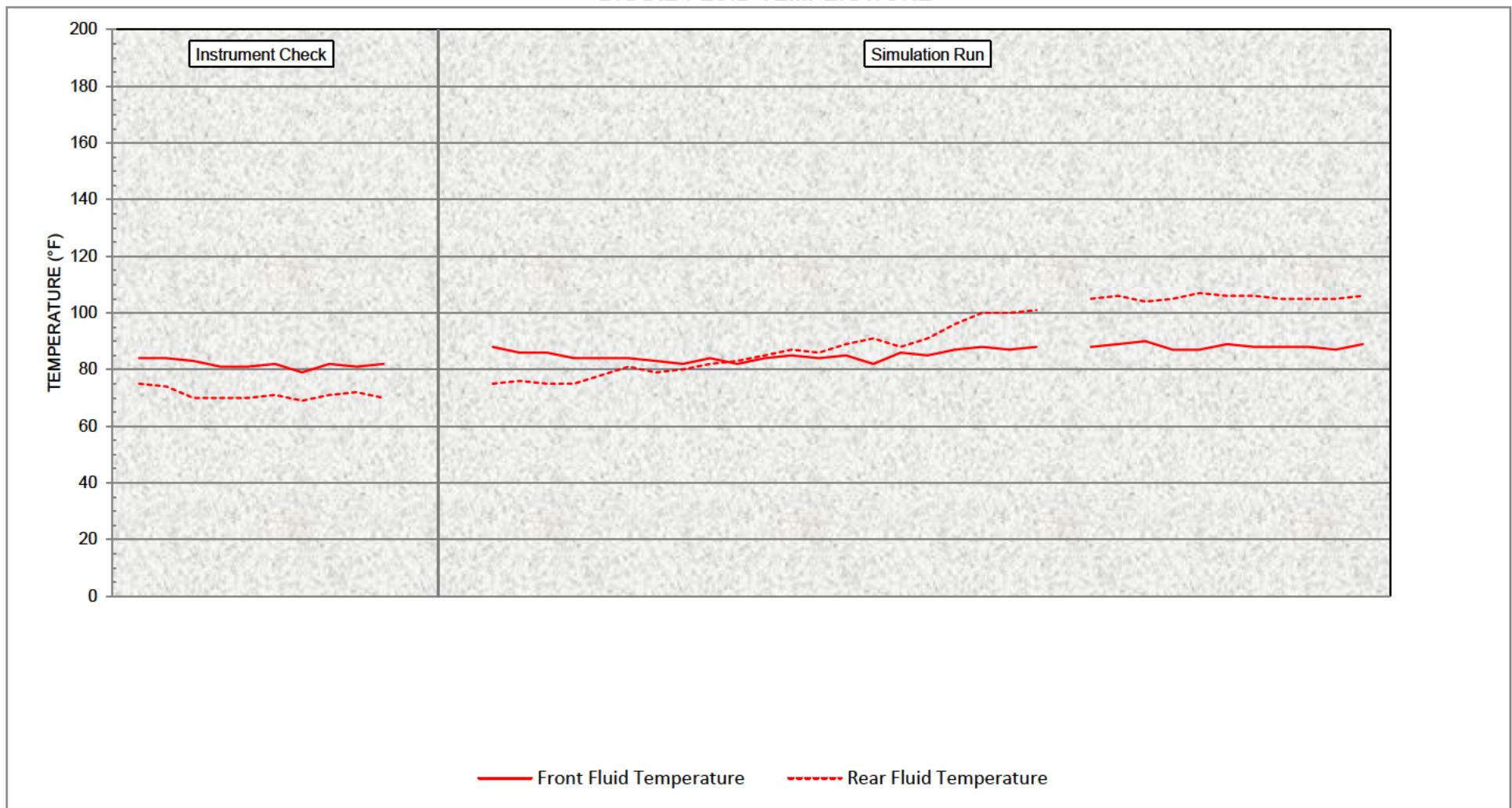
Report Number: 203145-2

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

BRAKE FLUID TEMPERATURE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-07

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

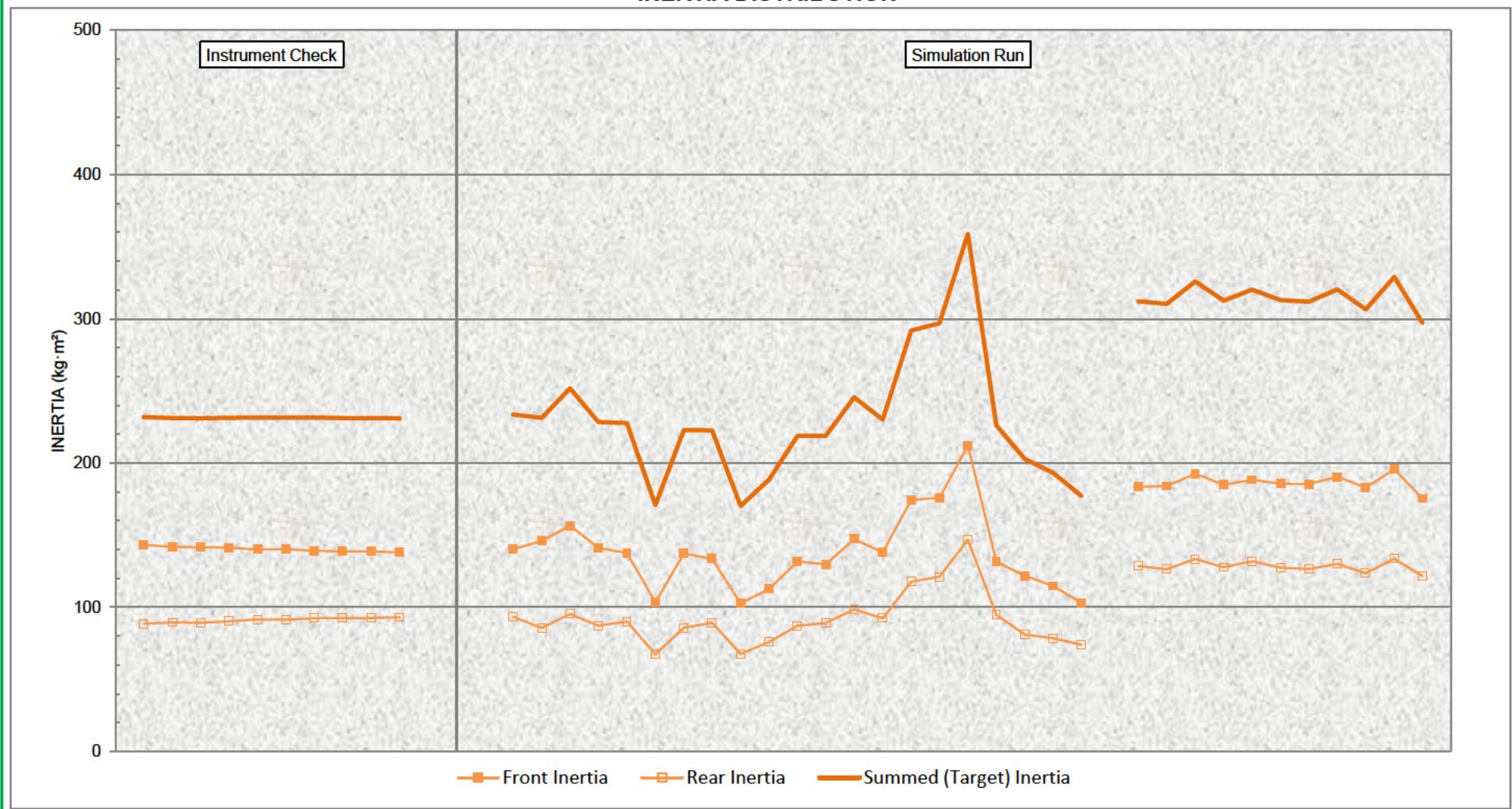
Report Number: 203145-2

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - 8,600 LB GVW

INERTIA DISTRIBUTION



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-07

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

Report Number: 203145-2

Test Report Date: 20 March 2020

Test Numbers: M20-064-07

Report Number: 203145-2

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DISTANCE		DECCEL		PRESSURE						TORQUE						TEMPERATURE												FLUID		FRICTION		INERTIA					
									Avg	Average	Sustained	Maximum	Average			Sustained	Maximum	Rotor	Front		Rear		Front		Rear		O/B	Fluid	Rotor	I/B	O/B	Fluid	Maximum		Sustained		Displace.		Coeff.		Inertia	
	Init	FNL	Stop	Rept	Stop	Rept	Dist	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Max	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear	
	mi/h		s		ft		ft/s ²																																			

Test Numbers: M20-064-07

Report Number: 203145-2

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DISTANCE		DECEL		PRESSURE						TORQUE						TEMPERATURE												FLUID		FRICTION		INERTIA				
									Avg	Average	Sustained	Maximum			Sustained		Maximum		Rotor	Front		Rear		O/B	Fluid	Rotor	Front		Rear		Displace.	Coeff.									
	Init	FNL	Stop	Rept	Stop	Rept	Dist	Front	Front	Front	Front	Front	Front	Sum	Front	Front	Front	Front	Front	Int	Max	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rept	Front	Rept	Front	Rept						
	mi/h		s		ft		ft/s ²																																		
1	60.0	30.0	6.84	0.0	459	0	6.32	325	328	329	331	395	408	1101	661	440	1122	676	446	735	523	84	175	87	167	81	124	88	83	203	82	199	87	148	75	0.31	0.28	0.31	0.28	140.3	93.3
2	30.0	19.9	2.34	48.8	88	2329	6.09	276	281	280	285	346	333	1051	662	389	1113	705	408	773	467	180	197	144	181	142	153	86	176	201	150	187	142	164	76	0.26	0.24	0.38	0.30	145.8	85.5
3	20.0	0.5	4.49	23.5	69	713	6.16	284	286	285	287	335	338	1155	718	437	1217	759	458	803	505	186	202	159	195	155	173	86	188	206	164	193	159	178	75	0.25	0.23	0.40	0.34	156.4	95.3
4	40.0	0.5	8.97	54.9	271	2631	6.35	228	238	251	251	335	360	1081	668	412	1098	685	413	738	478	179	258	157	246	155	215	84	179	253	168	240	167	220	75	0.26	0.24	0.41	0.35	141.3	87.2
5	54.9	39.9	3.46	211.7	246	16090	6.21	309	310	314	315	351	378	1054	637	417	1107	664	443	711	508	145	189	153	215	137	156	84	150	229	156	208	156	195	78	0.26	0.25	0.32	0.30	137.6	90.0
6	54.8	35.0	4.55	70.8	307	5619	6.25	217	217	220	219	347	432	795	482	313	824	499	325	868	585	172	210	169	231	156	176	84	175	224	173	226	174	204	81	0.29	0.26	0.34	0.31	103.5	67.3
7	35.0	14.9	4.58	20.1	171	1114	6.27	238	239	240	240	280	287	1042	642	401	1074	658	416	694	446	218	286	204	257	195	236	83	219	279	202	248	209	244	79	0.23	0.22	0.41	0.37	137.2	85.7
8	54.9	39.9	3.45	92.2	246	6886	6.23	274	279	284	284	327	326	1034	620	414	1075	644	431	732	484	200	310	191	261	178	231	82	197	329	198	252	201	267	80	0.26	0.23	0.35	0.32	133.5	89.1
9	54.8	49.9	1.12	57.5	91	4534	6.12	212	215	224	226	289	285	776	468	308	839	505	334	626	419	216	240	208	225	193	202	84	217	250	212	236	213	234	82	0.24	0.22	0.34	0.31	102.7	67.5
10	49.7	39.5	3.33	56.5	214	4177	4.58	136	136	138	137	283	278	643	384	259	526	325	201	611	410	202	238	197	232	186	205	82	202	250	202	237	205	234	83	0.24	0.22	0.36	0.31	112.6	75.9
11	55.0	39.9	3.45	113.6	245	9102	6.25	270	271	274	274	311	341	1020	614	406	1063	638	425	697	481	174	281	181	241	164	216	84	179	288	186	234	192	249	85	0.26	0.24	0.35	0.33	131.7	87.2
12	54.9	29.6	6.74	101.3	406	8099	5.67	222	223	224	225	308	322	926	549	377	891	528	363	679	472	180	428	183	274	167	357	85	186	399	188	259	191	326	87	0.26	0.24	0.36	0.34	129.8	89.0
13	55.0	39.9	3.48	63.9	248	4890	6.19	291	294	296	298	326	343	1134	680	454	1189	705	484	770	526	221	333	205	280	195	263	84	220	346	218	288	220	299	86	0.26	0.24	0.36	0.34	147.2	98.4
14	55.0	39.9	3.47	128.4	246	10300	6.23	274	273	279	331	358	1068	640	429	1107	664	443	770	523	197	271	199	263	181	222	85	202	291	206	260	211	258	89	0.26	0.25	0.36	0.33	137.8	92.3	
15	55.0	39.9	3.56	62.1	253	4910	6.06	341	344	347	350	364	378	1319	788	531	1370	824	546	874	620	216	463	211	289	195	375	82	220	411	220	288	221	328	91	0.27	0.25	0.36	0.33	174.5	117.6
16	45.0	0.2	10.23	42.0	347	2782	6.29	294	297	295	298	378	413	1391	823	568	1423	841	582	1009	685	258	471	237	353	227	417	86	263	469	247	350	255	421	88	0.27	0.25	0.43	0.41	175.7	121.2
17	45.1	0.2	10.33	84.4	352	4790	6.20	351	356	353	358	430	449	1659	980	679	1711	1003	708	1092	782	278	504	258	399	244	449	85	287	464	274	409	283	417	91	0.29	0.25	0.43	0.42	212.1	146.8
18	54.9	39.9	3.46	207.8	246	15760	6.22	271	278	276	282	335	335	1049	610	438	1096	638	458	723	520	218	255	231	287	207	218	87	238	317	247	311	251	293	96	0.26	0.24	0.35	0.34	131.6	94.5
19	39.8	0.5	8.93	94.2	268	5612	6.37	191	198	192	199	313	311	962	578	384	975	579	396	750	496	214	258	222	269	197	230	88	241	299	244	303	246	285	100	0.26	0.23	0.46	0.42	121.8	81.0
20	54.9	0.5	12.31	89.7	506	6170	6.40	201	203	202	204	282	283	921	547	374	927	549	378	632	428	212	392	217	323	199	339	87	239	431	243	358	247	394	100	0.24	0.23	0.41	0.39	114.7	78.5
21	54.9	0.5	12.31	260.0	504	20000	6.42	187	188	187	188	288	303	848	494	354	859	499	360	585	413	164	248	178	269	160	216	88	194	302	203	301	204	280	101	0.25	0.24	0.40	0.40	103.1	74.0
22	60.0	55.0	1.30	35.6	112	1864	5.56	354	357	374	374	420	483	1293	761	532	1420	853	567	983	723	209	306	204	245	195	250	88	233	319	234	282	232	278	105	0.29	0.27	0.34	0.32	183.6	128.5
23	60.1	55.0	1.30	14.5	114	1252	5.58	197	239	359	361	411	421	1291	765	525	1444	862	582	939	664	237	356	234	270	224	290	89	262	345	251	307	255	303	106	0.26	0.25	0.36	0.34	184.0	126.3
24	60.0	55.0	1.32	14.4	115	1																																			



**Brake Performance Study Attachment 4: Dynamometer Testing Report: Downhill Braking
Simulation Test– 2001 Ford Excursion with Limousine Conversion, 13565 lbs**

Schoharie, NY

HWY19H001

NATIONAL TRANSPORTATION SAFETY BOARD

SCHOHARIE, NY DOWNHILL BRAKING SIMULATION TEST

Client NTSB Acquisition and Lease Management Division
490 L'Enfant Plaza East SW
Washington, DC 20594-0003

Report Number 203145-3
(Used Parts - 13,565 lb GVW)

Vehicle Simulated 2001 Ford Excursion with Limousine Conversion

Front Lining Edge Code MPV 2000-EE

Rear Lining Edge Code MPV 2000-EE

Test Completion Date 20 March 2020

Signature

Kevin C. Machus, Test Engineer
for Greening Testing Laboratories, Inc.

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Complete test report in Microsoft® Excel format available upon request.



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Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

Test Numbers	M20-064-08	
Test Program Number	3947.01.20V01 - 2001 FORD EXCURSION.TST	
Vehicle System Simulated	2001 Ford Excursion with Limousine Conversion	
Reference	Contract No. 9531BM20P0015	
Test Date(s)	20 March 2020	
Date Test Report Prepared	27 March 2020	
Test Report Prepared By	K. Machus	
Gross Vehicle Weight	13,565 lbs (per NTSB)	
Static Rolling Radius	16.1 inches (based on revolutions per mile of LT265/75R16D tires)	
Test Inertia (without loss)	379.2 slug·ft ²	
Parasitic Loss	3.0% (based on vehicle measurements)	
Test Inertia (with loss)	368.8 slug·ft ²	
Equivalent 1/2 Vehicle Weight	6,579 lbs	
	Front Disc Brake	Rear Disc Brake
Lining Edge Code	MPV 2000-EE	MPV 2000-EE
Brake Pad Part Number	Motorcraft BR1266	Motorcraft BR1275
Brake Pad FMSI® Number	7625-D756	7626-D757
Brake Configuration	dual piston, separate function caliper disc brake	dual piston, separate function caliper disc brake
Piston Diameter(s)	2 x 54 mm	2 x 46 mm
Rotor Part Number	Ford 1G3Z-1V102-AB	Ford YC3Z-2C026-BB
Brake Size (nominal)		
Rotor Diameter x Thickness	13.0 x 1.5 inches	12.8 x 1.2 inches
Rotor Mass (nominal)	20.7 kg	10.9 kg
Rotor Effective Radius	5.599 inches	5.529 inches
Wheel Rotation	right hand	left hand
Test Fixture	096622	190316
Date Parts Received	16 January 2020	16 January 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

DATA NOTES

- 1 All average and sustained values shown in this report are calculated with respect to **DISTANCE**.
- 2 The data presented in this report has been gathered as follows:

START Threshold = 50 lbf·ft of brake torque during brake apply.

AVERAGE = average value between START and STOP Threshold levels.

INITIAL Data Point = Values are taken at the point where the control level is achieved.

SUSTAINED Data = average value between the INITIAL and END data points.

END Data Point = Values are taken 0.1 seconds prior to the STOP threshold

MAXIMUM = maximum value observed in the SUSTAINED Data Interval.

STOP Threshold = brake release

FINAL temperature is the highest temperature value observed in a 4.0 second "window" beginning 1.0 seconds after brake release.

- 3 Brake application is initiated when the control temperature (rotor) reaches the desired initial brake temperature.
- 4 Cooling Air Temperature = 80°F ($\pm 5^\circ\text{F}$)
- 5 Cooling Air Velocity = 20 mi/h for front brake, 2 mi/h for rear brake as determined by cooling curves conducted on a 2001 Ford Expedition.
- 6 For all stops which show "zero" (0) or negative values for some of the computed pressure, torque or coefficient values:

These stops achieved final speed but did not achieve the torque level required for the particular stop. Since the START data and STOP data thresholds were satisfied, deceleration rate, distance, time to stop, etc., are accurate values, and can be used for data comparison purposes.

The presence of "zero" values generally is caused by lack of brake performance, resulting in a "clamp" condition. "Clamp" condition is defined by the brake calling for the maximum pressure the test section allows ("clamp" pressure) and the brake being unable to attain the deceleration rate required in the test section at that pressure.

- 7 Thermocouple locations and depths:

Front Rotor: Center of inboard rubbing track at a depth of 0.040 inches

Front Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches

Front Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches

Rear Rotor: Center of inboard rubbing track at a depth of 0.040 inches

Rear Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches

Rear Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

COMPUTED DATA DESCRIPTIONS

SPEED

INIT = Speed start threshold is achieved.

FNL = Brake release speed

TIME

STOP = Time elapsed between start threshold and brake release

REPT = Time elapsed between cycles

DISTANCE

STOP = Distance elapsed between start threshold and brake release

REPT = Distance elapsed between cycles

DECCEL

AVG = Average deceleration measured from start threshold to brake release

PRESSURE

AVERAGE = Average pressure from start threshold to brake release

SUSTAINED = Average pressure from point control level is achieved to brake release

MAXIMUM = Maximum pressure from start threshold to brake release

TORQUE

AVERAGE = Average torque from start threshold to brake release

SUSTAINED = Average torque from point control level is achieved to brake release

MAXIMUM = Maximum torque from start threshold to brake release

TEMPERATURE

INT = Temperature at start threshold

MAX = Maximum temperature between start threshold and 0.1 seconds after brake release

FLUID DISPLACEMENT

MAX = Maximum fluid displacement between start threshold and brake release

FRICITION COEFFICIENT

SUST = Friction coefficient (μ) calculated using the following formula:

$$\mu = \frac{\text{Sustained Torque (lbf}\cdot\text{ft) / Rotor Effective Radius (ft)}}{\text{Sustained Pressure (lbf/in}^2\text{) * Total Caliper Piston Area (in}^2\text{)}} * 0.5$$

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

TEST ROUTE - NEW AMSTERDAM TO SCHOHARIE NEW YORK

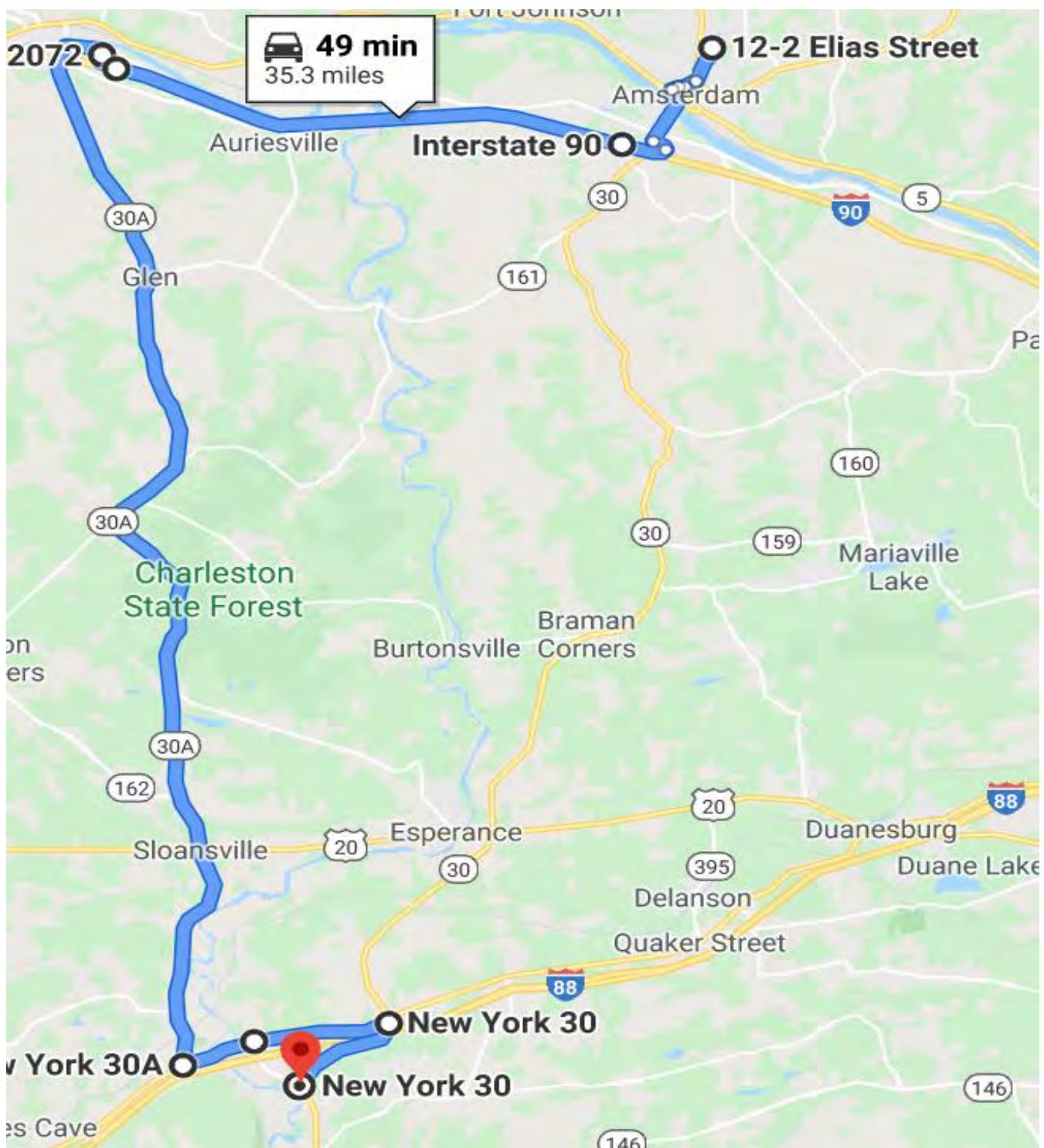
Cycle	Mile	Latitude (GPS)	Longitude (GPS)	Altitude (ft)	Grade Input (%g)	Braking Deceleration (g)	Apply Speed (mi/h)	Release Speed (mi/h)
0	0.0	42.94908	-74.18265	574.1	—	—	—	—
1	10.8	42.94409	-74.35478	293.3	-0.14%	0.2	60	30
2	11.1	42.94722	-74.35869	296.3	0.21%	0.2	30	20
3	11.2	42.94865	-74.35809	288.1	-1.69%	0.2	20	0
4	11.7	42.94957	-74.36914	287.4	0.28%	0.2	40	0
5	14.6	42.91169	-74.35237	469.5	0.40%	0.2	55	40
6	15.6	42.89860	-74.34632	647.3	5.20%	0.2	55	35
7	15.7	42.89696	-74.34592	666.0	0.80%	0.2	35	15
8	17.0	42.87979	-74.34609	802.8	0.90%	0.2	55	40
9	17.7	42.86949	-74.34253	871.7	5.27%	0.2	55	50
10	18.4	42.86000	-74.33732	1016.7	3.88%	0.2	50	40
11	20.4	42.83745	-74.35430	1200.1	1.12%	0.2	55	40
12	21.8	42.82276	-74.33815	1259.2	1.09%	0.2	55	30
13	22.6	42.81189	-74.33648	1295.6	-1.10%	0.2	55	40
14	24.5	42.78596	-74.33829	1284.1	0.19%	0.2	55	40
15	25.3	42.77450	-74.33766	1075.5	-4.69%	0.2	55	40
16	25.7	42.76815	-74.33585	955.1	-5.45%	0.2	45	0
17	26.5	42.75714	-74.33045	681.8	-10.46%	0.2	45	0
18	29.4	42.71859	-74.33721	676.2	0.59%	0.2	55	40
19	30.4	42.70533	-74.33539	633.2	2.50%	0.2	40	0
20	31.5	42.71097	-74.31464	681.4	3.31%	0.2	55	0
21	33.6	42.71540	-74.27608	1183.4	4.71%	0.2	55	0
2 MINUTE STOP - BRAKES RELEASED								
22	33.9			1078.1	-5.92%	0.2	60	55
23	34.0			1033.7	-5.92%	0.2	60	55
24	34.2			989.3	-5.92%	0.2	60	55
25	34.3			944.9	-5.92%	0.2	60	55
26	34.5			900.6	-5.92%	0.2	60	55
27	34.6			856.2	-5.92%	0.2	60	55
28	34.8			811.8	-5.92%	0.2	60	55
29	34.9			767.4	-5.92%	0.2	60	55
30	35.0			723.1	-5.92%	0.2	60	55
31	35.2	42.70259	-74.29994	678.5	-5.95%	0.2	60	55
32	35.4	42.70043	-74.30176	628.3	-5.40%	0.2	50	0

*NOTE: Test route was derived using the following criteria:

Speed limit and warning speeds were identified along the simulated route and used to control speed in the simulations. At Stop signs and controlled signalized intersections along the simulated route complete stops were modeled. At last stop before the final downhill descent a completed stop of 2 minutes was modeled. During downhill descents if the speed exceeded the posted speed limit by 5 mph braking at a maximum of 0.2 g was applied to reduce the speed to the speed limit.

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

TEST ROUTE - OVERVIEW MAP

Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

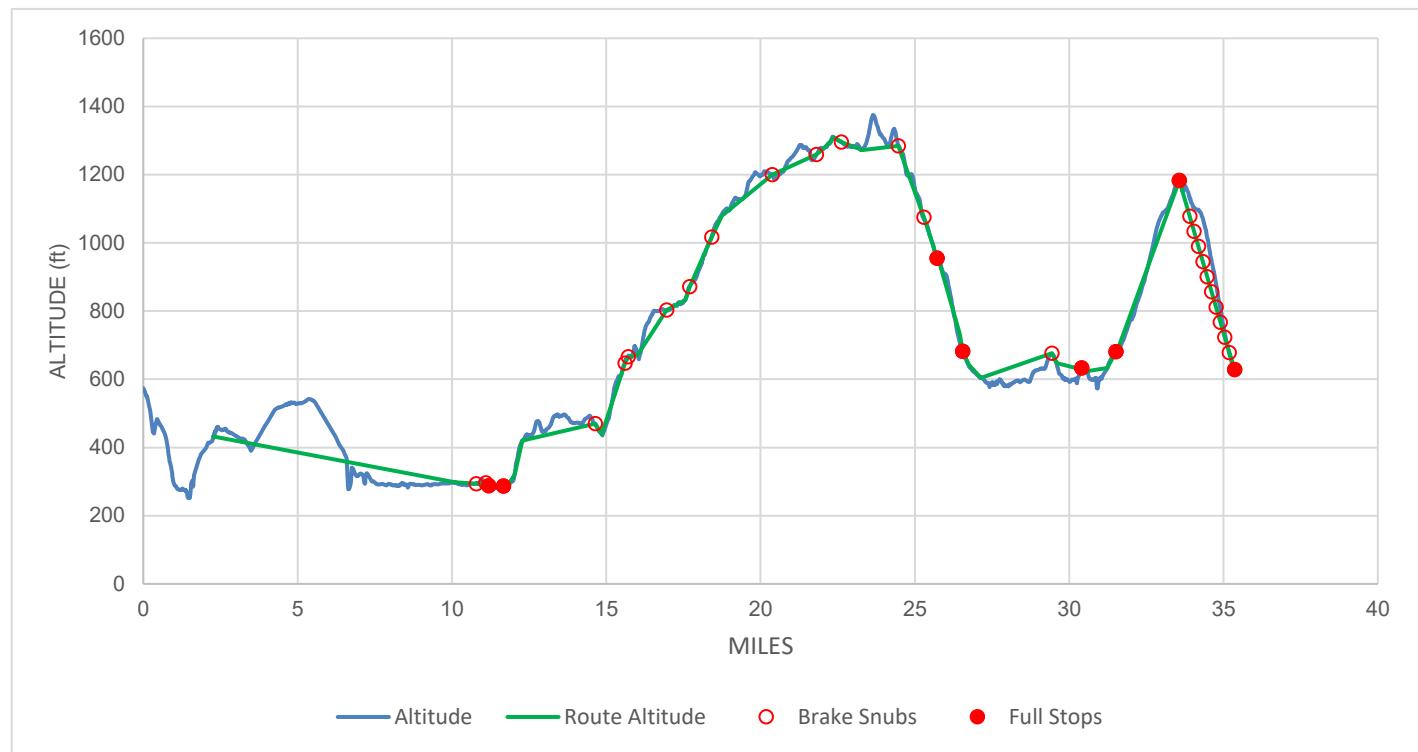
NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

TEST ROUTE - PROFILE



Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

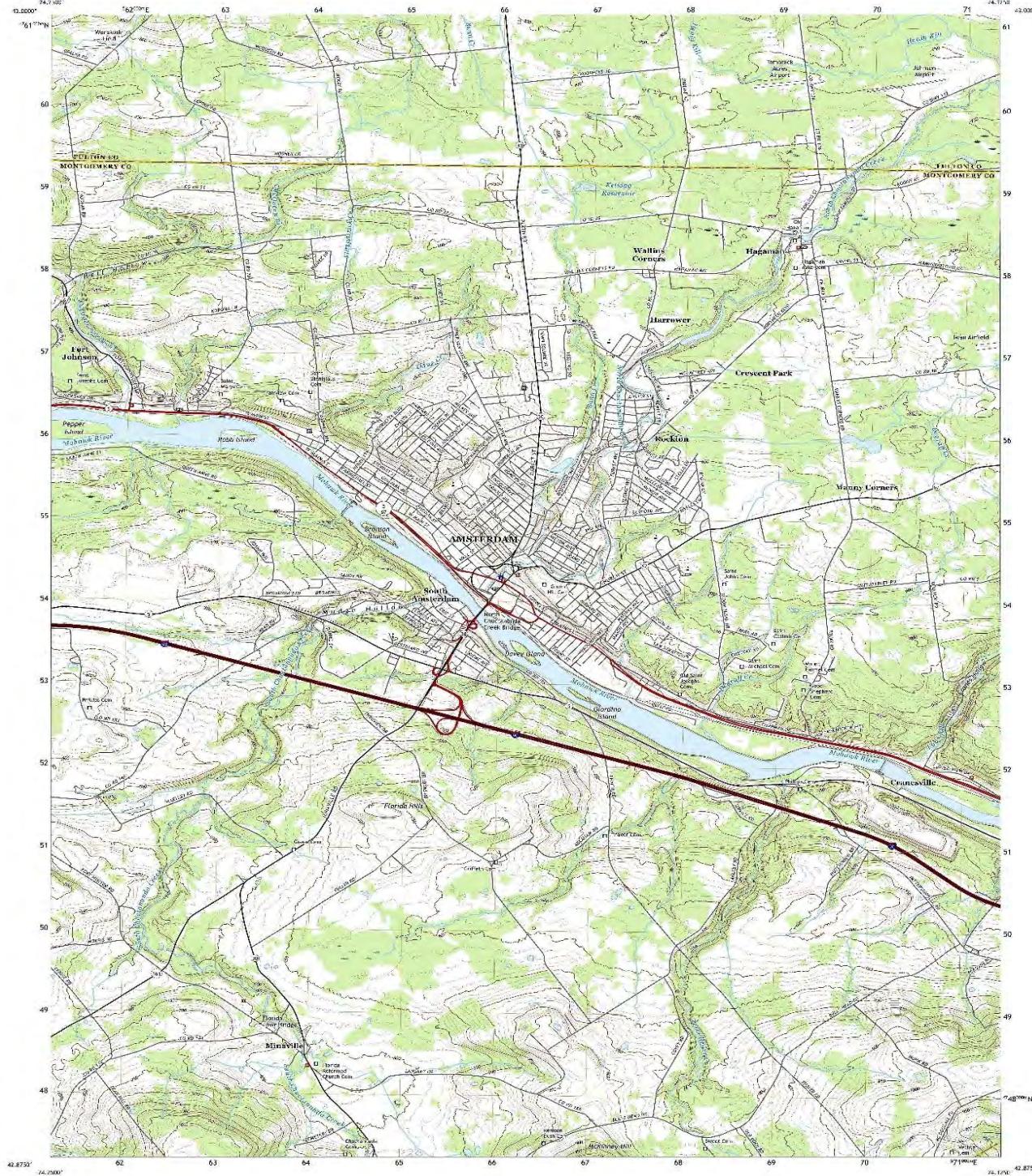
TEST ROUTE - AMSTERDAM QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



AMSTERDAM QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

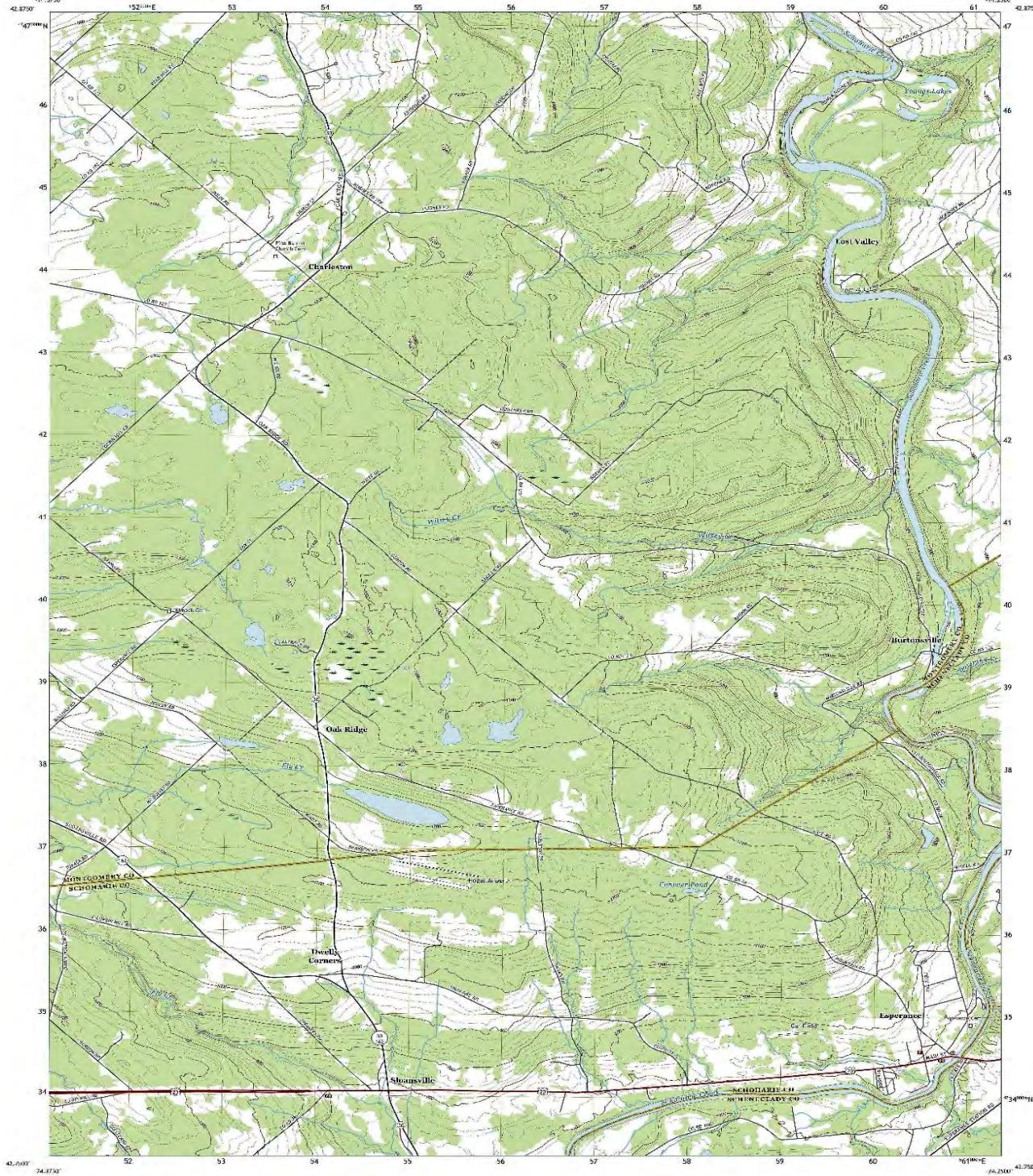
TEST ROUTE - ESPERANCE QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



