VRTC Report DCD9157-1

Vehicle Characterization and Performance Study of Toyota Camrys

VEHICLE RESEARCH AND TEST CENTER
EAST LIBERTY OHIO 43319-0337

FINAL REPORT
January 2011

www.nhtsa.gov
U.S Department of Transportation
National Highway Traffic Safety Administration

DISCLAIMER

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NHTSA-NVS-2011-ETC-SR13	2. Government Accession No.	3. Recipients's Catalog No. TDB
4. Title and Subtitle Vehicle Characterization and Performance Tests of Toyota Camrys		5. Report Date February 8, 2011
		6. Performing Organization Code **NVS-313**
7. Author(s)		8. Performing Organization Report No. **VRTC-DCD9157- WDC**
9. Performing Organization Name and Address National Highway Traffic Safety Administration Vehicle Research and Test Center P.O. Box 37 East Liberty, OH 43319		10. Work Unit No. (TRAIS)n code
		11. Contract of Grant No.
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration 1200 New Jersey Ave, SE Washington, DC 20590		13. Type of Report and Period Covered DRAFT January 2010 – February 2011
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

In response to incidents of unintended acceleration in Toyota vehicles, NHTSA VRTC conducted a Toyota Camry “Vehicle Characteristics and Performance Study” comprised of 20 Toyota Camrys. Nine of the Camrys tested were complaint vehicles purchased from consumers that allegedly experienced incidents of unwanted acceleration. Attributes and configurations of each vehicle’s systems that could affect performance was documented and evaluated. Observations are stated in Section 5 of the report. Listed features and performance measures are included in the attached appendices. No safety defects in the acceleration control systems were found during these vehicle characterizations. Subsequent to testing, these vehicles were made available to NASA for further study of the electronic systems to discover whether a safety defect could be found.

17. Key Words Toyota, Lexus, Camry, Unwanted, Acceleration, ETC, Electronic, Throttle, Control		18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, VA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page)	21. No of Pages	22. Price

Form DOT F1700.7 (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

In response to incidents of unintended acceleration (UA) in Toyota vehicles, the National Highway Traffic Safety Administration's (NHTSA) Vehicle Research and Test Center (VRTC) conducted a Toyota Camry "Vehicle Characteristics and Performance Study" comprised of 20 Toyota Camrys. Nine of the Camrys tested were complaint vehicles purchased from consumers that allegedly experienced incidents of unwanted acceleration. Attributes and configurations of each vehicle's systems that could affect performance were documented and evaluated. Listed features and performance measures are included in the attached appendices. No safety defects in the acceleration control systems were found during these vehicle characterizations. Subsequent to testing, these vehicles were made available to the National Aeronautics and Space Administration (NASA) for further study of the electronic systems to discover whether a safety defect could be found.

The following observations were made during VRTC's Toyota Camry Vehicle Characterization and Performance Study:

1. Beginning with the 2002 model year, the fully electronic throttle control was introduced in Toyota Camrys, which provided quicker engine responsiveness with less pedal displacement than cable driven throttles. Much of this increase in responsiveness appeared to be attributable to the reduction of slack normally found in mechanical accelerator systems. Increased responsiveness is a typical characteristic of electronic throttle control (ETC) over mechanical linkage accelerator control systems.
2. In the event of dual pedal applications, the faster throttle response of the ETC system may increase the likelihood of vehicle movement compared to mechanical throttle systems.
3. Starting with the 2002 model, the accelerator pedal force-versus-displacement effort changed and with measurement was found to be somewhat similar to the brake pedal force-versus-displacement effort during the initial apply. The minimum brake pedal force and displacement required to hold a vehicle stationary became about the same as the accelerator pedal force and displacement required to command initial engine torque.
4. Based on a limited sample size of the vehicles tested, the lateral separation distance between the brake and accelerator pedal was closer to the steering wheel centerline in 2002 and newer Camrys, compared to the earlier generation Camrys. Lateral separation measured values

were not abnormal compared to other manufacturers' vehicles.

5. The step-over height between pedals in test vehicles slightly decreased beginning in 2002, though the limited sample size did not permit a statistical conclusion.
6. As vehicle model iterations were introduced, newer models were equipped with more powerful engines. The transmissions had more forward gears (4, 5, and later 6 gears) that optimized power and made stopping while applying engine power more difficult.
7. When braking was applied in one continuous motion where vacuum assist was operating normally and the engine was at full throttle, all tested Camrys either came to a stop or near stop from 65 mph with 112 lbs. or less of brake pedal force.
8. If the brakes were pumped more than once while the accelerator was depressed, vacuum was partially, if not fully depleted and would not regenerate until the throttle plate moved to a more closed position. Without vacuum, a significant increase in operator effort was required to stop the vehicle.
9. The amount of brake pedal force required to hold the test vehicles stationary with a wide open throttle ranged from 15.0 lbs. to 43.6 lbs with vacuum assist, well within the braking capabilities generated by the vast majority of, if not all, drivers. Without vacuum assist, the brake pedal force required to remain stationary increased substantially to a range from 86.7 lbs to 268.2 lbs., though evidence of stationary Camrys not having vacuum was not encountered in complaint searches.
10. Vehicles equipped with keyed ignitions provided a readily discernable means to instantaneously turn off engine ignition, whereas pushbutton functionality had no instantaneous emergency shutoff feature.
11. The ignition control button was labeled as "Engine Start/Stop" only. Specific operation was noted in the owner's manual; however it was described within the context that it was discouraged and could cause an accident.
12. Shifting the transmission was more complicated with the newer models. In 2002 and model years prior, moving the shifter from park to drive required only one longitudinal movement, and gear locations were intuitively labeled right next to the gear selector. By 2007, shifting to drive also required at least one lateral movement for four cylinder vehicles and two lateral movements for V6 Camrys; and the gear labeling may not be readily discernable to the driver in a panic situation.

13. In all test vehicles, the transmission shifter was mechanically linked to the transmission. Placing the vehicle into park or reverse at highway speeds and under acceleration did not cause any of the vehicles to engage those shift positions, nor wheel lockup, though this action caused both 2001 Camrys to stall.

1.0 INTRODUCTION/BACKGROUND

This program was performed to provide technical analysis, insight, and support data to the United States Department of Transportation (USDOT), National Highway Traffic Safety Administration (NHTSA), and the Office of Defects Investigation (ODI) in substantiating and evaluating claims of unintended acceleration (UA) in Toyota products. The purpose of this testing was to indentify, obtain, measure, and document characteristics of vehicles that were associated with allegations of unwanted acceleration, specifically focusing on Toyota Camrys manufactured from 2001 through 2009. Toyota was selected as the subject manufacturer because they exhibited the highest rate among manufacturers. Further supporting this decision, a preliminary keyword search of NHTSA's database indicated that Toyota Camrys:

- Exhibited a relatively high complaint rate in comparison to other Toyota vehicles with electronic throttle control system (ETCS);
- Exhibited the highest crash rates;
- Displayed a marked increase in complaint rate in the model year 2002 when a new generation of Camry was introduced that featured ETCS among a multitude of other changes;
- They were the subject of several inquiries by the Office of Defects Investigation where no defect was found.

The Vehicle Research and Test Center (VRTC) procured and tested 20 Toyota Camrys spanning three model iterations and eight model years from 2001 to 2009. Some of these were complaint vehicles while others were not the subject of a complaint but represented a year before or during a major model change.

2.0 APPROACH

Manufacturer-responsible vehicle defects may be traced to design deficiencies, manufacturing non-conformances, or both. Here, it was not known whether any design or manufacturing problems existed, so vehicle selection encompassed the potential for either. The appropriate test vehicles for these different alleged defect causes would not necessarily be the same vehicles, but also were not mutually exclusive. It was therefore foreseeable that there would be an overlap in vehicle test groups.

For design-based defects, engineering changes such as new model introduction and technology upgrades provide opportunities to address old problems with former designs, but also present opportunities to introduce new problems. In the alternate case of manufacturing defects, any given model in any year of production may perform well in testing but experience field failures due to substandard durability or build quality.

Three model life cycles, or generations, of Toyota Camrys were encompassed in this study. The first group was referred to as the MY1996-2001 Camrys with production spanning from model years 1996 through 2001. These vehicles were the last Toyota Camrys to use a mechanical linkage accelerator pedal. Among the procured vehicles were two 2001 Camrys, associated with relatively lower incidents of unwanted acceleration. Also included in this study were the 2002 through 2006 Camrys that were referred to as MY2002-2006 models. Finally, 2007-2009 Toyota Camrys were studied and were referred to in the report as MY2007-2009 models. While the complaints of UA associated with the MY1996-2001 Camrys were relatively low, the last year for this model was 2001, which was the model year that immediately preceded the significant increase in complaints of UA. Characterizing the attributes of the MY1996-2001 models provided valuable baseline information for documenting changes observed moving into subsequent models.

2.1 Test Vehicle Selection Methodology for a Design-Based Defect

The logic used as a basis for vehicle selection in search of a design-based defect included:

- Determining and acquiring vehicles associated with relatively high rates of unintended acceleration.

- Determining and acquiring the first build year for model generations exhibiting high rates of unintended acceleration. Unintended acceleration rates for the Toyota Camry exhibited a significant increase in rates of complaints at the time the MY2002-2006 model was introduced in 2002 and again when the MY2007-2009 model was introduced in 2007, implying that the model changes could relate to causes of unintended acceleration. The first year MY2002-2006 model beginning (2002) Toyota Camry and the first year MY2007-2009 Toyota Camry (2007) were included in this group.
- Determining and acquiring the last build years for model generations adjacent to models that demonstrated high rates of unintended acceleration to encompass all mid-model upgrades and changes associated with a specific generation. This included the last year of the MY1996-2001 Toyota Camry (2001) and the last year for the MY2002-2006 Toyota Camry (combined 2005 & short build year 2006).
- Selecting both four-cylinder (L4) and six-cylinder (V6) engines from each model to encompass differences in wiring, grounding, components, and powertrain performance.
- Selecting vehicles that have been reprogrammed with brake override software to compare them to the same models that do not have the software revision. The MY2007-2009 Toyota Camry (2007) was included in this group because brake override software was not available in previous model years.

2.2 Test Vehicle Selection Methodology for a Manufacturing Based Defect

The logic used as a basis for vehicle selection in search of a manufacturing-based defect included:

- Analyzing vehicle complaint data from vehicle owner questionnaires (VOQs) and other sources to identify possible candidate vehicles.
- Contacting owners of selected vehicles to further explore the details of the alleged incidents. This included some site visits and in-person interviews.

- Selecting vehicles to obtain for testing and evaluation. Selection criteria included vehicles for which floor mat entrapments and “sticky pedals” were eliminated by the complainant as potential causes. Ideal incident vehicles included those that had any or all of the following:
    - Multiple drivers, having experienced an unintended acceleration event that could reduce the possibility of a single driver’s error;
    - Multiple incidents, that would increase the probability of a vehicle again demonstrating the problem during testing;
    - Recent incidents, where crash data recorders still retained incident records; and where drivers’ accounts of the events were more complete;
    - Limited damage/unrepaired incidents, where potentially defective relevant components, such as throttle bodies and pedal assemblies had not been replaced with new components. If essential electronic components had been replaced, those vehicles would have been disqualified from testing; and
    - Drivable vehicles, where vehicles and vehicle systems were intact and able to be used for testing.
- Including vehicles that were repaired under the Toyota recall and subsequently allegedly experienced an unwanted acceleration event.

2.3 Procurement and Logistics Activities of Vehicles

Procurement and logistic activities included:

1. Identifying vehicles suitable for testing.
2. Acquiring vehicles & repair history documentation. Test vehicles are pictured in Appendix D.
3. Transporting vehicles to the NHTSA VRTC.
4. Completing VRTC inspection and the Vehicle Characterization and Performance Study according to the test matrix.
5. Transporting vehicles to the NASA sites as required for additional electronics testing outside the scope of VRTC’s performance study.

3.0 TEST METHODOLOGY

Test vehicles had various features and capabilities measured to discover whether factors other than electronics, studied separately, may contribute to instances of unintended acceleration.

All acquired vehicles were subjected to all characterization tests. Vehicle characterization efforts were divided into eight modules. Some modules documented vehicle history and confirmed fitness for test use. Other modules tested braking and acceleration performance under changing conditions. A central document file was created in both paper and electronic form. Module completion was tracked on a master matrix. Testing was completed on schedule. A copy of the schedule can be found in Appendix F. A copy of each blank test form used by technicians for all modules can be found in Appendix G.

3.1 Module 1 - Level 1-Preliminary Inspection and Visual Verification

This module began the processing of each vehicle and verified the basic information and condition of the vehicle. Vehicle features and options were documented along with a multitude of other visually verifiable items. Examples include but were not limited to: make, model, year, color, trim level, engine, vehicle identification number, mileage, tire type/tread depth, etc. Documentation from this module also identified whether the vehicle was acquired because it was a complaint vehicle (denoted with a "C") or a vehicle acquired for a design change comparison (denoted with a "D"). If it was identified as a complaint vehicle, this triggered the collection of other documents associated with the incident. In the event that a vehicle was exhibiting a malfunctioning or abnormal condition, this was recorded for corrective action in Module 2, 3, or 4.

3.2 Module 2 - Level 2- Comprehensive Inspection and Electronic Interrogation

In this module, significant interrogation of vehicle systems took place and results were recorded. Event data recorders (EDR) (installed in many supplemental restraint system [SRS] electronic control units) were downloaded and main electronic control unit (ECU) records were downloaded. Technical service bulletins repairs and recall fulfillment were verified. Accelerator pedal position sensor voltages and rates were measured. Transmission specifications, including mounting locations were documented. Repair history was researched. Functionality of vehicle systems was confirmed by a certified mechanic. Malfunctioning or abnormal conditions were either corrected during this module or they were scheduled for repair in Module 4 – Repairs and Restoration.

3.3 Module 3 – Drivability Fitness

Each vehicle was subjected to a test drive by a certified mechanic to determine if the vehicle was performing adequately. This included all relevant systems on the vehicle, with special emphasis on systems that were given authority over the accelerator control system, such as cruise control. If the vehicle was in the population receiving brake override reprogramming, then the presence of brake override was confirmed. Any deficiencies found would cause the vehicle to be scheduled for repair in Module 4 – Repairs and Restoration, unless it was a complaint vehicle that would need to be preserved in its original state. Examples of deficiencies would have been: worn wheel bearings, poor alignment, braking problems, electrical charging problems, etc.

3.4 Module 4 – Repairs and Restoration

This module addressed all known deficiencies in a given vehicle that would otherwise have invalidated or compromised the performance of the vehicle during testing. Successful completion of the module confirmed that the vehicle was safe and nominally functional for testing. Had a vehicle been beyond reasonable repair, it would not have been approved for dynamic performance and electronics testing.

3.5 Module 5 – Acceleration and Braking Assessment

This module contained the dynamic portion of the testing that measured the effect of full throttle acceleration on the performance of braking. Here each vehicle underwent acceleration and braking performance tests to quantify the effectiveness of brake systems with and without the assistance of vacuum. Parking lot “drive-in” tests were also conducted to see whether additional engine power caused by the air conditioner compressor affected controllability. These parking lot tests showed no significant consequence to acceleration.

For the acceleration and brake testing, each vehicle was instrumented with a data acquisition system as shown in Figure 1 and Figure 2. The system recorded vehicle speed, vehicle longitudinal acceleration, brake pedal force, and brake pedal travel. Calibration certificates for test equipment used can be found Appendix I. In MY1996-2001 vehicles that utilized a cable operated throttle, the output voltage of the throttle position sensor (TPS) was recorded. In MY2002-2006 and MY2007-2009 vehicles with ETCS, the output voltages generated by both the TPS sensors and the accelerator pedal position sensors (APPS) were recorded. This data acquisition system was used for all dynamic tests except for the cruise control tests.

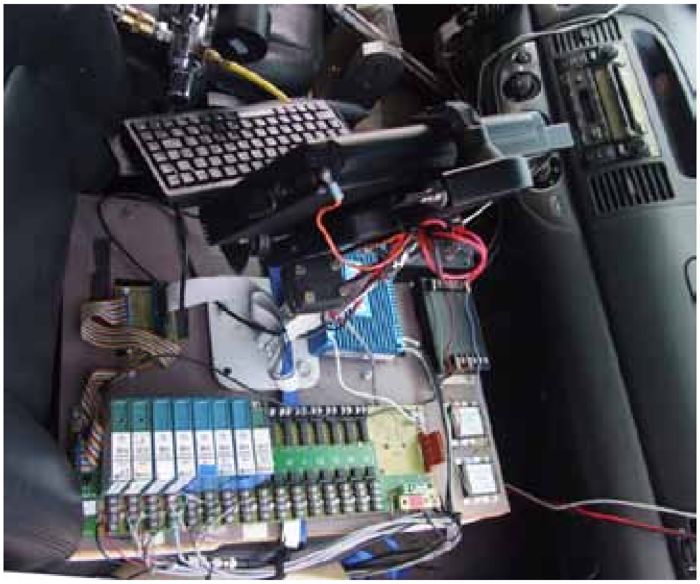


Figure 1 - Data Acquisition Equipment - Top View

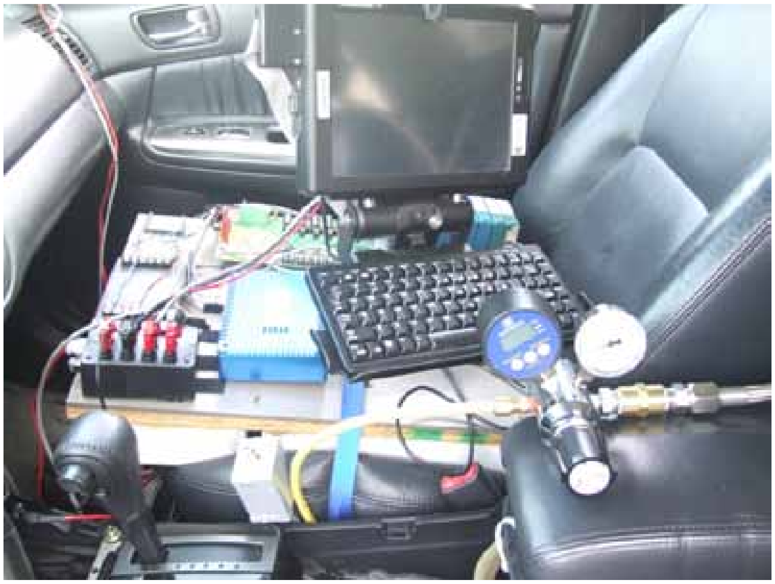


Figure 2 - Data Acquisition Equipment - Side View

For the brake tests, each vehicle was fitted with a pneumatic brake actuation system installed to apply the brake pedal to a set force. The set point of the force was varied by changing the nitrogen pressure supplied to the pneumatic ram. The ram and force load cell were connected to the brake pedal by a magnet. This connection allowed for the driver to disengage the brake actuation system at any time in case of an emergency. The brake actuation system is shown in Figure 3 and Figure 4. This brake actuation system was installed for all dynamic tests except for the cruise control tests. This system was used to activate the brakes in most tests that required brake application except for the 100 – 0 mph panic stops. Manual braking by the driver was used during panic stops for safety reasons.