ESPERANCE QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

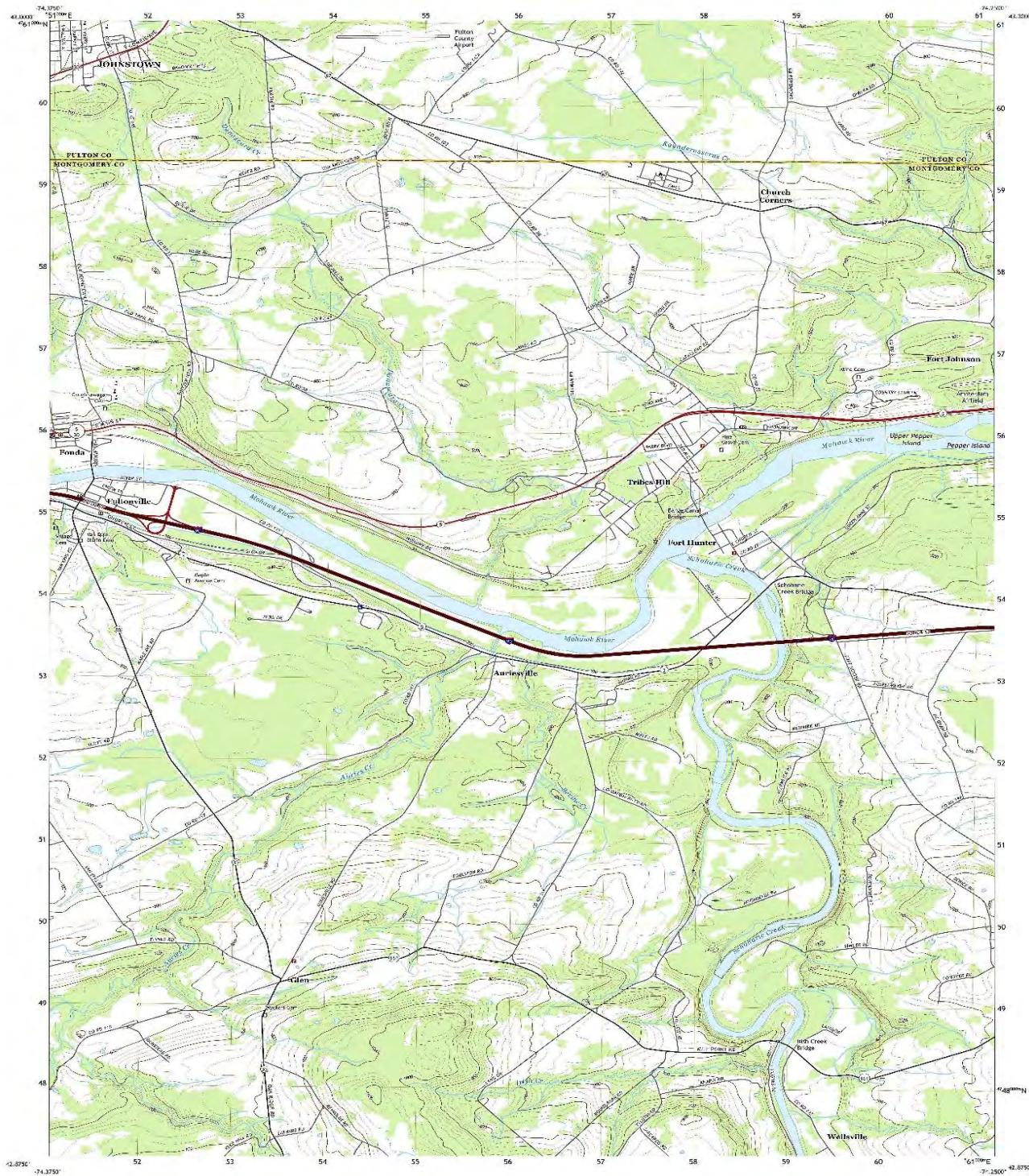
TEST ROUTE - TRIBES HILL QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



TRIBES HILL QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

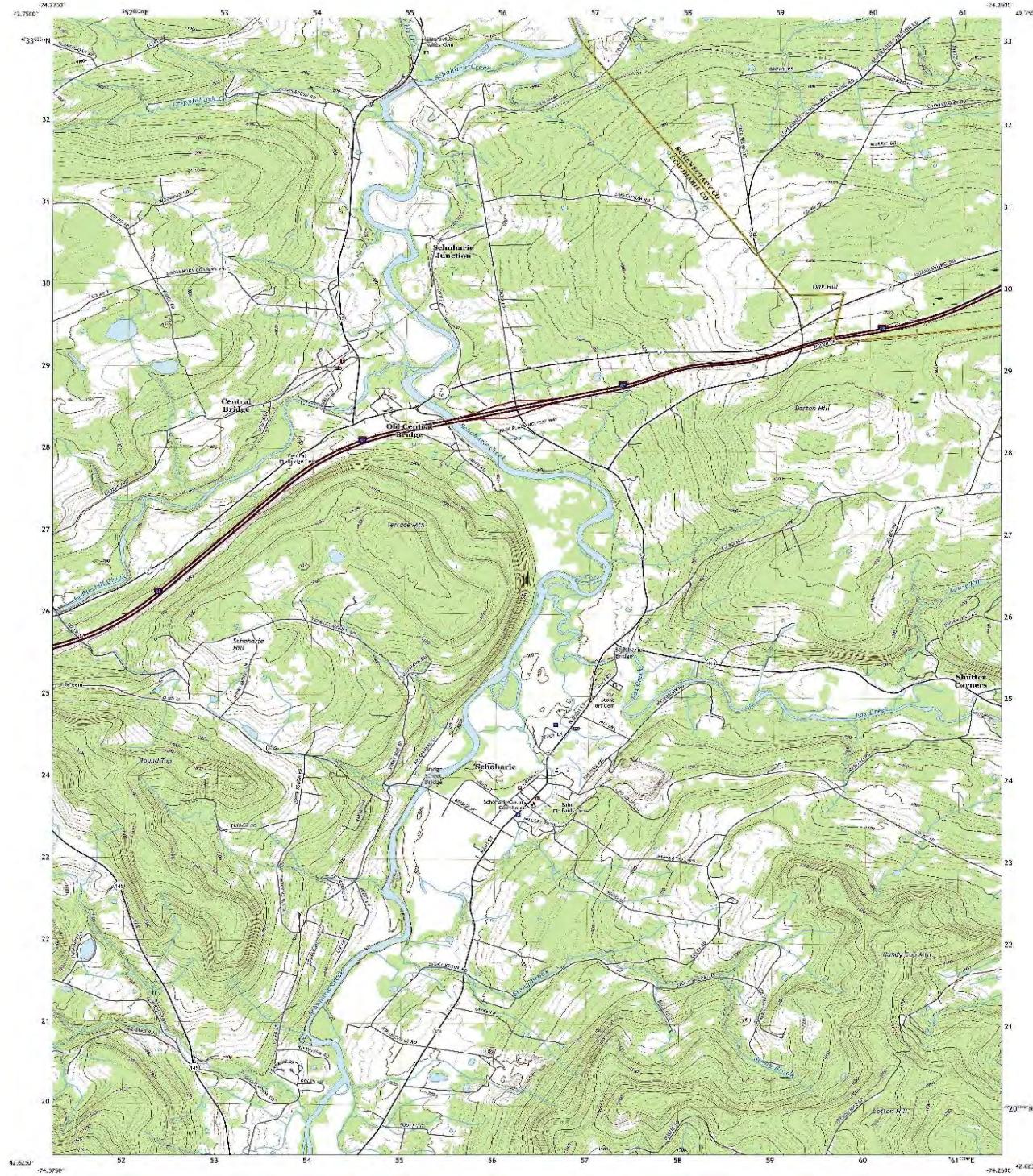
TEST ROUTE - SCHOHARIE QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



SCHOHARIE QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

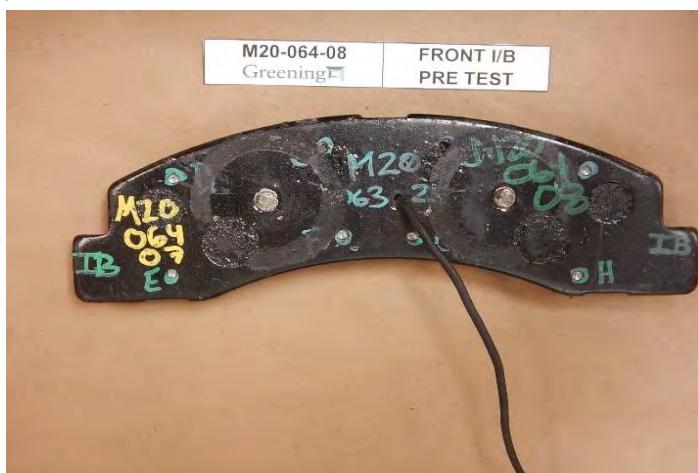
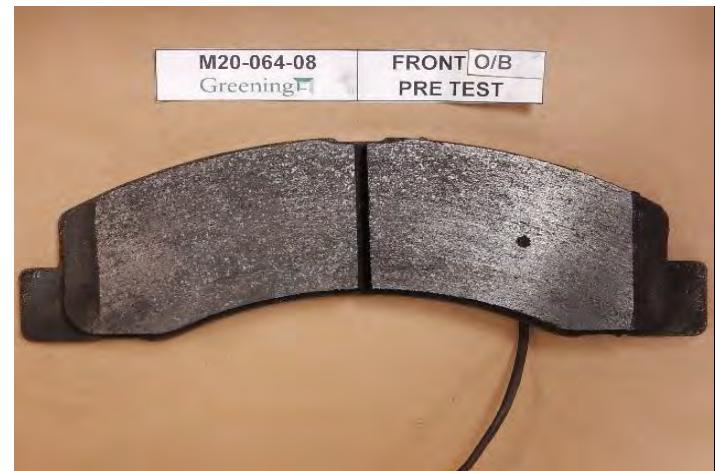
NTSB

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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

PRE TEST PHOTOGRAPHS - FRONT BRAKE



Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

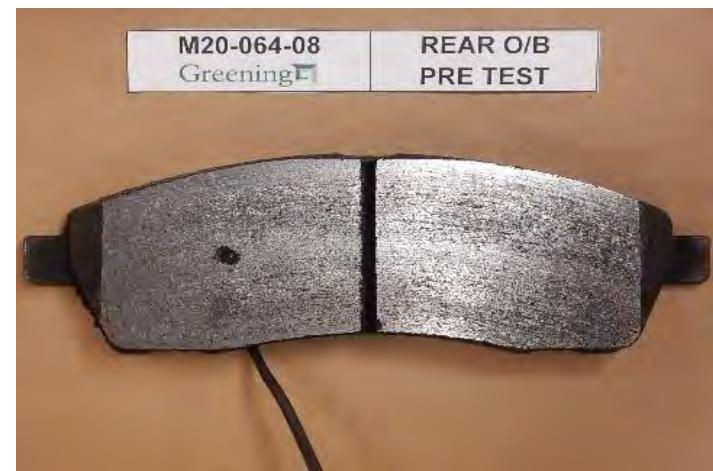
NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

PRE TEST PHOTOGRAPHS - REAR BRAKE



Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

POST TEST VISUAL INSPECTION - FRONT BRAKE

Inboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is blue/grey in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

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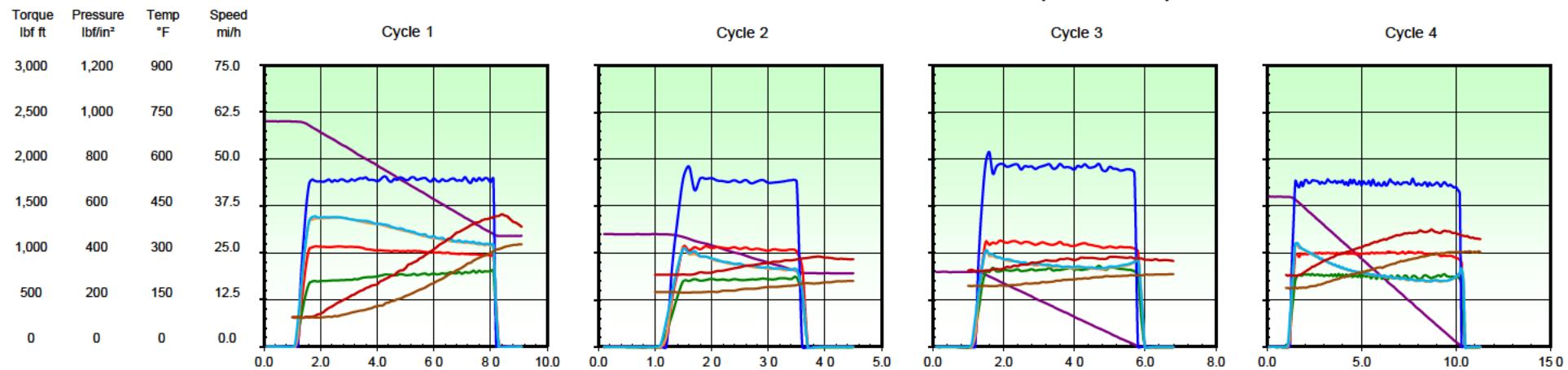
PHOTOGRAPHS



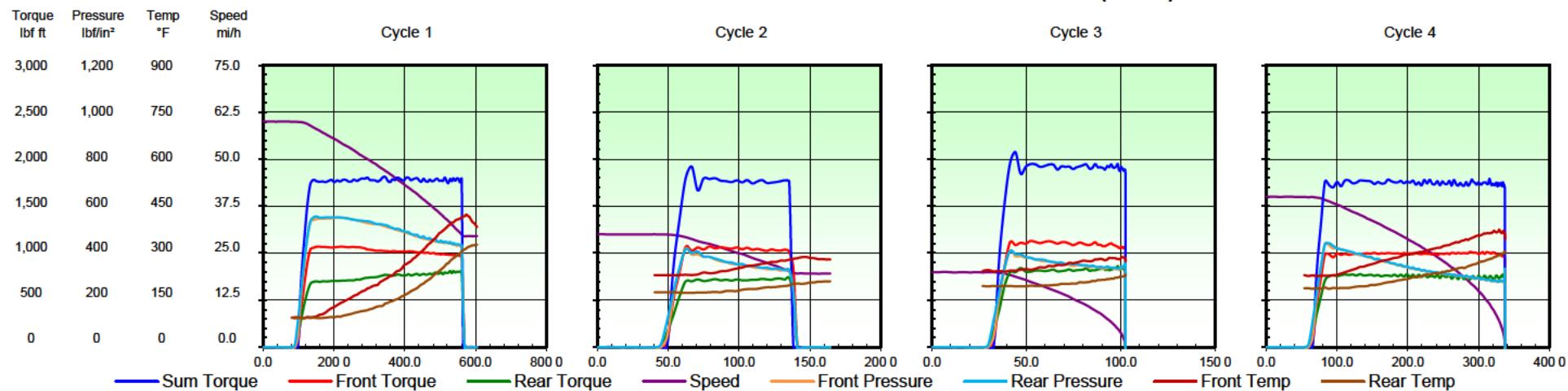
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

GRADE SIMULATION CYCLES IN-STOP DATA vs. TIME (SECONDS)



GRADE SIMULATION CYCLES IN-STOP DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-08

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

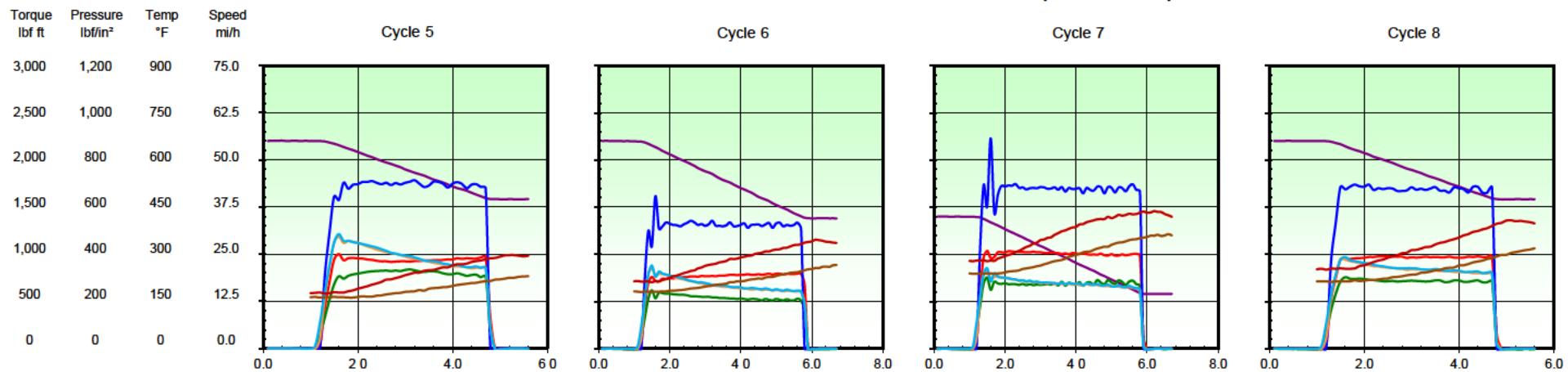
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Test Report Date: 20 March 2020

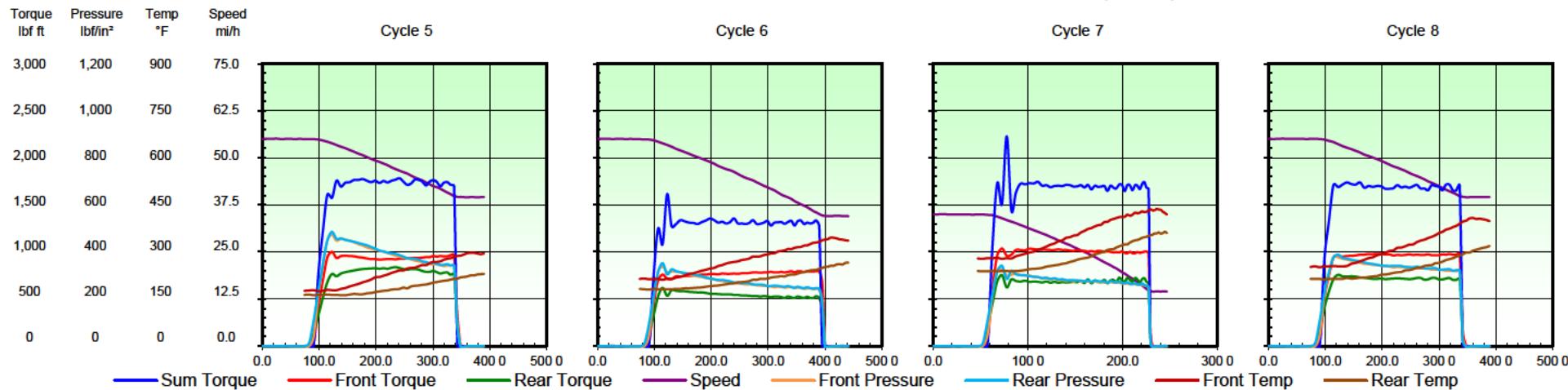
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

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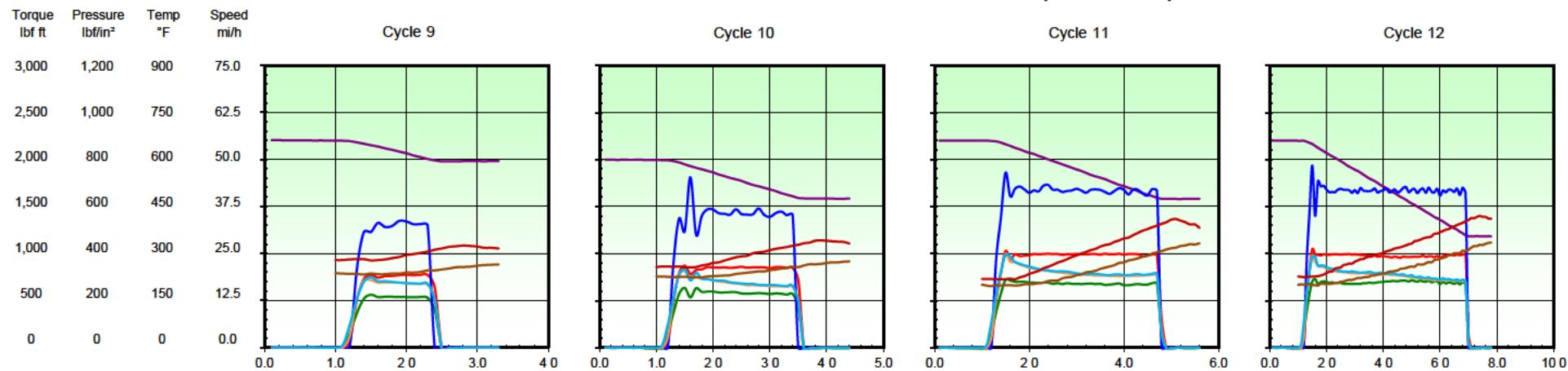
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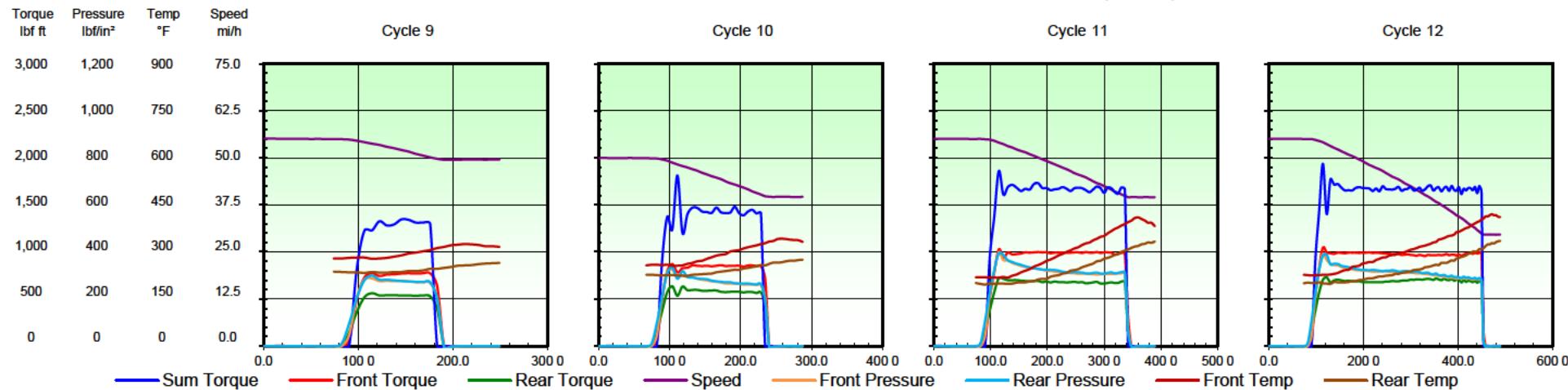
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

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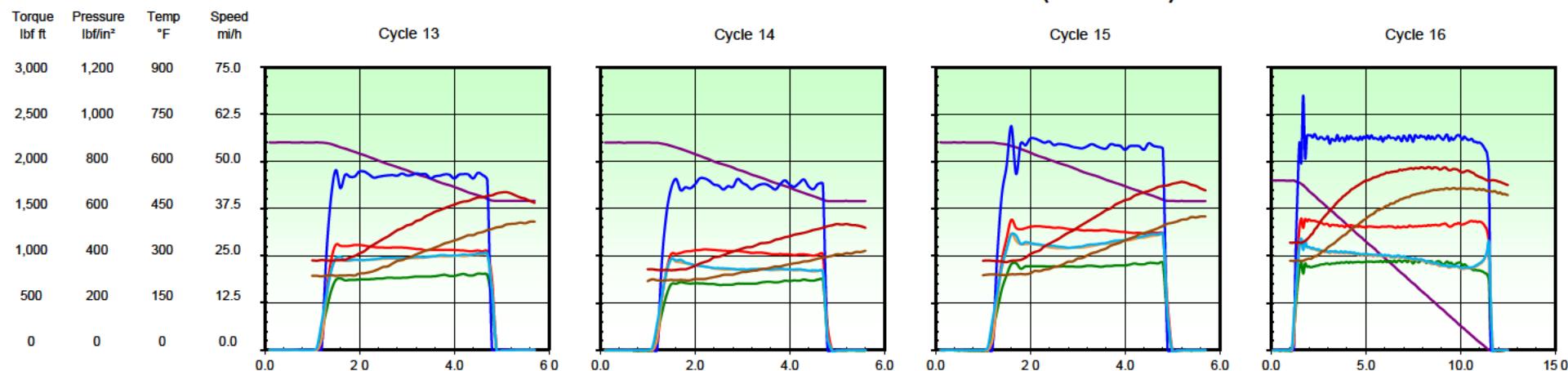
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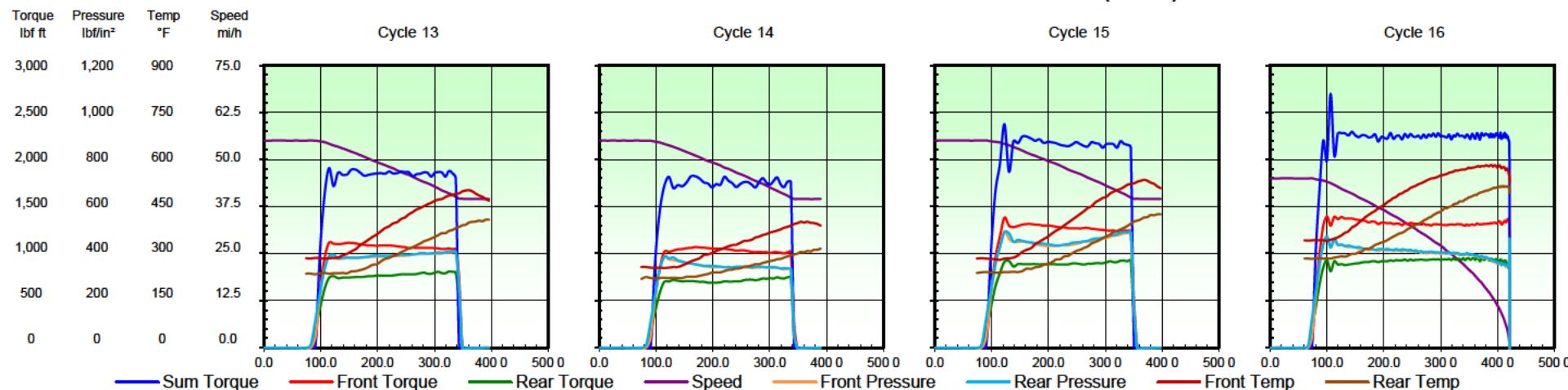
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

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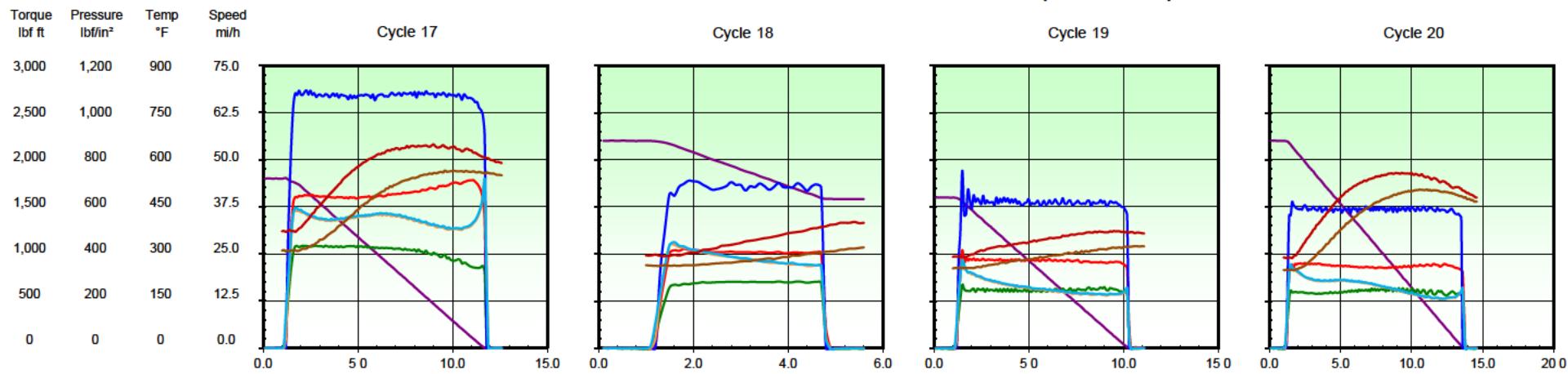
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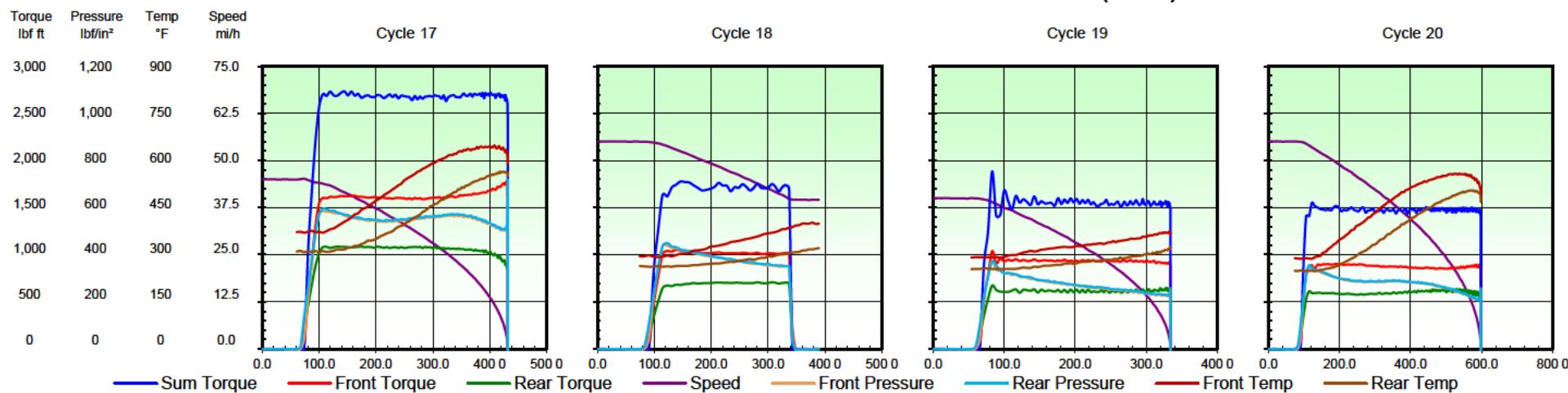
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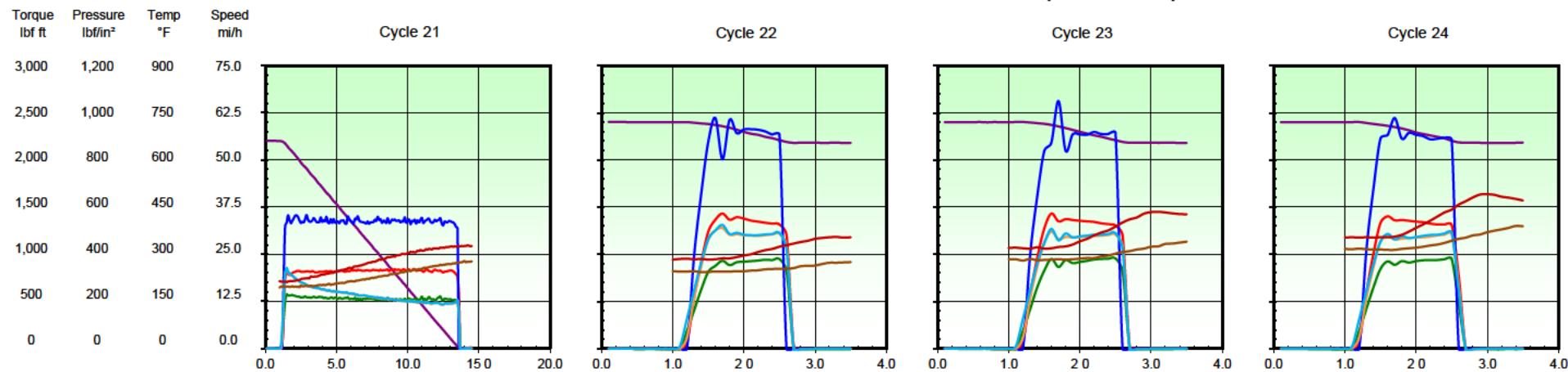
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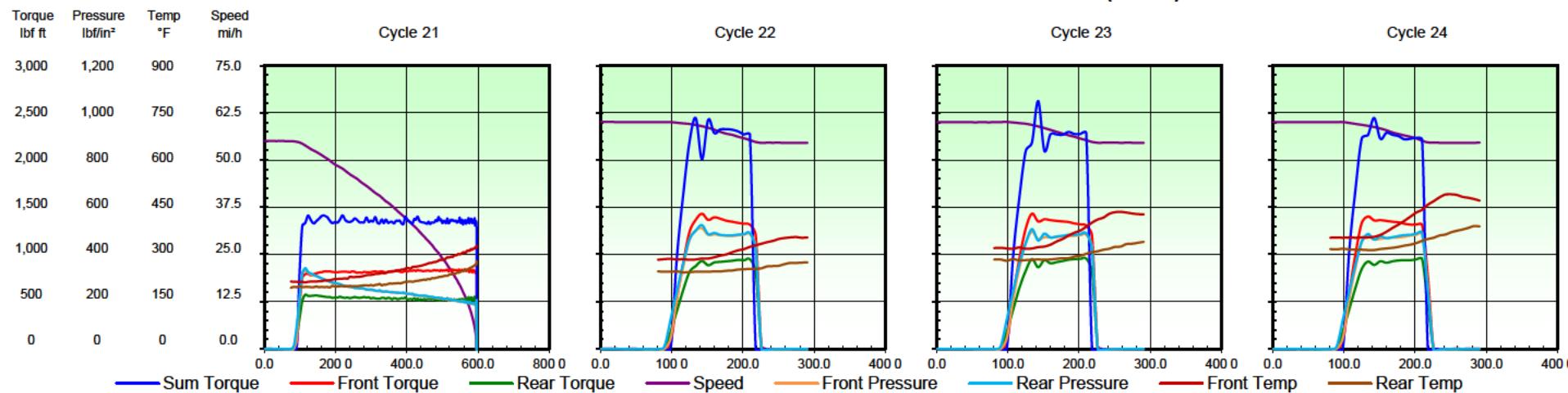
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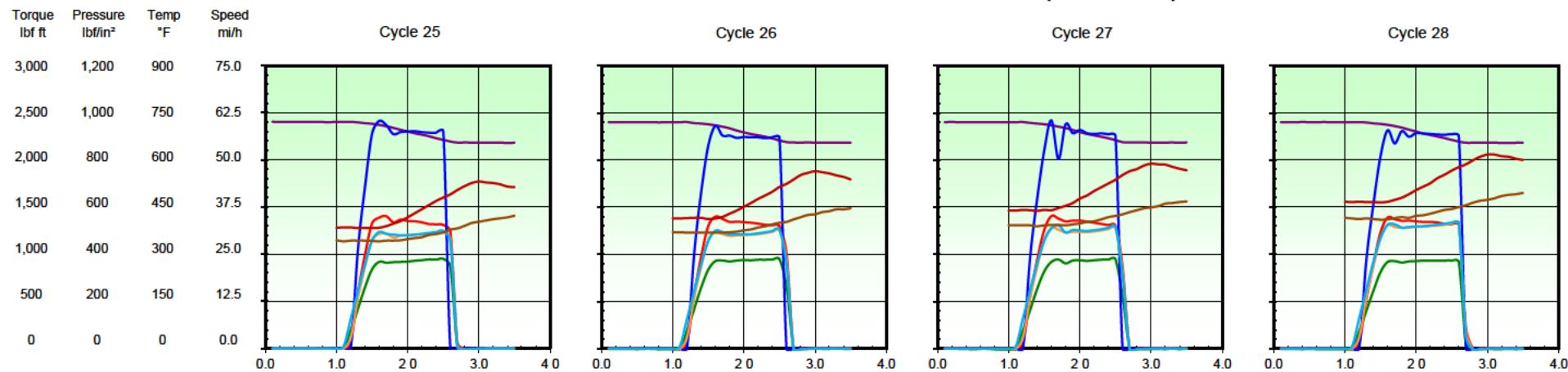
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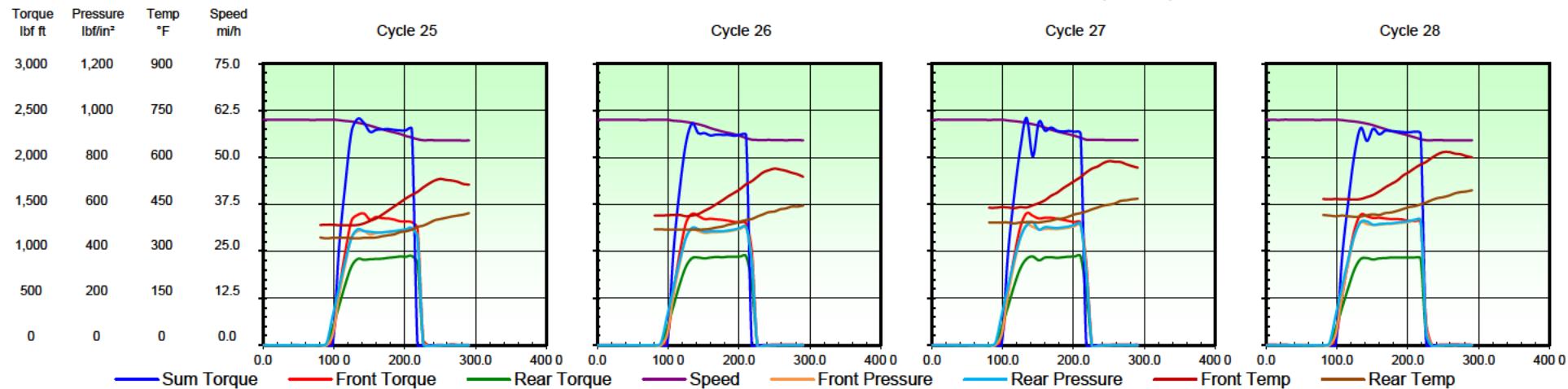
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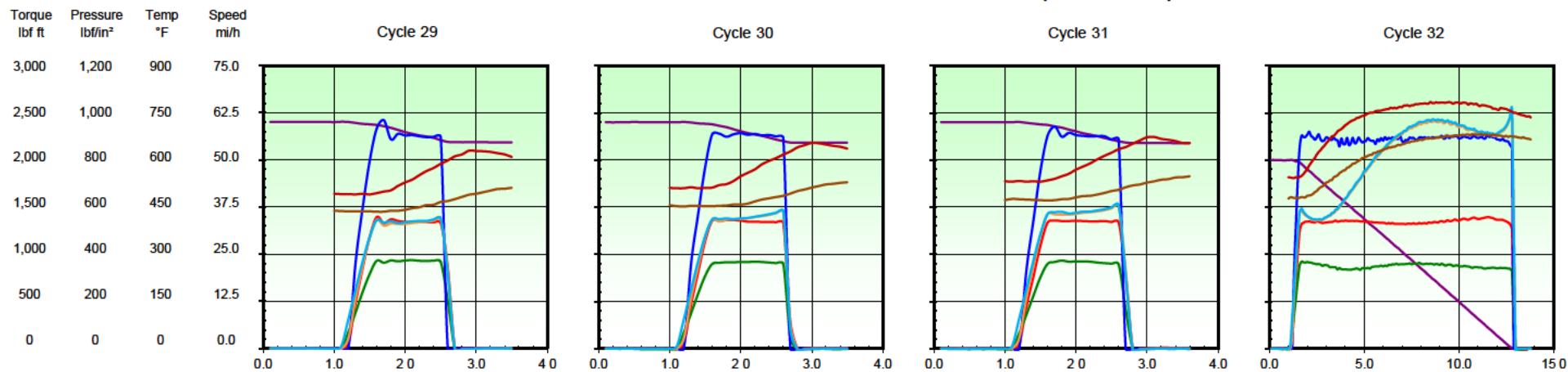
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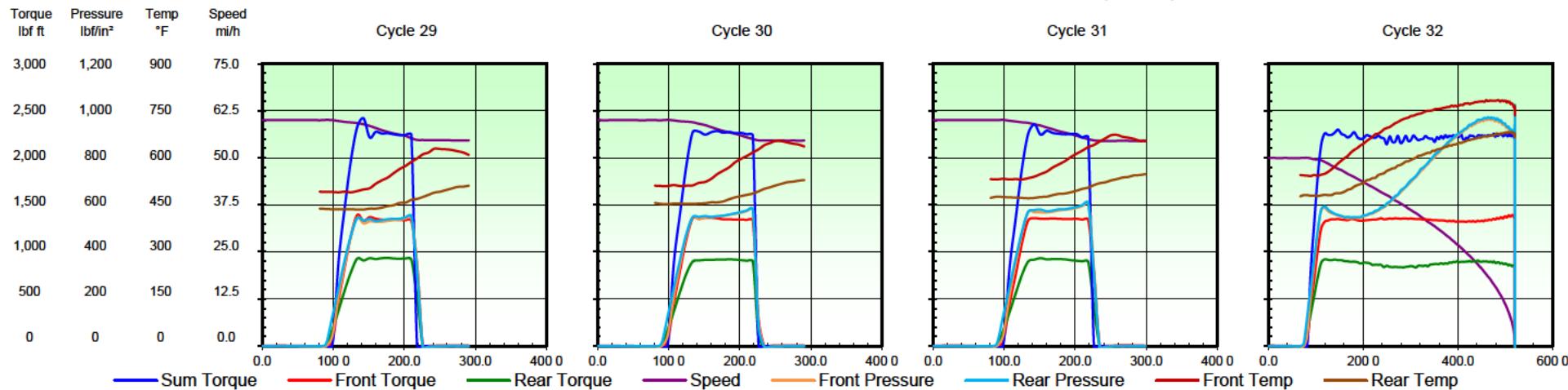
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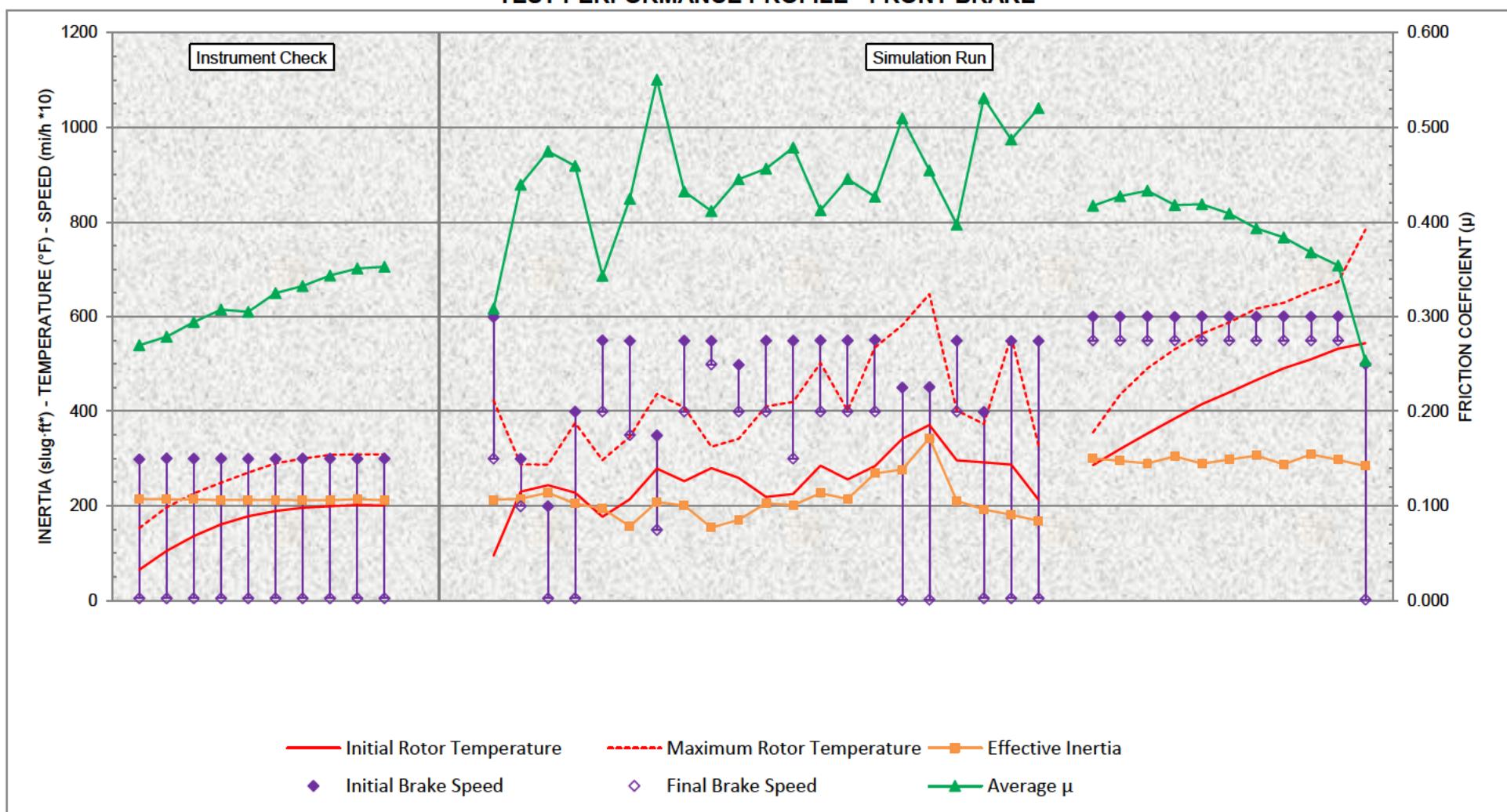
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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-08