Figure 3 - Pneumatic Brake Ram Used in Testing

Figure 4 - Nitrogen Supply Tank and Solenoid Valves Used for Pneumatic Brake Ram Actuation

In every test the vehicle carried two technicians, a driver and a recorder. The driver maintained control of the vehicle and the recorder operated data logging test equipment and recorded test results.

3.5.1 Acceleration Tests

Baseline acceleration test were conducted to measure the time and distance required by each vehicle accelerate from 0 – 100 mph under wide open throttle (WOT). Each vehicle had this baseline test conducted three times to allow for the variations in the one-half percent slope of the test surface.

3.5.2 Acceleration Tests with Brakes Applied

A series of acceleration tests from 0 – 70 mph with the brakes applied was conducted for each vehicle. These tests were conducted using forces of the following values: 0 lbs., 15 lbs. (67N), 50 lbs. (222N), 112 lbs. (500N), and 225 lbs (1,000N).[1]

With the vehicle in a stationary condition, the nitrogen pressure of the brake actuation system was adjusted to obtain the desired brake apply force from the actuator. The data acquisition system was activated and the brake actuator applied. The transmission was then shifted to drive and accelerator was rapidly depressed to WOT. Technicians were instructed to terminate any given test if the vehicle failed to accelerate or if the vehicle began decelerating after forward movement had started. This was to prevent unnecessary damage to the transmission that would make the vehicle unavailable for the remaining performance tests.

3.5.3 Braking Tests

Braking tests were conducted using brake pedal forces of the following values: 0 lbs., 15 lbs. (67N), 50 lbs. (222N), 112 lbs. (500N), and 225 lbs (1,000N) to measure stopping distances of each vehicle traveling at 65 miles per hour. These tests were conducted with 1) no acceleration, with and without vacuum assisted braking, 2) full acceleration with vacuum assisted braking, and 3) full acceleration without vacuum assisted braking.

---

[1] 112 lbs (500N) is used as a standard maximum achievable braking force in CFR49 571.135. This value was adopted in part, for international harmonization of standards as noted in FR Volume 60/No. 22.

The tests were conducted with the driver controlling the accelerator pedal position and the recorder controlling the brake actuator system. The tests were started with a countdown to synchronize the accelerator and brake applications required for each test. Technicians were instructed to terminate any given test if stopping distance was indefinite (where the vehicle was not decelerating), to prevent unnecessary damage to the brakes.

Prior to each test, the brake temperatures were measured using an infrared thermometer and recorded to ensure that brakes did not have an initial temperature in excess of 300 degrees Fahrenheit. A cool down period between test runs was conducted if necessary to maintain maximum nominal brake performance without biasing from excessive heat.

1) **No Acceleration:** With the vehicle stopped, the nitrogen pressure of the brake actuation system was set to achieve the desired force. The vehicle was driven until speed was stabilized at approximately 70 mph. The data acquisition system was triggered to record, and a countdown was started. On the drivers signal, the brake system actuator was applied. To compensate for variances in stopping initiation timing, reported stopping distance measurements begin from a speed of 65 mph.

2) **Full Acceleration with Vacuum Assisted Braking:** With the vehicle stopped, the nitrogen pressure of the brake actuation system was set to achieve the desired force. The vehicle was driven until speed was stabilized at approximately 70 mph. The data acquisition system and countdown were started. On the drivers signal, the accelerator was fully depressed and the brake system actuator was applied.

3) **Full Acceleration without Vacuum Assisted Braking:** The source vacuum line was disconnected from the brake booster and plugged. The brake pedal was activated several times to deplete the brake booster of vacuum. This was done to simulate loss of vacuum caused by pumping the brake pedal several times with the throttle plate open. As the throttle plate opens, the engine in less able to replenish vacuum as would be the case with a UA event. With the vehicle stopped, the nitrogen pressure of the brake actuation system was set to achieve the desired force. The vehicle was driven until speed was stabilized at approximately 70 mph. The data acquisition system and countdown were

started. On the drivers signal, the accelerator was fully depressed and the brake system actuator was applied.

Braking tests were conducted on the “D” design change comparison vehicles using new friction materials and rotors, and these had been processed through appropriate burnishing procedures. Braking test conducted on the “C” complaint vehicles utilized the as received brake parts after passing a mechanical inspection. The rationale for this was to ensure each complaint vehicle was preserved in an as-received condition. Five of the vehicles submitted for testing were purchased subsequent to reprogramming by Toyota with brake override. This offered the opportunity to measure the software effectiveness in aiding the braking system when attempting to slow the vehicle during a full throttle event, though this feature was intentionally disabled (by disconnecting one brake switch wire) for some of the brake tests to measure maximum braking capabilities.

3.5.4 100 – 0 mph Panic Stop Tests

At the beginning of each vehicle’s brake test module and again at the end of the module, a 100-0 mile per hour panic stop was conducted to measure the permanent effect of the repeated brake tests on stopping capability. The brake actuator was not used for safety reasons. The vehicle was driven until speed was stabilized at approximately 100 mph. The data acquisition system was activated. The driver applied as much force to the brake pedal as possible, unless the vehicle was not equipped with an anti-lock brake system (ABS), in an attempt to stop the vehicle in the shortest amount of time.

3.5.5 Brake Hold Tests

Another brake test performed was a brake hold test. A given amount of brake force was applied to a stationary vehicle. The accelerator was fully depressed, and brake force was slowly released until the vehicle began to move. The minimum brake force required to hold the vehicle stationary was recorded. This test was repeated with and without vacuum assist to the brakes.

3.5.6 Cruise Control Tests

Functionality of the cruise control/speed control system was tested on every Camry in the test fleet. This test evaluated and documented the vehicle cruise control activation switch, as well as the set, cancel, and resume commands.

3.6 Module 6 – Gearshift Lever/Transmission Operation

The ability to quickly disengage engine power from the wheels can be a valuable countermeasure to unwanted acceleration. Increased complexity in achieving neutral would not be helpful to a driver unfamiliar with the change in complexity. The gearshift pattern and required movements to achieve drive, neutral, reverse, and park were measured, photographed, and documented. Extra efforts, such as squeezing a button on the shifter to place the vehicle into any gear were also recorded. Transmission features, such as the number and type of mounts were also noted, and the numbers of forward gears were identified.

3.7 Module 7 – Ignition Switch Control Functionality

The functions of the keyed ignition have remained relatively unchanged over the years, but a pushbutton ignition requires a driver to learn new procedures, not all of which are intuitive. With regard to an unwanted acceleration event, the most relevant of these new procedures is the emergency shutdown operation, because it offers the ability to remove the ignition source from a vehicle producing unwanted power. Complainants in some Toyota unwanted acceleration situations stated they were unable to turn off the engine. Therefore, the study identifies whether each vehicle used a traditional keyed ignition or a pushbutton ignition. Owner's manual instructions on the operation of each were verified. The functionality of the ignition switch control system was documented to assist in understanding its operation.

3.8 Module 8 – Pedal Positioning

Module 8 measured the orientation, location, and operation of the accelerator and brake pedals in relation to the driver. Pedal interaction with the floor pan was characterized. Data included operator seating position relative to the steering wheel, pedals, and floor pan in the vehicle for comparison between model years.

Brake and accelerator pedal position measurements included the static step-over distance between the brake and accelerator pedal. Also measured was the critical vertical offset (CVO), which measures the maximum displacement where the vehicle will remain stationary with a given level of brake pedal force.

3.8.1 Brake and accelerator pedal position

Accelerator and brake pedal locations were measured with respect to adjacent features of the vehicle including: other pedals, the floor pan, the steering column center line, the seat cushion centerline, the left vertical floor pan wall, and the right vertical floor pan wall. These measurements were recorded on all subject model years for comparison.

3.8.2 Pedal Application Force versus Displacement

A pedal application robotic apparatus was constructed to actuate and displace the brake or accelerator pedal while measuring the linear displacement (see Figure 5 and Figure 6). The forces required to displace the accelerator and brake pedals were not linear, so dynamic force was also measured.

Figure 5 - Setup of Brake Pedal Force versus Displacement Device in a Typical Test Vehicle

Figure 6 - Setup of Brake Pedal Force versus Displacement Device in a Typical Test Vehicle - Close-up

3.8.3 Step-over Distance

Static step-over was measured in all test vehicles using the three-dimensional FARO scanning tool.[2] The scanning tool can be seen in Figure 7 and Figure 8. A profile of pedal locations was developed using the scanning tool for each vehicle with a resolution of approximately 0.052 mm.

Figure 7 - FARO Laser Scan Arm - Close-up

Figure 8 - FARO Laser Scan Arm Operating in Vehicle

---

[2] Vehicle pedal dimensions were taken with a laser scan tool and then digitized to acquire all critical dimensions. The laser scan tool is illustrated in figures in this section of the report. The scan tool is trade named FARO Arm. The FARO Arm is m/n P10, rev 22.7 s/n: P010-05-06-04789, Two different laser probes were used in the project: Version 2, m/n Na, s/n: LLP000602501 and Version 3, m/n Na, s/n: LLP000804330 (no Model No. available). The software used to do the scanning, take the dimensions, and create the layouts was Polyworks Version 11 (InnovMetric Software).

3.8.4 Critical Vertical Offset (CVO)

CVO is determined in a dynamic test that dimensionally compares the actuation of the brake pedal to the actuation of the accelerator pedal. Like the static step-over, it is a measure of the distance from the brake pedal face to the accelerator pedal face, but unlike the static step-over, the CVO also quantifies the effects of dual pedal applications by measuring the amount of pedal displacement, determined when the engine torque overcomes the brake torque.

The procedure involved placing a plate over the brake pedal. The plate extended to just above the accelerator with a threaded rod protruding from the plate down towards the accelerator. The device is shown in Figure 9 and Figure 10.

Figure 9 - Critical Vertical Offset Device with Brake Pedal Force Load Cell Attached

Figure 10 - Critical Vertical Offset Device Clamped on Brake Pedal with Offset Device Contacting Accelerator Pedal - Close-up

The stationary vehicle was placed into gear and the brake was initially depressed with a constant 20 pounds of force. The threaded rod was adjusted to push into the accelerator pedal until the vehicle began to move. At this point, the CVO distance was recorded as a positive value. The test was repeated with 40 and 60 pounds of brake force. The CVO device was limited to measuring a minimum of 0.5 inches and a maximum of 2.5 inches in 0.25 inch increments. Therefore any value of 0.5 inches indicated a value CVO that was 0.5 inches or less. If a CVO was negative, this device was unfortunately not capable of reading below 0.5 inches. The tests were conducted in both drive (1st gear) and in reverse. Documentation also included pedal construction and material.

3.8.5 Floor Pan Contours

Contours and dimensional measurements of the floor pan and associated protective materials and pedal interaction with the floor pan were described and documented. These measurements were also performed using the three-dimensional FARO scanning tool.[3] The propensity for the interaction between the floor pan and accelerator pedal to lead to pedal entrapment was evaluated

---

[3] Vehicle pedal dimensions were taken with a laser scan tool and then digitized to acquire all critical dimensions. The laser scan tool is illustrated in figures in this section of the report. The scan tool is trade named FARO Arm. The FARO Arm is m/n P10, rev 22.7 s/n: P010-05-06-04789, Two different laser probes were used in the project: Version 2, m/n Na, s/n: LLP000602501 and Version 3, m/n Na, s/n: LLP000804330 (no Model No. available). The software used to do the scanning, take the dimensions, and create the layouts was Polyworks Version 11 (InnovMetric Software).

using a series of attributes that are believed to mitigate or aggravate instances of pedal entrapment including:

- Spring return force;
- Pedal hinging methods;
- Geometric interaction with the floor pan; and
- Positive backstop location.

Original carpeted floor mats and all-weather floor mats were placed in various orientations in the driver’s foot well area to determine whether an interference condition with the accelerator pedal actuation could occur.

4.0 RESULTS

4.1 Results Module 1 - Level 1-Preliminary Inspection and Visual Verification-Master Matrix

The Toyota Camrys selected and procured for testing are listed in Table 1 below. Pictures of test vehicles are available in Appendix D. Appendix E1 lists the status of each vehicle with regard to Module 1.

Table 1 - Test Vehicles and Identification Key

Vehicle Identifier C = Complaint D = Design	Vehicle Location Status	Vehicle Model Year	Vehicle Model	Trim Level	Vehicle Color	Engine	VIN	ODI VOQ#	Mileage
1D	VRTC	2002	Camry	SE	Silver	V6	4T1BF30K02UXXXXXX	No	125331
2D	VRTC	2002	Camry	XLE	Dark Gray	L4	4T1BE32K82UXXXXXX	No	69721
3D	VRTC	2001	Camry	LE	White	L4	JT2BG22KX10XXXXXX	No	94006
4D	VRTC	2007	Camry	SE	Red	L4	4T1BE46K574XXXXXX	No	89964
5D	VRTC	2006	Camry	LE	Silver	L4	4T1BE32K96UXXXXXX	No	55319
6D	VRTC	2007	Camry	LE	Green	L4	4T1BE46K57UXXXXXX	No	161690
7D	Goddard	2005	Camry	XLE	Gray	L4	4T1BE32K65UXXXXXX	No	69634
8D	VRTC	2001	Camry	XLE	Champaign	V6	4T1BF28K31UXXXXXX	No	88651
9D	VRTC	2005	Camry	LE	Charcoal	V6	4T1BF32K55UXXXXXX	No	69649
10D	VRTC	2007	Camry	LE	Green	V6	4T1BK46K97UXXXXXX	No	53322
11D	Goddard	2005	Camry	XLE	Silver	V6	4T1BF30K55UXXXXXX	No	65199
12C	EMI Facility	2007	Camry	XLE	Burgundy	V6	JTNBK46K073XXXXXX	10319201	44673
13C	EMI Facility	2002	Camry	XLE	Champaign	V6	4T1BF30K92UXXXXXX	10319308	195266
14C	EMI Facility	2004	Camry	XLE	Champaign	V6	4T1BF30K34UXXXXXX	10321093	77739
15C	EMI Facility	2003	Camry	XLE	Deep Purple	L4	4T1BE32K33UXXXXXX	10283433	52773
16C	VRTC	2009	Camry	NA	Blue	L4	4T1BE46K39UXXXXXX	10326631	23763
17C	VRTC	2004	Camry	LE	Champaign	L4	4T1BE32K64UXXXXXX	10316061	47776
18C	EMI Facility	2004	Camry	LE	Blue	L4	4T1BE32K04UXXXXXX	10327490	61039
19C	EMI Facility	2007	Camry	LE	Gray	L4	4T1BE46K27UXXXXXX	10326416	37385
20C	VRTC	2004	Camry	LE	Tan	L4	4T1BE32K64UXXXXXX	10290867	54822

Included in this table were identifiers for vehicle year, trim level, color, and engine size. The vehicle identification number was partially redacted to protect personal identification of the former consumers. Additional information in the table included the inventory number, where a

“C” indicated the vehicle was a complaint vehicle in the NHTSA database. If the vehicle was associated with a complaint, the NHTSA complaint number was provided. A “D” indicated the vehicle was procured because it was the first or last year of a major model or technology change. Vehicles denoted with a “D” had no history associated with a specific complaint of unwanted acceleration. The table also lists mileages at the time of acquisition. Table 2 indicates Camry model changes, along with corresponding engine and transmission information.

Table 2 - Engines, Transmissions, and Nomenclature for Toyota Camrys Used in this Report

Generation (GEN)	Designation/Production Model Year	Engine/Transmission/Remarks
4	Camry (V20) 1996-2001	133 HP, L4-2.2L (5S-FE), A/T A140E 192 HP, V6-3.0L (1MZ-FE), A/T A541E
5	Camry (V30) 2002-2006	157 HP, L4-2.4L (2AZ-FE), A/T U250E 192 & 210 HP V6-3.0L (1MZ-FE), A/T U151E 225 HP, V6-3.3L (3MZ-FE), A/T U151E Introduction of Electronic Throttle Control
6	Camry (V40) 2007-Present	158 HP, L4-2.4L (2AZ-FE), A/T U250E 268 HP, V6-3.5L (2GR-FE), A/T NR Introduction of Controller Area Network Bus

4.2 Results Module 2 - Level 2- Comprehensive Inspection and Electronic Status Interrogation

All published records such as technical service bulletins (TSB), safety recalls, and repair campaigns that were identified as potentially related to accelerator control systems or that could affect engine performance were collected and researched. Figure 11 lists the associated document titles. Appendix E2 lists the status of each vehicle with regard to Module 2.