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

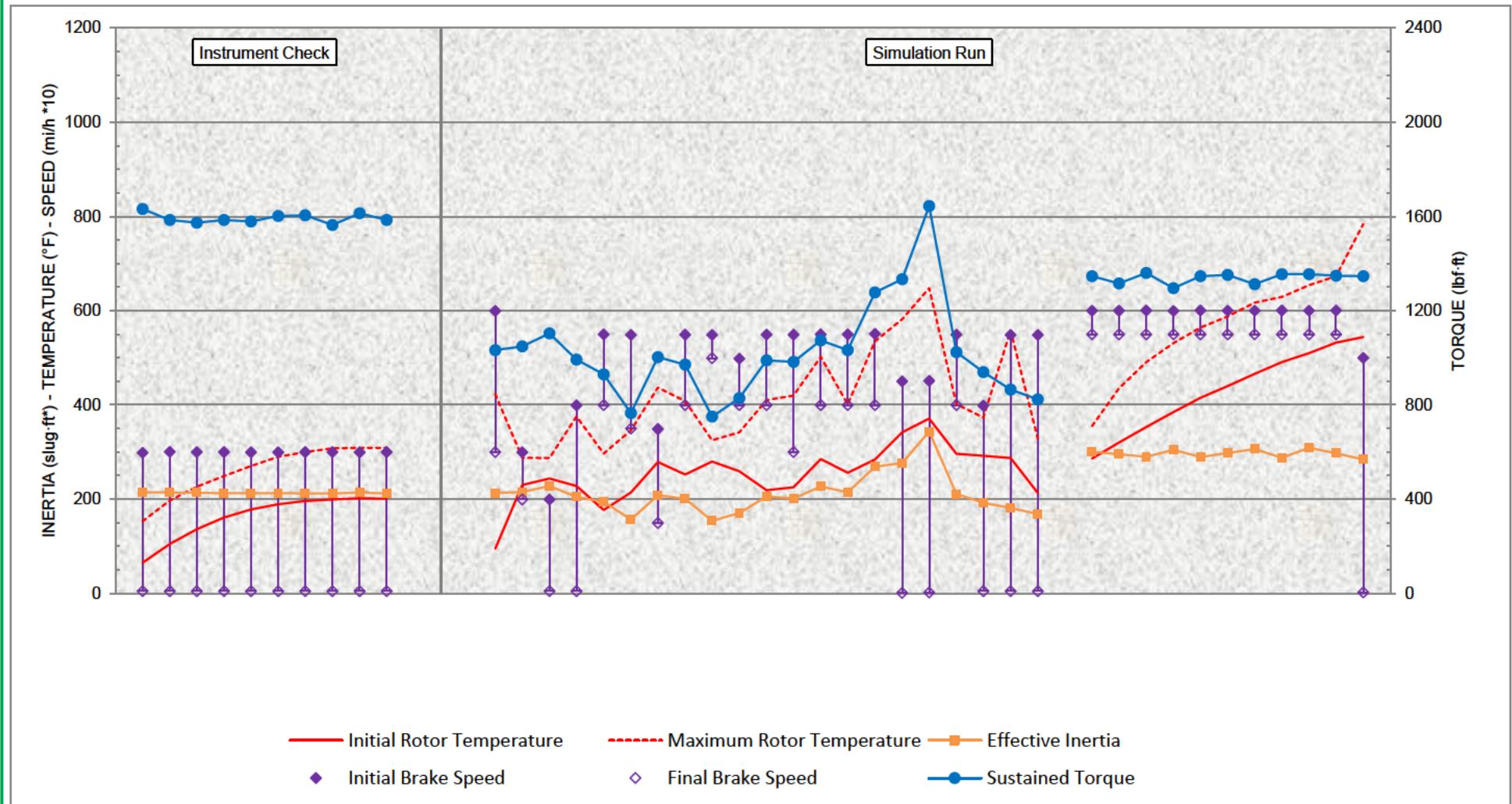
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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
 2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

TEST PERFORMANCE PROFILE - FRONT BRAKE



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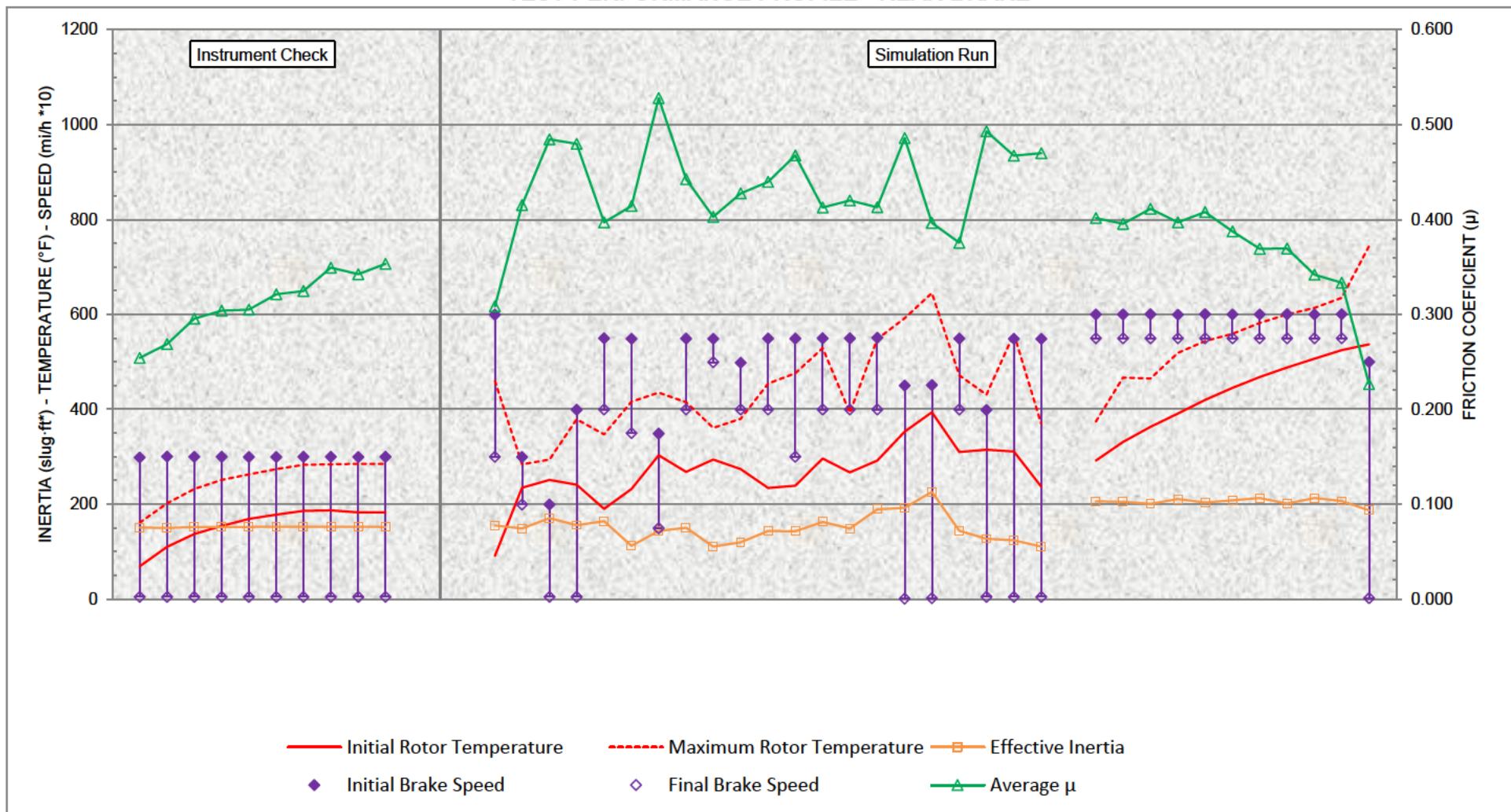
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Report Number: 203145-3

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
 2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-08

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

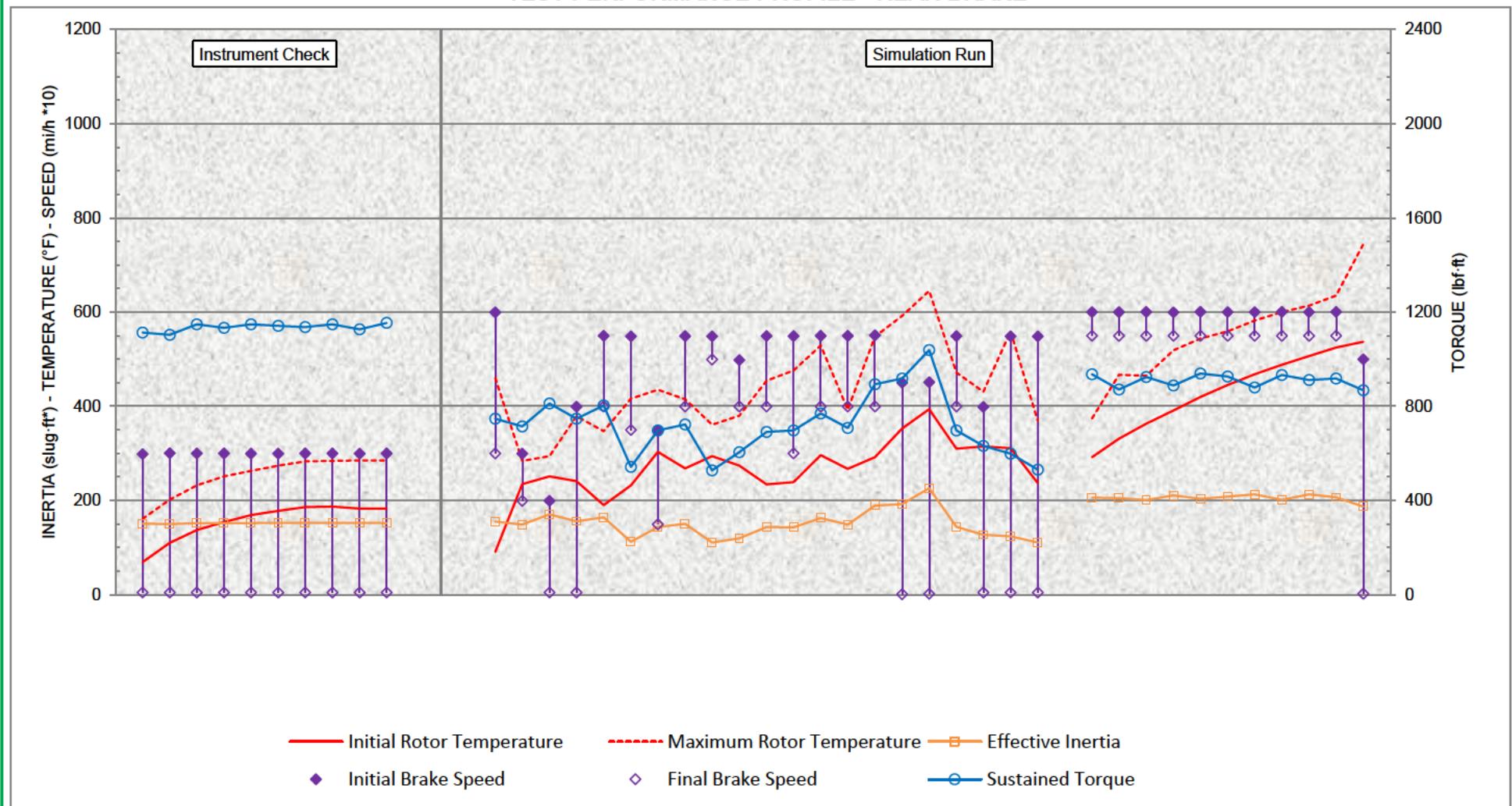
Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

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Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
 2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-08

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

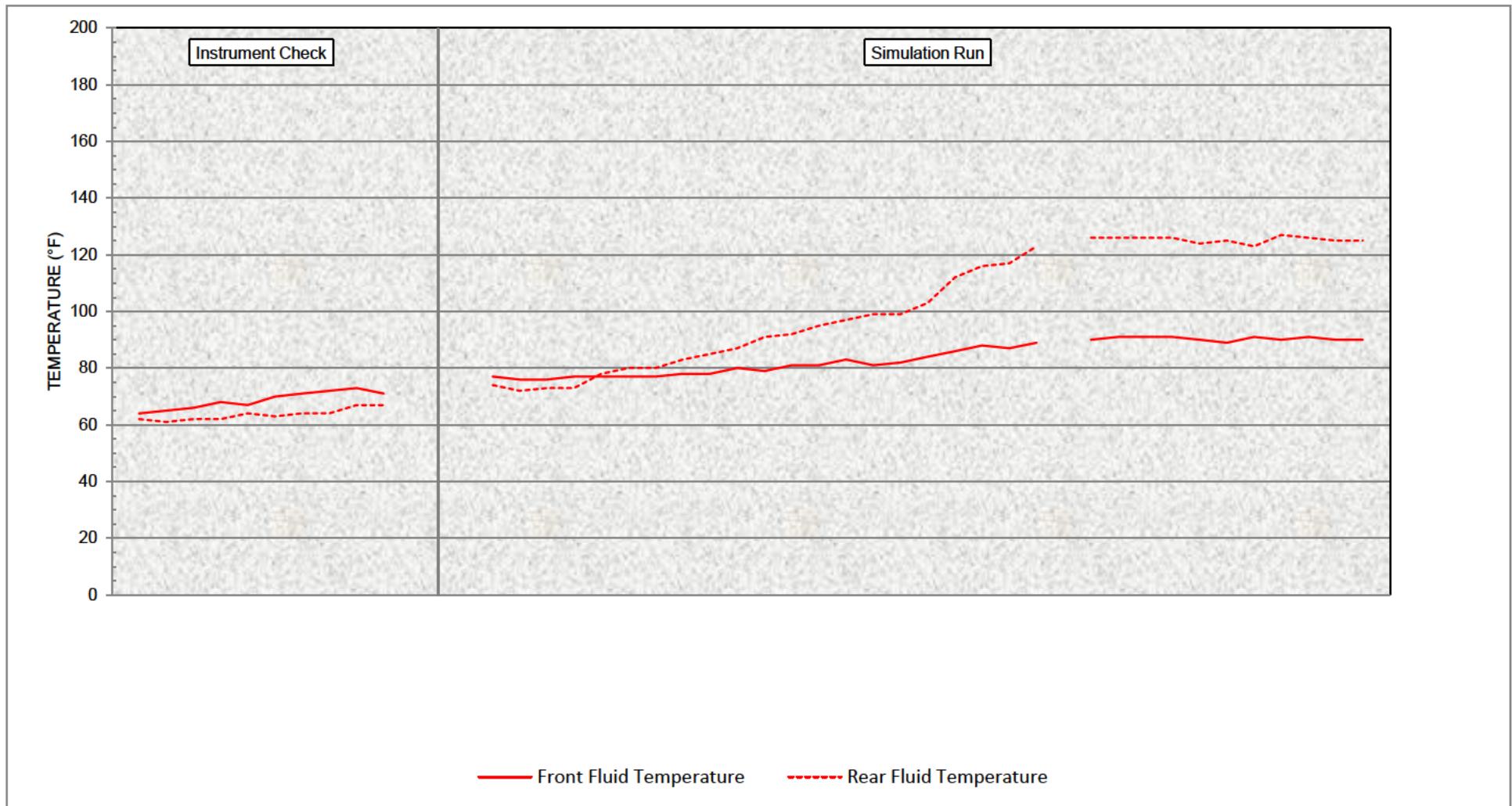
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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

BRAKE FLUID TEMPERATURE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-08

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

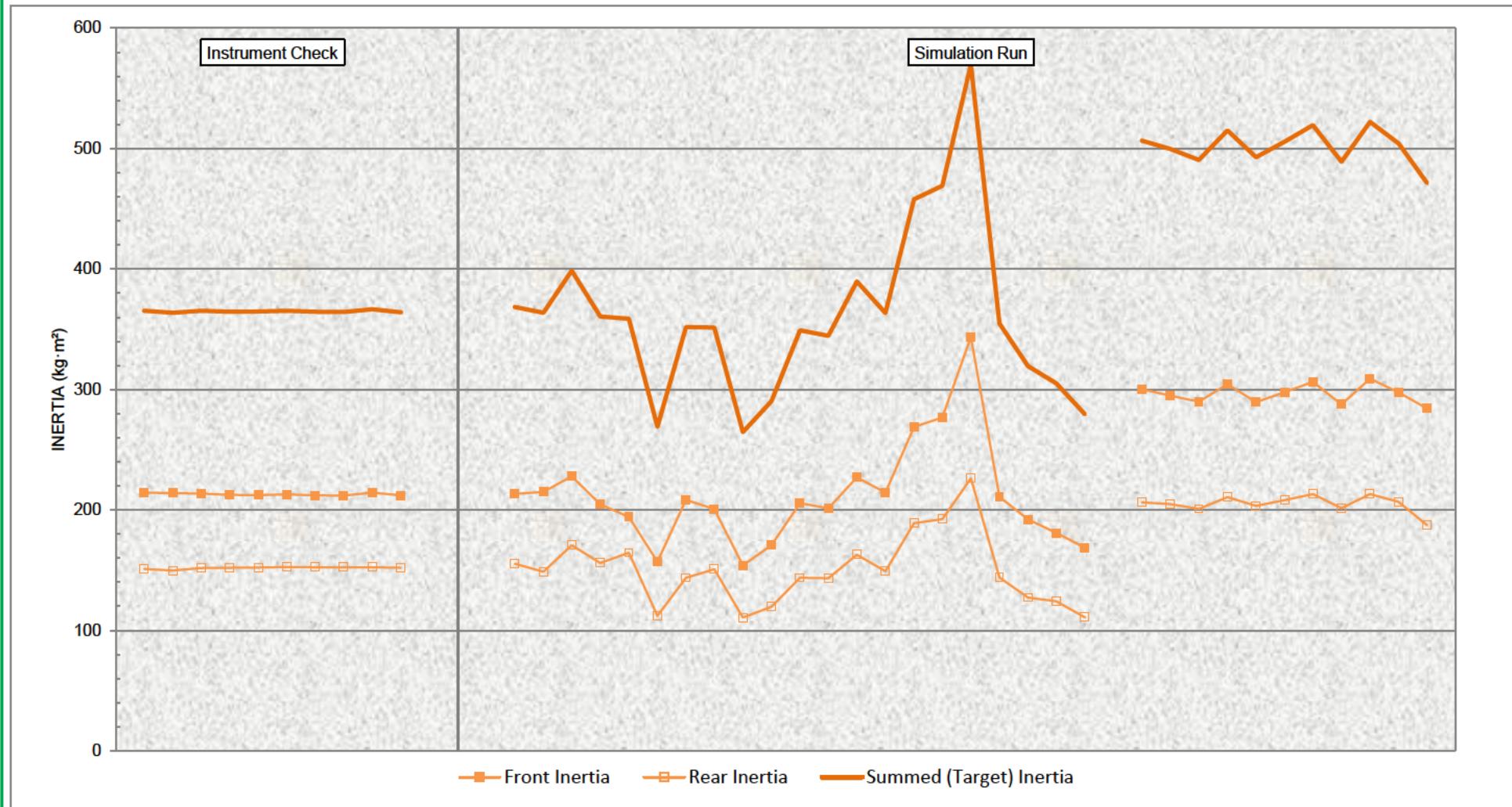
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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

INERTIA DISTRIBUTION



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-08

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

Report Number: 203145-3

Test Report Date: 20 March 2020

Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DISTANCE		DECCEL		PRESSURE						TORQUE						TEMPERATURE												FLUID		FRICTION		INERTIA	
									Avg	Average	Sustained	Maximum	Average			Sustained	Maximum	Rotor	Front		Rear		O/B	Fluid	Rotor	Front		Rear		Displace.	Coeff.							
	Init	FNL	Stop	Rept	Stop	Rept	Dist	Front	Front	Front	Front	Front	Front	Front	Front	Sum	Front	Front	Front	Front	Front	Int	Max	Int	Max	Int	Max	Int	Max	Int	Max	Front	Front	Front	Front			
	mi/h		s		ft		ft/s ²									lbf/in ²						lbf ft										in ³	μ	slug ft ²				

INSTRUMENT CHECK

30 mi/h - 0.31g Deceleration Rate - 200°F Initial Rotor Temperature

1	29.8	0.5	4.56	0.0	108	0	8.87	903	915	913	922	1046	1060	2414	1417	997	2745	1632	1113	1706	1172	65	153	68	134	64	64	69	161	64	139	69	134	62	2.75	1.93	0.27	0.25	214.4	150.9	
2	30.0	0.5	4.62	58.1	110	58	8.79	830	839	858	865	910	923	2384	1402	981	2689	1585	1104	1679	1154	105	197	92	165	88	153	65	110	202	95	171	95	160	61	0.89	0.38	0.28	0.27	214.0	149.8
3	30.0	0.5	4.61	60.0	110	60	8.78	601	645	807	818	868	896	2392	1398	994	2721	1573	1148	1655	1180	136	226	119	190	114	181	66	137	232	119	194	114	184	62	0.46	0.31	0.29	0.30	213.6	151.8
4	30.0	0.5	4.59	60.1	109	60	8.85	717	728	778	785	843	873	2404	1402	1002	2718	1585	1133	1655	1204	161	249	142	209	134	205	68	154	251	143	213	137	203	62	0.43	0.29	0.31	0.30	212.6	152.0
5	30.0	0.5	4.60	60.1	109	60	8.86	555	601	781	793	821	849	2409	1403	1006	2727	1579	1148	1641	1180	178	270	160	225	149	223	67	169	263	156	226	151	217	64	0.41	0.28	0.31	0.30	212.3	152.3
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8	30.0	0.5	4.57	66.8	109	67	8.89	531	560	687	692	797	838	2415	1404	1010	2712	1564	1148	1673	1207	199	308	193	257	174	253	72	187	284	177	243	174	239	64	0.40	0.27	0.34	0.35	211.9	152.5
9	29.9	0.5	4.57	72.1	109	72	8.85	684	685	694	693	786	811	2419	1414	1005	2741	1614	1127	1661	1192	202	309	195	258	175	253	73	183	285	176	242	174	239	67	0.40	0.27	0.35	0.34	214.3	152.3
10	30.0	0.5	4.56	70.9	108	71	8.92	670	680	678	688	778	818	2421	1410	1010	2739	1585	1154	1673	1237	201	309	198	262	177	255	71	183	285	176	243	171	241	67	0.40	0.27	0.35	0.35	212.1	151.9

Test Numbers: M20-064-08

Report Number: 203145-3

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DISTANCE		DECEL		PRESSURE								TORQUE								TEMPERATURE												FLUID	FRICTION	INERTIA		
									Avg	Average	Sustained	Maximum					Sustained	Maximum	Rotor	Front		Rear				O/B	Fluid	Rotor	Front		Rear		Displace.	Coeff.							
	Init	FNL	Stop	Rept	Stop	Rept	Dist	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear							
	mi/h		s		ft		ft/s ²																																		
lbf/in ²																																									
lbf ft																																									
F																																									
in ³																																									
μ																																									
slug ft ²																																									
DOWNHILL SIMULATION TEST																																									
0.20g Deceleration Rate																																									
1	59.9	30.0	6.94	595.1	467	50440	6.20	497	501	506	510	555	586	1704	986	718	1780	1033	747	1107	832	95	423	101	320	93	327	77	91	460	92	260	99	379	74	0.34	0.25	0.31	0.31	213.3	155.2
2	29.9	19.9	2.38	48.9	91	2335	5.93	359	359	360	362	438	461	1607	950	657	1762	1048	714	1142	835	230	288	195	255	175	210	76	235	284	209	264	188	221	72	0.29	0.21	0.44	0.42	214.9	148.7
3	19.9	0.5	4.58	23.5	71	714	5.99	352	354	351	353	434	458	1781	1018	763	1916	1104	812	1225	939	244	287	215	266	195	232	76	251	294	228	273	214	249	73	0.28	0.20	0.47	0.48	227.9	170.7
4	39.9	0.5	9.06	56.6	275	2632	6.24	324	326	326	328	460	499	1678	952	725	1739	992	747	1086	897	228	375	206	369	187	305	77	241	379	230	321	219	321	73	0.30	0.21	0.46	0.48	204.6	155.9
5	54.9	39.9	3.52	214.0	251	16090	6.10	387	401	409	426	503	546	1630	882	747	1733	930	803	1113	912	177	297	188	322	163	230	77	190	347	203	321	199	284	78	0.32	0.23	0.34	0.40	194.2	164.5
6	54.9	35.0	4.55	71.1	305	5628	6.31	268	272	272	276	376	443	1264	738	527	1308	765	543	962	809	214	346	211	378	181	266	77	232	416	236	356	225	327	80	0.28	0.20	0.42	0.41	157.0	112.0
7	34.9	14.9	4.61	20.0	172	1107	6.20	272	275	275	278	376	463	1626	963	664	1700	1003	697	1352	1012	279	437	280	408	238	364	77	303	435	290	407	279	375	80	0.27	0.19	0.55	0.53	208.3	143.6
8	54.9	39.9	3.52	93.5	250	6890	6.10	316	323	339	344	410	410	1597	912	685	1694	971	723	1036	806	252	408	249	376	214	319	78	268	415	277	397	259	359	83	0.28	0.19	0.43	0.44	200.7	150.7
9	54.9	49.9	1.17	57.6	96	4528	5.85	248	248	275	276	316	339	1154	671	482	1278	750	528	844	626	280	325	272	316	235	265	78	294	361	299	340	285	318	85	0.24	0.18	0.41	0.40	154.0	110.7
10	49.8	39.9	2.29	56.5	155	4178	6.16	274	291	281	298	365	418	1332	783	549	1434	829	605	1124	821	259	342	257	333	227	275	80	274	380	283	347	274	328	87	0.27	0.20	0.45	0.43	170.7	19.6
11	54.9	39.9	3.52	113.8	251	9107	6.08	320	325	327	331	436	496	1582	931	651	1680	989	691	1175	918	219	410	230	374	197	333	79	234	454	252	334	246	370	91	0.29	0.22	0.46	0.44	205.5	143.6
12	54.9	30.0	5.71	101.4	362	8092	6.28	306	311	310	314	423	471	1613	942	670	1680	983	697	1195	888	225	420	231	413	201	335	81	239	476	253	433	247	391	92	0.29	0.21	0.48	0.47	201.3	143.2
13	55.0	39.9	3.56	64.4	254	4891	6.04	384	386	393	393	408	435	1753	1021	732	1844	1074	770	1163	862	285	502	278	485	235	408	81	296	529	301	428	290	443	95	0.28	0.21	0.41	0.41	227.0	162.7
14	54.9	39.9	3.51	128.6	251	10310	6.10	343	349	350	355	397	410	1653	975	678	1741	1033	708	1101	791	256	401	260	365	223	316	83	267	393	284	408	272	331	97	0.29	0.21	0.45	0.42	214.4	149.0
15	55.1	39.9	3.61	62.2	258	4903	5.98	419	428	425	456	522	577	2041	1198	843	2172	1278	894	1473	1136	284	535	282	494	241	425	81	292	548	302	451	287	458	99	0.32	0.24	0.43	0.41	268.8	189.1
16	45.0	0.1	10.39	42.1	351	2786	6.20	367	377	395	398	516	611	2168	1279	889	2252	1334	918	1685	1178	342	582	331	572	284	515	82	353	592	348	542	331	524	99	0.33	0.24	0.51	0.49	276.8	192.4
17	45.1	0.2	10.54	86.3	361	4791	6.06	548	554	546	552	704	710	2571	1550	1021	2683	1644	1039	1791	1160	371	648	369	626	310	565	84	394	645	391	577	373	576	103	0.36	0.26	0.45	0.40	343.6	226.2
18	54.9	39.9	3.51	210.3	250	15770	6.11	378	382	389	391	469	479	1614	959	655	1721	1024	697	1107	744	296	402	316	460	262	321	86	310	472	341	462	335	419	112	0.32	0.23	0.40	0.38	210.8	143.9
19	39.8	0.5	9.00	94.2	271	5613	6.29	263	266	267	270	410	472	1498	901	597	1571	939	632	1175	874	292	373	304	410	255	325	88	315	431	335	435	323	397	116	0.31	0.23	0.53	0.49	192.1	127.3
20	54.9	0.5	12.39	91.9	511	6165	6.33	266	269	268	270	376	420	1440	854	586	1464	865	599																						



**Brake Performance Study Attachment 5: Dynamometer Testing Report: Downhill Braking
Simulation Test– 2001 Ford Excursion with Limousine Conversion, 13565 lbs -Front
Brakes Only**

Schoharie, NY

HWY19H001

NATIONAL TRANSPORTATION SAFETY BOARD

SCHOHARIE, NY DOWNHILL BRAKING SIMULATION TEST

Client NTSB Acquisition and Lease Management Division
490 L'Enfant Plaza East SW
Washington, DC 20594-0003

Report Number 203145-4
(Used Parts - 13,565 lb GVW - Front Brake Only)

Vehicle Simulated 2001 Ford Excursion with Limousine Conversion

Front Lining Edge Code MPV 2000-EE

Rear Lining Edge Code MPV 2000-EE

Test Completion Date 20 March 2020

Signature

Kevin C. Machus, Test Engineer
for Greening Testing Laboratories, Inc.

This test report issued in Adobe® Acrobat® format only.

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Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

Test Numbers	M20-064-09	
Test Program Number	3947.02.20V01 - 2001 FORD EXCURSION.TST	
Vehicle System Simulated	2001 Ford Excursion with Limousine Conversion	
Reference	Contract No. 9531BM20P0015	
Test Date(s)	20 March 2020	
Date Test Report Prepared	27 March 2020	
Test Report Prepared By	K. Machus	
Gross Vehicle Weight	13,565 lbs (per NTSB)	
Static Rolling Radius	16.1 inches (based on revolutions per mile of LT265/75R16D tires)	
Test Inertia (without loss)	379.2 slug·ft ²	
Parasitic Loss	3.0% (based on vehicle measurements)	
Test Inertia (with loss)	368.8 slug·ft ²	
Equivalent 1/2 Vehicle Weight	6,579 lbs	
	Front Disc Brake	Rear Disc Brake
Lining Edge Code	MPV 2000-EE	MPV 2000-EE
Brake Pad Part Number	Motorcraft BR1266	Motorcraft BR1275
Brake Pad FMSI® Number	7625-D756	7626-D757
Brake Configuration	dual piston, separate function caliper disc brake	dual piston, separate function caliper disc brake
Piston Diameter(s)	2 x 54 mm	2 x 46 mm
Rotor Part Number	Ford 1G3Z-1V102-AB	Ford YC3Z-2C026-BB
Brake Size (nominal)		
Rotor Diameter x Thickness	13.0 x 1.5 inches	12.8 x 1.2 inches
Rotor Mass (nominal)	20.7 kg	10.9 kg
Rotor Effective Radius	5.599 inches	5.529 inches
Wheel Rotation	right hand	left hand
Test Fixture	096622	190316
Date Parts Received	16 January 2020	16 January 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

DATA NOTES

- 1 All average and sustained values shown in this report are calculated with respect to **DISTANCE**.
- 2 The data presented in this report has been gathered as follows:

START Threshold = 50 lbf·ft of brake torque during brake apply.

AVERAGE = average value between START and STOP Threshold levels.

INITIAL Data Point = Values are taken at the point where the control level is achieved.

SUSTAINED Data = average value between the INITIAL and END data points.

END Data Point = Values are taken 0.1 seconds prior to the STOP threshold

MAXIMUM = maximum value observed in the SUSTAINED Data Interval.

STOP Threshold = brake release

FINAL temperature is the highest temperature value observed in a 4.0 second "window" beginning 1.0 seconds after brake release.

- 3 Brake application is initiated when the control temperature (rotor) reaches the desired initial brake temperature.
- 4 Cooling Air Temperature = 80°F ($\pm 5^\circ\text{F}$)
- 5 Cooling Air Velocity = 20 mi/h for front brake, 2 mi/h for rear brake as determined by cooling curves conducted on a 2001 Ford Expedition.
- 6 For all stops which show "zero" (0) or negative values for some of the computed pressure, torque or coefficient values:

These stops achieved final speed but did not achieve the torque level required for the particular stop. Since the START data and STOP data thresholds were satisfied, deceleration rate, distance, time to stop, etc., are accurate values, and can be used for data comparison purposes.

The presence of "zero" values generally is caused by lack of brake performance, resulting in a "clamp" condition. "Clamp" condition is defined by the brake calling for the maximum pressure the test section allows ("clamp" pressure) and the brake being unable to attain the deceleration rate required in the test section at that pressure.

- 7 Thermocouple locations and depths:

Front Rotor: Center of inboard rubbing track at a depth of 0.040 inches

Front Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches

Front Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches

Rear Rotor: Center of inboard rubbing track at a depth of 0.040 inches

Rear Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches

Rear Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

COMPUTED DATA DESCRIPTIONS

SPEED

INIT = Speed start threshold is achieved.