Safety Recalls and Technical Service Bulletins Relating to Vehicle Acceleration Performance

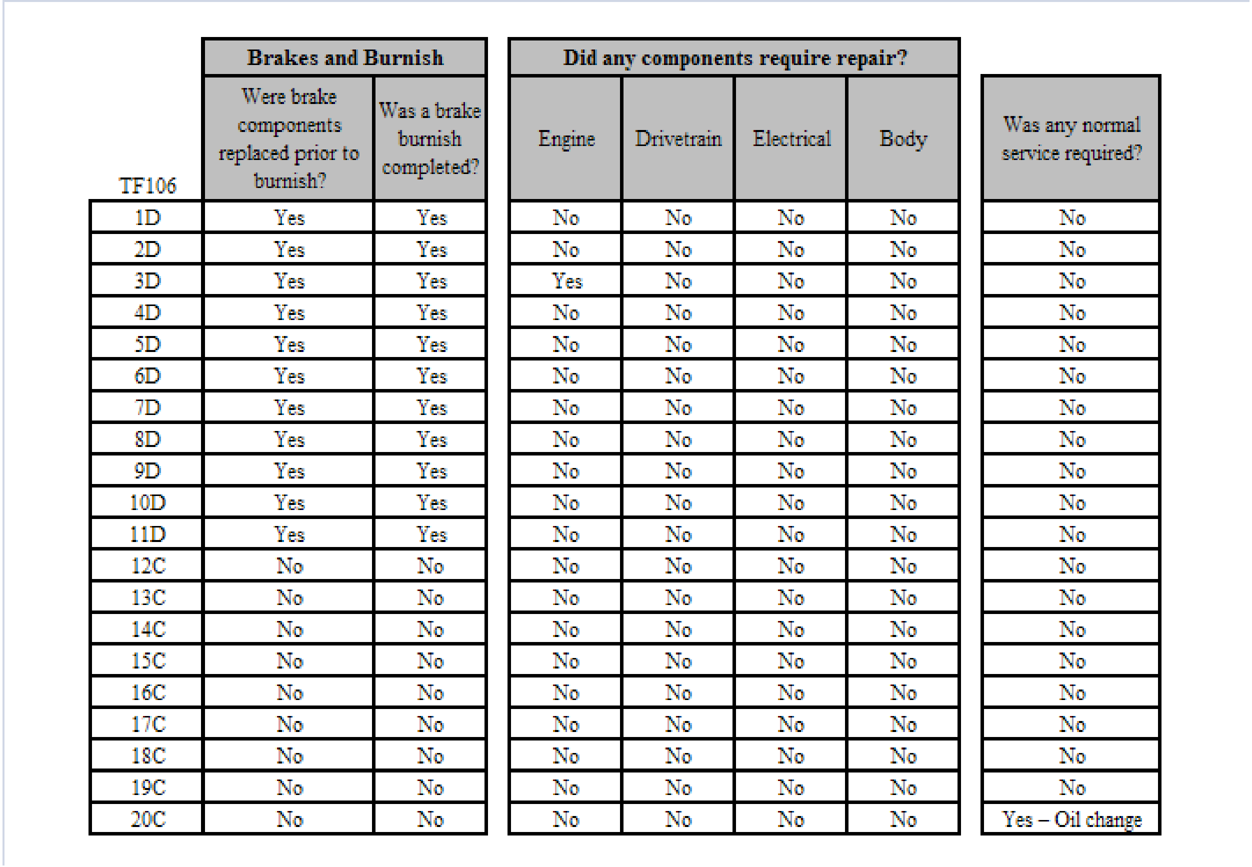
01V012000
10V012000
NHTSA01V012000
90L
SB0001-1-O2 CIRCUIT
SB0064-10 REFLASH
SB039709R1 CARPET GROMMET
SCA0A Accelerator Pedal Sticking
Special Service Campaign 10A
Special Service Campaign AOA
SS002-07 Engine Reflash
SS002-07 01-08 All
SS00207 Tech Stream Reflash Program
SSC90L Floor Mat/Accelerator Pedal
SSC90L Floor Mat Pedal Interference
TSB0064-10 ECU Reflash Procedure
TSB0373 0 All

Figure 11 - Technical Service Bulletins (TSBs), Safety Recalls, and Repair Campaigns

4.3 Results Modules 3 and 4 -Drivability Fitness/Repairs and Restoration

No significant drivability deficiencies were found in any of the vehicles that would disqualify them from testing. Tires were replaced on two non-complaint vehicles to assure safety during high-speed testing. For non-complaint vehicles, brake components and friction material conditions were unknown, therefore non-complaint vehicles were replaced with new materials and a standard brake burnish procedure was performed to assure best-case conditions. No changes were made to complaint vehicles however, to preserve them in their as-received condition. Appendix E3 and E4 list the status of each vehicle with regard to Modules 3 and 4. Burnish and repair information is listed by vehicle below in Table 3.

Table 3 – Burnish and Repair Information



	Brakes and Burnish		Did any components require repair?				
TF106	Were brake components replaced prior to burnish?	Was a brake burnish completed?	Engine	Drivetrain	Electrical	Body	Was any normal service required?
1D	Yes	Yes	No	No	No	No	No
2D	Yes	Yes	No	No	No	No	No
3D	Yes	Yes	Yes	No	No	No	No
4D	Yes	Yes	No	No	No	No	No
5D	Yes	Yes	No	No	No	No	No
6D	Yes	Yes	No	No	No	No	No
7D	Yes	Yes	No	No	No	No	No
8D	Yes	Yes	No	No	No	No	No
9D	Yes	Yes	No	No	No	No	No
10D	Yes	Yes	No	No	No	No	No
11D	Yes	Yes	No	No	No	No	No
12C	No	No	No	No	No	No	No
13C	No	No	No	No	No	No	No
14C	No	No	No	No	No	No	No
15C	No	No	No	No	No	No	No
16C	No	No	No	No	No	No	No
17C	No	No	No	No	No	No	No
18C	No	No	No	No	No	No	No
19C	No	No	No	No	No	No	No
20C	No	No	No	No	No	No	Yes – Oil change

4.4 Results Module 5 – Acceleration and Braking Assessment

Following are the results for performance of the cruise control, acceleration, and braking systems.

4.4.1 Cruise Control Testing

The complete matrix of test results can be found in Appendix E5D. The following are the results of the cruise control functionality testing:

1. The master cruise switch illuminated and extinguished the cruise light when depressed.
2. If the cruise light was on and the ignition was turned off, the cruise light turned off in MY2001-2006 and MY2007-2009 and would not turn back on. In MY1996-2001 Camrys, the cruise light turned back on with the ignition.

3. Unless the master cruise switch was enabled, no cruise functions had an effect on the vehicle.

4. All tested vehicles disengaged cruise control immediately when the brakes were depressed.

5. All tested vehicles disengaged cruise control immediately after the "Cancel" feature was commanded.

6. All tested vehicles resumed to the set 60 mph value after tapping the brake, slowing to 35 mph, and depressing "Resume".

7. Most cruise control resume functions were sufficiently aggressive to downshift into a lower forward gear when resuming to 90 mph from 60 mph.

8. When the "Accel" function was commanded after having set the cruise control, all vehicles capable of reaching 120 mph achieved that speed. At least one vehicle, 3D was not capable of this speed.

9. When shifted to neutral, cruise control disengaged on all vehicles.

10. When downshifted, cruise control disengaged on all vehicles.

11. While maintaining a set cruise control speed of 50 mph, then accelerating to 60 mph, followed by a coast down, the cruise control automatically resumed when the vehicle slowed to 50 mph and maintained the speed in all test vehicles.

12. After setting cruise control to 60 mph, then turning the master cruise switch off and back on, pressing "Resume" did not resume cruise control.

4.4.2 Brake Hold Test

The results, given in Table 4, indicate that vacuum multiplied the effective force with a gain of approximately 5-6 times, with some reaching much higher gains. Also noted is whether the brake pedal lever was one of two configurations found on Toyota Camrys: single linkage or double linkage.

Table 4 – Brake Hold Test Results

Vehicle Information								Brake Hold at Wide Open Throttle	
				Engine		Transmission		Brake Pedal Force Required (lbs.)	
Veh. ID.	Model	Trim Line	MY	Config.	Displacement	Fwd Speeds	Brake Pedal Single or Double Linkage	Full Vacuum	No Vacuum
1D	CAMRY	SE	2002	V6	3.0L	4	S	26.2	154.5
2D	CAMRY	XLE	2002	L4	2.4L	4	D	22.0	141.8
3D	CAMRY	LE	2001	L4	2.2L	3	S	25.5	147.5
4D	CAMRY	SE	2007	L4	2.4L	5	S	24.9	193.0
5D	CAMRY	LE	2006	L4	2.4L	5	D	15.4	234.3
6D	CAMRY	LE	2007	L4	2.4L	5	S	25.3	138.1
7D	CAMRY	XLE	2005	L4	2.4L	5	D	29.8	167.1
8D	CAMRY	XLE	2001	V6	3.0L	4	S	32.5	158.1
9D	CAMRY	LE	2005	V6	3.0L	5	D	43.6	268.2
10D	CAMRY	LE	2007	V6	3.5L	6	S	30.9	217.8
11D	CAMRY	XLE	2005	V6	3.0L	5	S	25.7	236.0
12C	CAMRY	XLE	2007	V6	3.5L	6	S	22.1	148.6
13C	CAMRY	XLE	2002	V6	3.0L	4	S	22.3	173.2
14C	CAMRY	XLE	2004	V6	3.0L	5	S	17.8	167.9
15C	CAMRY	XLE	2003	L4	2.4L	4	D	27.9	152.3
16C	CAMRY	-	2009	L4	2.4L	5	S	15.0	86.7
17C	CAMRY	LE	2004	L4	2.4L	4	D	21.1	153.8
18C	CAMRY	LE	2004	L4	2.4L	4	D	29.9	176.8
19C	CAMRY	LE	2007	L4	2.4L	5	S	28.3	192.0
20C	CAMRY	LE	2004	L4	2.4L	4	D	28.1	197.9

4.4.3 Braking Tests From 65 MPH

Tests were conducted to measure the ability to stop a vehicle from high speeds under different circumstances such as: loss of vacuum, full engine power, and differing levels of brake pedal force. There were test situations when the accelerator was being fully depressed during braking and the applied brake force was insufficient to stop the vehicle and the test was suspended. This was also the case when the vehicle reached a slow enough speed to downshift to first gear, where the engine torque was sufficient to overcome the prescribed brake force.

With full vacuum, all test vehicles were able to be stopped, or nearly stopped, from a wide open throttle condition with 112 pounds or less of brake pedal force. These tests also revealed that in extreme situations where the vacuum booster was depleted (where the brakes were pumped more than once) and the engine was producing power (the throttle plate was open), a driver sometimes was unable to stop the vehicle, depending on physical capability and braking technique. Stopping distances under multiple circumstances for each vehicle were measured. Appendices E5A and E5B contain tables and graphs of the performance of each vehicle in each circumstance. An example of the comparison of the effects of these variables in a single test vehicle (with brake override disabled) can be seen in terms of stopping time in Figure 12 below. Figures in Appendices E5a and E5B list stopping distance rather than stopping time because the distance traveled better illustrates the physical, positional effects on the vehicle.

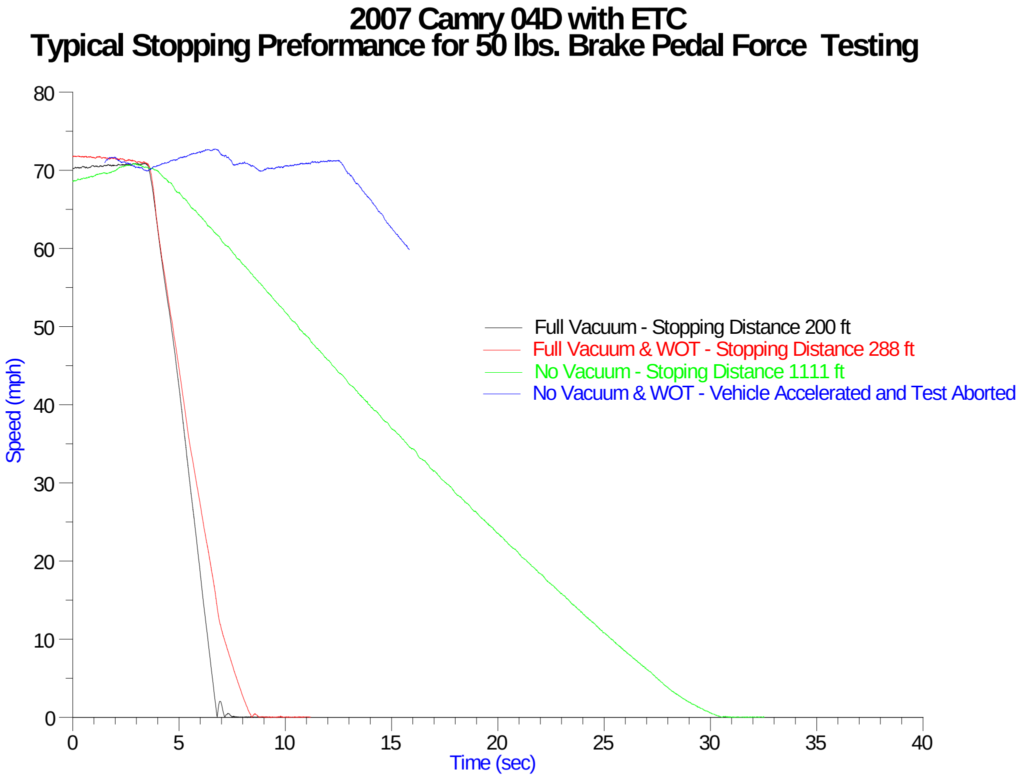


Figure 12 - Comparison of the Effects of Variables in a Single Test Vehicle

Five of the tested vehicles were reprogrammed with “Brake Override” software (Camrys: 4D, 6D, 10D, 16C, and 19C). This programmed function used the brake pedal switch to detect the application of the brake. In the event the accelerator pedal was also already being applied, the program electronically reduced engine power by lowering throttle plate voltage, regardless of accelerator pedal application, until the brake pedal was released. The event was illustrated in Figure 13 below involving a test of Camry 19C, a 2007 L4 Toyota Camry. Approximately 0.4 seconds after the brake pedal was applied, the throttle voltage was reduced to a minimum even though the accelerator pedal was still depressed and commanding full acceleration. This feature was effective at mitigating extended stopping distances during full throttle testing with no vacuum. Brake override in these test vehicles was sequence dependent. In the event the brake was applied prior to the accelerator pedal application, the brake override software did not execute. This conditional functionality would allow for situations where the driver would need to hold the car with the brake while accelerating, in cases such as hill starts. In stopping distance testing from 65 mph, brake override was intentionally disabled in vehicles 6D, 16C, and 19C in order to measure baseline performance without the brake override feature. Vehicles 4D and 10D were tested both with and without brake override to compare stopping distances among single vehicles. When brake override was activated, stopping distances were predictably shorter than without brake override. Refer to Appendix E5B for graphical illustrations of stopping distances. It should be noted that in brake tests where the accelerator pedal was depressed, the rate of deceleration was reduced, and sometimes reversed, when the vehicles shifted to lower gears capable of producing greater wheel torque.

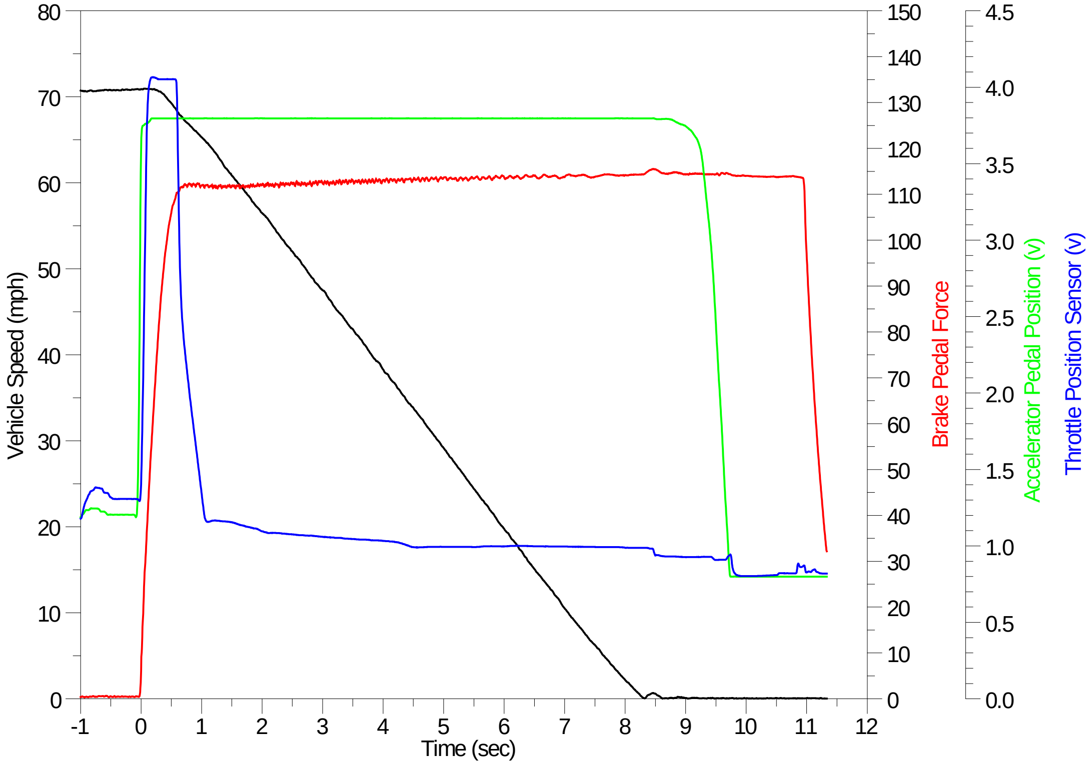


Figure 13 – 70 to 0 mph Brake Stop with 112 lbs Brake Pedal Force and Accelerator Command Wide Open Throttle (WOT)

4.4.4 0-70 MPH Acceleration Performance Tests

Vehicle accelerations with varying levels of brake efforts were recorded. As expected, increasing amounts of brake force caused an increasing amount of time required to reach 70 mph, though some vehicles were not capable of reaching 70 mph with the given brake pedal force being applied. The graphical results of these tests can be seen in Appendix E5B.