FNL = Brake release speed

TIME

STOP = Time elapsed between start threshold and brake release

REPT = Time elapsed between cycles

DISTANCE

STOP = Distance elapsed between start threshold and brake release

REPT = Distance elapsed between cycles

DECCEL

AVG = Average deceleration measured from start threshold to brake release

PRESSURE

AVERAGE = Average pressure from start threshold to brake release

SUSTAINED = Average pressure from point control level is achieved to brake release

MAXIMUM = Maximum pressure from start threshold to brake release

TORQUE

AVERAGE = Average torque from start threshold to brake release

SUSTAINED = Average torque from point control level is achieved to brake release

MAXIMUM = Maximum torque from start threshold to brake release

TEMPERATURE

INT = Temperature at start threshold

MAX = Maximum temperature between start threshold and 0.1 seconds after brake release

FLUID DISPLACEMENT

MAX = Maximum fluid displacement between start threshold and brake release

FRICTION COEFFICIENT

SUST = Friction coefficient (μ) calculated using the following formula:

$$\mu = \frac{\text{Sustained Torque (lbf}\cdot\text{ft) / Rotor Effective Radius (ft)}}{\text{Sustained Pressure (lbf/in}^2\text{) * Total Caliper Piston Area (in}^2\text{)}} * 0.5$$

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

TEST ROUTE - NEW AMSTERDAM TO SCHOHARIE NEW YORK

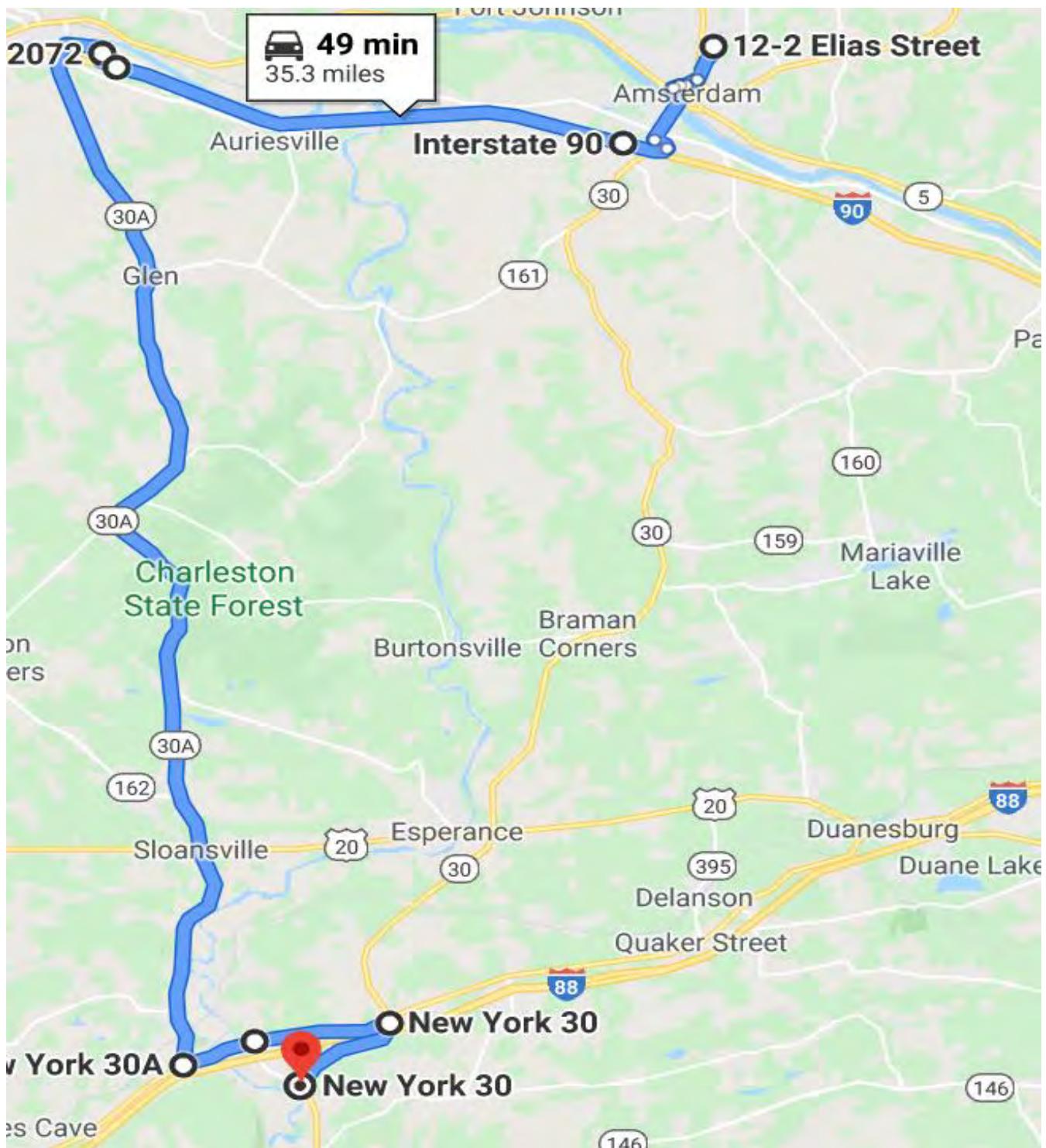
Cycle	Mile	Latitude (GPS)	Longitude (GPS)	Altitude (ft)	Grade Input (%g)	Braking Deceleration (g)	Apply Speed (mi/h)	Release Speed (mi/h)
0	0.0	42.94908	-74.18265	574.1	—	—	—	—
1	10.8	42.94409	-74.35478	293.3	-0.14%	0.2	60	30
2	11.1	42.94722	-74.35869	296.3	0.21%	0.2	30	20
3	11.2	42.94865	-74.35809	288.1	-1.69%	0.2	20	0
4	11.7	42.94957	-74.36914	287.4	0.28%	0.2	40	0
5	14.6	42.91169	-74.35237	469.5	0.40%	0.2	55	40
6	15.6	42.89860	-74.34632	647.3	5.20%	0.2	55	35
7	15.7	42.89696	-74.34592	666.0	0.80%	0.2	35	15
8	17.0	42.87979	-74.34609	802.8	0.90%	0.2	55	40
9	17.7	42.86949	-74.34253	871.7	5.27%	0.2	55	50
10	18.4	42.86000	-74.33732	1016.7	3.88%	0.2	50	40
11	20.4	42.83745	-74.35430	1200.1	1.12%	0.2	55	40
12	21.8	42.82276	-74.33815	1259.2	1.09%	0.2	55	30
13	22.6	42.81189	-74.33648	1295.6	-1.10%	0.2	55	40
14	24.5	42.78596	-74.33829	1284.1	0.19%	0.2	55	40
15	25.3	42.77450	-74.33766	1075.5	-4.69%	0.2	55	40
16	25.7	42.76815	-74.33585	955.1	-5.45%	0.2	45	0
17	26.5	42.75714	-74.33045	681.8	-10.46%	0.2	45	0
18	29.4	42.71859	-74.33721	676.2	0.59%	0.2	55	40
19	30.4	42.70533	-74.33539	633.2	2.50%	0.2	40	0
20	31.5	42.71097	-74.31464	681.4	3.31%	0.2	55	0
21	33.6	42.71540	-74.27608	1183.4	4.71%	0.2	55	0
2 MINUTE STOP - BRAKES RELEASED								
22	33.9			1078.1	-5.92%	0.2	60	55
23	34.0			1033.7	-5.92%	0.2	60	55
24	34.2			989.3	-5.92%	0.2	60	55
25	34.3			944.9	-5.92%	0.2	60	55
26	34.5			900.6	-5.92%	0.2	60	55
27	34.6			856.2	-5.92%	0.2	60	55
28	34.8			811.8	-5.92%	0.2	60	55
29	34.9			767.4	-5.92%	0.2	60	55
30	35.0			723.1	-5.92%	0.2	60	55
31	35.2	42.70259	-74.29994	678.5	-5.95%	0.2	60	55
32	35.4	42.70043	-74.30176	628.3	-5.40%	0.2	50	0

*NOTE: Test route was derived using the following criteria:

Speed limit and warning speeds were identified along the simulated route and used to control speed in the simulations. At Stop signs and controlled signalized intersections along the simulated route complete stops were modeled. At last stop before the final downhill descent a completed stop of 2 minutes was modeled. During downhill descents if the speed exceeded the posted speed limit by 5 mph braking at a maximum of 0.2 g was applied to reduce the speed to the speed limit.

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

TEST ROUTE - OVERVIEW MAP

Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

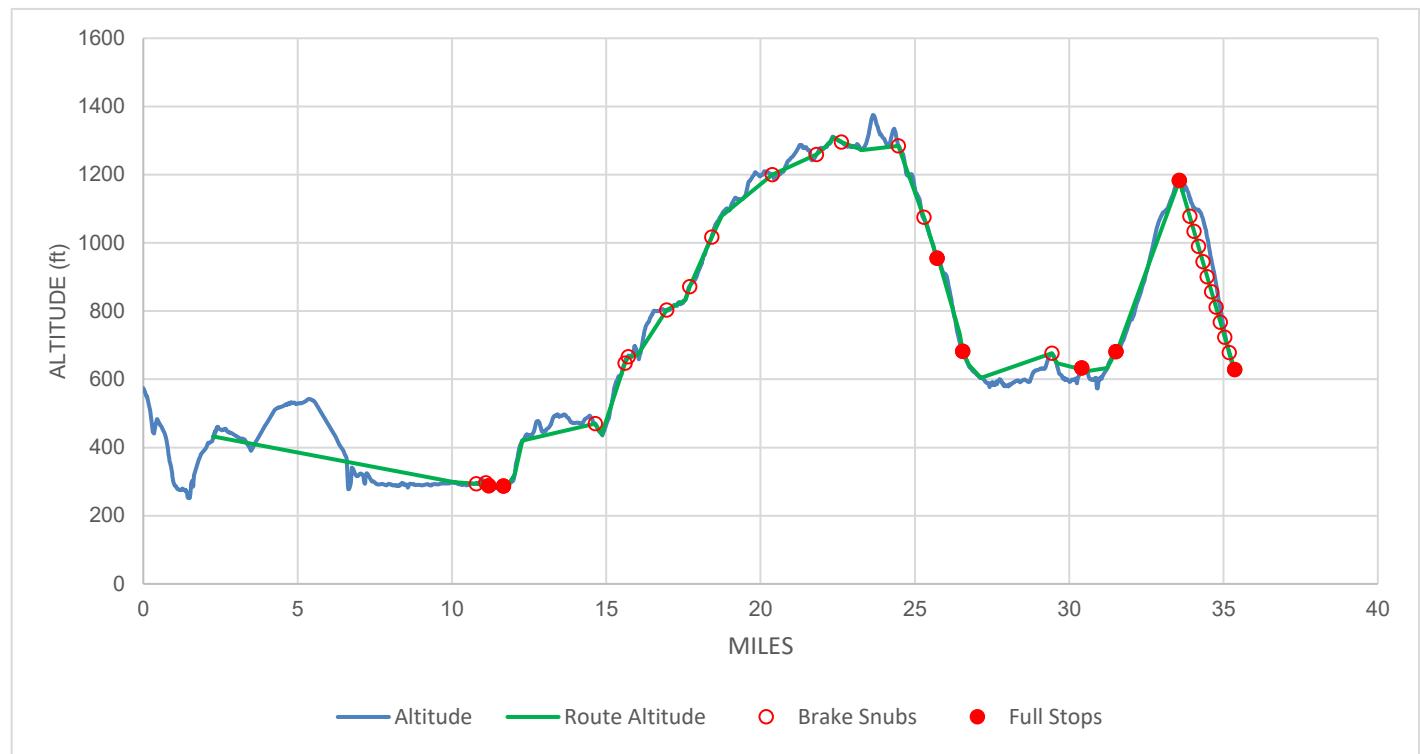
NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

TEST ROUTE - PROFILE



Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

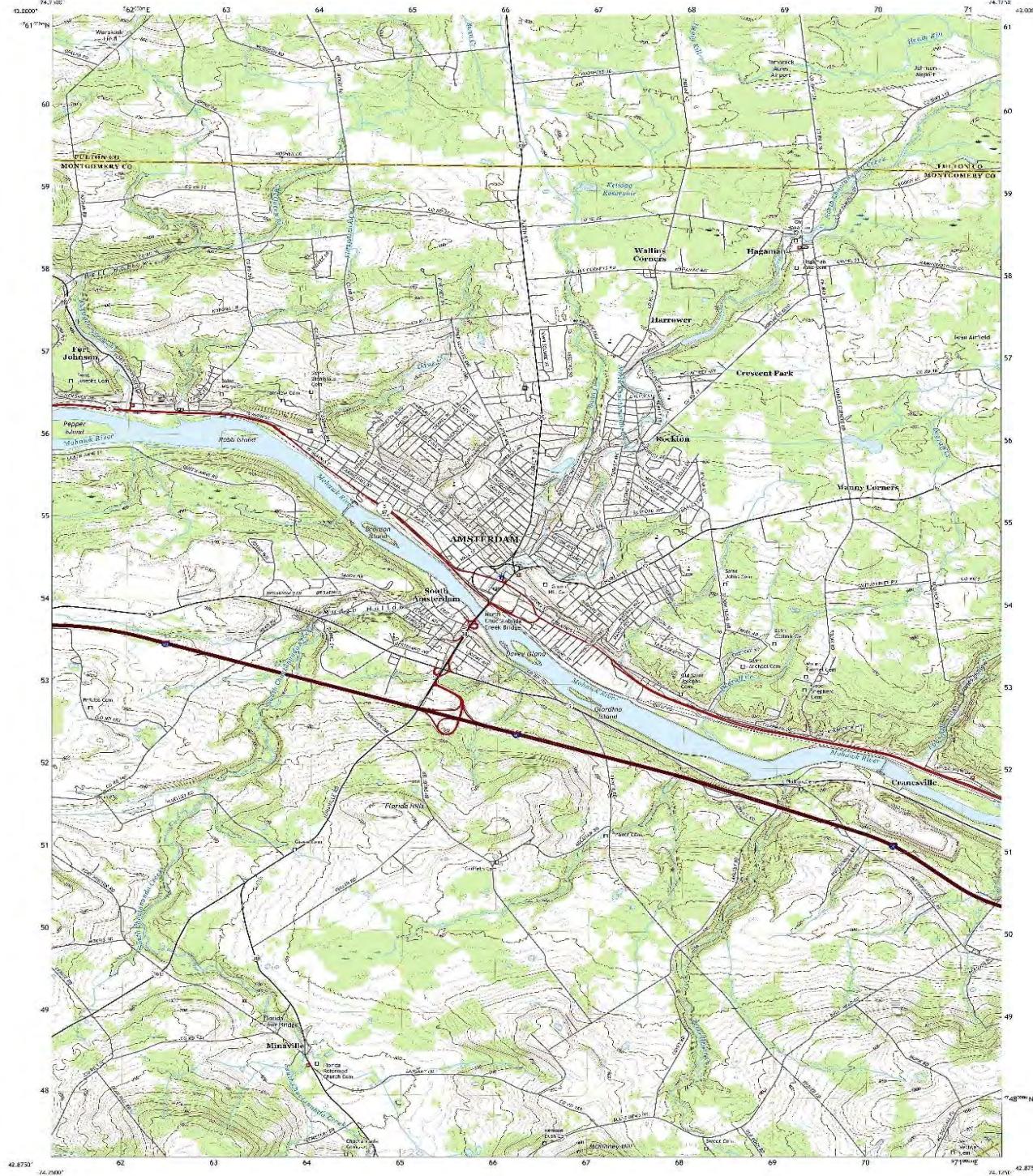
TEST ROUTE - AMSTERDAM QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



AMSTERDAM QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

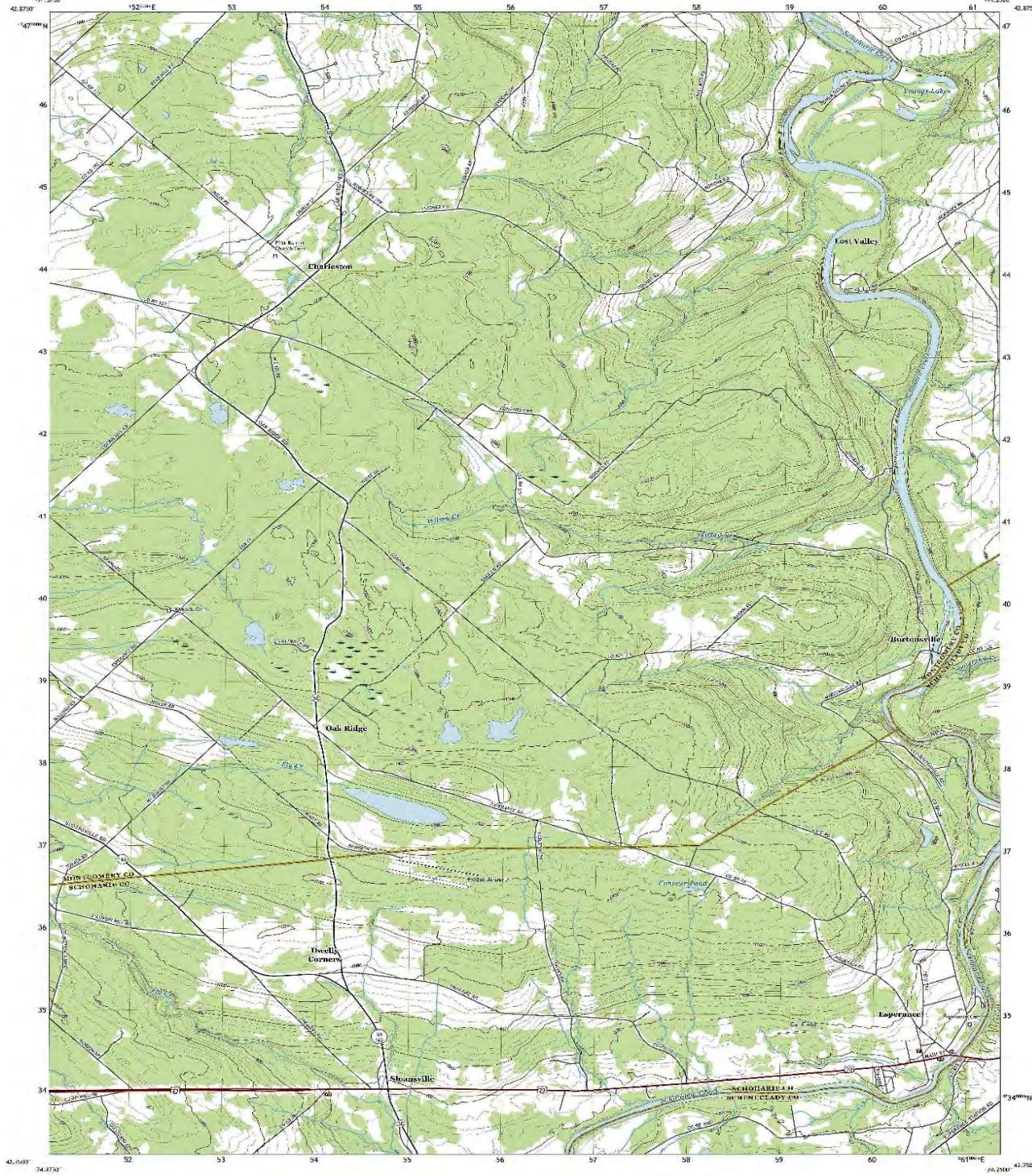
TEST ROUTE - ESPERANCE QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



ESPERANCE QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

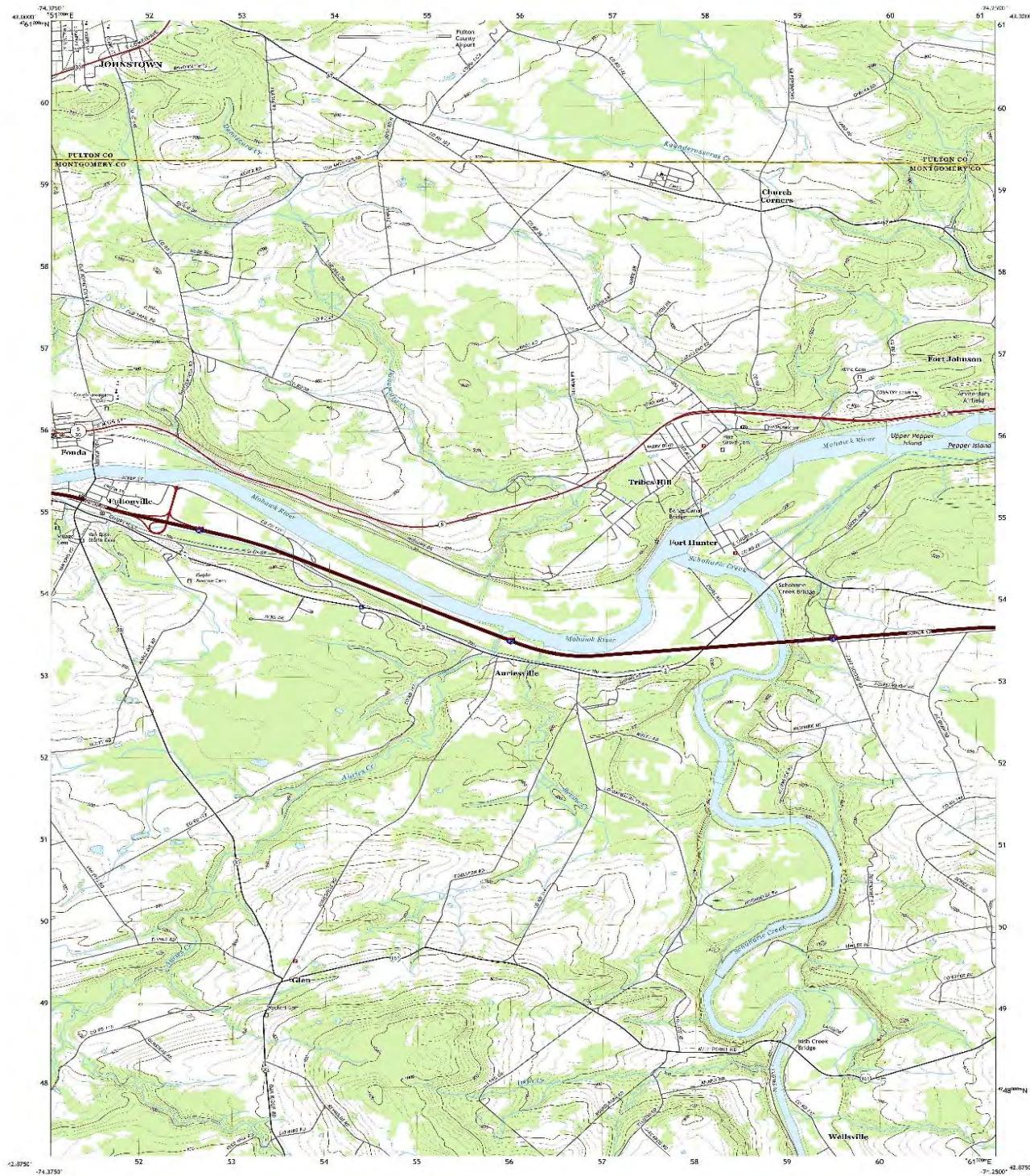
TEST ROUTE - TRIBES HILL QUADRANGLE



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TRIBES HILL QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

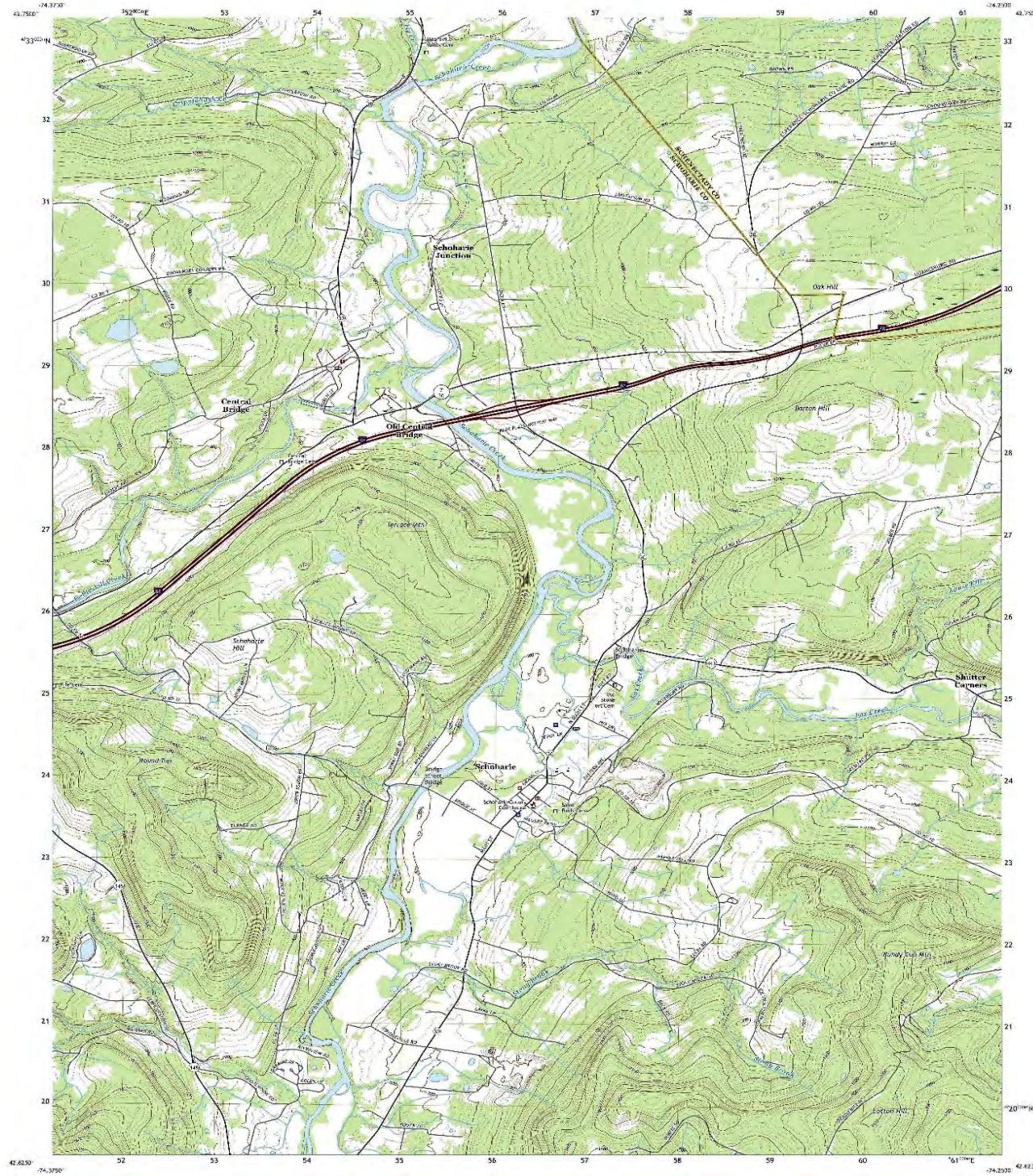
TEST ROUTE - SCHOHARIE QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



SCHOHARIE QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

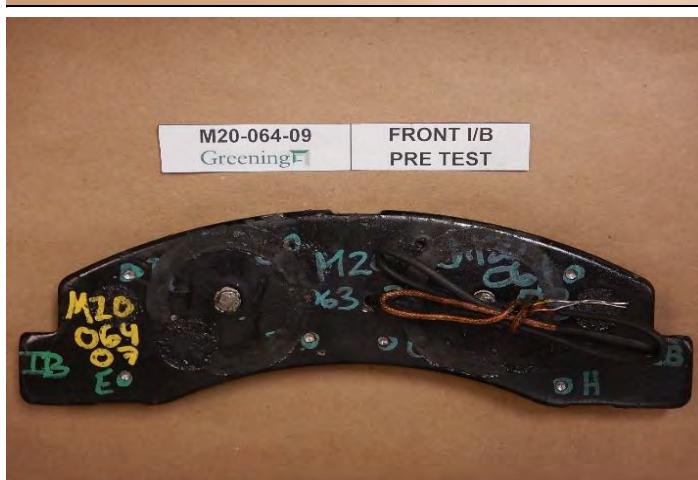
NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

PRE TEST PHOTOGRAPHS - FRONT BRAKE



Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

PRE TEST PHOTOGRAPHS - REAR BRAKE



Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

POST TEST VISUAL INSPECTION - FRONT BRAKE

Inboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Outboard Pad: The pad has light flaking, light glazing, light grooving, light pitting and light resin bleed.

Rotor: The braking surface has light grooving, light hot spots, light lining transfer and is blue/grey in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

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All other test hardware appears in good condition.

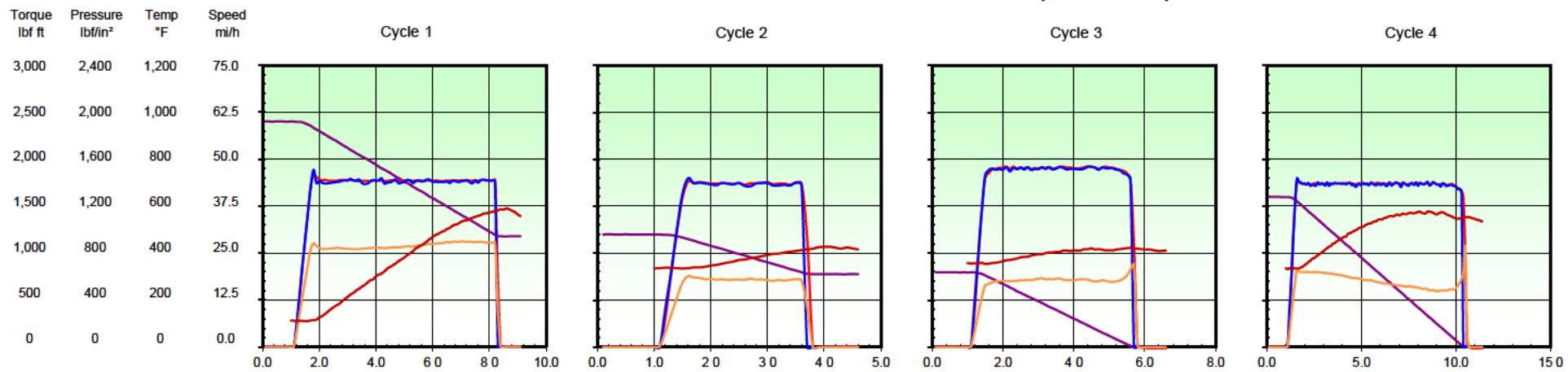
PHOTOGRAPHS



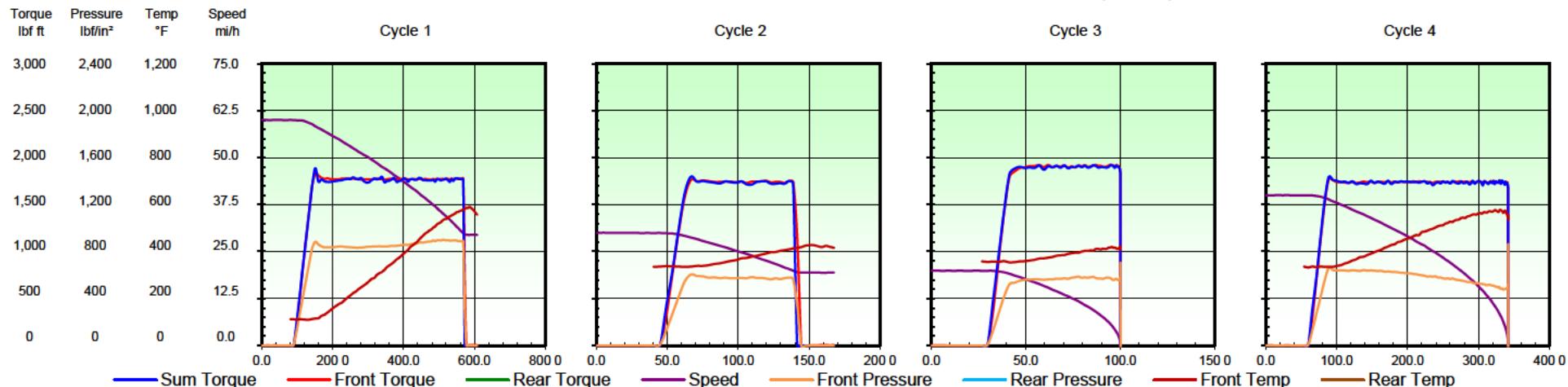
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

GRADE SIMULATION CYCLES IN-STOP DATA vs. TIME (SECONDS)



GRADE SIMULATION CYCLES IN-STOP DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-09

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

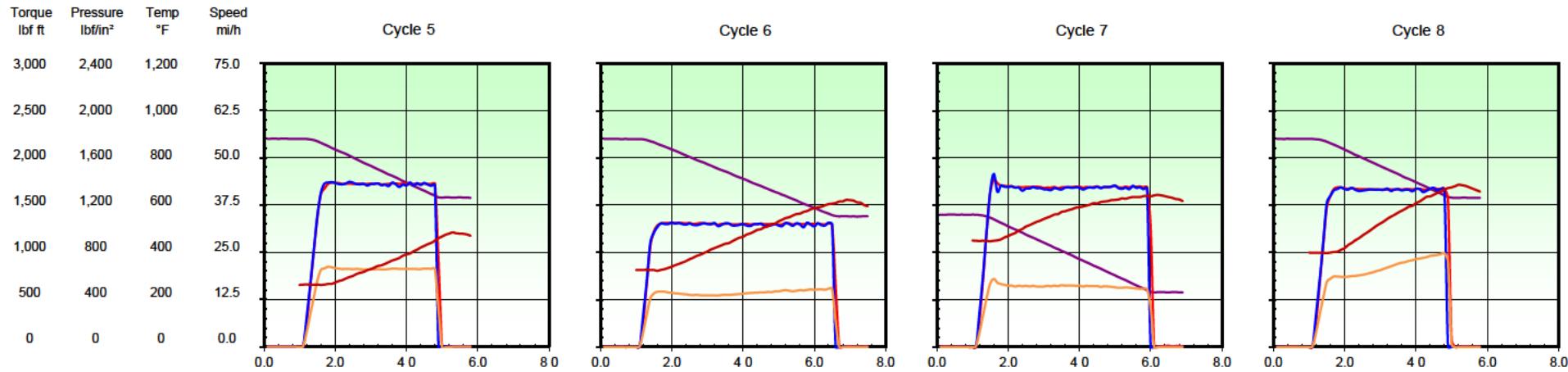
Report Number: 203145-4

Test Report Date: 20 March 2020

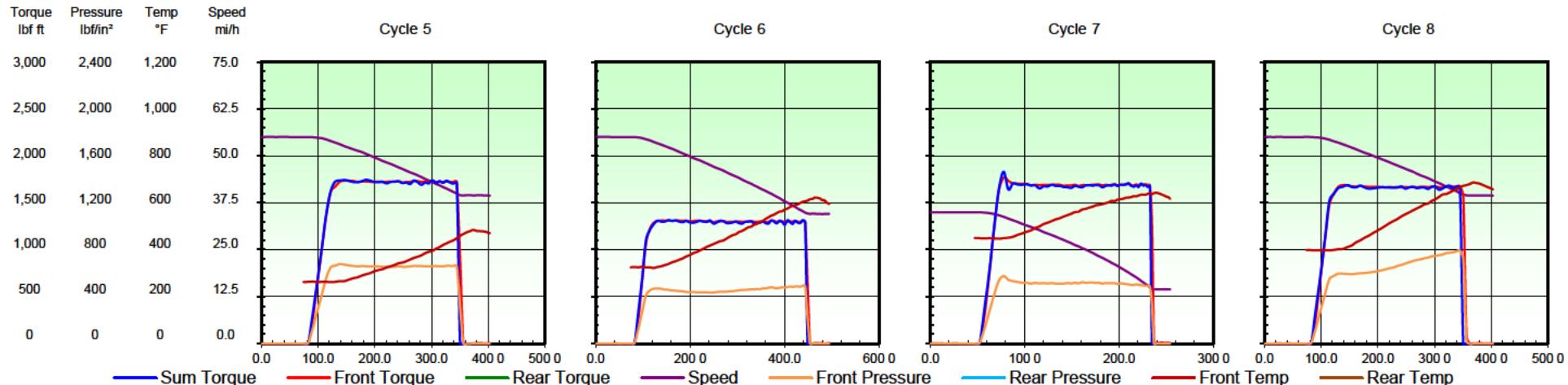
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

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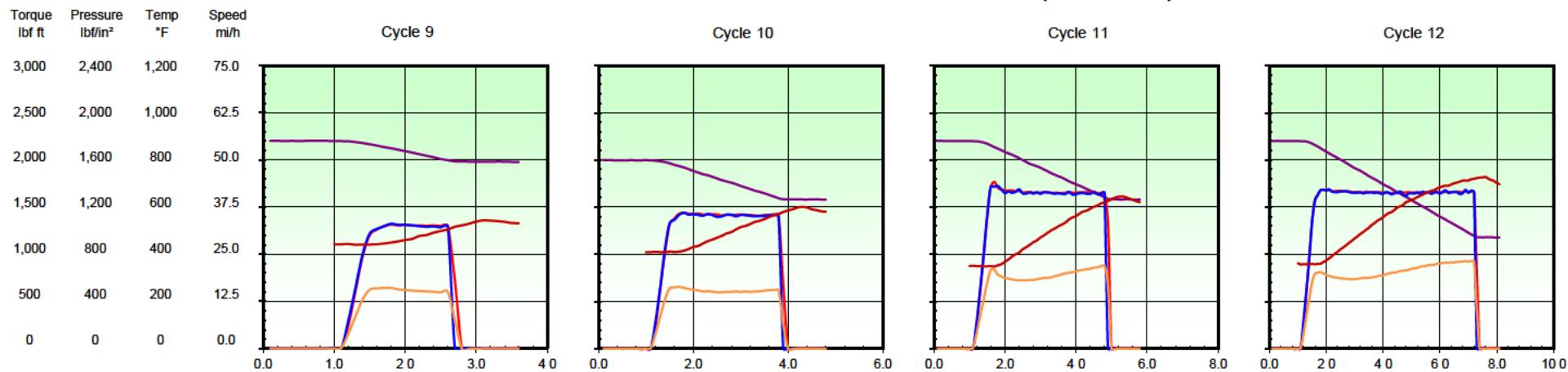
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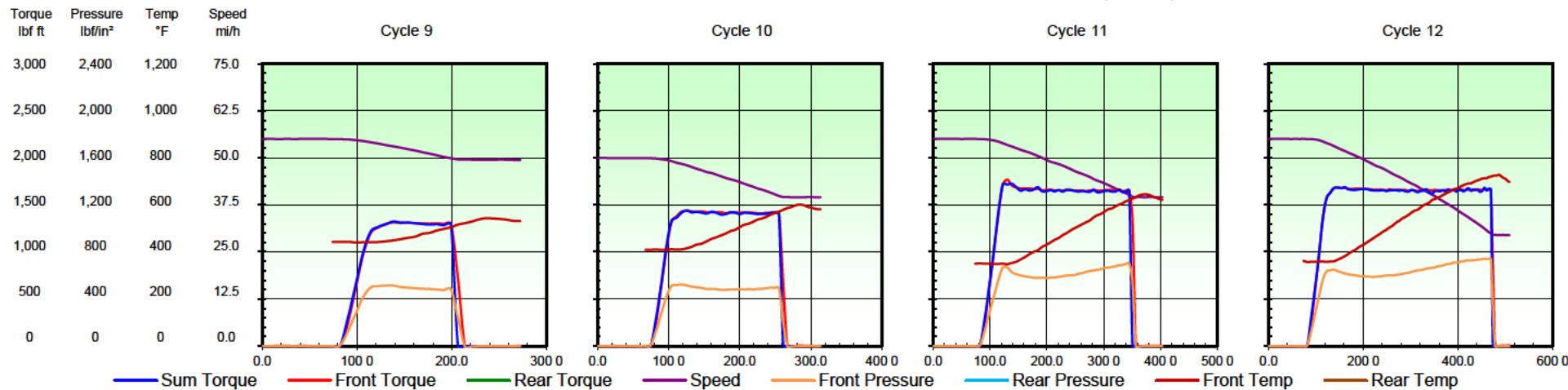
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

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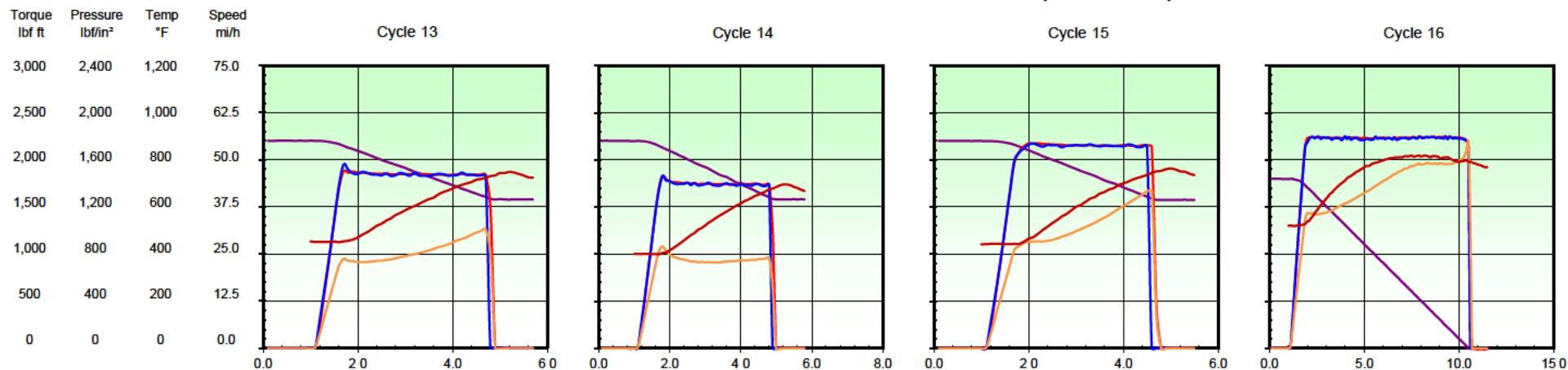
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Test Report Date: 20 March 2020

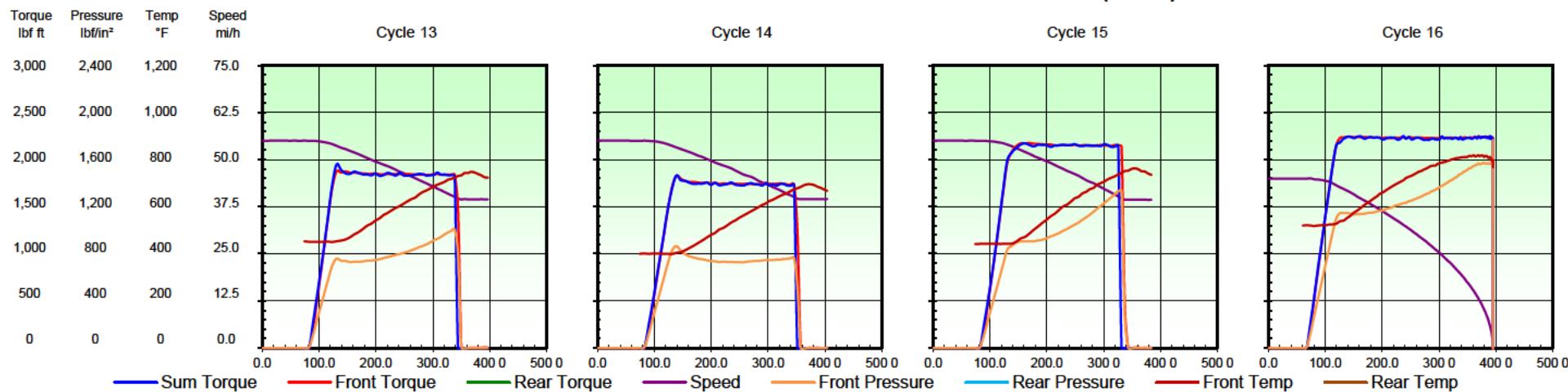
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

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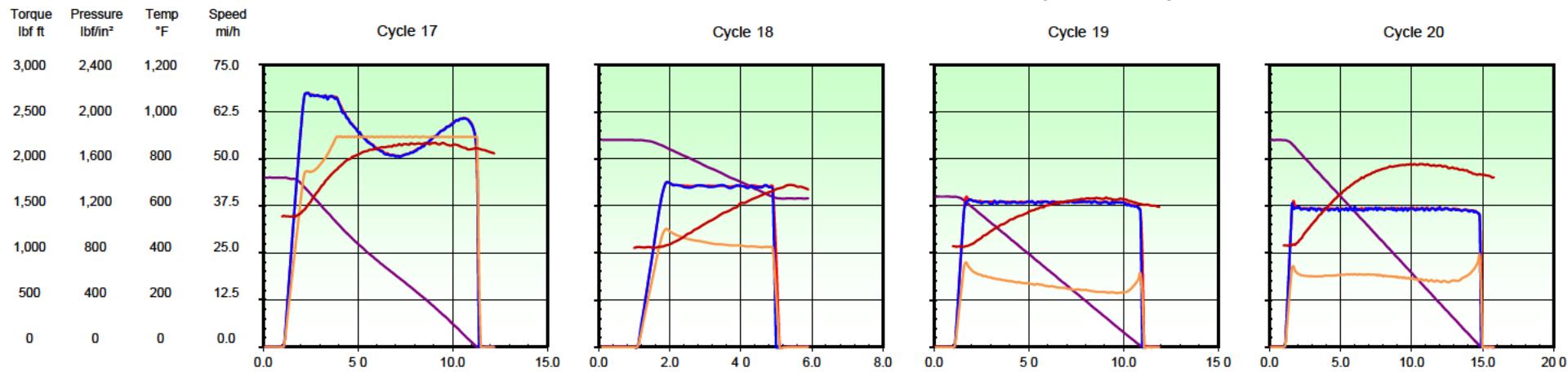
Report Number: 203145-4

Test Report Date: 20 March 2020

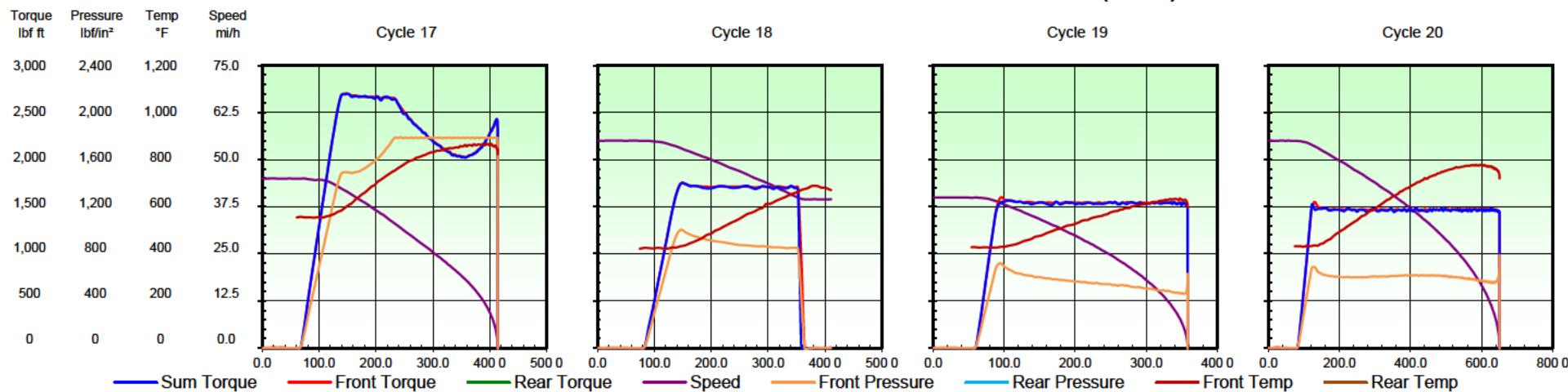
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

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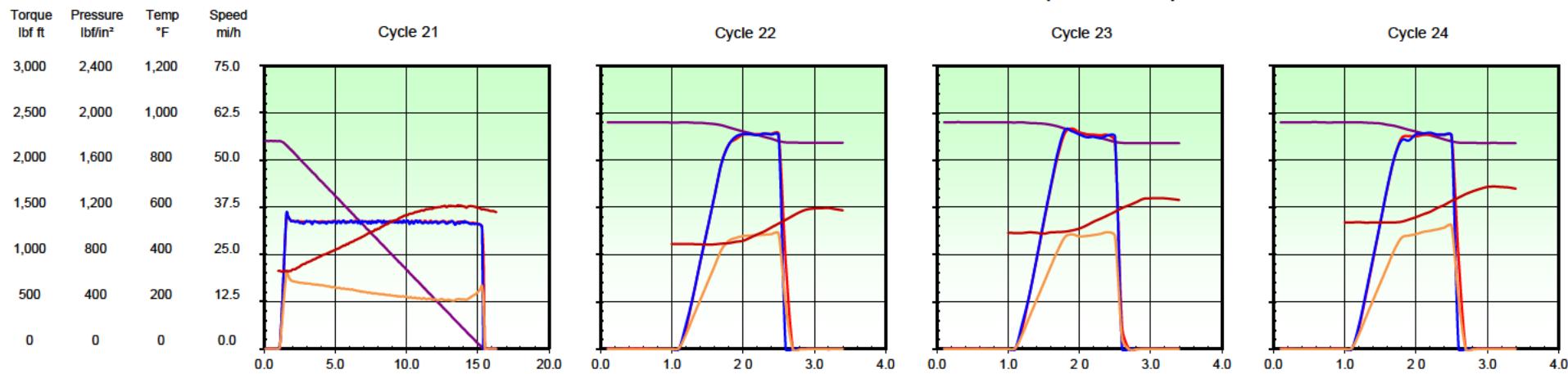
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Test Report Date: 20 March 2020

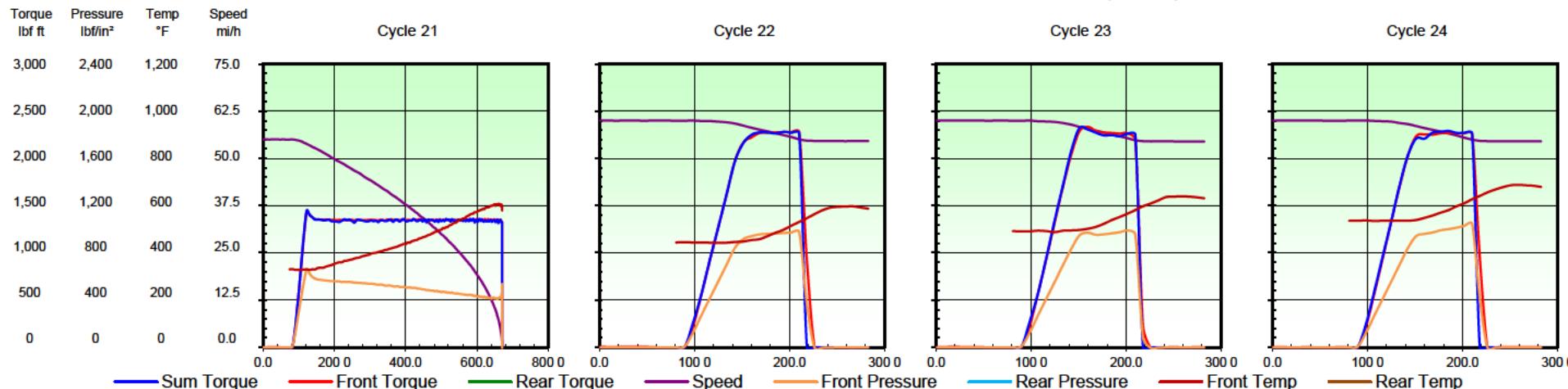
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2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

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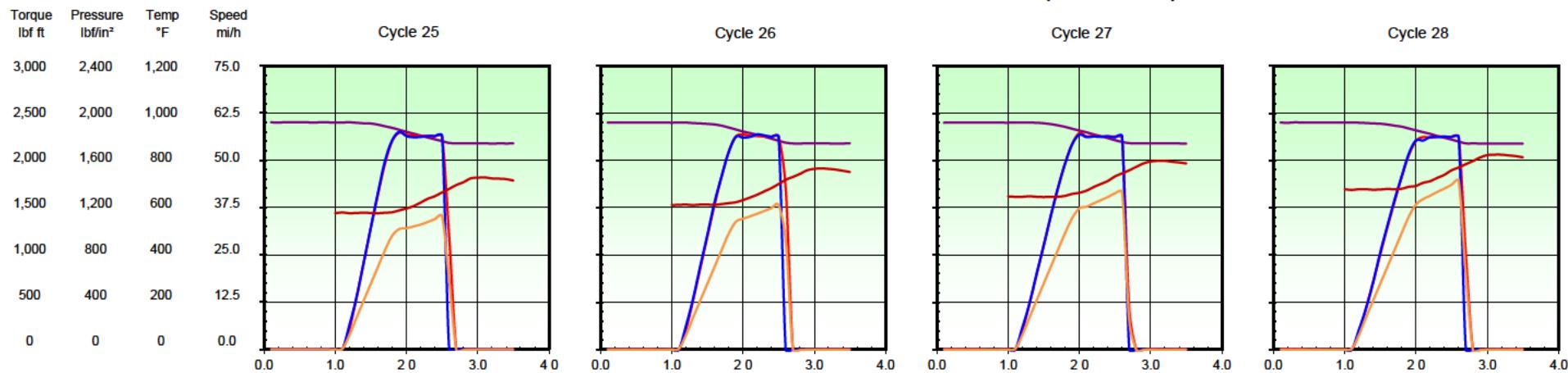
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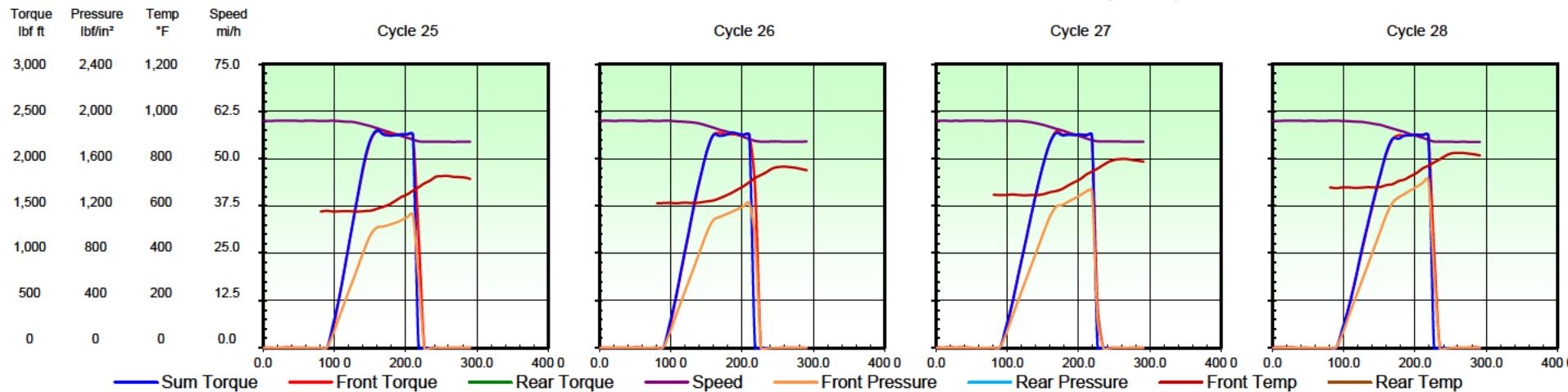
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

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GRADE SIMULATION CYCLES IN-STOP DATA vs. TIME (SECONDS)



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Test Numbers: M20-064-09

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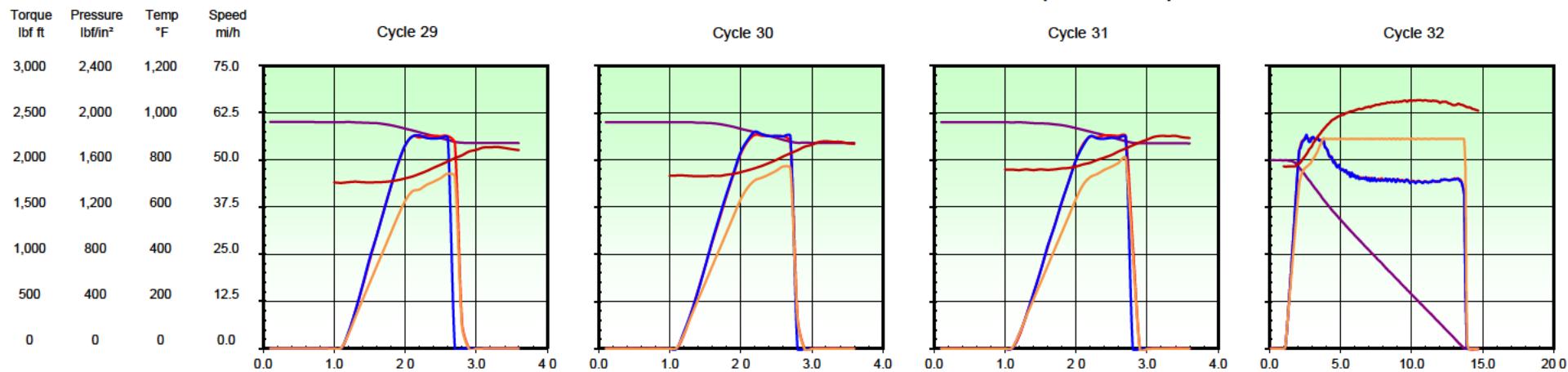
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Test Report Date: 20 March 2020

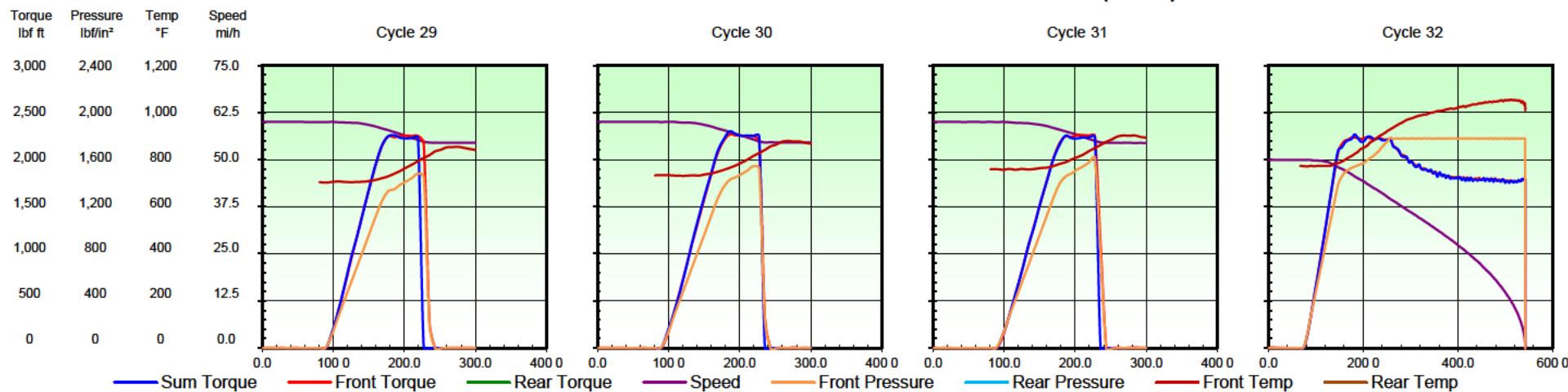
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

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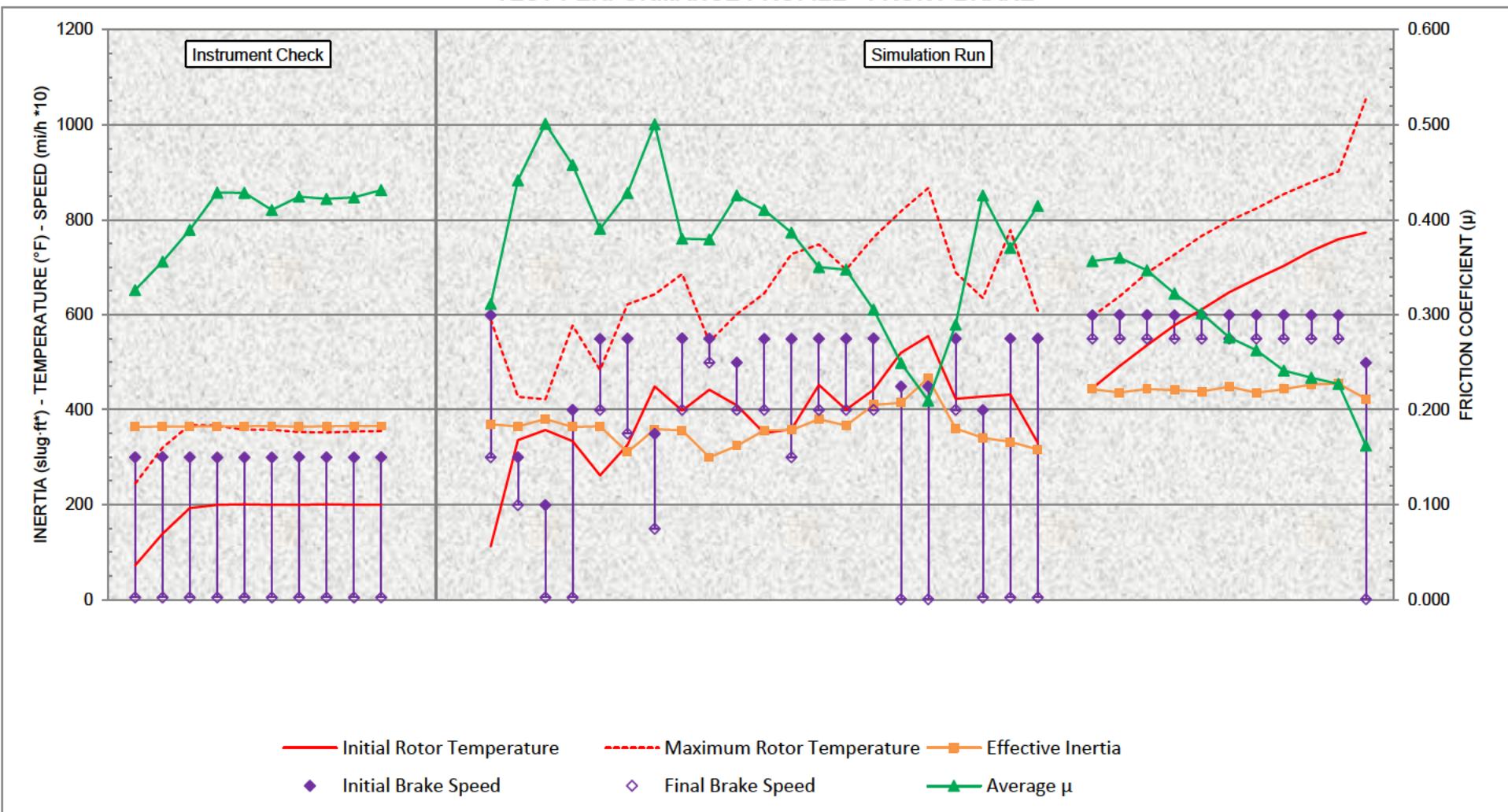
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Report Number: 203145-4

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
 2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-09

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

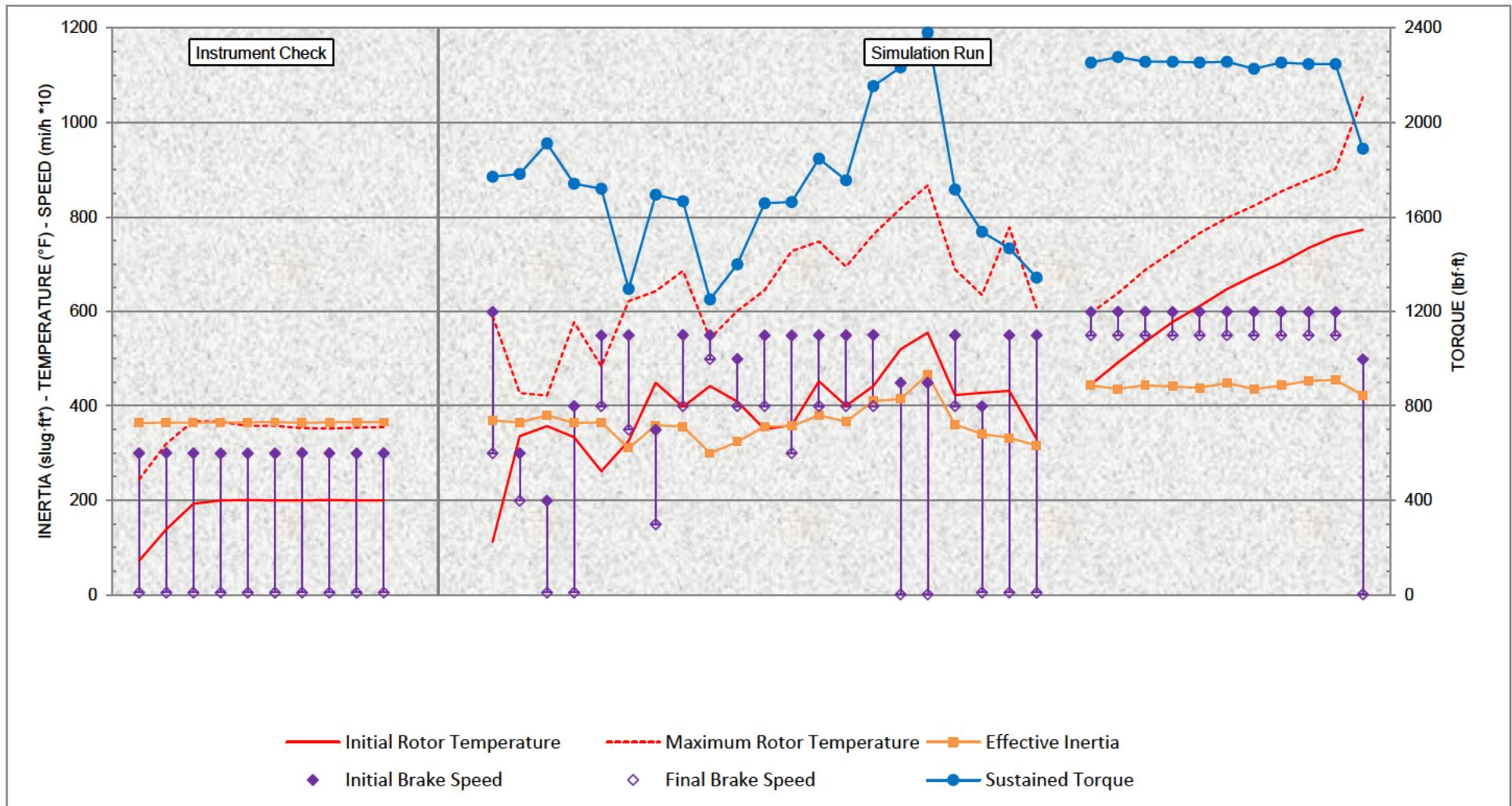
Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

Report Number: 203145-4

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
 2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-09

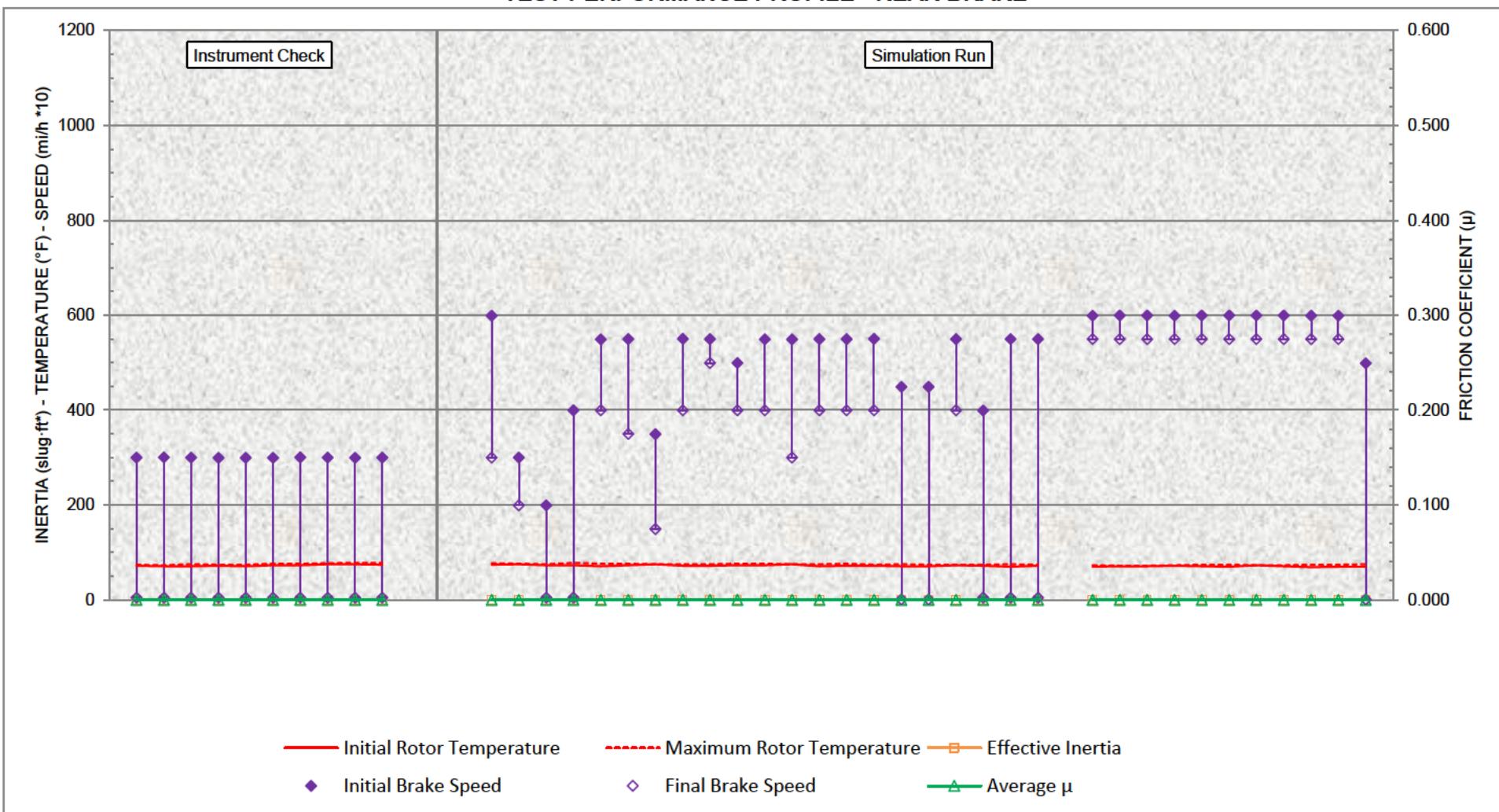
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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
 2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY
TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-09

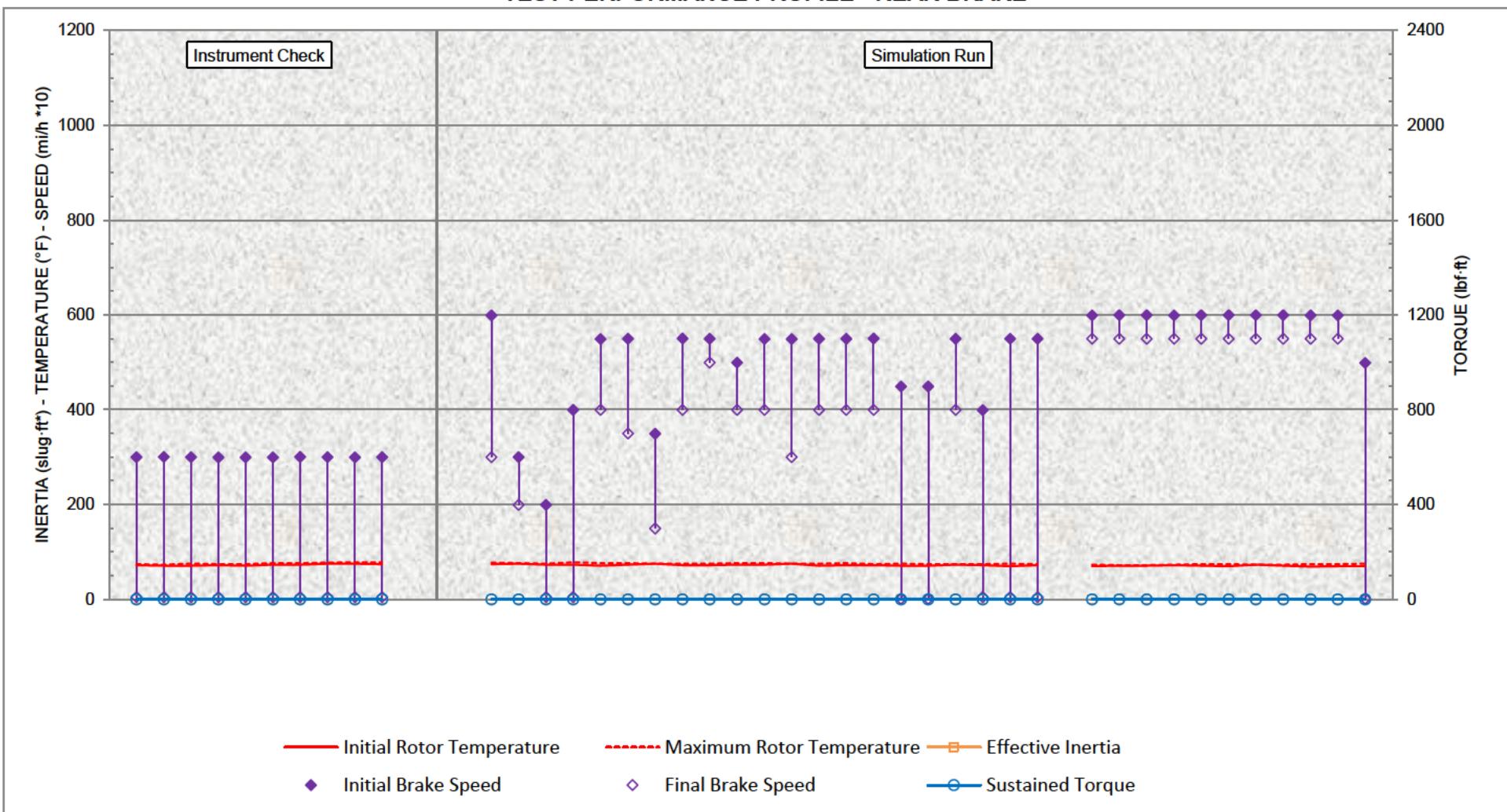
Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
 2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY
TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-09

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

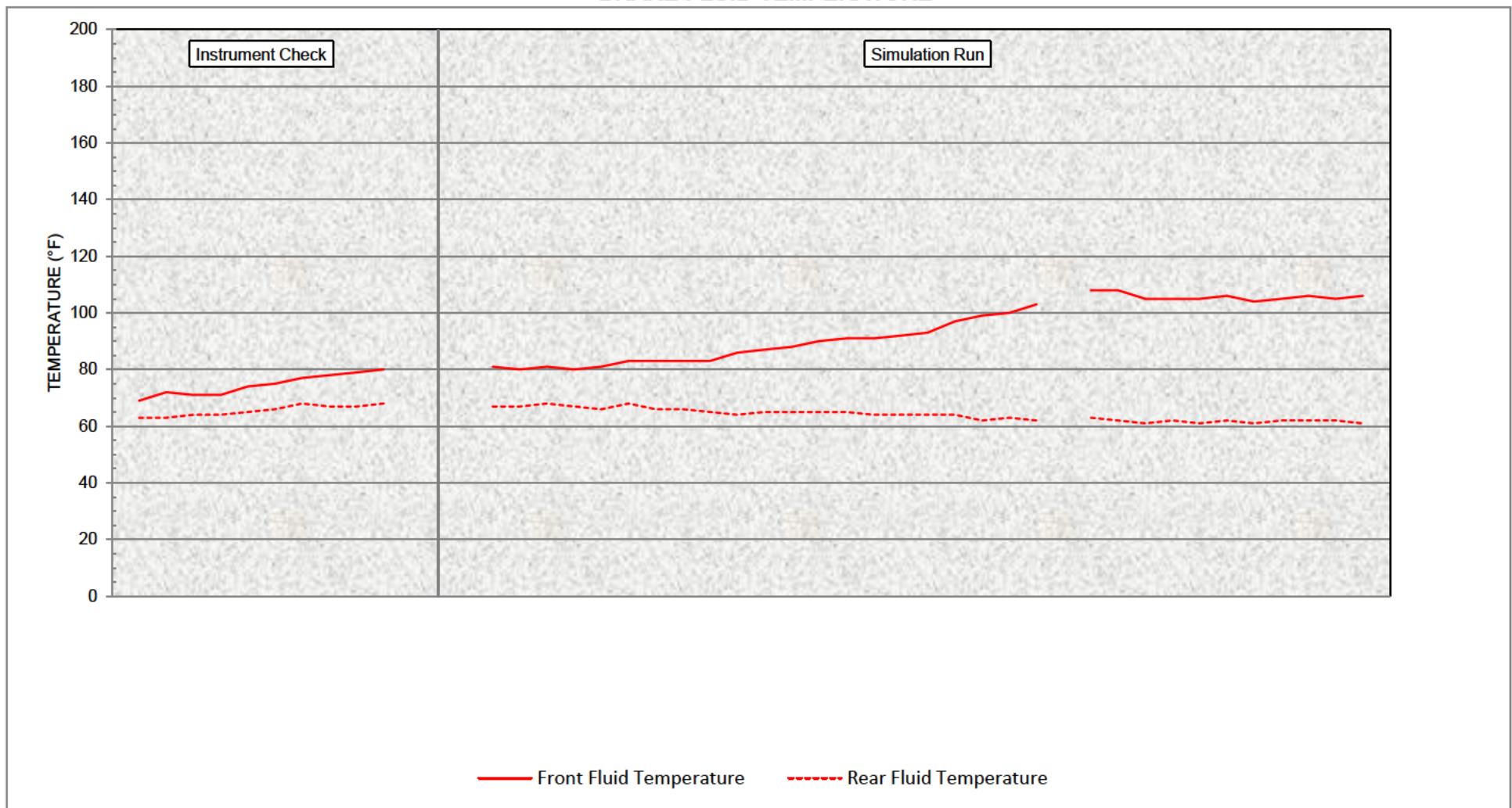
Report Number: 203145-4

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

BRAKE FLUID TEMPERATURE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-09

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

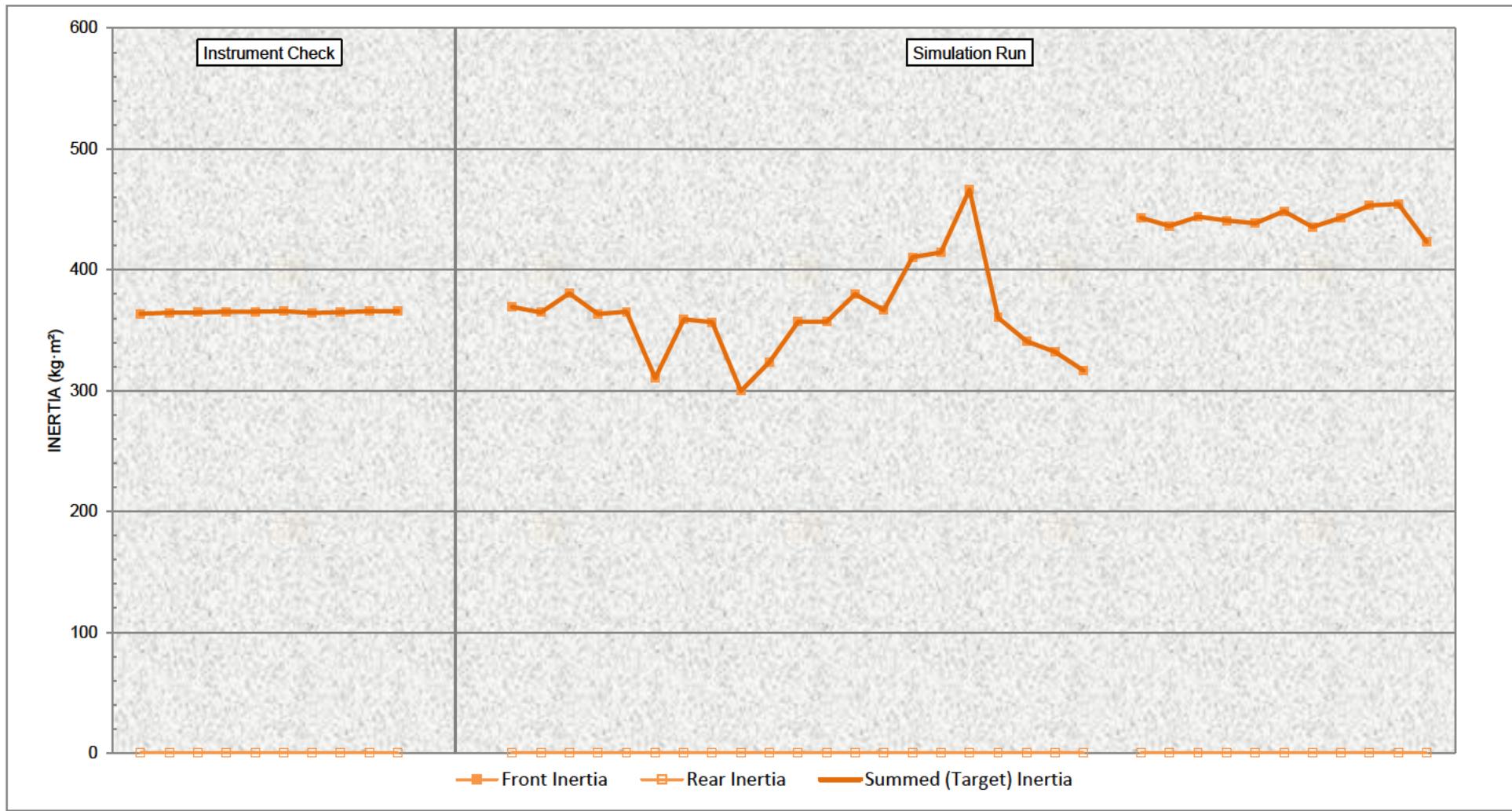
Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