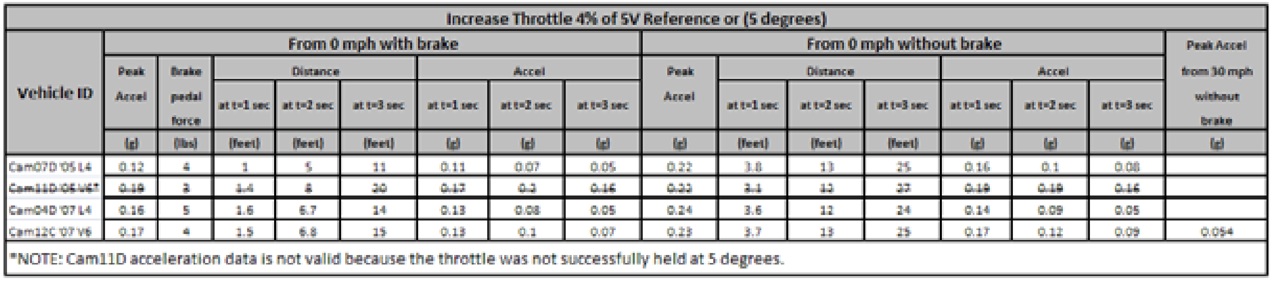
4.4.5 Four Percent, Five Degree Throttle Open Test

The VRTC conducted tests on four Toyota Camrys to determine the effects of a five degree increase in throttle with the vehicle stopped, with and without the brake pedal depressed. Five degrees is also equivalent to four percent of the five volt reference voltage measured at VTA1, which is the voltage returning from the throttle body. For the tests where the brake pedal was depressed, the force on the brake pedal was adjusted to a value just sufficient to prevent vehicle movement. The effects measured and reported were peak longitudinal acceleration, followed by instantaneous longitudinal acceleration and distance traveled at three time intervals (1, 2 and 3 seconds) after the throttle increase. Results can be seen in Table 5 below.

To conduct the testing, an adjustable mechanical device was attached to the accelerator pedal that functioned as a travel limiter. With the vehicle in drive, the device was adjusted so that the throttle would open an additional 5 degrees when the pedal was depressed.

The tests were conducted to determine what brake pedal force was required to prevent vehicle movement on Camry 12C (2007 V6) with the 5 degree throttle increase, and the force threshold was found to be 8.5 pounds.

Table 5 –4%/5 Degree Throttle Increase Effects

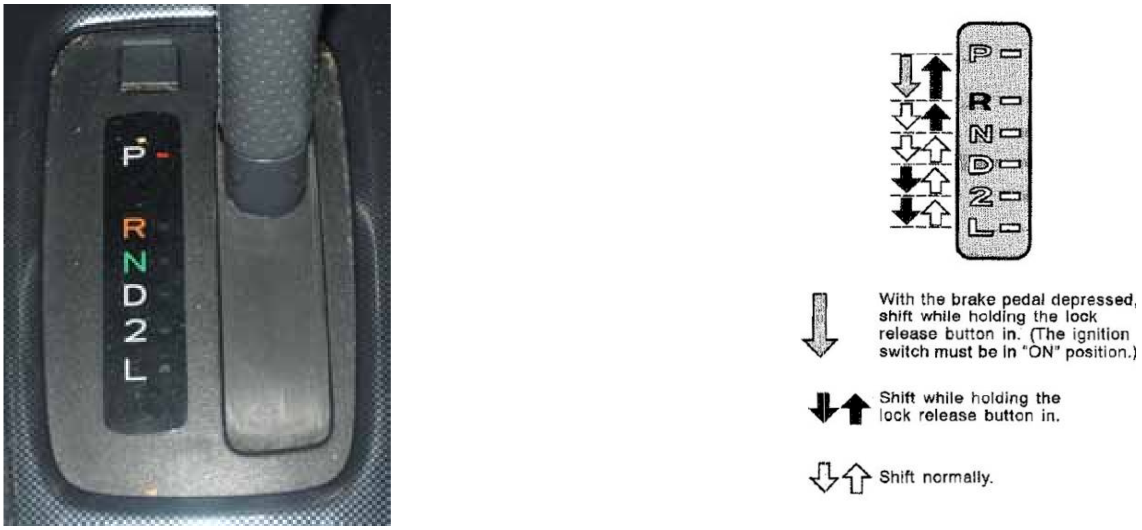


Increase Throttle 4% of 5V Reference or (5 degrees)																
Vehicle ID	From 0 mph with brake								From 0 mph without brake							Peak Accel from 30 mph without brake
	Peak Accel	Brake pedal force	Distance			Accel			Peak Accel	Distance			Accel			
			at t=1 sec	at t=2 sec	at t=3 sec	at t=1 sec	at t=2 sec	at t=3 sec		at t=1 sec	at t=2 sec	at t=3 sec	at t=1 sec	at t=2 sec	at t=3 sec	
	(g)	(lbs)	(feet)	(feet)	(feet)	(g)	(g)	(g)	(g)	(feet)	(feet)	(feet)	(g)	(g)	(g)	(g)
Cam07D '05 L4	0.12	4	1	5	11	0.11	0.07	0.05	0.22	3.8	13	25	0.16	0.1	0.08	
~~Cam11D '06 V6*~~	~~0.19~~	~~3~~	~~1.4~~	~~8~~	~~20~~	~~0.17~~	~~0.2~~	~~0.16~~	~~0.22~~	~~3.1~~	~~12~~	~~27~~	~~0.19~~	~~0.19~~	~~0.16~~	
Cam04D '07 L4	0.16	5	1.6	6.7	14	0.13	0.08	0.05	0.24	3.6	12	24	0.14	0.09	0.05	
Cam12C '07 V6	0.17	4	1.5	6.8	15	0.13	0.1	0.07	0.23	3.7	13	25	0.17	0.12	0.09	0.054
*NOTE: Cam11D acceleration data is not valid because the throttle was not successfully held at 5 degrees.																

4.5 Results Module 6 – Gearshift Lever/Transmission Operation

With the introduction of the new model in 2002, the Toyota Camry V6 automatic transmission shifting pattern changed. Figures 14, 15, and 16 illustrate the gearshifts and shift patterns. Beginning in 2007, instead of requiring a button press to release the vehicle from park, the operator was now required to move the shifter in a lateral direction, followed by the traditional longitudinal motion. A manual sport shift gate was introduced in some 2006 models. In 2007, the shift pattern became increasingly complex by introducing another required lateral motion. In test vehicles, the four cylinder vehicles did not feature an incremental shift mode, but the V6 vehicles did. In the V6 model, the gearshift detente to the incremental shift gate (sport shift) and remained there unless the driver moved it back into drive. From the detente sport shift gate, it was not possible to shift the vehicle to neutral or park with only a longitudinal movement. The gearshift needed to first be moved laterally, back to drive, where it could then be moved longitudinally into neutral.

MY1996-2001



With the brake pedal depressed, shift while holding the lock release button in. (The ignition switch must be in "ON" position.)

Shift while holding the lock release button in.

Shift normally.

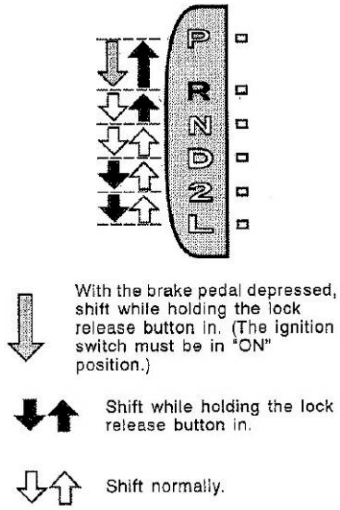
Gear Shift Gate

4 and 6 Cylinder Shifting Instruction

Figure 14– MY1996-2001 L4 and V6 Engine, Automatic Transmission Gearshift and Shift Patterns

MY2002-2006

4 Cylinder Gear Shift Gate



With the brake pedal depressed, shift while holding the lock release button in. (The ignition switch must be in "ON" position.)

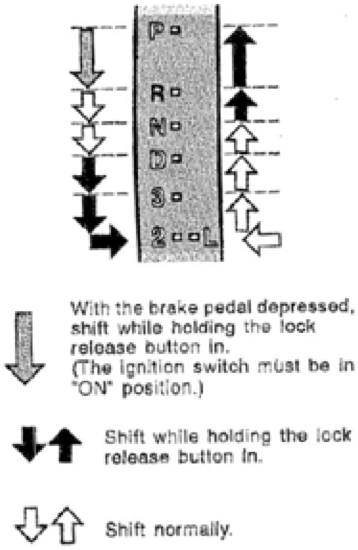
Shift while holding the lock release button in.

Shift normally.

4 Cylinder Shifting Instructions

Figure 15 – MY2002-2006, L4 Engine, Automatic Transmission Gearshift and Shift Pattern

6 Cylinder Gear Shift Gate



With the brake pedal depressed, shift while holding the lock release button in. (The ignition switch must be in "ON" position.)

Shift while holding the lock release button in.

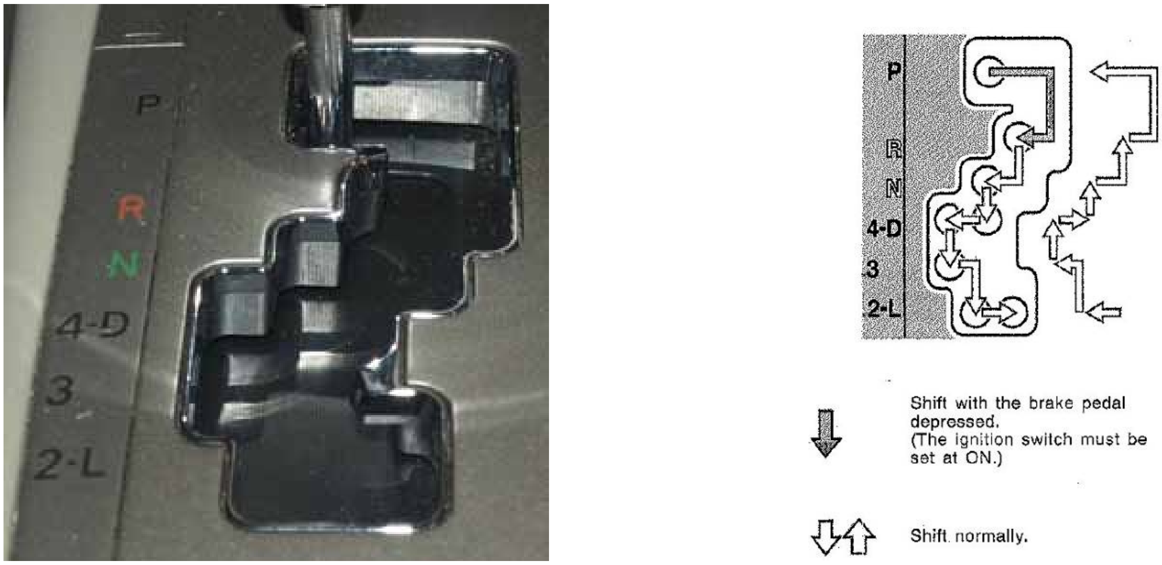
Shift normally.

6 Cylinder Shifting Instructions

Figure 16 - MY2002-2006, V6 Engine, Automatic Transmission Gearshift and Shift Pattern

The results showed that unlike MY1996-2001 Camrys and L4 MY2002-2006 Camrys, the gear position labels were not immediately adjacent to the position of the gearshift when placed in the corresponding gear for all MY2002-2006 V6 Camrys and all MY2007-2009 Camrys. Again, this can be seen in Figures 17 and 18.

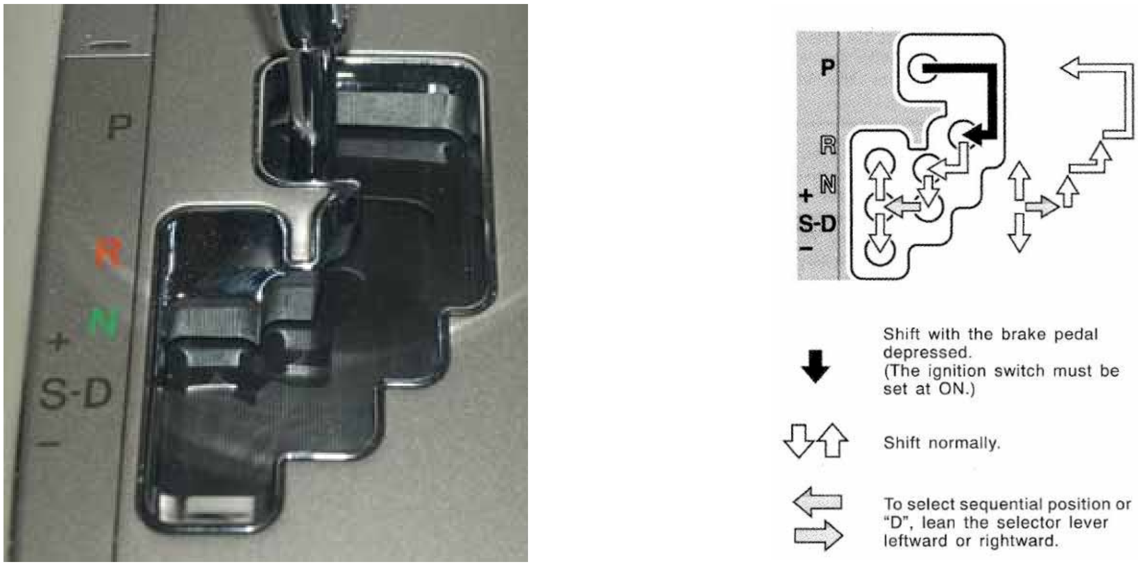
MY2007-2009



4 Cylinder Gear Shift Gate

4 Cylinder Shifting Instructions

Figure 17 - MY2007-2009, L4 Engine, Automatic Transmission Gearshift and Shift Pattern



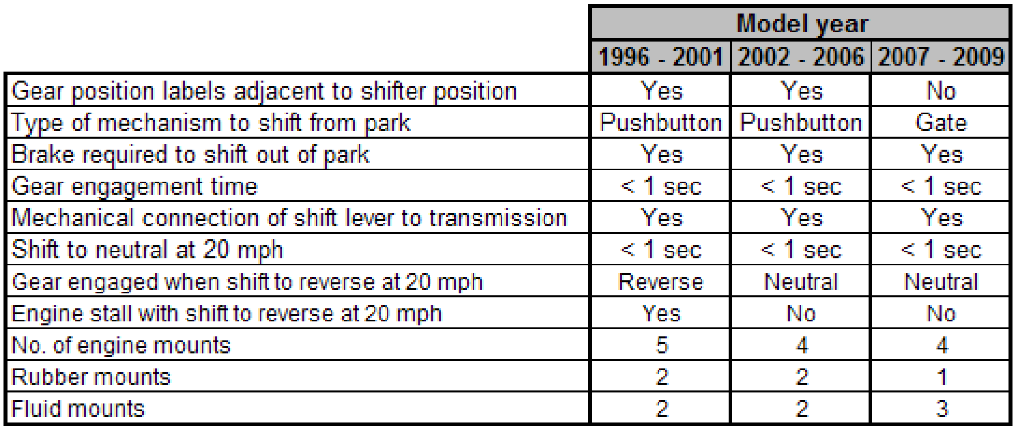
6 Cylinder Gear Shift Gate

6 Cylinder Shifting Instructions

Figure 18 - MY2007-2009, V6 Engine, Automatic Transmission Gearshift and Shift Pattern

Test findings include that all cars tested: 1) disengaged the engine from the transmission and drive wheels in less than one second when placed in neutral; 2) required a brake application to shift out of park; 3) used a mechanical linkage between the shifter and transmission, and 4) did not change the direction of rotation in the drive train when the shift lever was placed in reverse. Additional results regarding operation of the transmission are summarized in Table 6 below.

Table 6 – Operation of Automatic Transmission Summary



	Model year		
	1996 - 2001	2002 - 2006	2007 - 2009
Gear position labels adjacent to shifter position	Yes	Yes	No
Type of mechanism to shift from park	Pushbutton	Pushbutton	Gate
Brake required to shift out of park	Yes	Yes	Yes
Gear engagement time	< 1 sec	< 1 sec	< 1 sec
Mechanical connection of shift lever to transmission	Yes	Yes	Yes
Shift to neutral at 20 mph	< 1 sec	< 1 sec	< 1 sec
Gear engaged when shift to reverse at 20 mph	Reverse	Neutral	Neutral
Engine stall with shift to reverse at 20 mph	Yes	No	No
No. of engine mounts	5	4	4
Rubber mounts	2	2	1
Fluid mounts	2	2	3

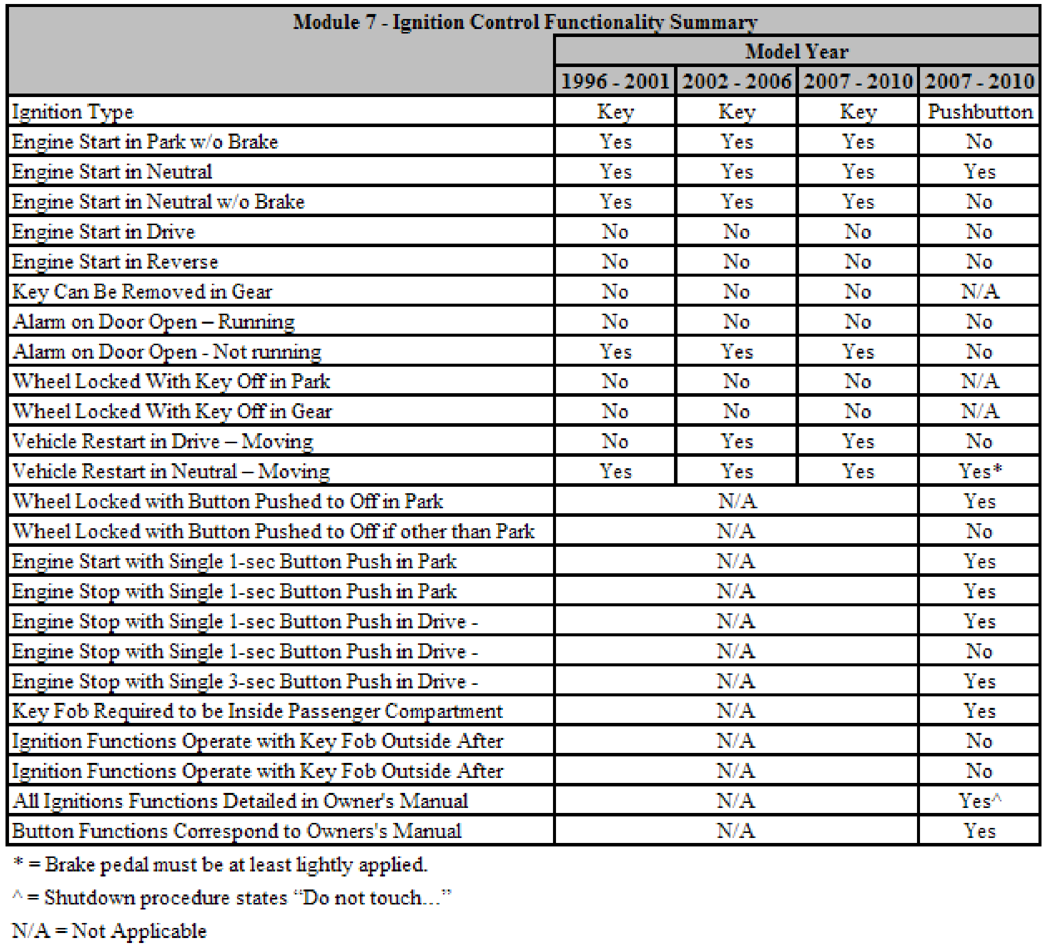
4.6 Results Module 7 – Ignition Switch Control Functionality

The ignition control mechanisms changed with the introduction of the 2007 model year equipped with an optional pushbutton ignition (See Figure 19). With a traditional key, the driver was able to turn the key counterclockwise one detent position to the accessory position to immediately cause ignition to cease, consequently depowering the engine. With the introduction of the pushbutton ignition, a conditional functionality was introduced. The pushbutton turned the engine on and off nearly instantly, but only if the vehicle was not in motion. If the vehicle was in motion, as it would be during an unwanted acceleration event, the vehicle computer would ignore the pushbutton tap request. Rather, an alternate procedure required the pushbutton be depressed for three seconds. While this was explained in the manual, it was stated in the context of a caution, advising the operator against the action. It should be noted that not all encountered situations on the road afford three seconds to wait for the engine to cease power.