Report Number: 203145-4

Test Report Date: 20 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST
2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - FRONT ONLY

INERTIA DISTRIBUTION



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-09

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

Report Number: 203145-4

Test Report Date: 20 March 2020

Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DISTANCE		DECCEL		PRESSURE						TORQUE						TEMPERATURE												FLUID		FRICTION		INERTIA	
									Avg	Average	Sustained	Maximum			Average		Sustained		Maximum		Rotor	I/B	O/B	Fluid	Rotor	I/B	O/B	Fluid	Maximum		Sustained		Displace.		Coeff.		Inertia	
	Init	FNL	Stop	Rept	Stop	Rept	Dist	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear			
	mi/h		s		ft		ft/s ²							lbf/in ²																		in ³	μ	slug ft ²				

INSTRUMENT CHECK

30 mi/h - 0.31g Deceleration Rate - 200°F Initial Rotor Temperature

1	30.0	0.5	4.90	0.0	122	0	7.90	1203	0	1268	0	1506	0	2142	2142	0	2738	2738	0	2771	0	72	244	72	203	72	188	69	72	74	70	71	71	74	63	0.63	0.00	0.33	0	363.6	0.0
2	30.0	0.5	4.86	58.2	121	58	8.03	1134	0	1162	0	1347	0	2180	2180	0	2741	2741	0	2777	0	139	320	131	270	114	244	72	71	73	66	70	72	74	63	0.58	0.00	0.36	0	364.4	0.0
3	30.0	0.5	4.82	60.0	119	60	8.15	1039	0	1065	0	1266	0	2216	2216	0	2747	2747	0	2782	0	193	368	183	328	153	284	71	71	75	67	70	72	73	64	0.55	0.00	0.39	0	364.8	0.0
4	29.9	0.5	4.77	106.7	117	107	8.23	941	0	963	0	1159	0	2240	2240	0	2735	2735	0	2788	0	200	366	201	354	167	290	71	72	74	66	71	71	74	64	0.52	0.00	0.43	0	365.2	0.0
5	29.9	0.5	4.75	116.1	117	116	8.27	962	0	966	0	1181	0	2252	2252	0	2741	2741	0	2892	0	201	358	207	364	173	286	74	71	74	68	70	73	74	65	0.52	0.00	0.43	0	365.2	0.0
6	29.9	0.5	4.77	117.7	117	118	8.24	821	0	1002	0	1109	0	2245	2245	0	2723	2723	0	2794	0	200	358	210	363	173	291	75	73	76	67	71	74	75	66	0.50	0.00	0.41	0	365.7	0.0
7	30.0	0.5	4.77	117.7	117	118	8.26	924	0	977	0	1084	0	2243	2243	0	2747	2747	0	2788	0	200	353	212	361	174	289	77	73	76	67	71	73	75	68	0.50	0.00	0.42	0	364.3	0.0
8	30.0	0.5	4.75	116.7	117	117	8.27	930	0	978	0	1176	0	2251	2251	0	2735	2735	0	2886	0	201	352	210	365	173	288	78	75	77	69	72	74	76	67	0.52	0.00	0.42	0	365.0	0.0
9	29.9	0.5	4.77	115.6	117	116	8.26	776	0	978	0	1169	0	2252	2252	0	2744	2744	0	2895	0	200	354	212	368	176	289	79	75	78	69	73	75	77	67	0.52	0.00	0.42	0	365.8	0.0
10	30.0	0.5	4.77	119.1	117	119	8.27	911	0	956	0	1136	0	2254	2254	0	2732	2732	0	2824	0	200	355	211	368	175	288	80	74	78	70	73	76	77	68	0.51	0.00	0.43	0	365.8	0.0

Test Numbers: M20-064-09

Report Number: 203145-4

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DISTANCE		DECEL		PRESSURE						TORQUE						TEMPERATURE												FLUID		FRICTION		INERTIA				
									Avg	Average	Sustained	Maximum							Rotor	Front		Rear		Front		Rear		O/B	Fluid	Rotor	Front		Rear		Displace.	Coeff.					
	Init	FNL	Stop	Rept	Stop	Rept	Dist	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear	in³	μ	slug ft²			
mi/h s ft ft/s² lbf/in² lbf ft F																																									
DOWNSHILL SIMULATION TEST																																									
0.20g Deceleration Rate																																									
1	59.9	30.0	7.11	635.9	483	52250	5.99	807	0	858	0	930	0	1648	1648	0	1771	1771	0	1891	0	112	590	113	589	104	456	81	74	77	69	71	74	76	67	0.45	0.00	0.31	0	369.3	0.0
2	30.0	19.9	2.55	49.0	97	2343	5.57	568	0	609	0	647	0	1512	1512	0	1782	1782	0	1830	0	336	427	304	376	246	306	80	75	76	69	70	73	75	67	0.34	0.00	0.44	0	364.6	0.0
3	19.9	0.5	4.50	23.6	72	716	5.95	533	0	576	0	629	0	1687	1687	0	1912	1912	0	1939	0	357	422	331	393	278	336	81	73	75	69	71	74	75	68	0.34	0.00	0.50	0	380.6	0.0
4	40.0	0.5	9.26	56.5	285	2632	6.02	565	0	574	0	704	0	1632	1632	0	1741	1741	0	1871	0	334	577	319	543	266	485	80	73	78	68	71	74	76	67	0.37	0.00	0.46	0	363.5	0.0
5	54.9	39.9	3.74	214.2	269	16100	5.70	629	0	665	0	687	0	1551	1551	0	1720	1720	0	1756	0	262	484	274	503	231	361	81	71	76	69	70	75	75	66	0.39	0.00	0.39	0	365.2	0.0
6	55.0	35.0	5.43	71.2	366	5635	5.29	444	0	457	0	494	0	1225	1225	0	1296	1296	0	1325	0	326	622	325	629	271	494	83	73	76	70	71	73	76	68	0.31	0.00	0.43	0	310.5	0.0
7	34.9	14.9	4.87	20.8	184	1161	5.83	491	0	511	0	633	0	1559	1559	0	1694	1694	0	1909	0	449	643	465	625	391	551	83	75	75	68	71	71	75	66	0.36	0.00	0.50	0	359.0	0.0
8	55.0	39.9	3.78	93.6	270	6895	5.70	629	0	662	0	798	0	1515	1515	0	1667	1667	0	1700	0	398	686	403	645	335	543	83	72	75	68	70	73	74	66	0.41	0.00	0.38	0	356.6	0.0
9	55.0	49.9	1.53	57.8	121	4542	4.72	451	0	498	0	519	0	1054	1054	0	1251	1251	0	1331	0	442	543	444	535	371	431	83	72	75	68	69	73	74	65	0.33	0.00	0.38	0	299.7	0.0
10	49.9	39.9	2.71	56.8	185	4201	5.20	471	0	496	0	532	0	1255	1255	0	1399	1399	0	1449	0	409	601	420	585	353	478	86	73	76	68	70	73	74	64	0.34	0.00	0.43	0	323.7	0.0
11	54.9	39.9	3.79	114.2	271	9133	5.65	487	0	610	0	735	0	1504	1504	0	1658	1658	0	1868	0	351	645	366	614	311	515	87	73	76	66	69	71	74	65	0.41	0.00	0.41	0	356.9	0.0
12	54.9	30.0	6.12	101.6	392	8109	5.81	582	0	650	0	749	0	1547	1547	0	1664	1664	0	1703	0	359	728	369	700	312	607	88	75	75	68	69	72	74	65	0.40	0.00	0.39	0	357.1	0.0
13	55.0	39.9	3.68	64.8	263	4918	5.82	626	0	796	0	1018	0	1648	1648	0	1847	1847	0	2009	0	452	748	451	691	380	594	90	71	75	66	69	72	73	65	0.49	0.00	0.35	0	379.8	0.0
14	54.9	39.9	3.75	128.6	270	10310	5.67	708	0	763	0	903	0	1550	1550	0	1756	1756	0	1883	0	400	695	416	653	350	557	91	72	76	65	68	72	74	65	0.47	0.00	0.35	0	366.5	0.0
15	55.0	39.9	3.49	62.4	252	4918	6.10	917	0	1065	0	1344	0	1867	1867	0	2154	2154	0	2186	0	442	763	454	712	380	607	91	72	74	65	68	71	72	64	0.62	0.00	0.31	0	410.5	0.0
16	44.9	0.1	9.48	41.9	331	2773	6.55	1301	0	1354	0	1800	0	2022	2022	0	2234	2234	0	2269	0	520	818	521	797	442	706	92	71	75	66	68	71	73	64	0.84	0.00	0.25	0	414.5	0.0
17	44.9	0.1	10.25	85.3	350	4767	6.18	1648	0	1715	0	1797	0	2149	2149	0	2381	2381	0	2718	0	555	867	565	855	481	756	93	71	74	66	68	71	72	64	0.90	0.00	0.21	0	466.4	0.0
18	55.0	39.9	3.84	209.8	275	15740	5.57	844	0	895	0	1038	0	1496	1496	0	1717	1717	0	1788	0	423	689	453	655	393	559	97	73	74	64	68	70	72	64	0.55	0.00	0.29	0	360.4	0.0
19	39.9	0.5	9.81	94.5	302	5634	5.69	536	0	545	0	787	0	1445	1445	0	1537	1537	0	1697	0	428	635	444	623	384	558	99	72	74	65	67	70	72	62	0.45	0.00	0.43	0	340.8	0.0
20	55.0	0.5	13.72	92.7	573	6192	5.68	589	0	598	0	767	0	1405	1405	0	1467	1467	0	1644	0	432	778	445	765	383	684	100	70	75	65	67	69	72	63	0.43	0.00	0.37	0	332.1	0.0
21	55.0	0.5	14.25	263.6	593	20060	5.48	483	0	489	0	695	0	1292	1292	0	1343	1343	0	1496	0	330	608	354	599	307	525	103	72	74	63	67	69	71	62	0.42	0.00	0.41	0	316.5	0.0
2 MINUTE STOP WITH VEHICLE IN PARK																																									
22	59.9	55.0	1.46	38.1	127	1868	4.80	660	0	954	0	985	0	1585	1585	0	2305	0	445	597	448	550	386	467	108	70	73	66	65	69	71	63	0.51	0.00	0.36	0	443.1	0.0			
23	59.9	55.0	1.41	14.5	124	1252	4.94	629	0	955	0	1003	0	1607	1607	0	2278	0	2381	0	492	639	504	610	445	522	108	71	72	65	66	68	71	62	0.51	0.00	0.36	0	436.2	0.0	
24	60.0	55.0	1.45	14.4	127	1242	4.86	701	0	983	0	1049	0	1606	1606	0	2257	0	2316	0	536	688	546	655	486	562	105	71	72	64	66	69	71	61	0.53	0.00	0.35	0	443.9	0.0	
25	59.9	55.0	1.44	14.5	126	1250	4.82	870	0	1057	0	1124	0	1583	1583																										



**Brake Performance Study Attachment 6: Dynamometer Testing Report: Downhill Braking
Simulation Test– 2001 Ford Excursion with Limousine Conversion, 13565 lbs -1/2 Rear
Brakes**

Schoharie, NY

HWY19H001

NATIONAL TRANSPORTATION SAFETY BOARD

SCHOHARIE, NY DOWNHILL BRAKING SIMULATION TEST

Client NTSB Acquisition and Lease Management Division
490 L'Enfant Plaza East SW
Washington, DC 20594-0003

Report Number 203145-5
(Used Parts - 13,565 lb GVW -1 Failed Rear Caliper)

Vehicle Simulated 2001 Ford Excursion with Limousine Conversion

Front Lining Edge Code MPV 2000-EE

Rear Lining Edge Code MPV 2000-EE

Test Completion Date 21 March 2020

Signature

Kevin C. Machus, Test Engineer
for Greening Testing Laboratories, Inc.

This test report issued in Adobe® Acrobat® format only.

Original retained on file at

Greening Testing Laboratories, Inc.

Complete test report in Microsoft® Excel format available upon request.



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Detroit, Michigan 48234-2742 U.S.A.

Phone: +1.313.366.7160 • Email: info@greeninginc.com • Web: www.greeninginc.com

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Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

Test Numbers	M20-064-10	
Test Program Number	3947.01.20V01 - 2001 FORD EXCURSION.TST	
Vehicle System Simulated	2001 Ford Excursion with Limousine Conversion	
Reference	Contract No. 9531BM20P0015	
Test Date(s)	21 March 2020	
Date Test Report Prepared	27 March 2020	
Test Report Prepared By	K. Machus	
Gross Vehicle Weight	13,565 lbs (per NTSB)	
Static Rolling Radius	16.1 inches (based on revolutions per mile of LT265/75R16D tires)	
Test Inertia (without loss)	379.2 slug·ft ²	
Parasitic Loss	3.0% (based on vehicle measurements)	
Test Inertia (with loss)	368.8 slug·ft ²	
Equivalent 1/2 Vehicle Weight	6,579 lbs	
	Front Disc Brake	Rear Disc Brake
Lining Edge Code	MPV 2000-EE	MPV 2000-EE
Brake Pad Part Number	Motorcraft BR1266	Motorcraft BR1275
Brake Pad FMSI® Number	7625-D756	7626-D757
Brake Configuration	dual piston, separate function caliper disc brake	dual piston, separate function caliper disc brake
Piston Diameter(s)	2 x 54 mm	2 x 46 mm
Rotor Part Number	Ford 1G3Z-1V102-AB	Ford YC3Z-2C026-BB
Brake Size (nominal)		
Rotor Diameter x Thickness	13.0 x 1.5 inches	12.8 x 1.2 inches
Rotor Mass (nominal)	20.7 kg	10.9 kg
Rotor Effective Radius	5.599 inches	5.529 inches
Wheel Rotation	right hand	left hand
Test Fixture	096622	190316
Date Parts Received	16 January 2020	16 January 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

DATA NOTES

- 1 All average and sustained values shown in this report are calculated with respect to **DISTANCE**.
- 2 The data presented in this report has been gathered as follows:

START Threshold = 50 lbf·ft of brake torque during brake apply.

AVERAGE = average value between START and STOP Threshold levels.

INITIAL Data Point = Values are taken at the point where the control level is achieved.

SUSTAINED Data = average value between the INITIAL and END data points.

END Data Point = Values are taken 0.1 seconds prior to the STOP threshold

MAXIMUM = maximum value observed in the SUSTAINED Data Interval.

STOP Threshold = brake release

FINAL temperature is the highest temperature value observed in a 4.0 second "window" beginning 1.0 seconds after brake release.

- 3 Brake application is initiated when the control temperature (rotor) reaches the desired initial brake temperature.
- 4 Cooling Air Temperature = 80°F ($\pm 5^\circ\text{F}$)
- 5 Cooling Air Velocity = 20 mi/h for front brake, 2 mi/h for rear brake as determined by cooling curves conducted on a 2001 Ford Expedition.
- 6 For all stops which show "zero" (0) or negative values for some of the computed pressure, torque or coefficient values:

These stops achieved final speed but did not achieve the torque level required for the particular stop. Since the START data and STOP data thresholds were satisfied, deceleration rate, distance, time to stop, etc., are accurate values, and can be used for data comparison purposes.

The presence of "zero" values generally is caused by lack of brake performance, resulting in a "clamp" condition. "Clamp" condition is defined by the brake calling for the maximum pressure the test section allows ("clamp" pressure) and the brake being unable to attain the deceleration rate required in the test section at that pressure.

- 7 Thermocouple locations and depths:

Front Rotor: Center of inboard rubbing track at a depth of 0.040 inches

Front Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches

Front Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches

Rear Rotor: Center of inboard rubbing track at a depth of 0.040 inches

Rear Inboard Pad: Centered radially and 0.5 inches toward the leading side of the slot set to a depth of 0.060 inches

Rear Outboard Pad: Center of the leading side of the slot set to a depth of 0.060 inches

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

COMPUTED DATA DESCRIPTIONS

SPEED

INIT = Speed start threshold is achieved.

FNL = Brake release speed

TIME

STOP = Time elapsed between start threshold and brake release

REPT = Time elapsed between cycles

DISTANCE

STOP = Distance elapsed between start threshold and brake release

REPT = Distance elapsed between cycles

DECCEL

AVG = Average deceleration measured from start threshold to brake release

PRESSURE

AVERAGE = Average pressure from start threshold to brake release

SUSTAINED = Average pressure from point control level is achieved to brake release

MAXIMUM = Maximum pressure from start threshold to brake release

TORQUE

AVERAGE = Average torque from start threshold to brake release

SUSTAINED = Average torque from point control level is achieved to brake release

MAXIMUM = Maximum torque from start threshold to brake release

TEMPERATURE

INT = Temperature at start threshold

MAX = Maximum temperature between start threshold and 0.1 seconds after brake release

FLUID DISPLACEMENT

MAX = Maximum fluid displacement between start threshold and brake release

FRICITION COEFFICIENT

SUST = Friction coefficient (μ) calculated using the following formula:

$$\mu = \frac{\text{Sustained Torque (lbf}\cdot\text{ft) / Rotor Effective Radius (ft)}}{\text{Sustained Pressure (lbf/in}^2\text{) * Total Caliper Piston Area (in}^2\text{)}} * 0.5$$

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

TEST ROUTE - NEW AMSTERDAM TO SCHOHARIE NEW YORK

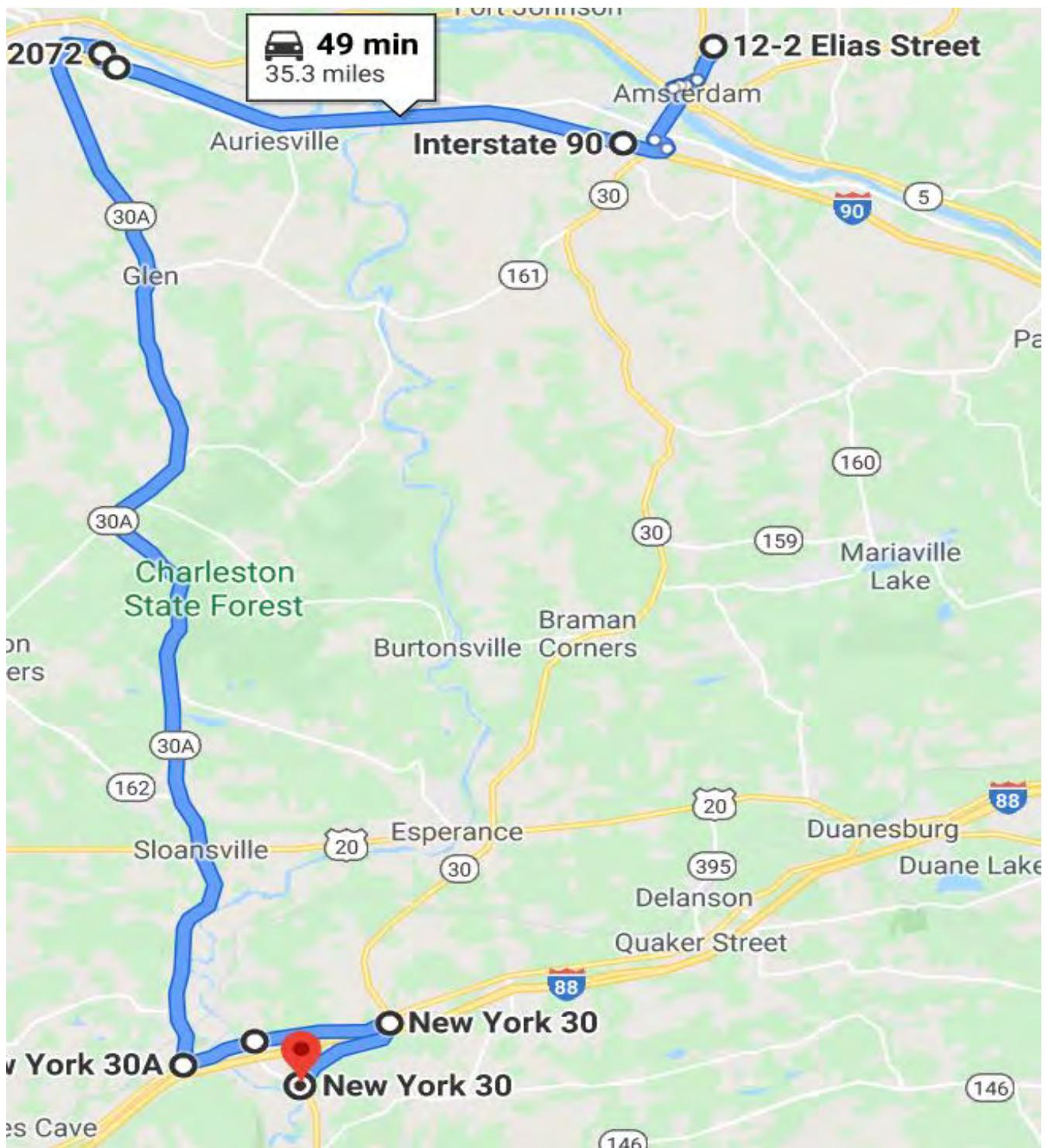
Cycle	Mile	Latitude (GPS)	Longitude (GPS)	Altitude (ft)	Grade Input (%g)	Braking Deceleration (g)	Apply Speed (mi/h)	Release Speed (mi/h)
0	0.0	42.94908	-74.18265	574.1	—	—	—	—
1	10.8	42.94409	-74.35478	293.3	-0.14%	0.2	60	30
2	11.1	42.94722	-74.35869	296.3	0.21%	0.2	30	20
3	11.2	42.94865	-74.35809	288.1	-1.69%	0.2	20	0
4	11.7	42.94957	-74.36914	287.4	0.28%	0.2	40	0
5	14.6	42.91169	-74.35237	469.5	0.40%	0.2	55	40
6	15.6	42.89860	-74.34632	647.3	5.20%	0.2	55	35
7	15.7	42.89696	-74.34592	666.0	0.80%	0.2	35	15
8	17.0	42.87979	-74.34609	802.8	0.90%	0.2	55	40
9	17.7	42.86949	-74.34253	871.7	5.27%	0.2	55	50
10	18.4	42.86000	-74.33732	1016.7	3.88%	0.2	50	40
11	20.4	42.83745	-74.35430	1200.1	1.12%	0.2	55	40
12	21.8	42.82276	-74.33815	1259.2	1.09%	0.2	55	30
13	22.6	42.81189	-74.33648	1295.6	-1.10%	0.2	55	40
14	24.5	42.78596	-74.33829	1284.1	0.19%	0.2	55	40
15	25.3	42.77450	-74.33766	1075.5	-4.69%	0.2	55	40
16	25.7	42.76815	-74.33585	955.1	-5.45%	0.2	45	0
17	26.5	42.75714	-74.33045	681.8	-10.46%	0.2	45	0
18	29.4	42.71859	-74.33721	676.2	0.59%	0.2	55	40
19	30.4	42.70533	-74.33539	633.2	2.50%	0.2	40	0
20	31.5	42.71097	-74.31464	681.4	3.31%	0.2	55	0
21	33.6	42.71540	-74.27608	1183.4	4.71%	0.2	55	0
2 MINUTE STOP - BRAKES RELEASED								
22	33.9			1078.1	-5.92%	0.2	60	55
23	34.0			1033.7	-5.92%	0.2	60	55
24	34.2			989.3	-5.92%	0.2	60	55
25	34.3			944.9	-5.92%	0.2	60	55
26	34.5			900.6	-5.92%	0.2	60	55
27	34.6			856.2	-5.92%	0.2	60	55
28	34.8			811.8	-5.92%	0.2	60	55
29	34.9			767.4	-5.92%	0.2	60	55
30	35.0			723.1	-5.92%	0.2	60	55
31	35.2	42.70259	-74.29994	678.5	-5.95%	0.2	60	55
32	35.4	42.70043	-74.30176	628.3	-5.40%	0.2	50	0

*NOTE: Test route was derived using the following criteria:

Speed limit and warning speeds were identified along the simulated route and used to control speed in the simulations. At Stop signs and controlled signalized intersections along the simulated route complete stops were modeled. At last stop before the final downhill descent a completed stop of 2 minutes was modeled. During downhill descents if the speed exceeded the posted speed limit by 5 mph braking at a maximum of 0.2 g was applied to reduce the speed to the speed limit.

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

TEST ROUTE - OVERVIEW MAP

Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

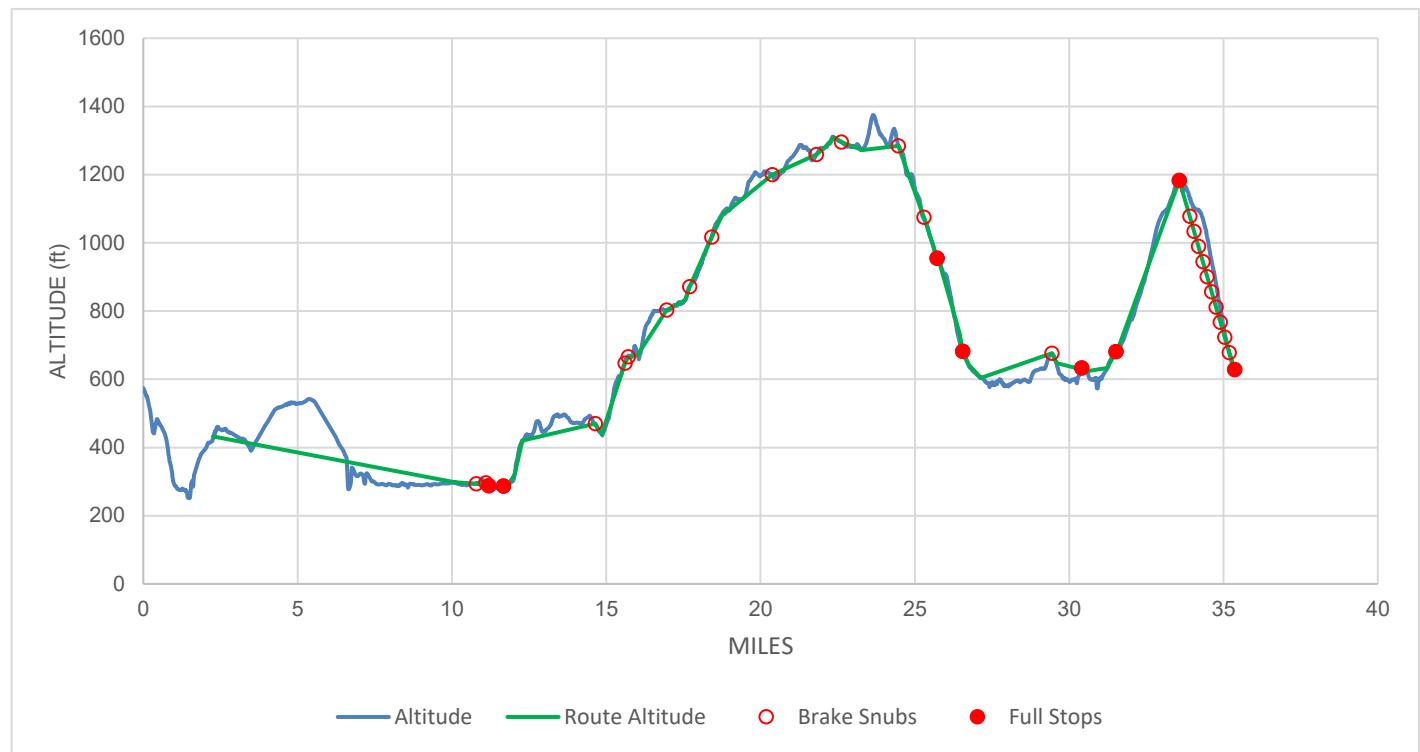
NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

TEST ROUTE - PROFILE



Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

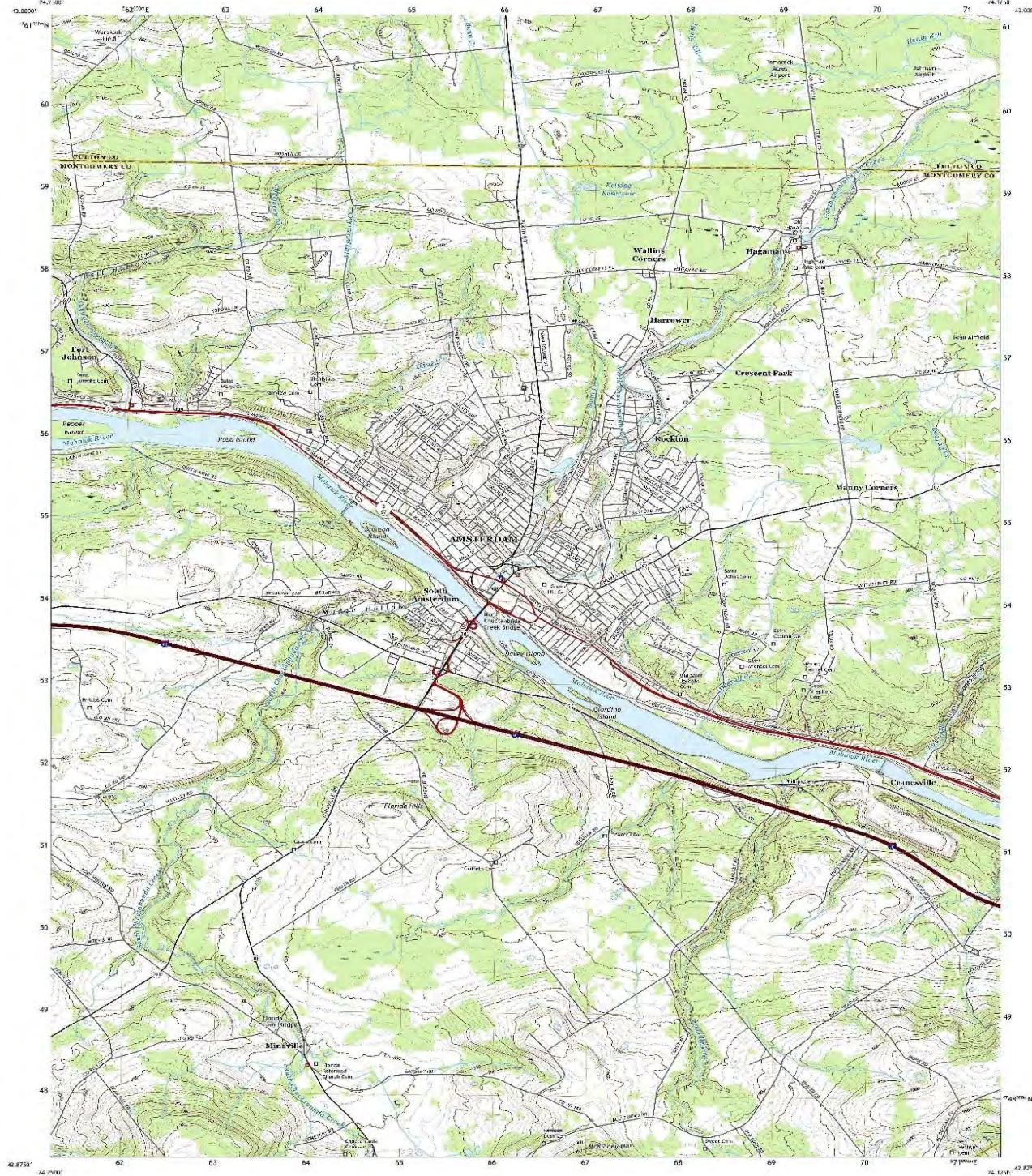
TEST ROUTE - AMSTERDAM QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



AMSTERDAM QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

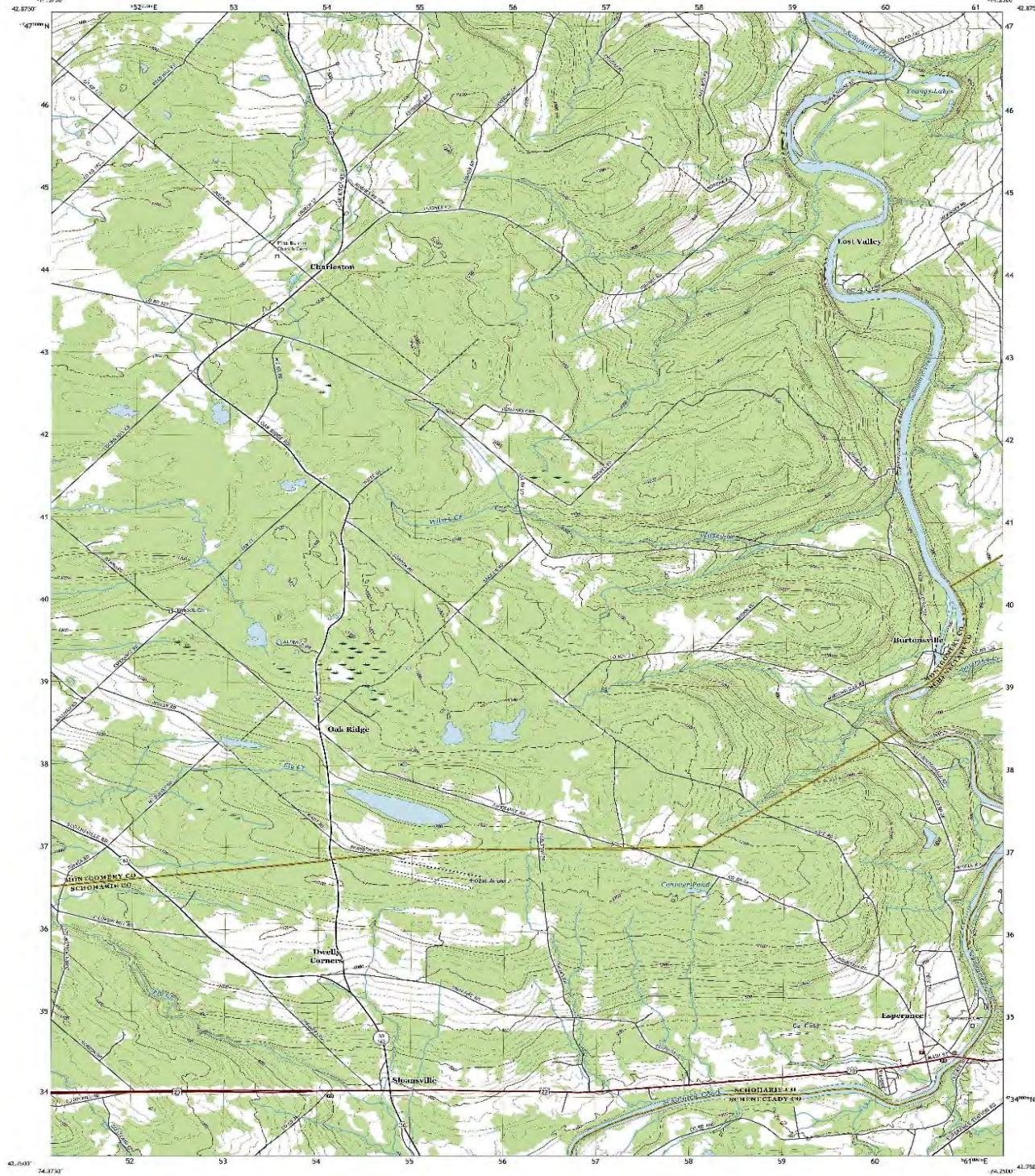
TEST ROUTE - ESPERANCE QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