Figure 19 - Pushbutton Ignition Option in 2007 Toyota Camry

Other ignition control characteristics are listed below in Table 7 that highlight the functional changes accompanying the introduction of the pushbutton as it is compared to the traditional key.

Table 7 – Documented Functional Changes



Module 7 - Ignition Control Functionality Summary				
	Model Year			
	1996 - 2001	2002 - 2006	2007 - 2010	2007 - 2010
Ignition Type	Key	Key	Key	Pushbutton
Engine Start in Park w/o Brake	Yes	Yes	Yes	No
Engine Start in Neutral	Yes	Yes	Yes	Yes
Engine Start in Neutral w/o Brake	Yes	Yes	Yes	No
Engine Start in Drive	No	No	No	No
Engine Start in Reverse	No	No	No	No
Key Can Be Removed in Gear	No	No	No	N/A
Alarm on Door Open – Running	No	No	No	No
Alarm on Door Open - Not running	Yes	Yes	Yes	No
Wheel Locked With Key Off in Park	No	No	No	N/A
Wheel Locked With Key Off in Gear	No	No	No	N/A
Vehicle Restart in Drive – Moving	No	Yes	Yes	No
Vehicle Restart in Neutral – Moving	Yes	Yes	Yes	Yes*
Wheel Locked with Button Pushed to Off in Park	N/A			Yes
Wheel Locked with Button Pushed to Off if other than Park	N/A			No
Engine Start with Single 1-sec Button Push in Park	N/A			Yes
Engine Stop with Single 1-sec Button Push in Park	N/A			Yes
Engine Stop with Single 1-sec Button Push in Drive -	N/A			Yes
Engine Stop with Single 1-sec Button Push in Drive -	N/A			No
Engine Stop with Single 3-sec Button Push in Drive -	N/A			Yes
Key Fob Required to be Inside Passenger Compartment	N/A			Yes
Ignition Functions Operate with Key Fob Outside After	N/A			No
Ignition Functions Operate with Key Fob Outside After	N/A			No
All Ignitions Functions Detailed in Owner's Manual	N/A			Yes^
Button Functions Correspond to Owners's Manual	N/A			Yes

* = Brake pedal must be at least lightly applied.

^ = Shutdown procedure states "Do not touch…"

N/A = Not Applicable

4.7 Results Module 8 – Pedal Positioning

Parameters were measured and evaluated to determine if any scenarios exist that could cause a dual pedal application or a pedal misapplication, where the driver applies either both pedals or the wrong pedal.

The potential for pedal entrapment, specifically due to interference from objects such as floor mats was evaluated using a series of attributes that are believed to mitigate or aggravate instances of pedal entrapment including: spring forces, pedal hinging methods, geometric interaction with the floor pan, and pedal positive backstop location.

Parameters that were measured are evaluated in the following sections:

1. Evaluation of static step-over
2. Evaluation of critical vertical offset (CVO)
3. Evaluation of lateral separation of pedals as a function of model
4. Changes in accelerator pedal responsiveness
5. Changes in accelerator pedal “force versus deflection” curves
6. Potential for accelerator pedal interaction with various floor mats & entrapment potential
7. Evaluation of dimensional change between models with respect to with respect to driver position

4.7.1 Evaluation of Static Step-over

Static step-over is the at-rest distance between the brake pedal face and the accelerator pedal face. A larger difference in these values serves to mitigate the propensity for the driver to apply both pedals with a single foot. A high step-over also requires the driver to retract their foot farther to apply the brake than to apply the accelerator. However, an excessively large step-over value can also extend braking reaction time. An example of the measured pedals image in one of the test vehicles is shown in Figure 20. In this vehicle, the pedals were not parallel, but the average measurement at the center of the pedals yielded essentially the same value. Fourteen of the 20 test vehicles exhibited a brake pedal that was slightly twisted toward the left, which was presumed to have been caused by the brake test fixture used during the panic stop testing, where forces exceeded 400 pounds. Despite this twisting plastic deformation, static step-over values are accurate because they measured the average height of the surface of the pedal, which remained near to the neutral axis of the bend. Table 8 lists the static step-over values for each vehicle. The average static step-over value for MY1996-2001 was 41.5 mm, MY2002-2006 was 35.7 mm, and MY2007-2009 was 39.5 mm,

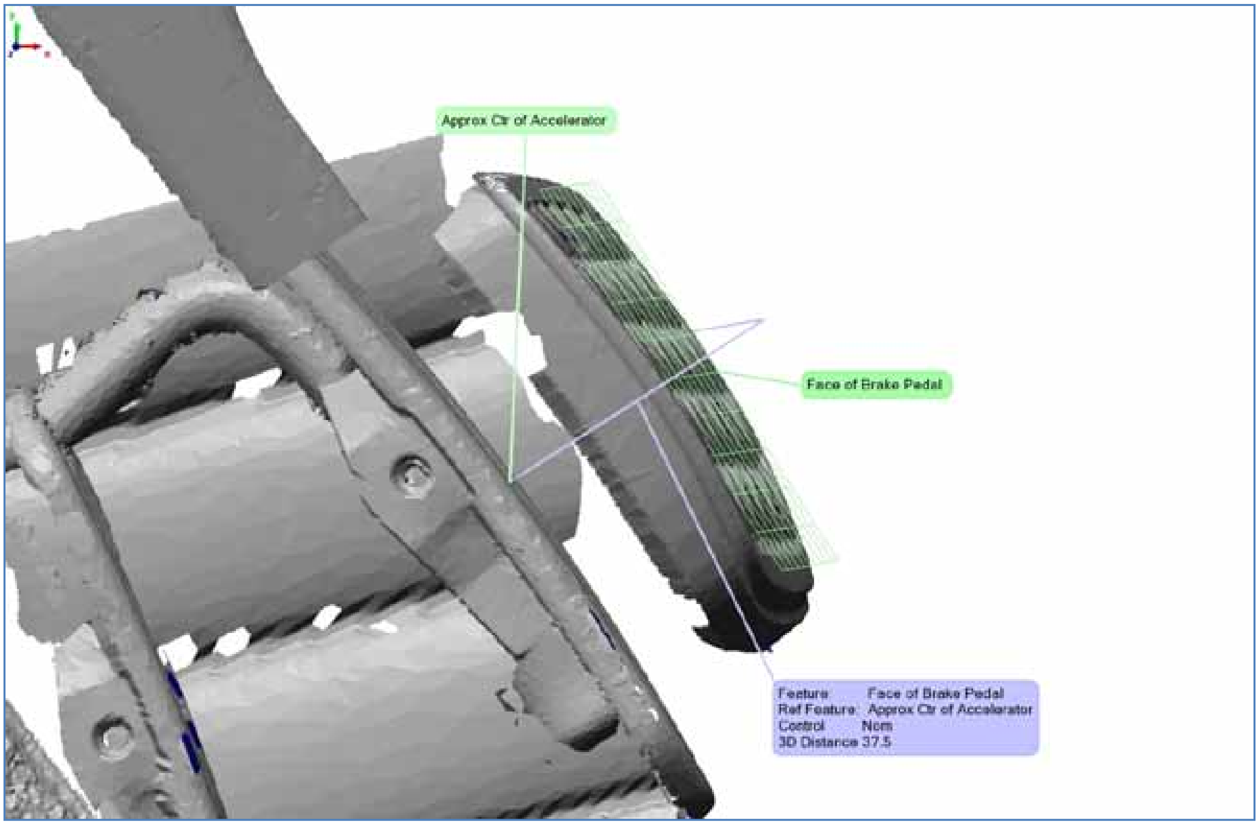
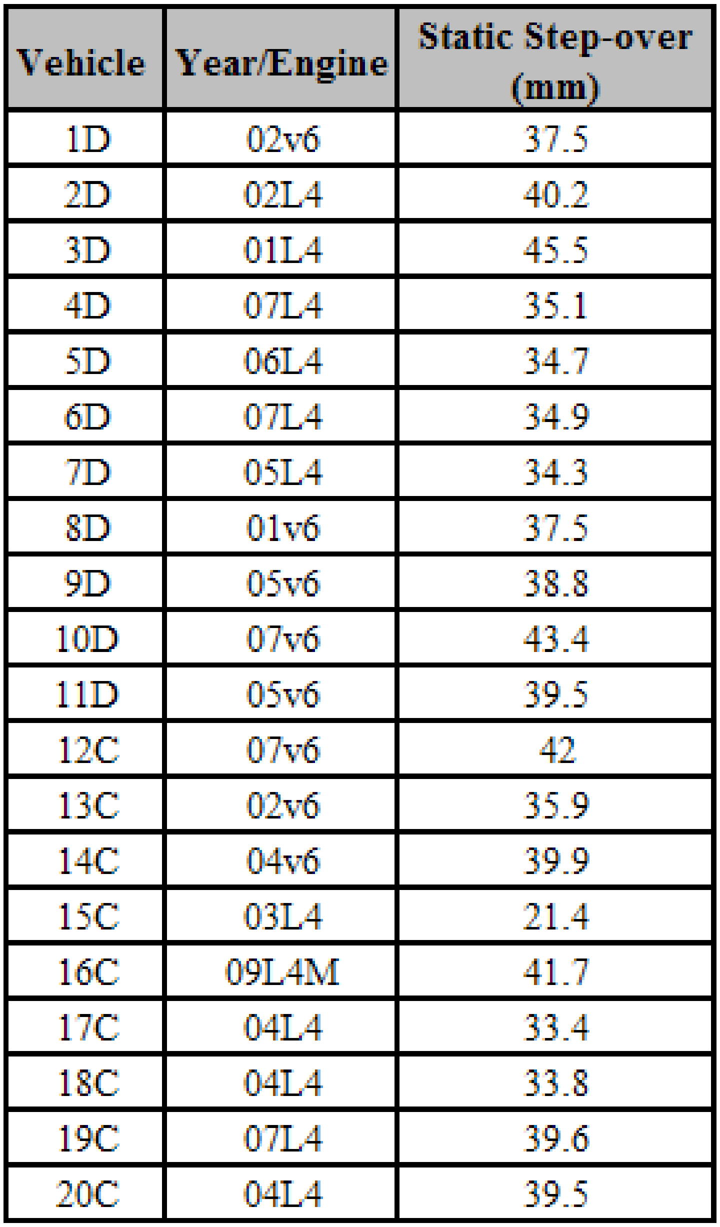


Figure 20 - Measured Pedal Image Illustrating Static Step-over Dimension for Vehicle 1D

Table 8 – Static Step-over



Vehicle	Year/Engine	Static Step-over (mm)
1D	02v6	37.5
2D	02L4	40.2
3D	01L4	45.5
4D	07L4	35.1
5D	06L4	34.7
6D	07L4	34.9
7D	05L4	34.3
8D	01v6	37.5
9D	05v6	38.8
10D	07v6	43.4
11D	05v6	39.5
12C	07v6	42
13C	02v6	35.9
14C	04v6	39.9
15C	03L4	21.4
16C	09L4M	41.7
17C	04L4	33.4
18C	04L4	33.8
19C	07L4	39.6
20C	04L4	39.5

4.7.2 Evaluation of Critical Vertical Offset and Lateral Separation

A higher CVO dimension indicated that the operating ranges of the accelerator and brake pedals were farther apart and therefore less likely to result in dual pedal application. This would be expected to reduce the potential for unwanted acceleration events caused by dual pedal applications. The test was repeated with 20, 40, and 60 pounds of brake force. The CVO device was limited to measuring a minimum of 0.5 inches and a maximum of 2.5 inches in 0.25 inch increments. Therefore any value of 0.5 inches indicated a CVO value that was 0.5 inches or less. If a CVO was negative, this device would not have been capable of indicating the negative value. The tests were conducted in both drive (1st gear) and in reverse. The results are shown in Figure 21, Figure 22, and Figure 23 for 20, 40, and 60 pounds of brake pedal force respectively, which were plotted against the lateral separation of the two pedals. Lateral separation was measured as the open-space distance from the right edge of the brake pedal to the left edge of the accelerator pedal. A small lateral separation distance would increase the potential to have a one-foot, dual pedal application or pedal misapplication. A large lateral separation could reduce reaction time during normal brake applications. In Figures 21, 22, and 23 it can be seen that Toyota Camrys typically exhibited a 0.5 inch or less CVO with 20 pounds of brake force. With 40 and 60 pounds of brake force, the CVO on the test vehicles increased.

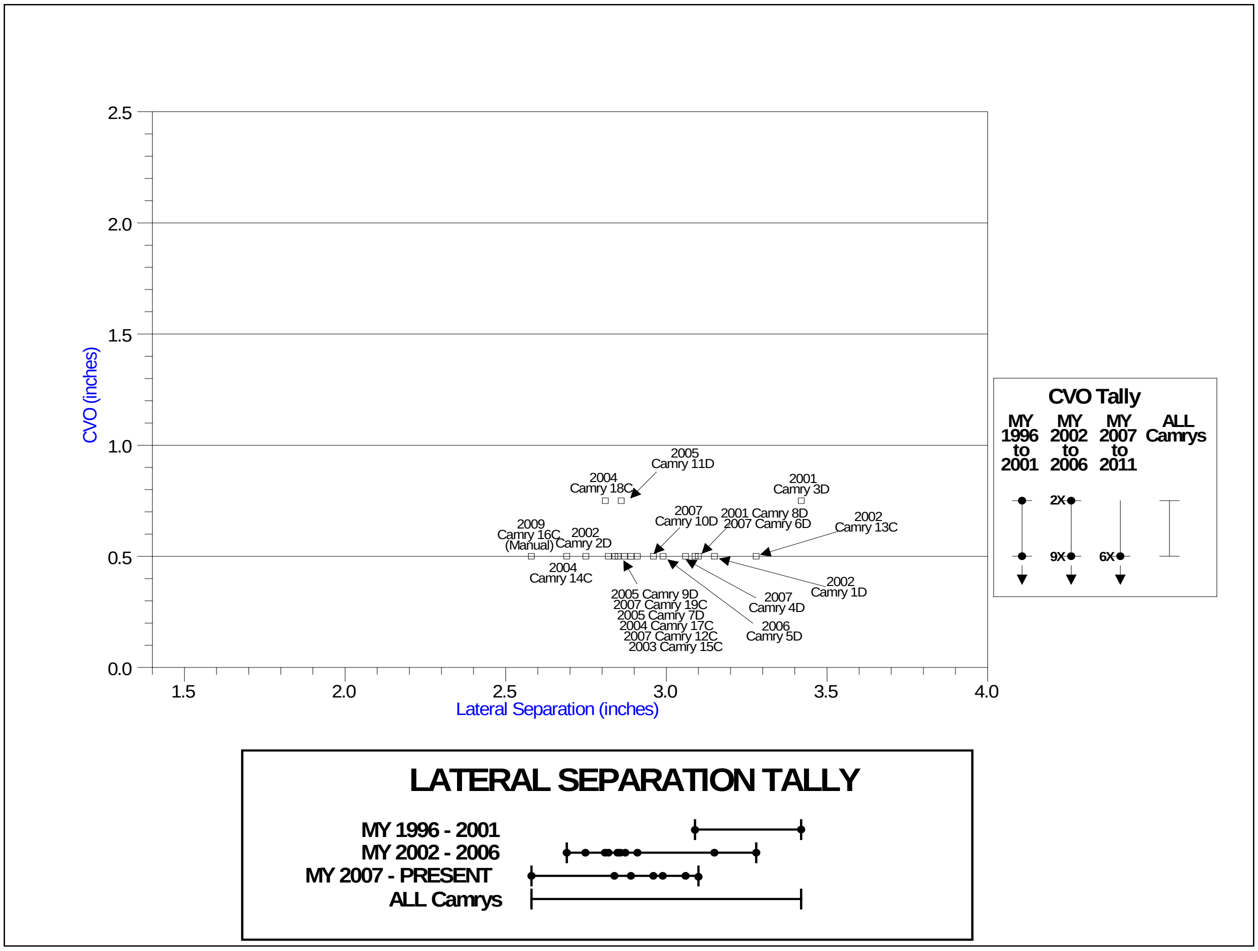


Figure 21 - 20 Pounds of Brake Pedal Force - Critical Vertical Offsets and Lateral Separations