ESPERANCE QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

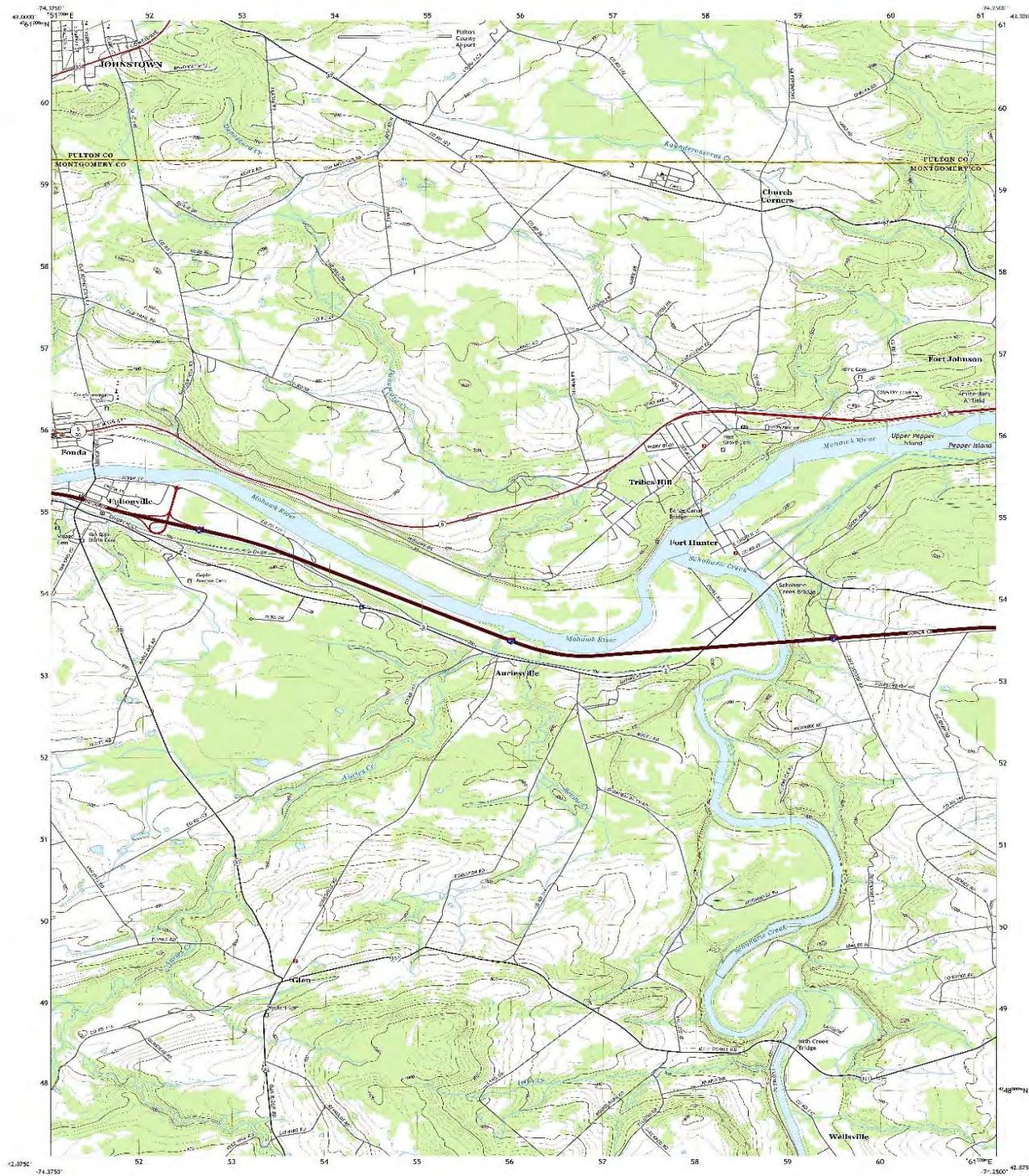
TEST ROUTE - TRIBES HILL QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



TRIBES HILL QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

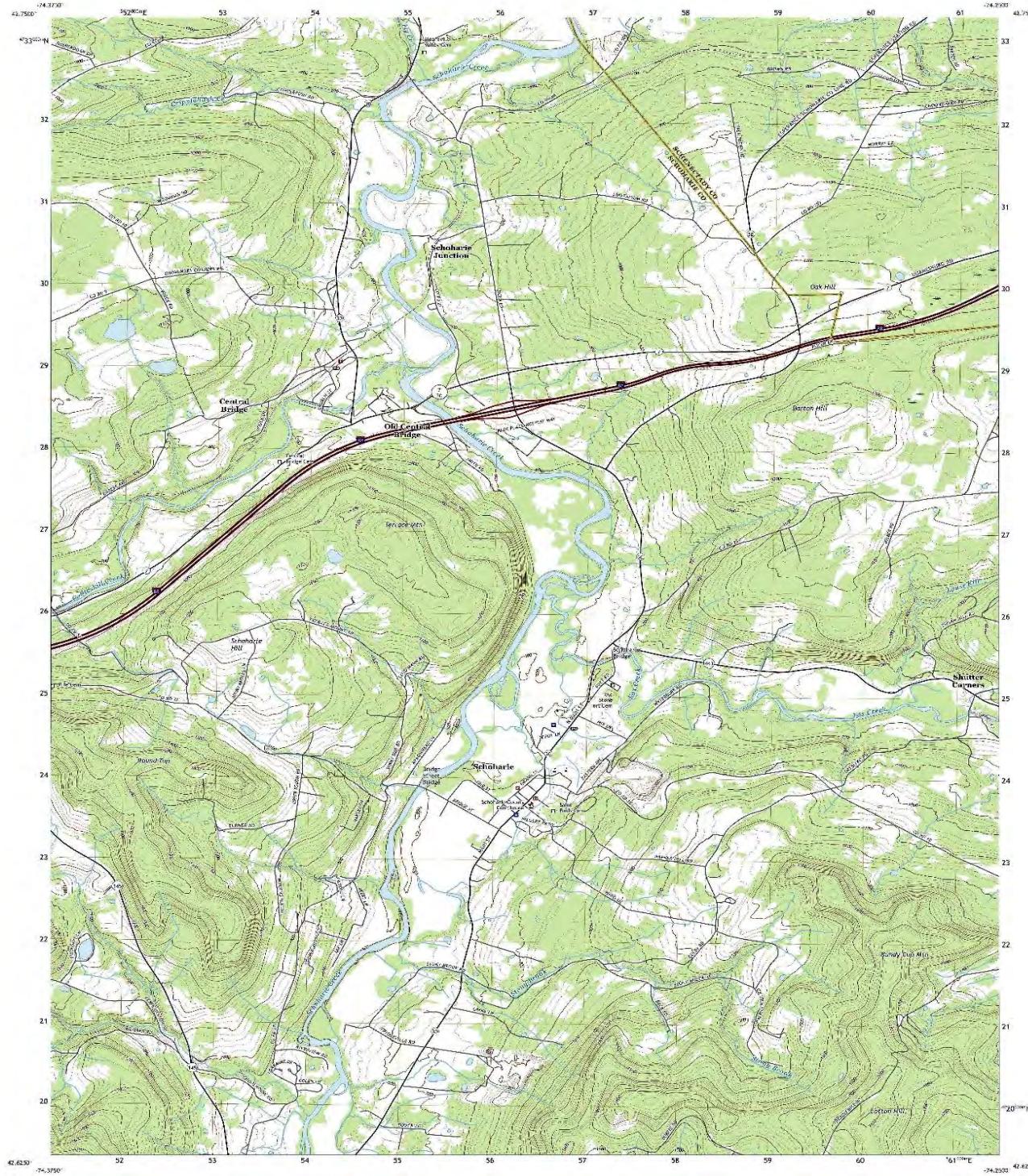
TEST ROUTE - SCHOHARIE QUADRANGLE



U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



SCHOHARIE QUADRANGLE
NEW YORK
7.5-MINUTE SERIES



Test Numbers: M20-064-10

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Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

PRE TEST PHOTOGRAPHS - FRONT BRAKE



Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

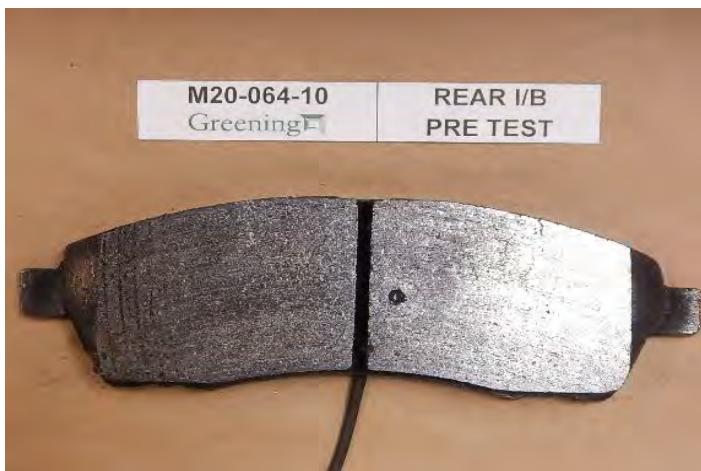
NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

PRE TEST PHOTOGRAPHS - REAR BRAKE



Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

POST TEST VISUAL INSPECTION - FRONT BRAKE

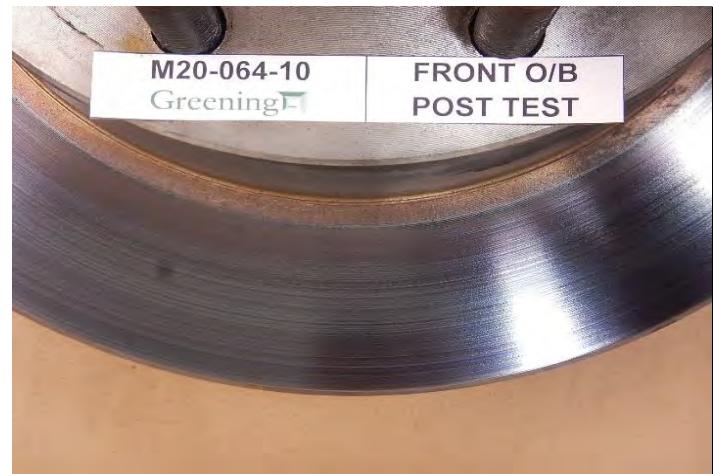
Inboard Pad: The pad has light flaking, light glazing, light grooving, moderate pitting and light resin bleed.

Outboard Pad: The pad has light flaking, light glazing, light grooving, moderate pitting and light resin bleed.

Rotor: The braking surface has light grooving, light heat checks, light hot spots, light lining transfer and is black/blue/grey in color.

All other test hardware appears in good condition.

PHOTOGRAPHS



Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

POST TEST VISUAL INSPECTION - REAR BRAKE

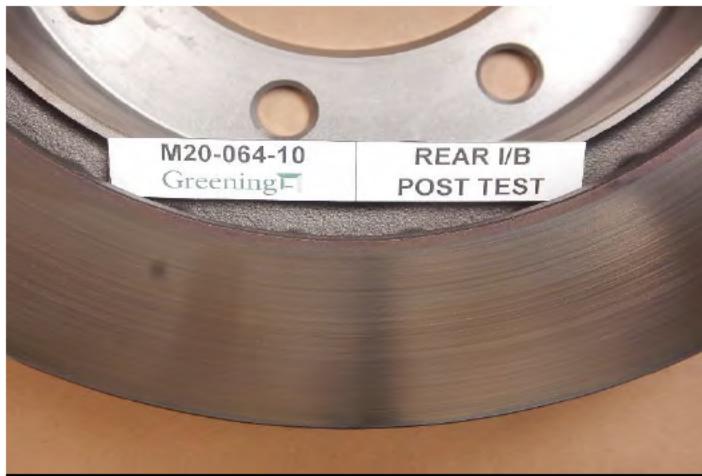
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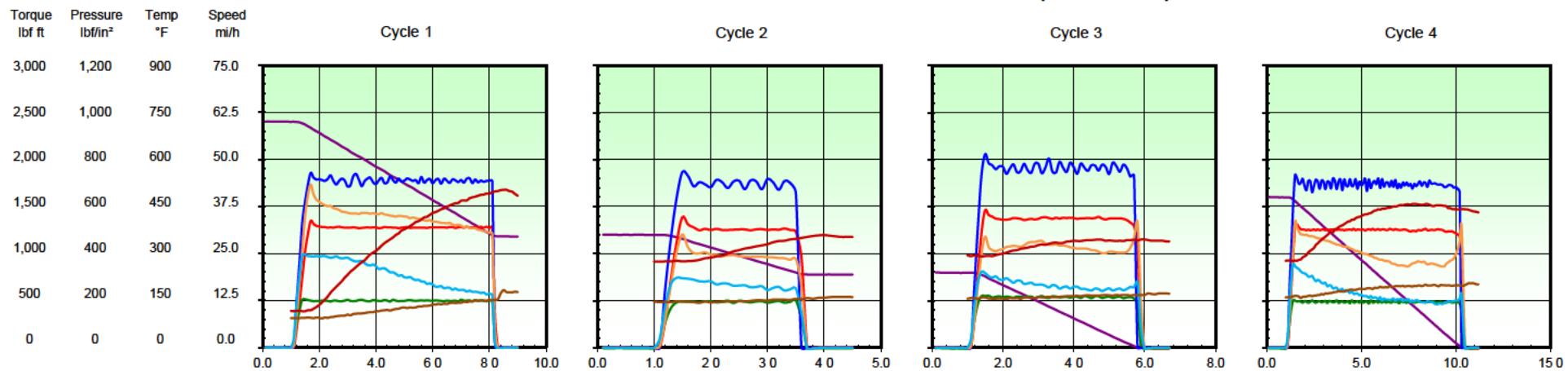
PHOTOGRAPHS



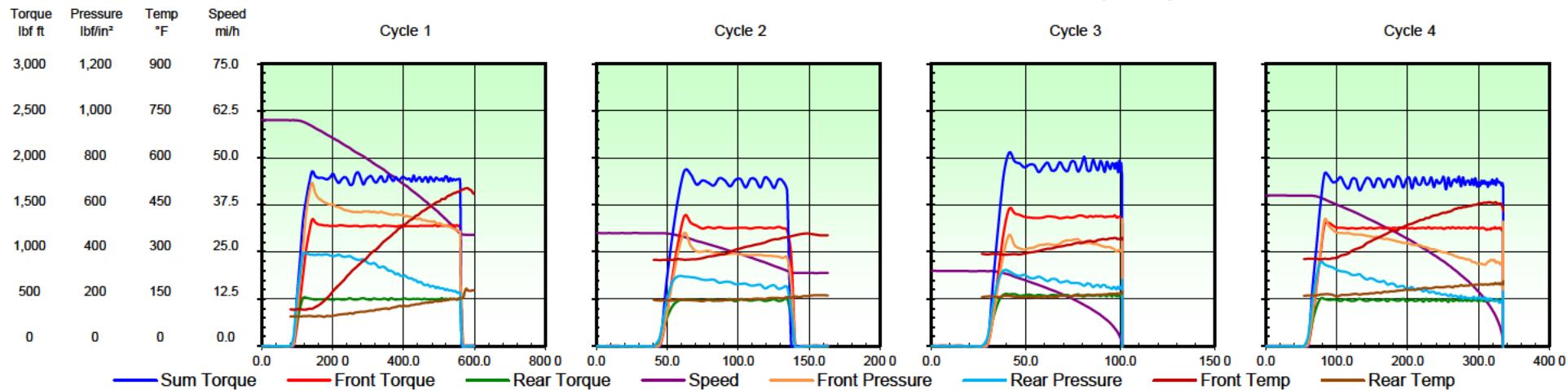
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

GRADE SIMULATION CYCLES IN-STOP DATA vs. TIME (SECONDS)



GRADE SIMULATION CYCLES IN-STOP DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-10

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

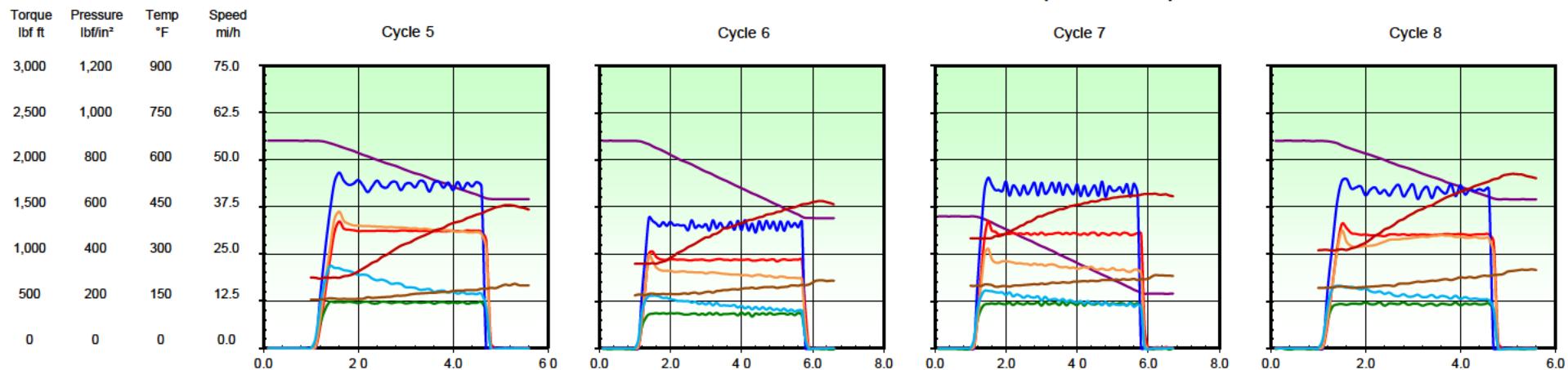
Report Number: 203145-5

Test Report Date: 21 March 2020

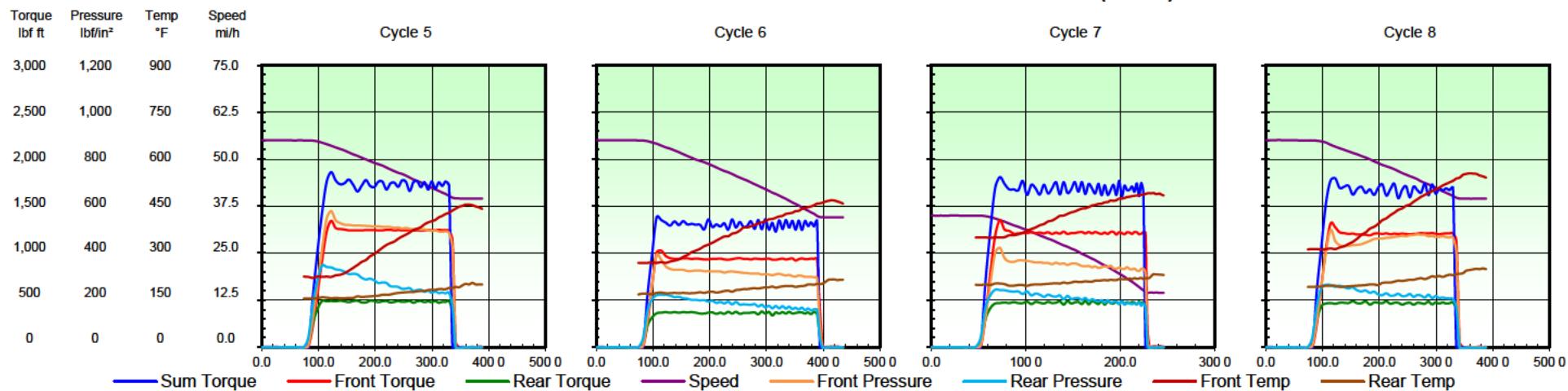
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

GRADE SIMULATION CYCLES IN-STOP DATA vs. TIME (SECONDS)



GRADE SIMULATION CYCLES IN-STOP DATA vs. DISTANCE (FEET)



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-10

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

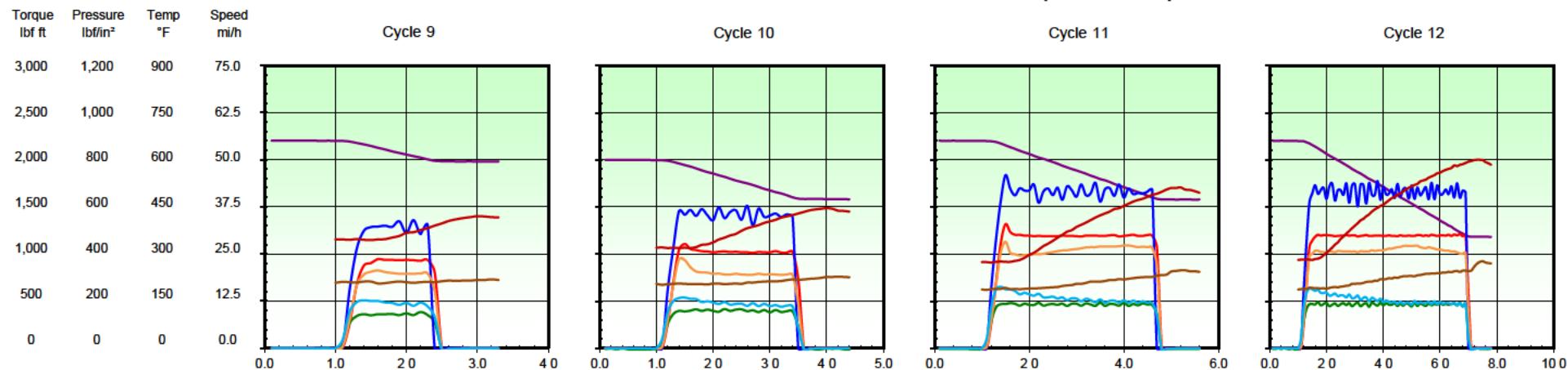
Report Number: 203145-5

Test Report Date: 21 March 2020

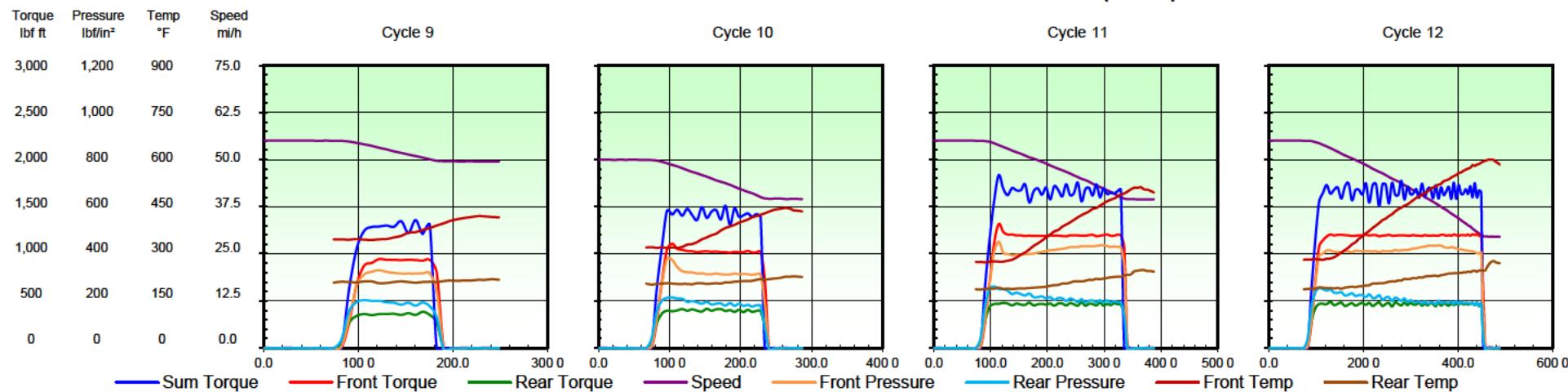
NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

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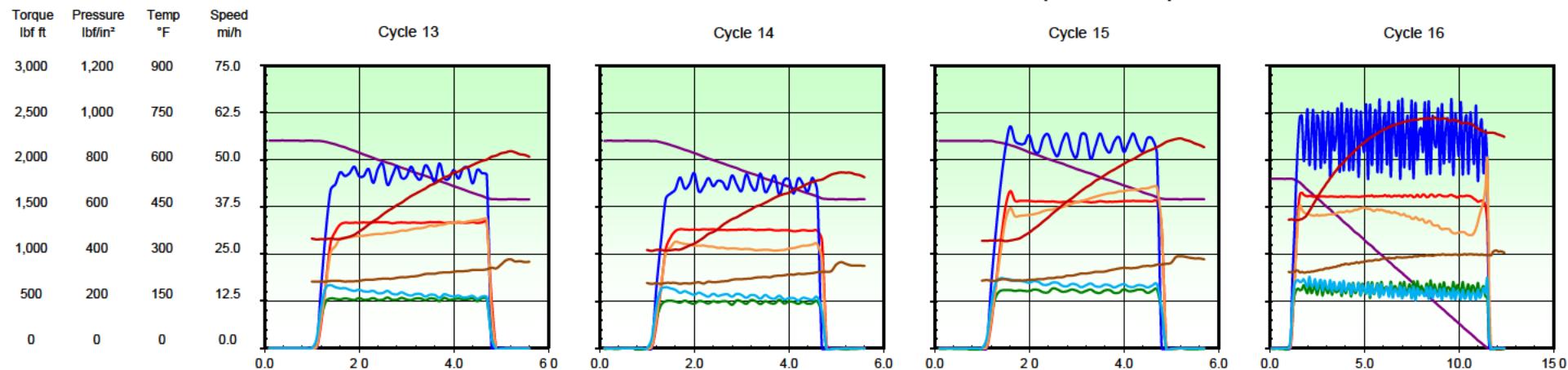
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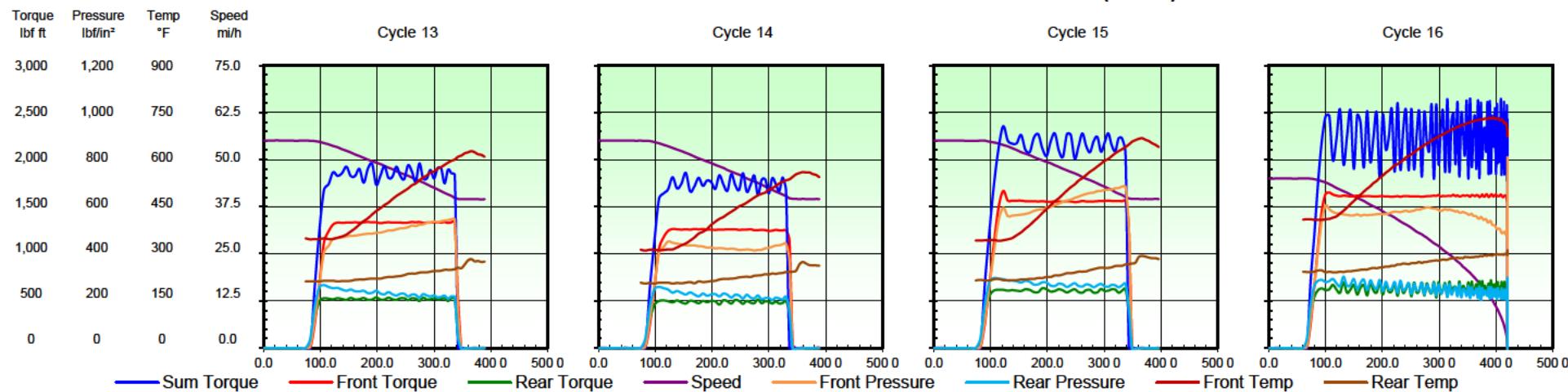
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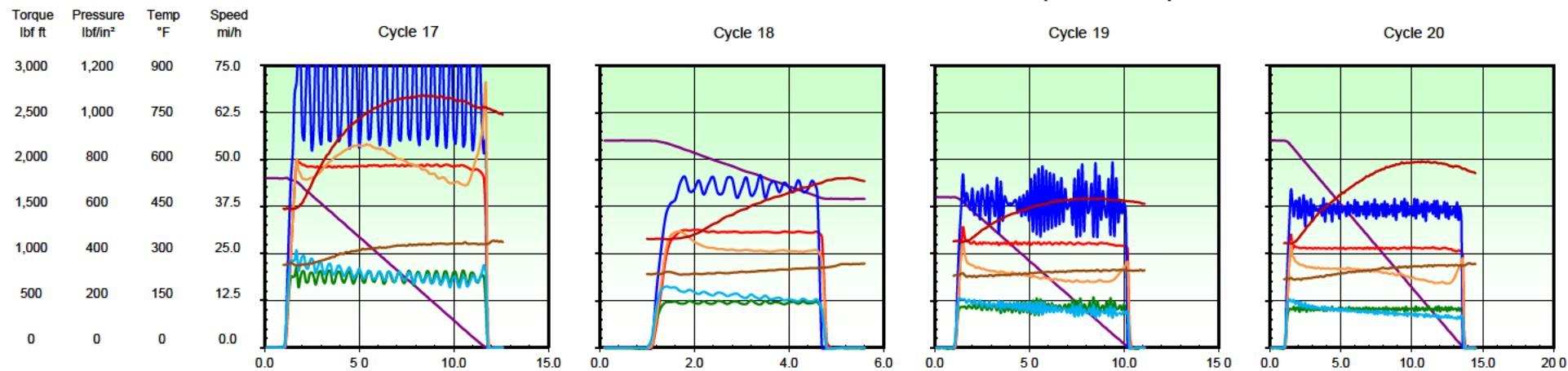
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Test Report Date: 21 March 2020

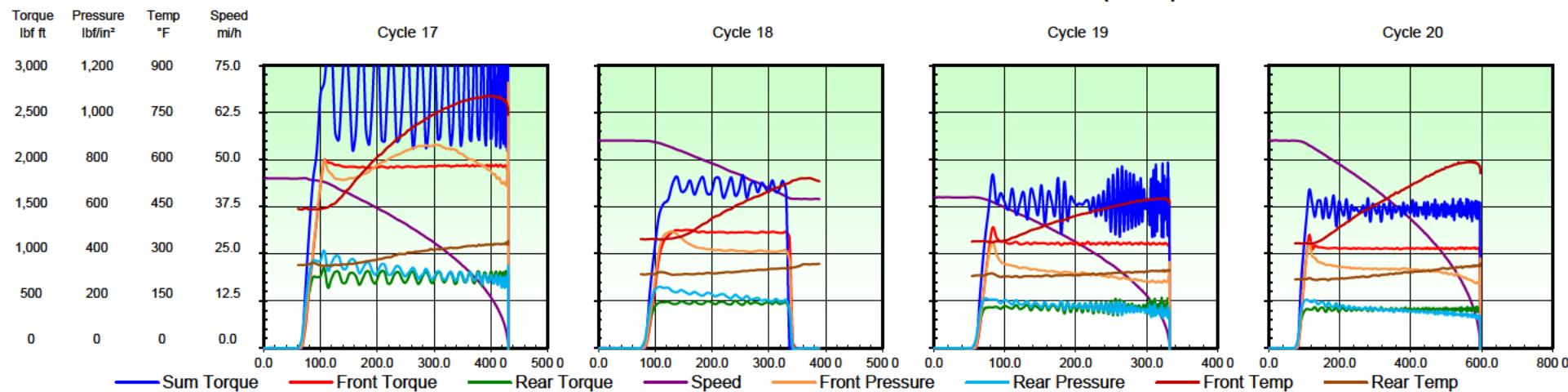
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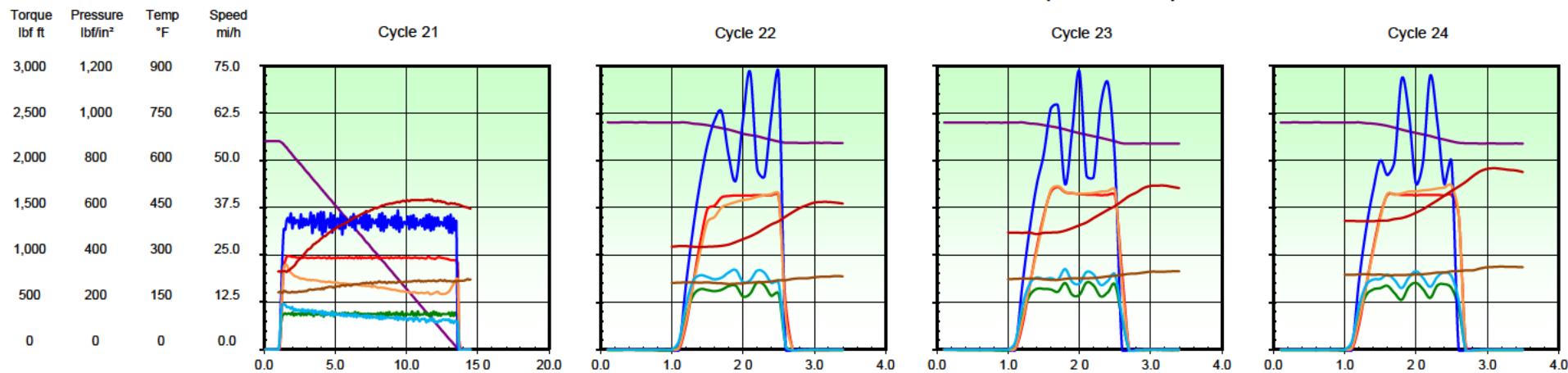
Report Number: 203145-5

Test Report Date: 21 March 2020

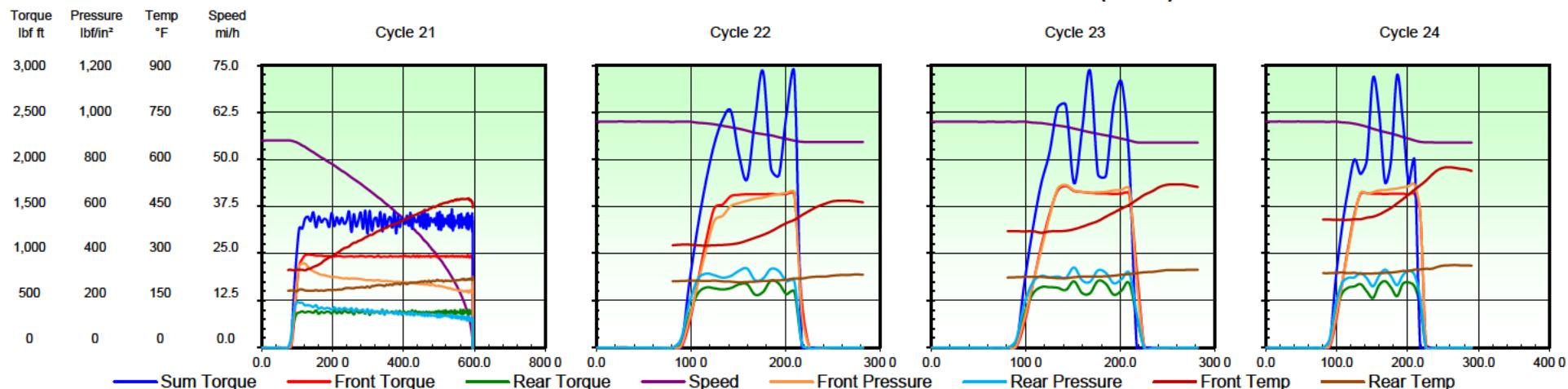
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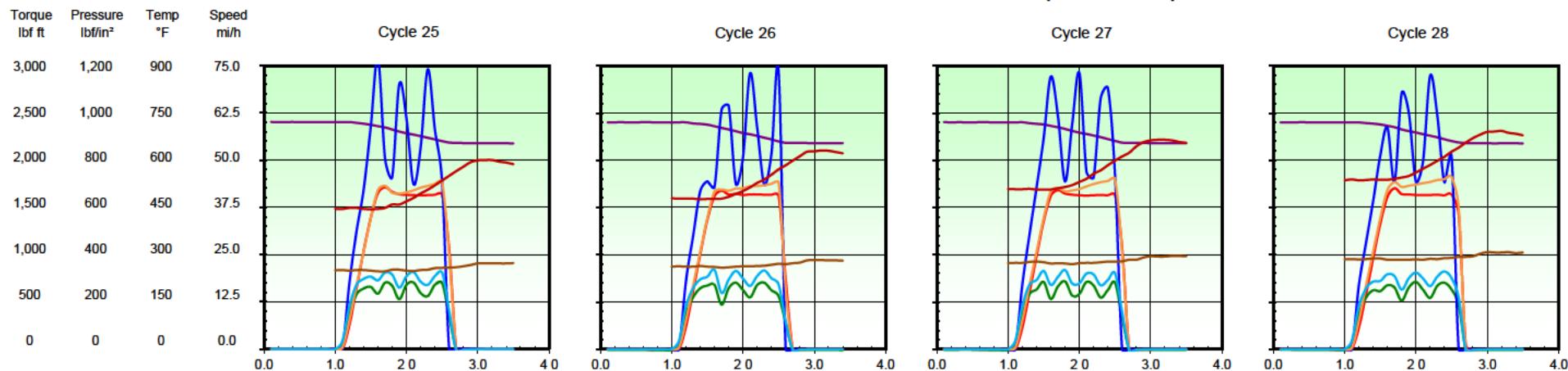
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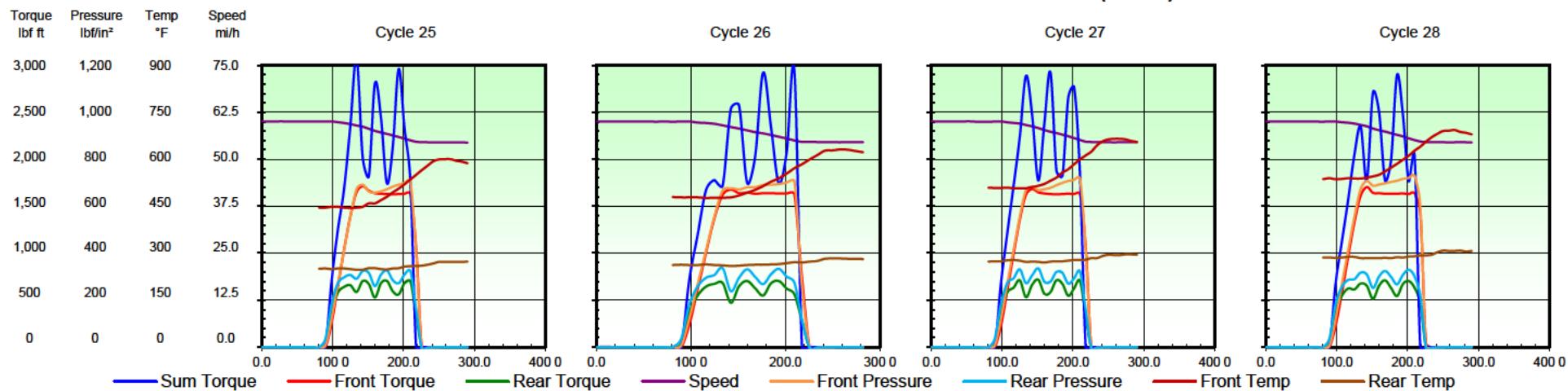
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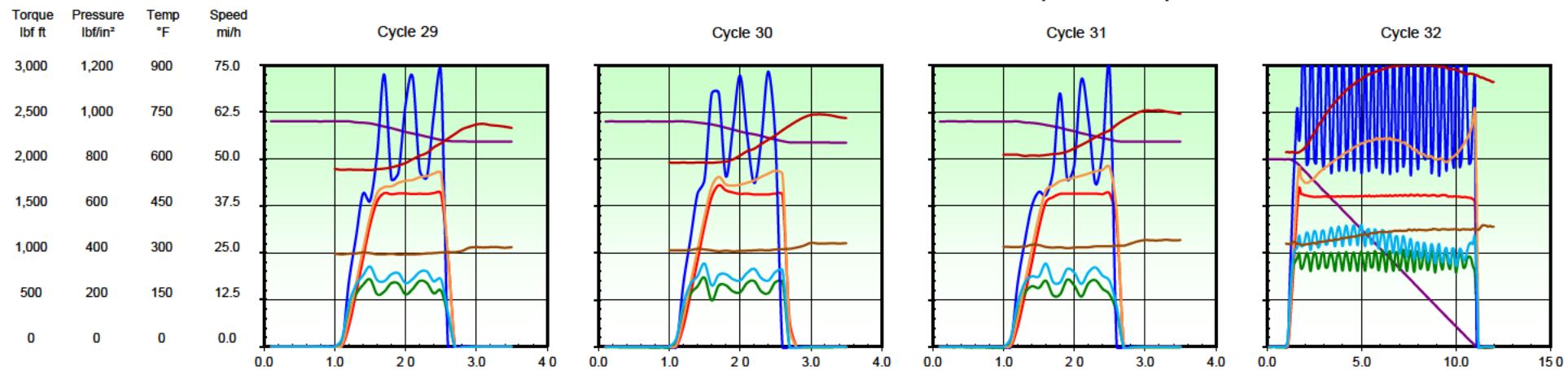
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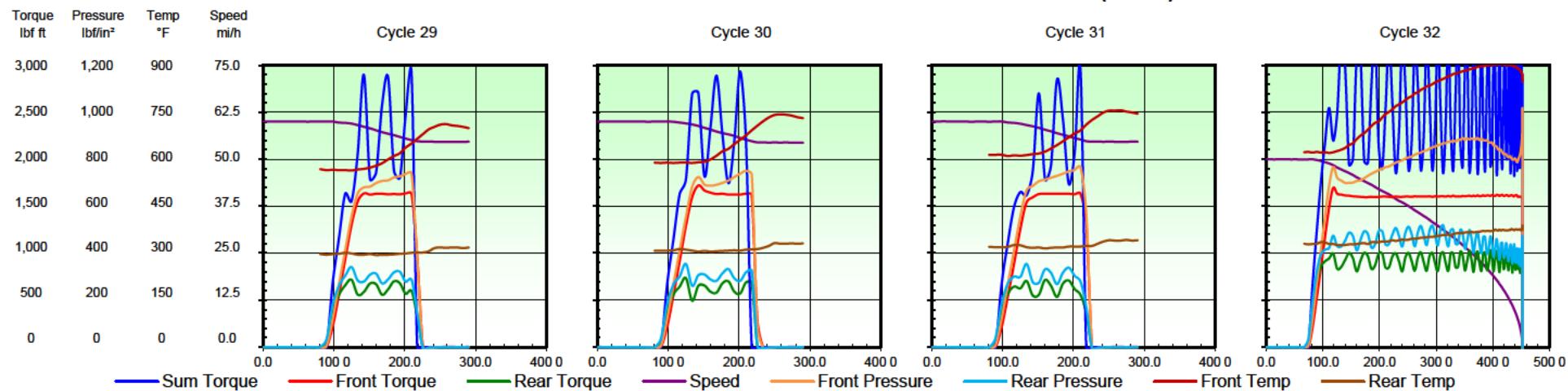
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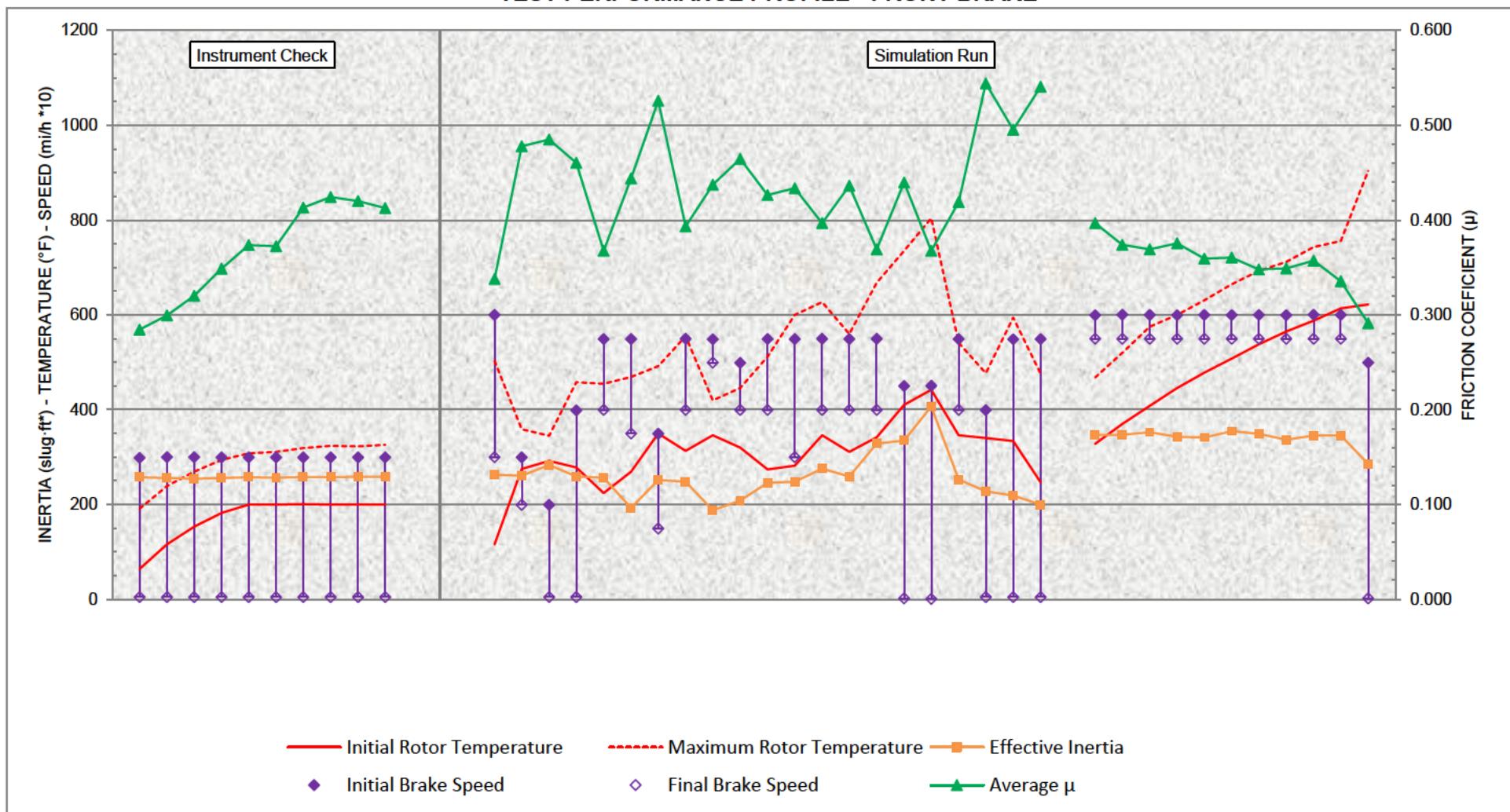
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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-10