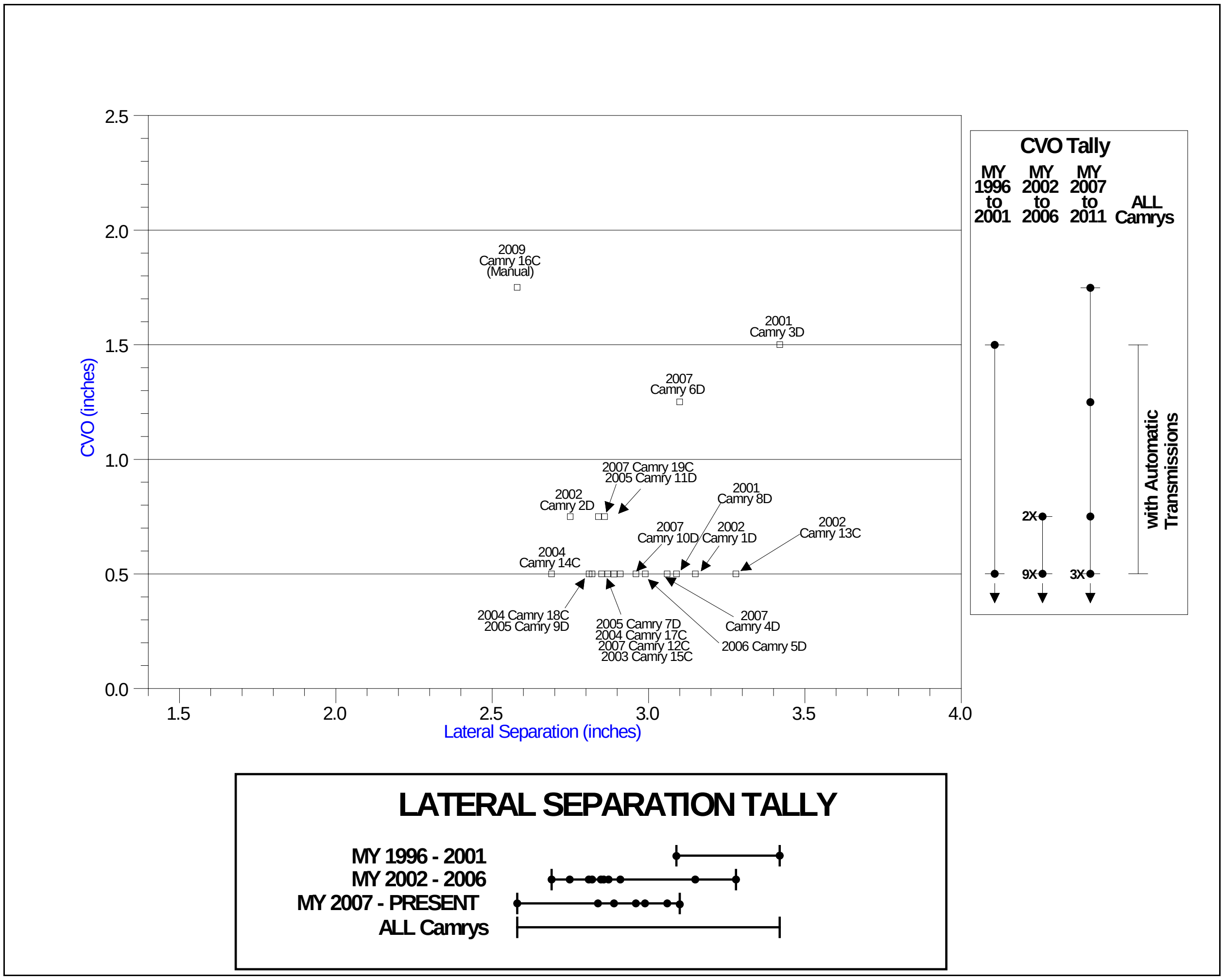


Figure 22 - 40 Pounds of Brake Pedal Force - Critical Vertical Offsets and Lateral Separations

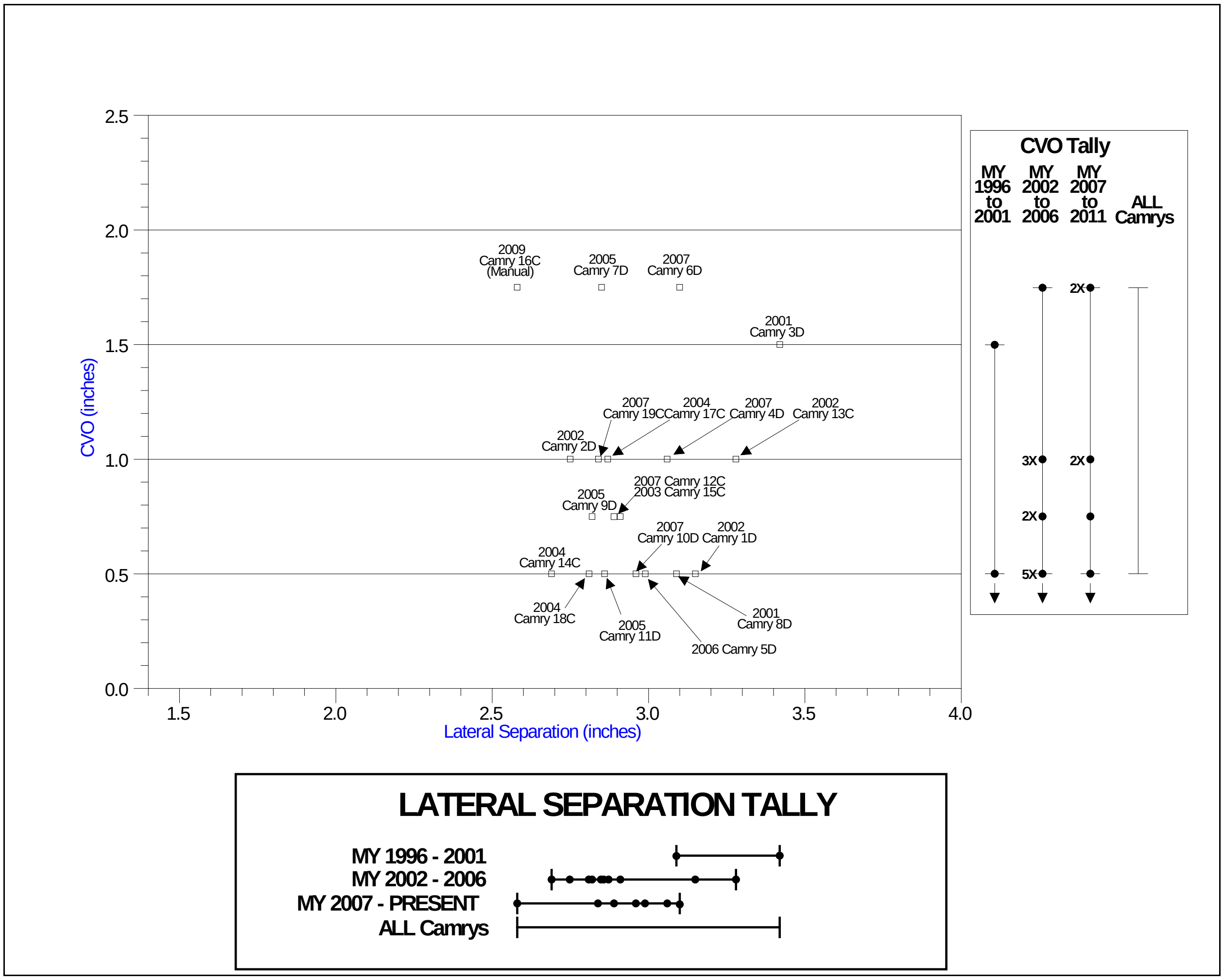


Figure 23 - 60 Pounds of Brake Pedal Force - Critical Vertical Offsets and Lateral Separations

In addition to pedal dimensions, brake and accelerator pedal responsiveness both change the CVO value. While brake pedal responsiveness remained largely unchanged from model year to model year, accelerator pedal responsiveness increased significantly, with the largest incremental change occurring in 2002 with the introduction of the electronic accelerator pedal.

Lateral separations for each vehicle are listed below in Table 9. Table 10 groups and averages these values by model generation. From the group of test vehicles, the average lateral separation was reduced from 3.25 inches in 2001 vehicles to 2.87 inches in MY2002-2006 test vehicles for an average change of 0.38 inches. MY2007-2009 test vehicle averages increased over MY2002-2006 by 0.10 inches. In relation to the center of the steering column, brake pedal lateral location has not changed significantly. However, accelerator pedals in MY2002-2006 test vehicles did on average move closer to the steering center by 0.67 inches from MY1996-2001vehicles as can be seen in Table 11. Average measured MY2007-2009 vehicle accelerator pedals were similar to MY2002-2006 vehicles with only a 0.04 inch increase in distance from the steering center.

Table 9 - Lateral Offset Spacing from Brake Pedal Edge to Accelerator Pedal Edge[4]

Vehicle	Right Edge of Brake Pedal to Left Edge of Accelerator Pedal in	
	Millimeters	Inches
3D 2001 Camry LE L4	86.9	3.42
8D 2001 Camry XLE V6	78.4	3.09
13C 2002 Camry XLE V6	83.3	3.28
1D 2002 Camry SE V6	80.0	3.15
2D 2002 Camry XLE L4	69.8	2.75
15C 2003 Camry XLE L4	74.0	2.91
14C 2004 Camry XLE V6	68.2	2.69
18C 2004 Camry LE L4	71.3	2.81
20C 2004 Camry LE L4	63.1	2.48
17C 2004 Camry LE L4	72.9	2.87
7D 2005 Camry XLE L4	72.4	2.85
11D 2005 Camry XLE V6	72.6	2.86
9D 2005 Camry LE V6	71.6	2.82
5D 2006 Camry LE L4	75.9	2.99
6D 2007 Camry LE L4	78.8	3.10
12C 2007 Camry XLE V6	73.3	2.89
4D 2007 Camry SE L4	77.7	3.06
10D 2007 Camry LE V6	75.1	2.96
19C 2007 Camry LE L4	72.1	2.84
16C 2009 Camry NR L4/Manual	65.5	2.58

---

[4] Note that vehicle 15C had no brake pedal cover as tested.

Table 10-Average and Range of Lateral Offset Spacing by Generation

Offset by Generation	Average (inches)	Minimum (inches)	Maximum (inches)	Range (inches)	Average Change from Previous Generation (Inches)
MY1996-2001	3.25	3.09	3.42	0.33	-
MY2002-2006	2.87	2.48	3.28	0.79	**-0.38**
MY2007-2009	2.97	2.84	3.10	0.26	+0.10

Table 11 - Test Vehicle Accelerator Pedal Lateral Distance to Center of Steering Wheel (Inches)

		Left Edge of Accelerator Pedal to Centerline of Steering Wheel (in Inches)	Average By Generation (Inches)	Average Change From Previous Generation (Inches)	
MY1996-2001	3D	5.91			
	6D	5.84	5.88	-	
MY2002-2006	1D	5.61			
	2D	5.25			
	5D	5.07			
	7D	4.81			
	9D	5.18			
	1D	4.95			
	13C	5.67			
	14C	5.17			
	15C	5.23			
	17C	5.41			
	18C	5.26			
	20C	4.91	5.21	**+0.67**	(Closer)
MY2007-2009	4D	5.02			
	6D	5.31			
	10C	5.23			
	12C	5.36			
	16C	5.37			
	20C	5.24	5.25	-0.04	(Relatively no Change)

Seat centerline to steering centerline was measured and compared between model years. Variation was generally limited to about six millimeters among models and no significant change was found between model years. The centerline dimensions are listed below in Table 12.

Table 12 - Steering Wheel Centerline to Seat Centerline

Vehicle	Steer CL to Seat CL	
	(mm)	(inch)
3D 2001 Camry LE L4	-9.0	-0.4
8D 2001 Camry XLE V6	-1.8	-0.1
13C 2002 Camry XLE V6	-6.3	-0.2
1D 2002 Camry SE V6	-4.4	-0.2
2D 2002 Camry XLE L4	1.7	0.1
15C 2003 Camry XLE L4	-10.6	-0.4
14C 2004 Camry XLE V6	-8.0	-0.3
18C 2004 Camry LE L4	-12.9	-0.5
20C 2004 Camry LE L4	-3.0	-0.1
17C 2004 Camry LE L4	-6.5	-0.3
7D 2005 Camry XLE L4	11.2	0.4
11D 2005 Camry XLE V6	-2.0	-0.1
9D 2005 Camry LE V6	0.0	0.0
5D 2006 Camry LE L4	-2.8	-0.1
6D 2007 Camry LE L4	8.2	0.3
12C 2007 Camry XLE V6	10.9	0.4
4D 2007 Camry SE L4	-6.2	-0.2
10D 2007 Camry LE V6	-0.5	0.0
19C 2007 Camry LE L4	6.5	0.3
16C 2009 Camry NR L4/Manual	-3.0	-0.1

4.7.3 Force Versus Deflection Curves in Accelerator and Brake Pedals

The MY1996-2001 Camry used a conventional cable connection through 2001, referred to as a Bowden cable, to open the throttle to command acceleration. When the MY2002-2006 Camry was introduced in 2002, electronic accelerator pedals were installed. These pedals used variable resistive potentiometers with varying voltage potentials to measure the displacement of the pedal by the driver’s foot. This voltage was relayed to the engine control module where it electronically actuated the throttle and fuel injectors to accelerate the vehicle. In 2007, the MY2007-2009 Camry changed the electronic pedal by replacing the potentiometer sensors with Hall-effect sensors, which measured voltage potentials across permanent magnets and amplified those values using operational amplifiers. The three generations of pedals can be seen in Figure

24, where the pedal at the top of the picture is the MY1996-2001 mechanical pedal, the middle pedal is the MY2002-2006 electronic pedal, and the pedal on the bottom is the MY2007-2009 Hall-Effect sensor pedal (manufactured by Denso Corporation).

Figure 24 – Three Pedal Generations, Cable driven (top), Potentiometer (center), Hall Effect (bottom)

Pedal characteristics changed with the introduction of electronic throttle control that included but were not limited to: shape, material, construction, spring force, responsiveness, and displacement (i.e. deflection). These all affect the "feel and feedback" of the pedal for the operator. Efforts were undertaken to quantify and compare these characteristics.

Responsiveness - The responsiveness of the accelerator pedal is the rate at which the accelerator produces throttle actuation for a given displacement (deflection). The displacement is plotted on the abscissa, and throttle opening voltage is plotted on the ordinate to create a "throttle voltage versus deflection" curve. A comparison of the throttle body voltage produced for the ETC MY2002-2006 and MY2007-2009 Camry accelerator pedals to the non-ETC, mechanical throttle-controlled MY1996-2001 Camry pedal is shown in Figure 25. It illustrates that the ETC accelerator pedals commanded earlier throttle opening and engine power than the MY1996-2001 mechanical accelerator pedals with less pedal displacement.

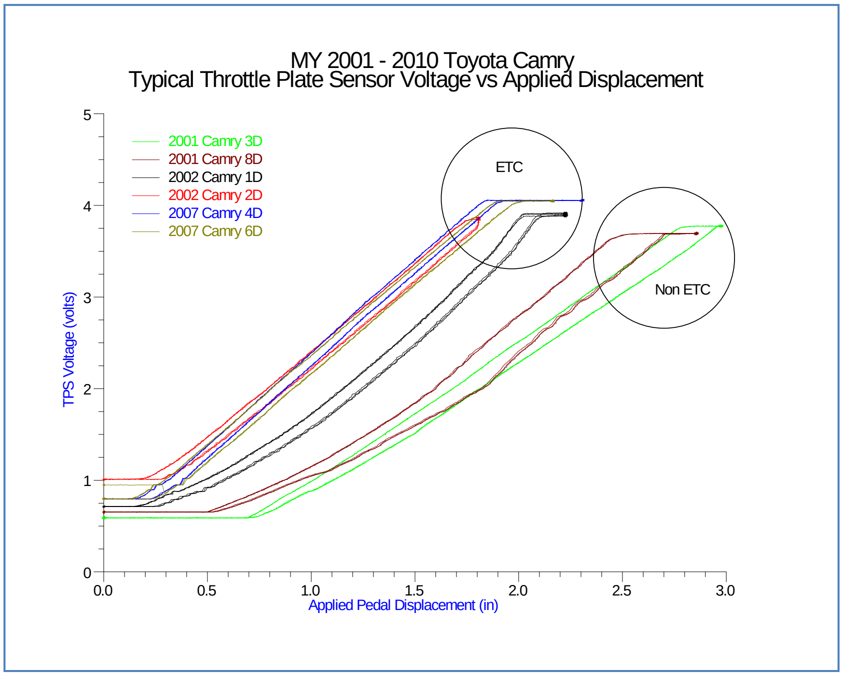


Figure 25 – Throttle Response Rate Comparison Between ETC and Non-ETC Test Camrys

Force Versus Deflection – When the brake and accelerator pedals were actuated (deflected); they deflected with non-linear forces as compliances in each system reached constraints. The displacement was plotted on the abscissa and the required pedal force was plotted on the ordinate. As the pedals were released, the amount of force required to prevent them from returning to an at-rest position was less than the force that was required to deflect them. This is due to a hysteresis effect that can be seen in the next several figures. When the 2001, non-ETC pedal was displaced, the mechanical compliance was measurable. In MY1996-2001 Camrys 3D and 8D, four pounds of force deflected the accelerator pedals between 0.5 inches and 0.75 inches (See Figure 26) and the pedals deflected a total of about three inches. The hysteresis effect shows the return of each of the pedals as the same colored, lower force line.

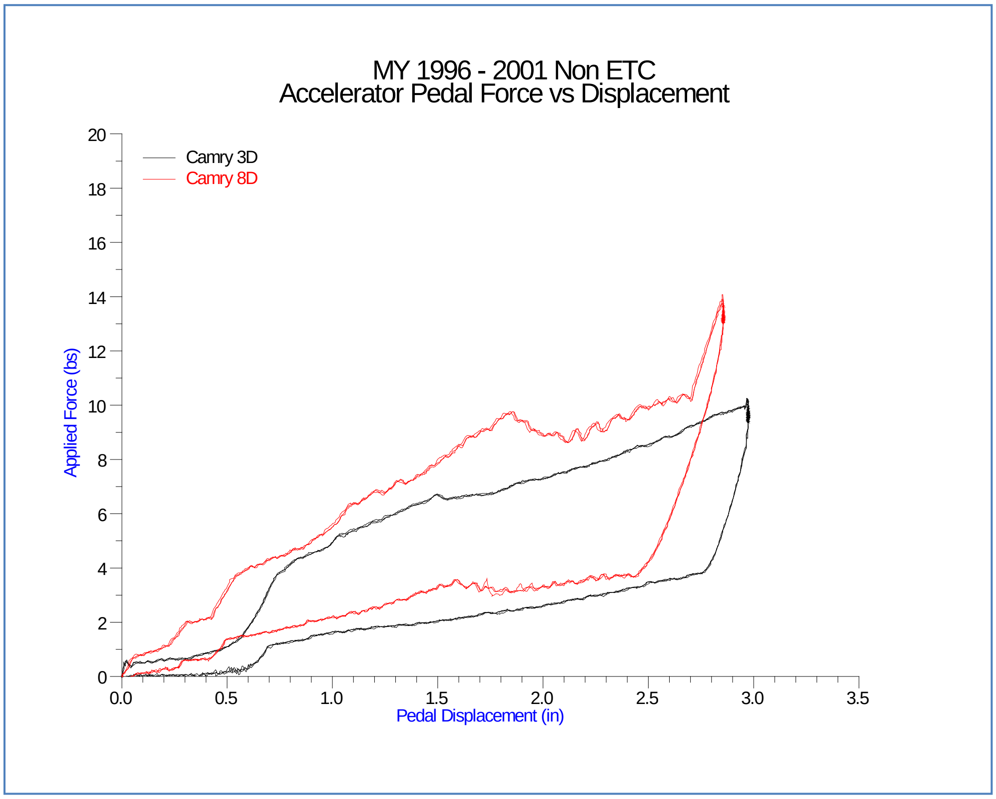


Figure 26 – Pedal Displacement vs. Applied Force for MY1996-2001 Camry

With the introduction of the MY2002-2006 ETC Camry, four pounds of force repeatedly produced about 0.1 inches of deflection (See Figure 27). The overall displacement was reduced to between 1.75 and 2.5 inches, depending on the thickness of the floor pan and carpet that acted as positive back stops for the pedals.

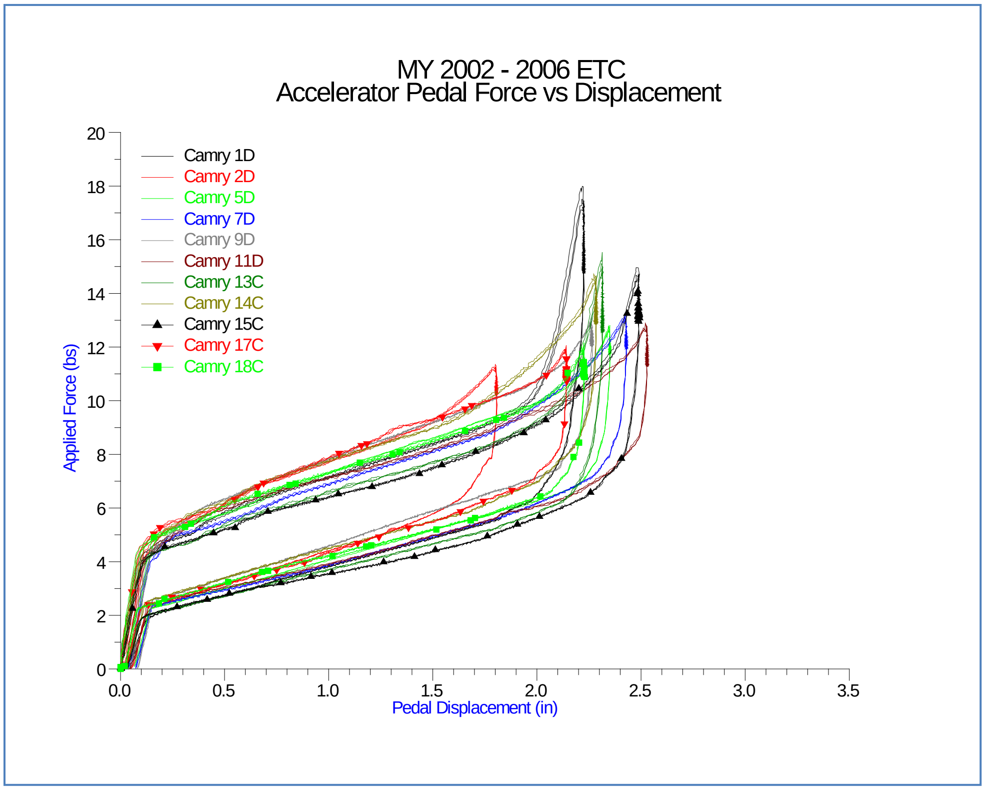


Figure 27 - Pedal Displacement vs. Applied Force for MY2002-2006 Camry

For the MY2007-2009 test Camrys, the force versus deflection curves appeared to have a more linear response range, but four pounds still produced about 0.10 inches of deflection (Figure 28).

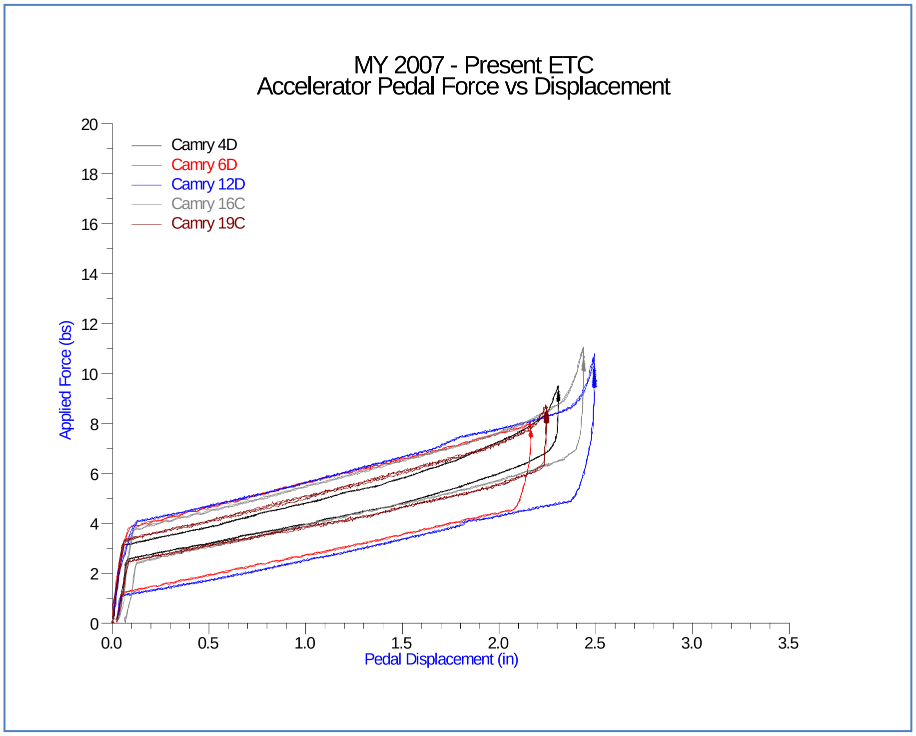


Figure 28 - Pedal Displacement vs. Applied Force for MY2007-2009 Camry

Additionaly, when the test was performed on a pedal that had received a shim in accordance with the safety recall (NHTSA 09V388/Toyota Recall 90L), the shim reduced the friction of the pedal. The result was less resistance to returning the pedal to the home position, as evidenced by the lessened effect on hysteresis, as seen in Figure 29.

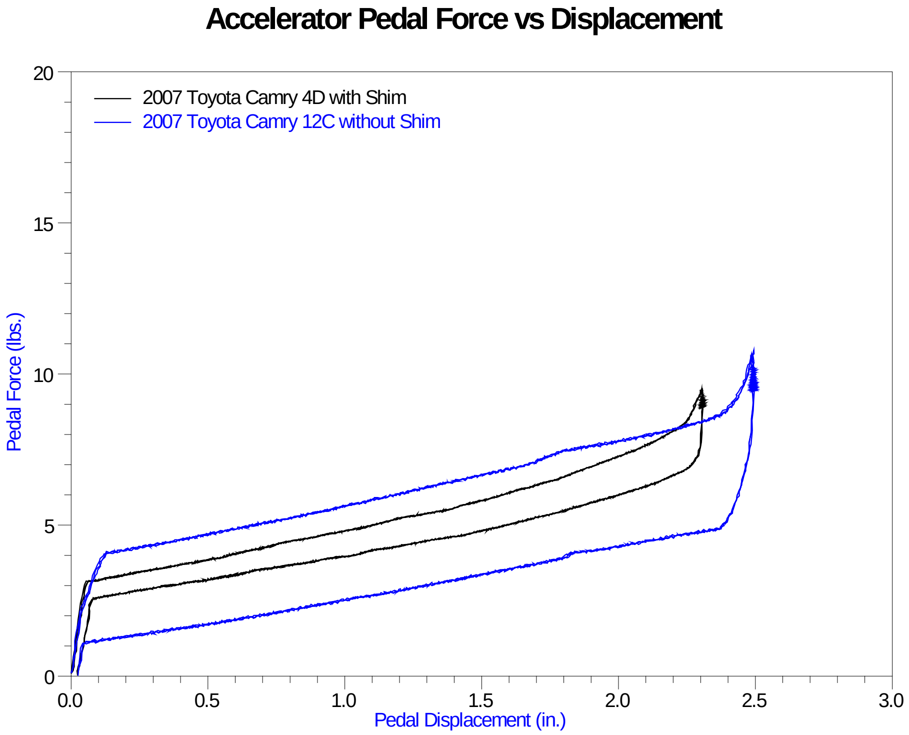


Figure 29 – Pedal Displacement vs. Applied Force

Brake and Accelerator Comparison - The pedal robot was connected to the brake pedal to measure force versus deflection curves encountered with a normally operating, vacuum assisted power brake system. The vehicles were operating at idle in park for this test. For the MY1996-2001, non-ETC mechanical throttle Camrys, four pounds of pedal force produced approximately 0.2 inches of displacement. The accelerator pedal and brake pedal curves were overlaid in Figure 30. The curves did not appear to be similar, with particular focus on the first four pounds, which was the approximate amount necessary to maintain a stationary position with an at-idle vehicle.

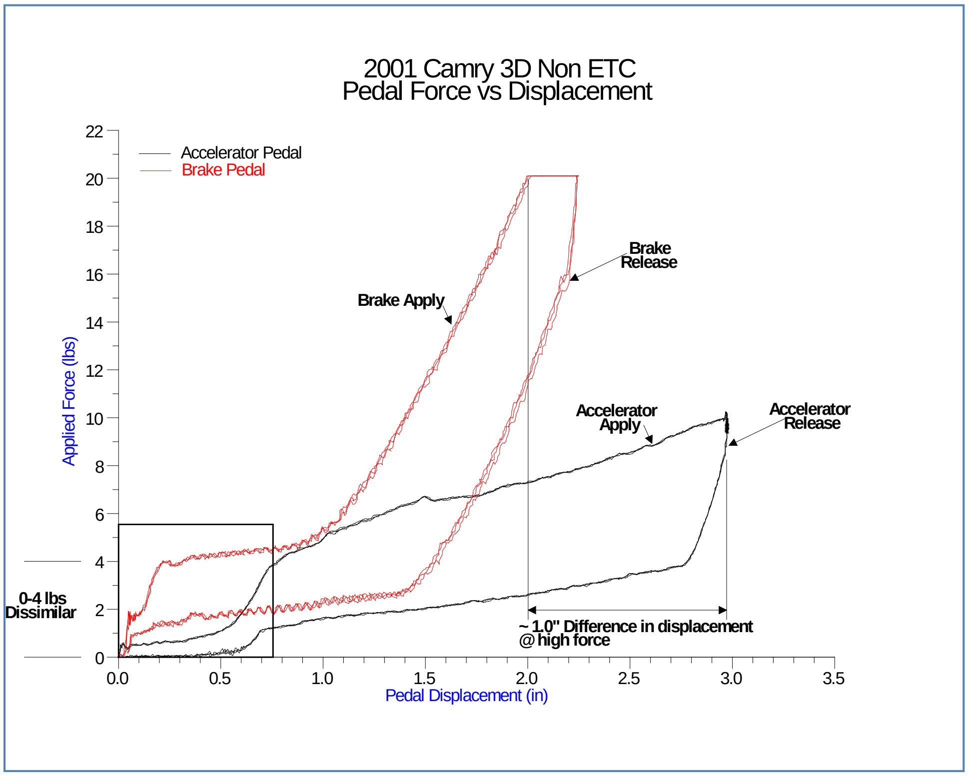


Figure 30 - Comparing Accelerator and Brake Pedal Displacement vs. Applied Force for MY1996-2001 Camry

For the MY2002-2006 Camry, four pounds of brake pedal force results in 0.1” of deflection, just as it did for the accelerator pedal. The force versus displacement curves for the brake and accelerator pedals appeared much more similar to each other, and they intersect several times through a similar displacement of 2.2 inches for the accelerator and 2.5 inches for the brake (See Figure 31).

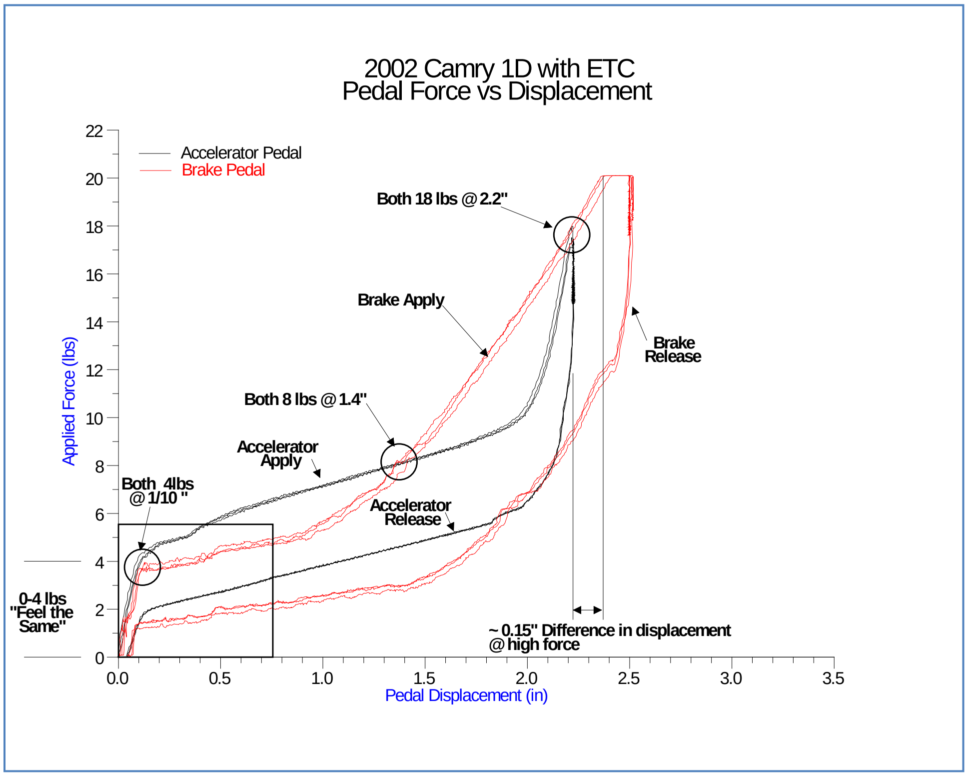


Figure 31 - Comparing Accelerator and Brake Pedal Displacement vs. Applied Force for MY2002-2006 Camry

The MY2007-2009 test Camrys brake and accelerator curves were slightly less similar than the MY2002-2006 test Camrys (See Figure 32).

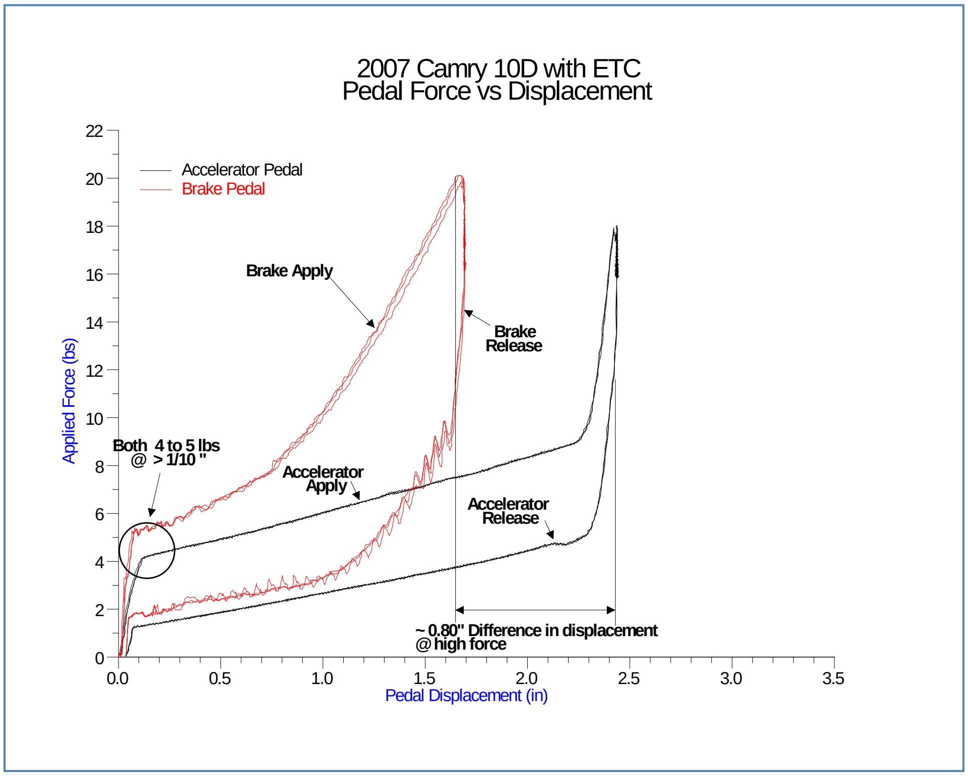


Figure 32 - Comparing Accelerator and Brake Pedal Displacement vs. Applied Force for MY2007 Camry

4.7.4 Potential for Accelerator Pedal Interaction with the Floor Pan and Potential Entrapment with Floor Mats

Some Toyota Camry/Lexus ES-350 All-Weather floor mats were recalled in 2007 due to a high propensity for pedal entrapment when interacting with the accelerator pedal (See Figure 33). These mats were used as “worst case” objects because they are known to cause pedal entrapment when incorrectly installed in many Toyota vehicles. Figure 34 shows the interference condition in MY2007-2009 Toyota product. Table 13 lists the results of placing this mat into each test vehicle and intentionally orienting it in such a way to facilitate pedal interference. Only one test vehicle, a 2007 Toyota Camry that had not yet received the recall remedy for pedal reshaping, was able to capture the accelerator pedal with the floor mat.