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

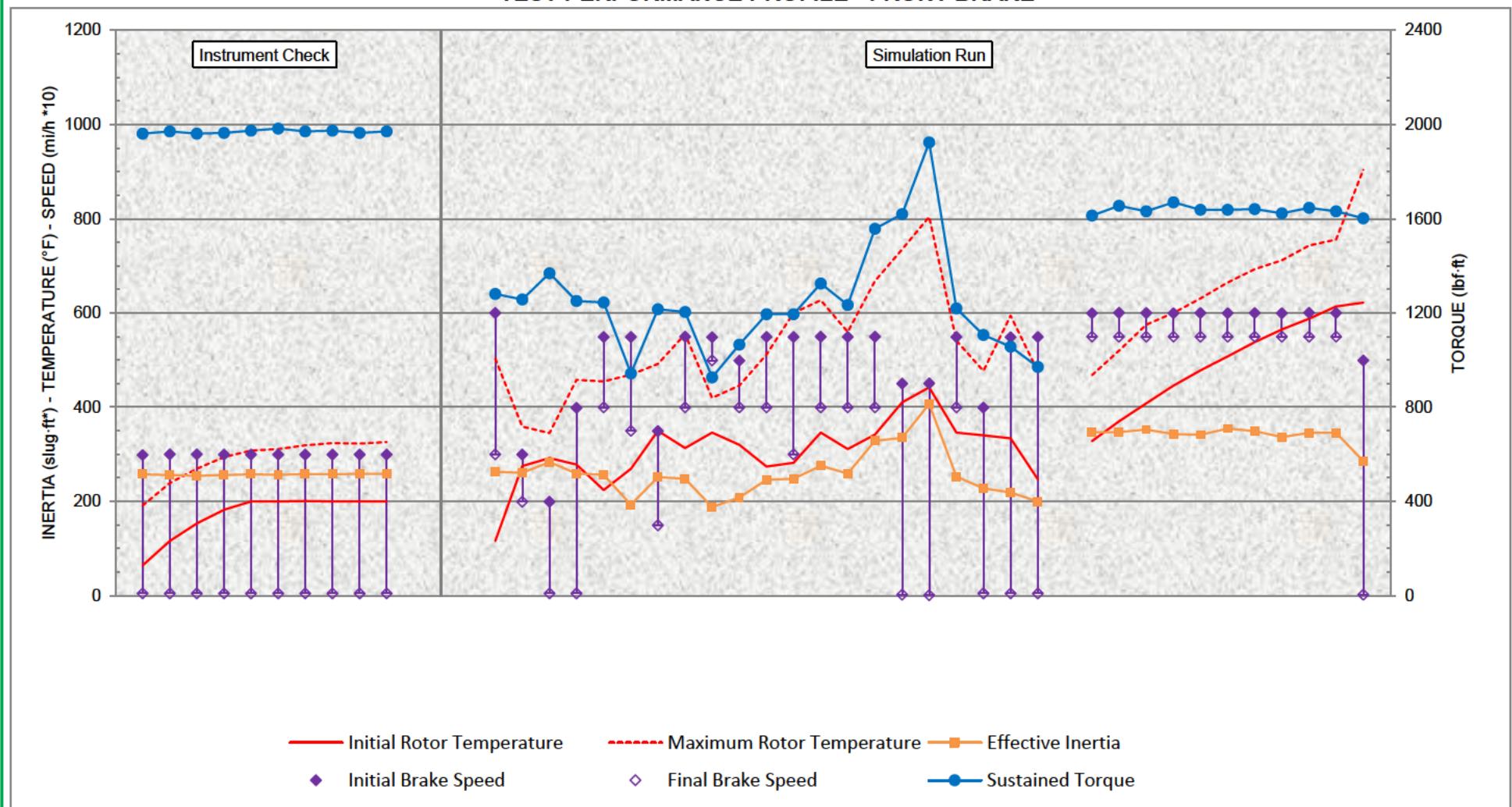
Report Number: 203145-5

Test Report Date: 21 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

TEST PERFORMANCE PROFILE - FRONT BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-10

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

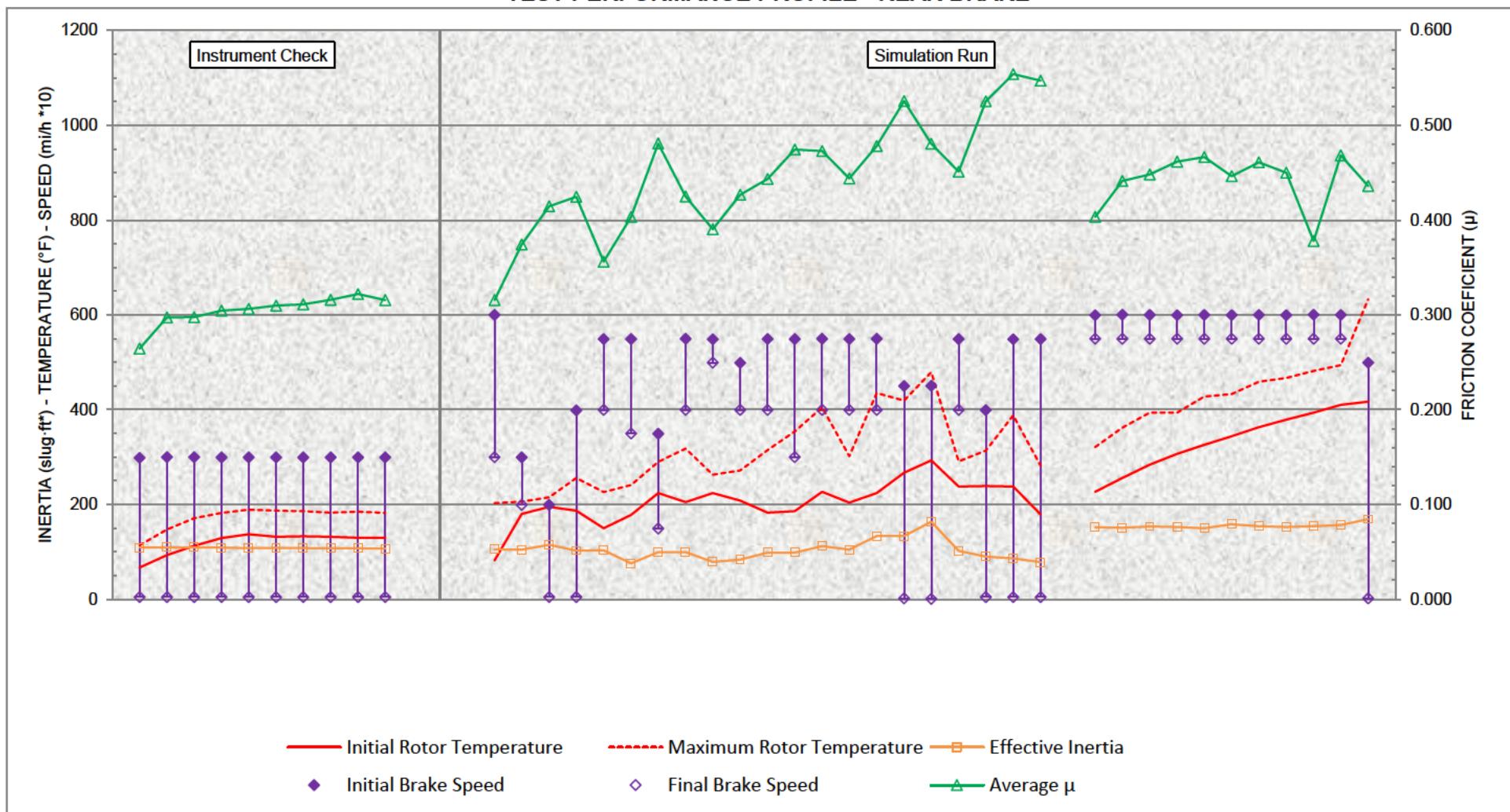
Report Number: 203145-5

Test Report Date: 21 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-10

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

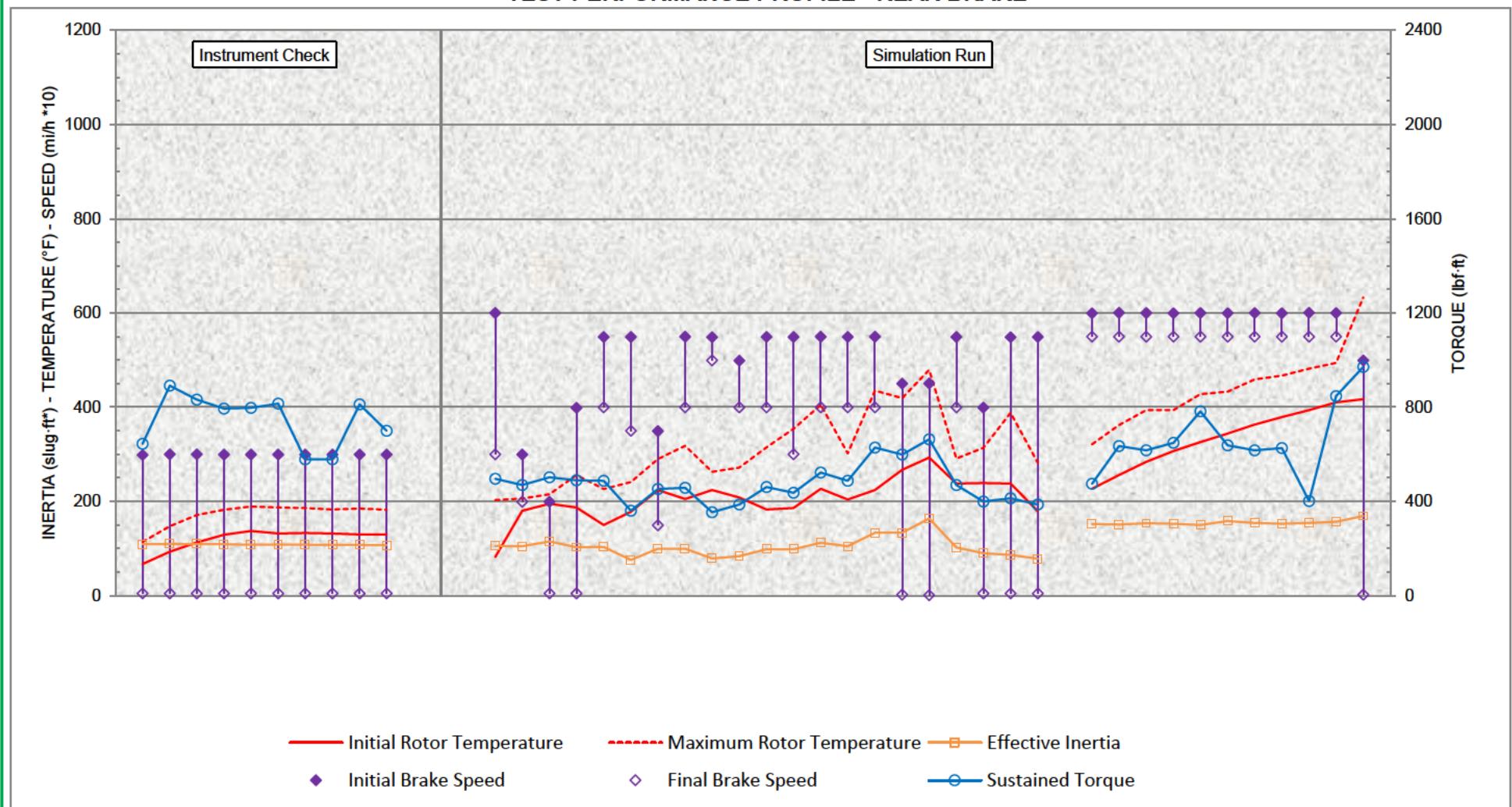
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Test Report Date: 21 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

TEST PERFORMANCE PROFILE - REAR BRAKE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-10

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

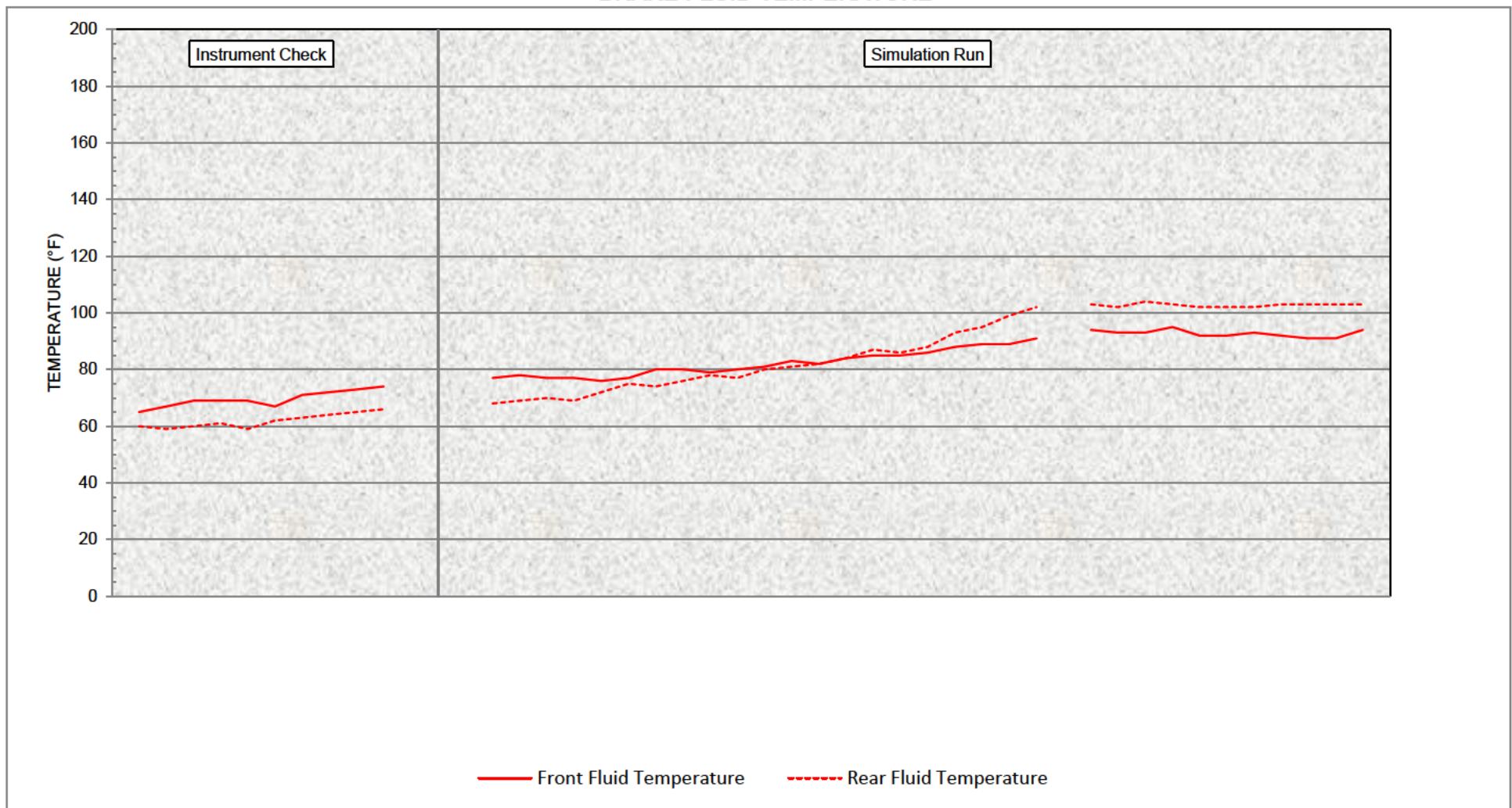
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NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

BRAKE FLUID TEMPERATURE



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-10

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Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

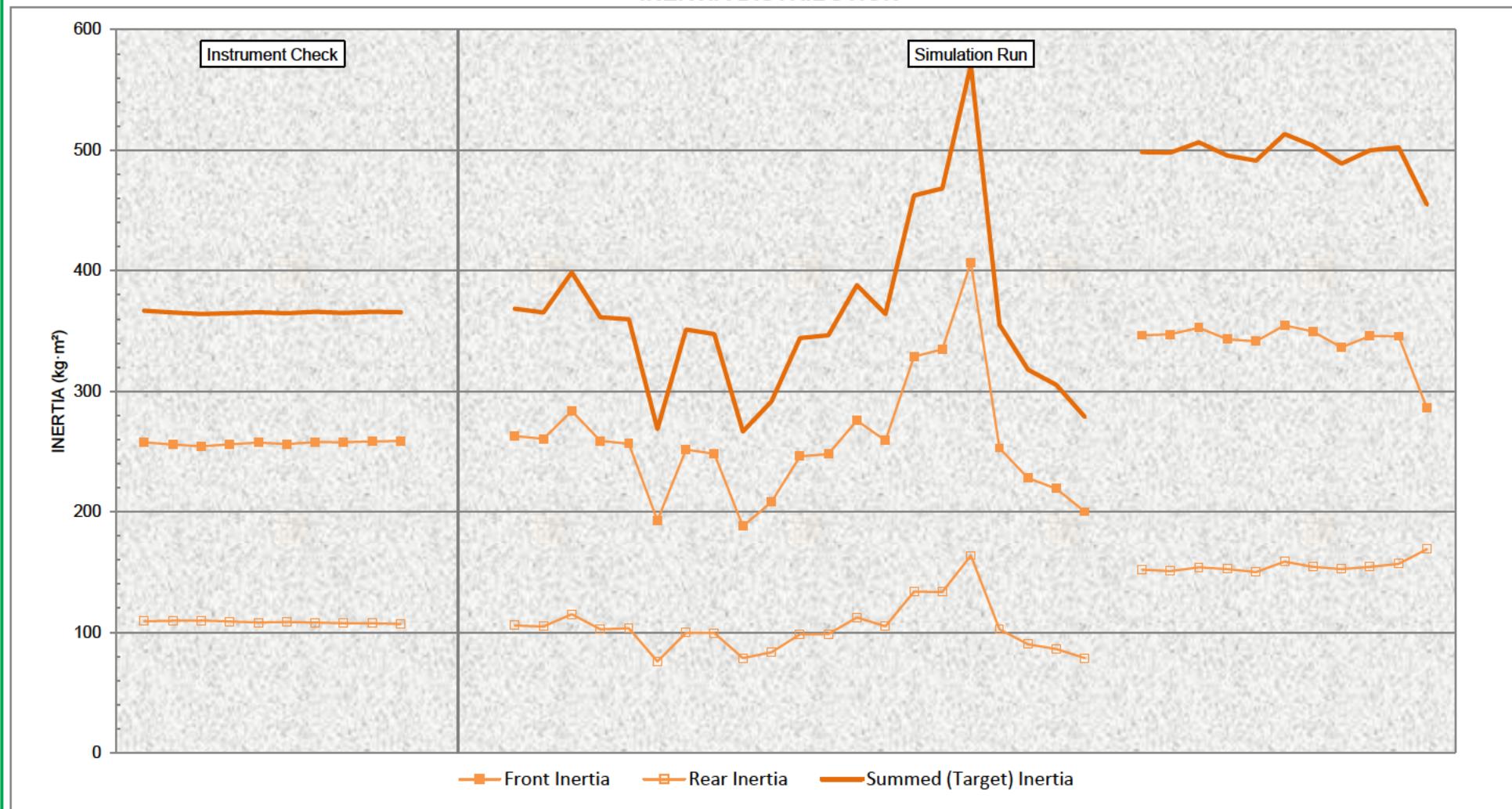
Report Number: 203145-5

Test Report Date: 21 March 2020

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW - 1 FAILED REAR CALIPER

INERTIA DISTRIBUTION



Client: NTSB Acquisition and Lease Management Division

Test Numbers: M20-064-10

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

Report Number: 203145-5

Test Report Date: 21 March 2020

Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DISTANCE		DECCEL		PRESSURE						TORQUE						TEMPERATURE												FLUID		FRICTION		INERTIA	
									Avg	Average	Sustained	Maximum	Average		Sustained		Maximum		Rotor	Front		Rear		O/B	Fluid	Rotor	I/B		Front		Rear		Displace.	Coeff.				
	Init	FNL	Stop	Rept	Stop	Rept	Dist	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear			
	mi/h		s		ft		ft/s ²							lbf/in ²																		in ³	μ	slug ft ²				

INSTRUMENT CHECK

30 mi/h - 0.31g Deceleration Rate - 200°F Initial Rotor Temperature

1	29.8	0.5	4.52	0.0	105	0	9.08	901	513	1041	513	1186	787	2482	1743	739	2606	1962	644	1998	1080	64	191	66	171	65	93	65	67	114	62	108	65	106	60	1.66	1.74	0.28	0.26	257.6	109.2
2	30.0	0.5	4.63	57.9	111	58	8.71	711	503	993	631	1163	984	2370	1660	711	2862	1971	891	1998	1387	116	239	105	216	81	106	67	93	147	80	137	87	131	59	0.85	0.42	0.30	0.30	255.8	109.5
3	30.0	0.5	4.62	60.0	110	60	8.78	878	583	925	589	1125	948	2383	1665	718	2794	1962	832	2033	1387	153	269	143	254	95	119	69	113	171	96	157	104	149	60	0.61	0.33	0.32	0.30	254.4	109.7
4	30.0	0.5	4.61	60.1	110	60	8.78	836	544	850	549	1009	958	2388	1675	713	2759	1965	794	2004	1464	182	294	174	284	109	133	69	129	182	110	169	117	161	61	0.57	0.31	0.35	0.30	255.9	108.8
5	30.0	0.5	4.59	64.5	110	65	8.81	785	544	797	548	982	932	2399	1689	710	2771	1974	797	2030	1461	200	308	194	305	121	145	69	137	189	121	175	127	168	59	0.55	0.30	0.37	0.31	257.3	108.1
6	30.0	0.5	4.58	86.2	109	86	8.89	632	428	804	554	893	916	2415	1697	718	2798	1983	815	2009	1490	200	311	202	308	127	152	67	132	187	123	169	127	168	62	0.52	0.30	0.37	0.31	256.2	108.4
7	29.9	0.5	4.56	85.2	109	85	8.87	696	388	720	392	857	899	2419	1705	714	2550	1971	579	2004	1487	201	319	208	314	133	153	71	133	186	123	170	126	168	63	0.51	0.29	0.41	0.31	257.9	108.1
8	30.0	0.5	4.56	89.3	108	89	8.93	684	383	702	386	881	904	2430	1715	715	2553	1974	579	2045	1484	200	324	208	316	134	156	72	132	183	123	171	126	168	64	0.51	0.29	0.42	0.32	257.6	107.4
9	29.9	0.5	4.55	91.3	108	91	8.93	696	527	706	531	913	890	2436	1720	715	2777	1965	812	2139	1484	200	323	208	318	134	156	73	130	185	123	168	126	167	65	0.52	0.29	0.42	0.32	258.6	107.5
10	29.9	0.5	4.57	91.8	108	92	8.93	701	463	721	467	905	883	2434	1723	711	2671	1971	700	2142	1473	200	326	210	319	136	158	74	130	182	122	170	126	166	66	0.51	0.28	0.41	0.32	258.7	106.8

Test Numbers: M20-064-10

Report Number: 203145-5

Lining Edge Codes: MPV 2000-EE Front / MPV 2000-EE Rear

NTSB

Rotor Part Numbers: Ford 1G3Z-1V102-AB Front / Ford YC3Z-2C026-BB Rear

CYCLE NO.	SPEED		TIME		DISTANCE		DECEL		PRESSURE						TORQUE						TEMPERATURE												FLUID		FRICTION		INERTIA	
									Avg	Average	Sustained	Maximum							Rotor	Front		Rear		Front		Rear		O/B	Fluid	Rotor	Front		Rear		Displace.	Coeff.		
	Init	FNL	Stop	Rept	Stop	Rept	Dist	Front	Rear	Front	Rear	Front	Rear	Sum	Front	Rear	Sum	Front	Rear	Front	Rear	Int	Max	Int	Max	Int	Max	Int	Max	Front	Rear	Front	Rear	Front	Rear			
	mi/h		s		ft		ft/s ²																												in ³	μ	slug ft ²	

DOWNHILL SIMULATION TEST

0.20g Deceleration Rate

1	60.0	30.0	6.94	606.3	468	50940	6.20	561	329	572	331	735	430	1704	1216	488	1777	1281	496	1384	582	116	503	117	497	94	183	77	82	203	84	240	89	172	68	0.45	0.21	0.34	0.32	262.9	105.6	
2	29.9	19.9	2.38	48.8	90	2330	5.96	323	249	397	264	509	309	1624	1158	466	1726	1257	469	1428	564	275	359	273	369	145	162	78	180	206	141	172	147	179	69	0.36	0.17	0.48	0.37	260.5	104.8	
3	19.9	0.5	4.57	23.5	71	712	6.05	371	247	426	255	505	328	1796	1278	518	1871	1369	502	1549	626	292	345	298	368	158	173	77	195	215	156	186	166	194	70	0.35	0.16	0.49	0.41	283.6	115.0	
4	39.9	0.5	9.07	56.7	275	2631	6.22	406	242	410	243	595	380	1677	1201	476	1741	1251	490	1440	579	278	458	271	479	161	206	77	187	256	163	233	170	236	69	0.38	0.18	0.46	0.42	258.9	102.6	
5	54.9	39.9	3.52	214.1	251	16090	6.09	468	285	511	288	638	375	1633	1164	469	1732	1245	487	1414	558	224	455	232	439	155	205	76	150	226	159	206	159	206	72	0.40	0.18	0.37	0.36	256.5	103.3	
6	54.9	35.0	4.55	71.0	306	5620	6.31	316	187	321	188	456	235	1263	907	356	1304	944	360	1175	434	269	469	272	491	170	216	77	178	241	175	218	175	226	75	0.33	0.15	0.44	0.40	192.8	75.8	
7	34.9	14.9	4.62	20.0	173	1106	6.20	344	197	349	198	467	263	1624	1164	460	1668	1216	452	1414	558	350	492	374	529	198	233	80	224	290	202	244	211	264	74	0.33	0.14	0.53	0.48	251.6	99.5	
8	55.0	39.9	3.52	93.5	249	6887	6.17	448	225	462	227	515	293	1598	1141	457	1662	1204	458	1349	561	313	555	315	534	192	251	80	205	318	200	247	201	274	76	0.36	0.16	0.39	0.42	248.1	99.4	
9	54.9	49.9	1.19	57.6	96	4527	5.81	293	186	320	191	337	226	1154	814	340	1281	927	354	968	461	346	420	347	424	211	219	79	224	263	215	228	214	246	78	0.28	0.14	0.44	0.39	188.0	78.6	
10	49.9	39.9	2.30	56.5	155	4177	6.17	337	190	346	191	447	226	1340	957	383	1452	1065	387	1260	496	320	446	325	463	202	228	80	208	272	209	230	231	208	257	77	0.33	0.14	0.46	0.43	208.1	83.4
11	54.9	39.9	3.49	113.8	248	9104	6.18	414	218	423	219	484	279	1585	1133	453	1656	1195	461	1349	567	274	512	285	511	186	248	81	183	315	193	230	191	274	80	0.34	0.16	0.43	0.44	245.9	98.3	
12	54.9	30.0	5.77	101.4	366	8091	6.21	411	194	416	194	438	286	1604	1148	456	1632	1195	437	1228	596	282	600	289	597	188	277	83	186	354	194	270	192	312	81	0.32	0.16	0.43	0.47	247.9	98.5	
13	54.9	39.9	3.55	64.4	252	4890	6.07	492	231	504	233	550	282	1754	1247	507	1848	1325	523	1363	641	346	627	347	594	212	283	82	227	405	220	269	218	344	82	0.36	0.16	0.40	0.47	275.8	112.2	
14	54.9	39.9	3.52	128.6	251	10310	6.09	418	230	427	231	458	282	1653	1176	477	1721	1234	487	1290	608	311	560	319	548	205	274	84	204	302	215	256	211	287	84	0.34	0.16	0.44	0.44	259.0	105.1	
15	54.9	39.9	3.61	62.2	258	4903	5.94	613	274	637	277	687	333	2048	1456	592	2187	1558	629	1726	750	342	668	345	612	216	293	85	224	435	226	290	221	369	87	0.41	0.17	0.37	0.48	328.7	133.7	
16	45.0	0.2	10.36	42.0	352	2780	6.19	550	239	556	240	766	425	2160	1544	616	2219	1620	599	1676	1080	410	735	408	688	242	311	85	267	419	253	369	251	393	86	0.42	0.19	0.44	0.53	334.8	133.5	
17	45.1	0.1	10.57	86.4	362	4795	6.03	777	290	790	291	1178	687	2564	1828	735	2588	1924	664	2074	1532	442	804	439	770	264	341	86	293	479	285	415	279	443	88	0.58	0.25	0.37	0.48	163.7	163.7	
18	54.9	39.9	3.52	210.3	251	15760	6.09	427	218	439	219	499	306	1613	1148	465	1688	1219	469	1278	608	346	541	365	568	235	268	88	238	291	266	285	285	93	0.37	0.18	0.42	0.45	252.9	102.4		
19	39.9	0.5	9.01	94.2	271	5612	6.32	294	160	307	160	499	310	1497	1073	424	1506	1107	399	1378	894	340	477	349	515	231	248	89	239	314	257	284	247	311	95	0.36	0.19	0.54	0.53	227.9	90.0	
20	54.9	0.5	12.42	92.1	512	6169	6.32	320	156	322	157	496	250	1438	1032	406	1470	1057	413	1316	593	334	594	343	636	219	269	89	238	388	254	312	244	364	99	0.35	0.16	0.50	0.55	219.1	86.1	
21	54.9	0.5	12.41	262.5	511	20010	6.34	270	149	271	149	370	213	1315	944	371	1358	971	387	1012	511	247	476	265	547	182	223	91	179	282	209	256	200	275	102	0.31	0.16	0.54	0.55	200.0	78.5	
22	60.0	55.0	1.35	38.2	118	1866	5.20	561	246	614	248	663	579	1933	1344	590	2089	1614	475	1655	1331	328	468	322	449	212	233	94	227	321	232	266	228	285	103	0.42	0.23	0.40	0.40	346.5	152.0	
23	60.0	55.0	1.34	14.4	118	1243	5.30	554	288	668	303	738	577	1965	1370	595	2290	1655	635	1800	1349	370	520	391	523	225	248	93	256	362	257	300	253	311	102	0.42	0.22	0.37	0.44	347.2	150.8	
24	60.0	55.0	1.37	14.5	120	1250	5.18	447	284	667	290	724	579	1955	1361	594	2249	1632	617	1750	1366	408	575	433	570	237	263	93	284</													



**Brake Performance Study Attachment 7: Dynamometer Testing Report: Example Cooling
Curve Calibration for Simulations**

Schoharie, NY

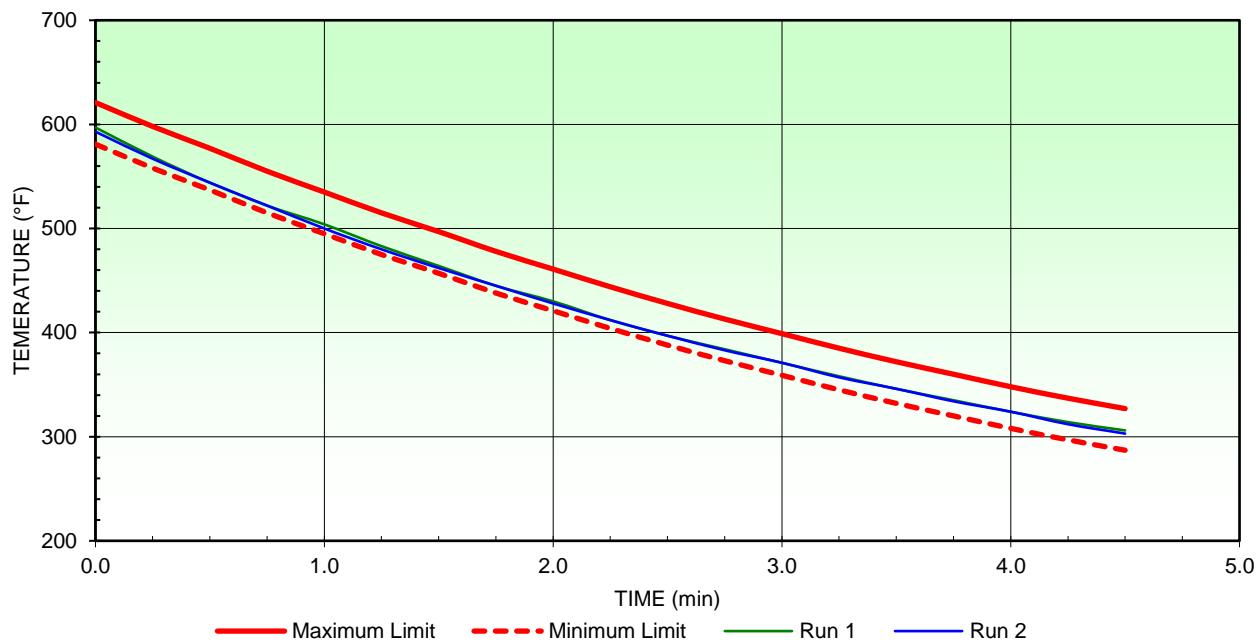
HWY19H001

NTSB - SCHOHARIE, NY BRAKING SIMULATION TEST

2001 FORD EXCURSION WITH LIMOUSINE CONVERSION - USED PARTS 13,565 LB GVW

50 mi/h BRAKE COOLING CURVES

(LIMITS DERIVED FROM VEHICLE DATA MEASURED BY NATIONAL AUTOMOTIVE TEST CENTER)

FRONT BRAKE COOLING CURVE**REAR BRAKE COOLING CURVE**