Figure 33 - Floor Mat Design Used to Evaluate Potential for Pedal Entrapment Test

Figure 34 – Pedal Entrapment with Incorrectly Installed Mat

Table 13 – Potential for Pedal Entrapment Using Recalled Toyota Camry All-Weather Floormat

Vehicle	Pedal Entrapment Facilitated Using All-Weather Mat (Yes/No)
3D 2001 Camry LE L4	No
8D 2001 Camry XLE V6	No
13C 2002 Camry XLE V6	No
1D 2002 Camry SE V6	No
2D 2002 Camry XLE L4	No
15C 2003 Camry XLE L4	No
14C 2004 Camry XLE V6	No
18C 2004 Camry LE L4	No
20C 2004 Camry LE L4	No
17C 2004 Camry LE L4	No
7D 2005 Camry XLE L4	No
11D 2005 Camry XLE V6	No
9D 2005 Camry LE V6	No
5D 2006 Camry LE L4	No
6D 2007 Camry LE L4 (Post-Recall	No
12C 2007 Camry XLE V6 (**Pre-Recall**)	Yes
4D 2007 Camry SE L4 (Post-Recall)	No
10D 2007 Camry LE V6 (Post-Recall)	No
19C 2007 Camry LE L4 (Post-Recall)	No
16C 2009 Camry NR L4/Manual (Post-Recall)	No

4.7.5 <u>Other Pedal Characteristics</u>

1. Other pedal characteristics that were documented include:
    a. Manufacturer (supplier) seen below - In Figure 35 the pedal on the left was manufactured by CTS Corporation (CTS) and the pedal on the right was manufactured by Denso Corporation (Denso) Both are original equipment suppliers to Toyota Motor Corp.
    b. Pedal modified by recall
        i. Trimmed (See Figure 36)
        ii. Shimmed
    c. Pedal pivots on arm
    d. Pedal mount method (suspended lever or floor mount) – Note that all test Camrys used suspended levers.

Figure 35 – Manufacturer Pedals (CTS on the left /Denso on the right)

Figure 36 – Modified Pedals (NHTSA Recall 09V388/Toyota Recall 90L)

Table 14 summarizes the accelerator attributes for each test vehicle.

Table 14 - Accelerator Pedal Parameter Summary for Each Vehicle

Vehicle	Mfg. A-Pedal	Mod A-Pedal Trimmed	Mod A-Pedal Shimmed	A-Pedal Pivots (Yes/No)	B-Pedal Pivots (Yes/No)	Mount Type Accelerator Pedal	Mount Type Brake Pedal
3D 2001 Camry LE L4	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
8D 2001 Camry XLE V6	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
13C 2002 Camry XLE V6	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
1D 2002 Camry SE V6	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
2D 2002 Camry XLE L4	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
15C 2003 Camry XLE L4	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
14C 2004 Camry XLE V6	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
18C 2004 Camry LE L4	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
20C 2004 Camry LE L4	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
17C 2004 Camry LE L4	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
7D 2005 Camry XLE L4	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
11D 2005 Camry XLE V6	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
9D 2005 Camry LE V6	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
5D 2006 Camry LE L4	Aisan	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
6D 2007 Camry LE L4	CTS	Yes	Yes	No	No	A-Pedal Pendant	B-Pedal Pendant
12C 2007 Camry XLE V6	Denso	No	No	No	No	A-Pedal Pendant	B-Pedal Pendant
4D 2007 Camry SE L4	CTS	Yes	Yes	No	No	A-Pedal Pendant	B-Pedal Pendant
10D 2007 Camry LE V6	Denso	Yes	NR	No	No	A-Pedal Pendant	B-Pedal Pendant
19C 2007 Camry LE L4	CTS	Yes	Yes	No	No	A-Pedal Pendant	B-Pedal Pendant
16C 2009 Camry NR L4/Manual	CTS	Yes	Yes	No	No	A-Pedal Pendant	B-Pedal Pendant

5.0 OBSERVATIONS

The following observations were made:

1. Beginning with the 2002 model year, the fully electronic throttle control was introduced in Toyota Camrys, which provided quicker engine responsiveness with less pedal displacement than cable driven throttles. Much of this increase in responsiveness appears to be attributable to the reduction of slack normally found in mechanical accelerator systems. Increased responsiveness is a typical characteristic of ETC over mechanical linkage accelerator control systems.
2. In the event of dual pedal applications, the faster throttle response of the ETC system may increase the likelihood of vehicle movement compared to mechanical throttle systems.
3. Starting with the 2002 model, the accelerator pedal force-versus-displacement effort changed and with measurement was found to be somewhat similar to the brake pedal force-versus-displacement effort during the initial apply. The minimum brake pedal force and displacement required to hold a vehicle stationary became about the same as the accelerator pedal force and displacement required to command initial engine torque.
4. Based on a limited sample size of the vehicles tested, the lateral separation distance between the brake and accelerator pedal was closer to the steering wheel centerline in 2002 and newer Camrys, compared to the earlier generation Camry. Lateral separation measured values were not abnormal compared to other manufacturers' vehicles.
5. The step-over height between pedals in test vehicles slightly decreased beginning in 2002, though the limited sample size did not permit a statistical conclusion.
6. As vehicle model iterations were introduced, newer models were equipped with more powerful engines. The transmissions had more forward gears (4, 5, and later 6 gears) that optimized power and made stopping while applying engine power more difficult.
7. When braking was applied in one continuous motion where vacuum assist was operating normally and the engine was at full throttle, all tested Camrys either came to a stop or near stop from 65 mph with 112 lbs. or less of brake pedal force.
8. If the brakes were pumped more than once while the accelerator was depressed, vacuum was partially, if not fully depleted and would not regenerate until the throttle plate moved to a more closed position. Without vacuum, a significant increase in operator effort was

required to stop the vehicle.

9. The amount of brake pedal force required to hold the test vehicles stationary with a wide open throttle ranged from 15.0 lbs. to 43.6 lbs with vacuum assist, well within the braking capabilities generated by the vast majority of, if not all, drivers. Without vacuum assist, the brake pedal force required to remain stationary increased substantially to a range from 86.7 lbs to 268.2 lbs., though evidence of stationary Camrys not having vacuum was not encountered in complaint searches.
10. Vehicles equipped with keyed ignitions provided a readily discernable means to instantaneously turn off engine ignition, whereas pushbutton functionality had no instantaneous emergency shutoff feature.
11. The ignition control button was labeled as “Engine Start/Stop” only. Specific operation was noted in the owner’s manual; however it was described within the context that it was discouraged and could cause an accident.
12. Shifting the transmission was more complicated with the newer models. In 2002 and model years prior, moving the shifter from park to drive required only one longitudinal movement, and gear locations were intuitively labeled right next to the gear selector. By 2007, shifting to drive also required at least one lateral movement for four cylinder vehicles and two lateral movements for V6 Camrys; and the gear labeling may not be readily discernable to the driver in a panic situation.
13. In all test vehicles, the transmission shifter was mechanically linked to the transmission. Placing the vehicle into park or reverse at highway speeds and under acceleration did not cause any of the vehicles to engage those shift positions, nor wheel lockup, though this action caused both 2001 Camrys to stall.

APPENDIX A - Acronyms

Table 15 – Acronym List

Acronym	Description
ABS	antilock brake system
AWD	all wheel drive
CID	cubic inches displacement
CG	center of gravity
DOT	Department of Transportation
DTC	diagnostic trouble code
ECU	electronic control unit
ESC	electronic stability control
GAWR	gross axle weight rating
GVWR	gross vehicle weight rating
LLVW	lightly loaded vehicle weight
MY	model year
NA	not applicable
NHSTA	National Highway Traffic Safety Administration
OBDII	on-board diagnostics generation two
OEM	original equipment manufacturer
RF	right front
RR	right rear
VIN	Vehicle Identification Number
WOT	Wide Open Throttle position
VOQ	Vehicle Owner Questionnaire
VRTC	Vehicle Research and Test Center
VSC	Vehicle Stability Control

APPENDIX B - Definitions

Table 16 – Definitions

Term	Definition
Acceleration	The rate of change of velocity with respect to time
Accelerator	a device (as a pedal) for controlling the speed of a motor vehicle engine
Anti-lock braking system (ABS)	A braking system that prevents the wheels from locking up during braking. Even under strong braking, the driver can better control and steer the car, potentially avoiding obstacles without having to release the brakes first.
Average deceleration	Average value taken from the initiation of the pedal force until completion of the stop.
Cruise control	An electronic device in a vehicle that controls the throttle so as to maintain a constant speed. This electronic aid keeps the car moving at a constant speed, reducing stress on the driver particularly where speed limits must be observed, when towing a trailer, and on long trips. The system stores and maintains the speed selected by the driver. The set speed can also be manually increased or decreased. The cruise control can be deactivated with the “off” switch or by pressing the brake or clutch pedal.
Deceleration	to reduce the speed of : slow down
Electronic stability control system	A system that has all the following attributes: (1) That augments vehicle directional stability by applying and adjusting the vehicle brake torques individually to induce a correcting yaw moment to a vehicle; (2) That is computer controlled with the computer using a closed-loop algorithm to limit vehicle over steer and to limit vehicle under steer; (3) That has a means to determine the vehicle’s yaw rate and to estimate its side slip or side slip derivative with respect to time; (4) That has a means to monitor driver steering inputs; (5) That has an algorithm to determine the need, and a means to modify engine torque, as necessary, to assist the driver in maintaining control of the vehicle, and (6) That is operational over the full speed range of the vehicle (except at vehicle speeds less than 20 km/h (12.4 mph), when being driven in reverse, or during system initialization).
Gross axle weight rating	Maximum weight an axle is rated to carry by the manufacturer. Includes both the weight of the axle and the portion of a vehicle's weight carried by the axle
Gross vehicle weight	The total weight of a fully equipped vehicle and its payload.
Gross vehicle weight rating	The standard or rating of a vehicle's carrying capacity. It includes the weight of the vehicle, fuel, fluids, and full payload.
Hydraulic brake system	A system that uses hydraulic fluid as a medium for transmitting force from a service brake control to the service brake and that may incorporate a brake power assist unit, or a brake power unit.
Idle position	Position of the throttle at which it first comes in contact with an engine idle speed control appropriate for existing conditions according to the manufacturer's recommendations. These conditions include, but are not limited to, engine speed adjustments for cold engine, air conditioning, and emission control, and the use of throttle setting devices.
Lateral acceleration	The component of the vector acceleration of a point in the vehicle perpendicular to the vehicle’s x axis (longitudinal) and parallel to the road plane.
Lightly loaded vehicle weight (LLVW)	Unloaded vehicle weight plus the weight of a mass of 180 kg (396 pounds), including driver and instrument.
Speed proportional power steering	A type of power-assisted steering which is light at low speeds and increasingly heavier at higher speeds, giving the driver more feel.
Stopping distance	The distance traveled by a vehicle from the point of application of force to the brake control to the point at which the vehicle reaches a full stop.
Throttle	Component of the fuel metering device that connects to the driver operated accelerator control system and that by input from the driver-operated accelerator control system controls the engine speed.
Traction control	A means of preventing wheel spin due to acceleration, either by braking the spinning wheel or reducing engine power.
Tread depth	The measurement from the bottom cm of the tread groove to the top of the tread expressed in millimeters or 32nds of an inch. The legal minimum amount of tread is 1.6 mm (2/32") across three-

Term	Definition
	quarters of the tire width
Wheel lockup	100 percent wheel slip.
Wide open throttle position (WOT)	Position of the throttle at the maximum point of travel of the accelerator control system when actuation force is applied.

APPENDIX C - Report References

Table 17 – Report Referenced

Number	Report Name
INCLA-EA07010-39520p.pdf	Final Report 2007 Lexus ES-350 Unintended Acceleration

APPENDIX D - Photos of Test Vehicles

2002 Camry 1D (with 3.0L V6 engine)

2002 Camry 2D (with 2.4L L4 engine)

2001 Camry 3D (with 2.2L L4 engine)

2007 Camry 4D (with 2.4L L4 engine)

2006 Camry 5D (with 2.4L L4 engine)

2005 Camry 6D (with 2.4L L4 engine)

2005 Camry 7D (with 2.4L L4 engine)

2001 Camry 8D (with 3.0L V6 engine)

2005 Camry 9D (with 3.0L V6 engine)

2007 Camry 10D (with 3.5L V6 engine)

2005 Camry 11D (with 3.0L V6 engine)

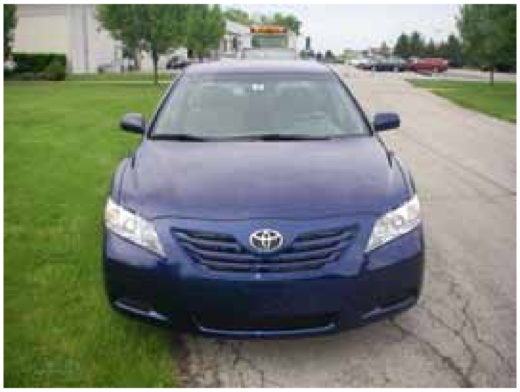
2007 Camry 12C (with 3.5L V6 engine)

2002 Camry 13C (with 3.0L V6 engine)

2004 Camry 14C (with 3.0L V6 engine)

2003 Camry 15C (with 2.4L L4 engine)

2009 Camry 16C (with 2.4L L4 engine and Manual Transmission)



2004 Camry 17C (with 2.4L L4 engine)

2004 Camry 18C (with 2.4L L4 engine)

2007 Camry 19C (with 2.4L L4 engine)

2004 Camry 20C (with 2.4L L4 engine)

APPENDIX E - Module Summary Data

Detailed results data for individual modules are summarized in the following sections:

E1 Module 1 – Level 1 – Preliminary Inspection and Visual Verifiction

E2 Module 2 – Level 2 – Comprehensive Inspection and Electronic Interrogation

E3 Module 3 – Drivability Fitness

E4 Module 4 – Repairs and Restoration

E5A Module 5 – Acceleration and Braking Summary

E5B Module 5 - Acceleration and Braking Stopping Distance Tables

E5C Module 5 - 0-100 and 100-0 MPH Brake Performance Tests Before and After Brake Testing

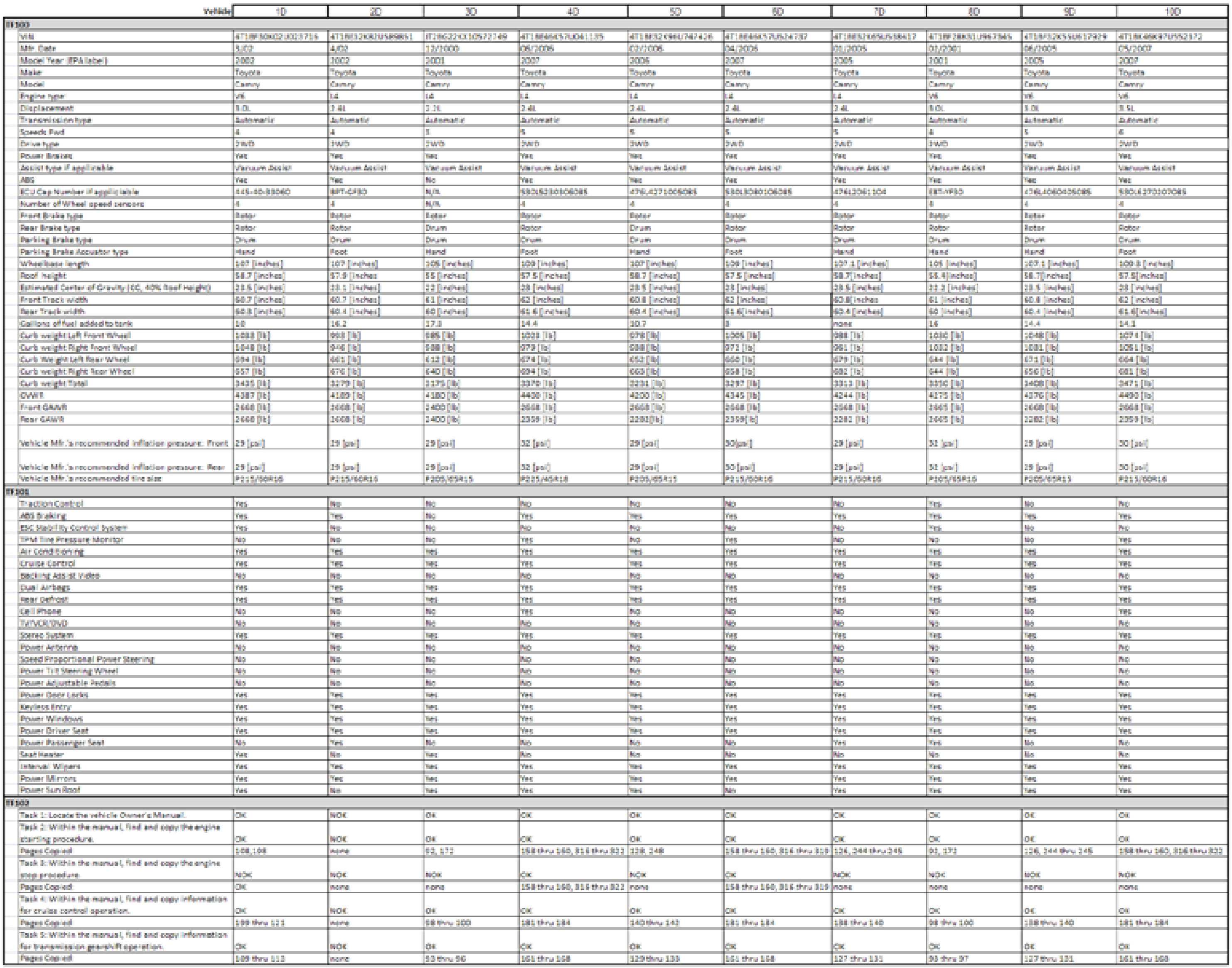
E5D Module 5 - Cruise Control Testing – Vehicles 1-20

E6 Module 6 – Gearshift Lever and Transmission

E7 Module 7 – Ignition Switch Control Functionality

E8 Module 8 – Pedal Positioning

APPENDIX E1 - Module 1 - Level 1-Preliminary Inspection and Visual Verification (Vehicles 1-10)

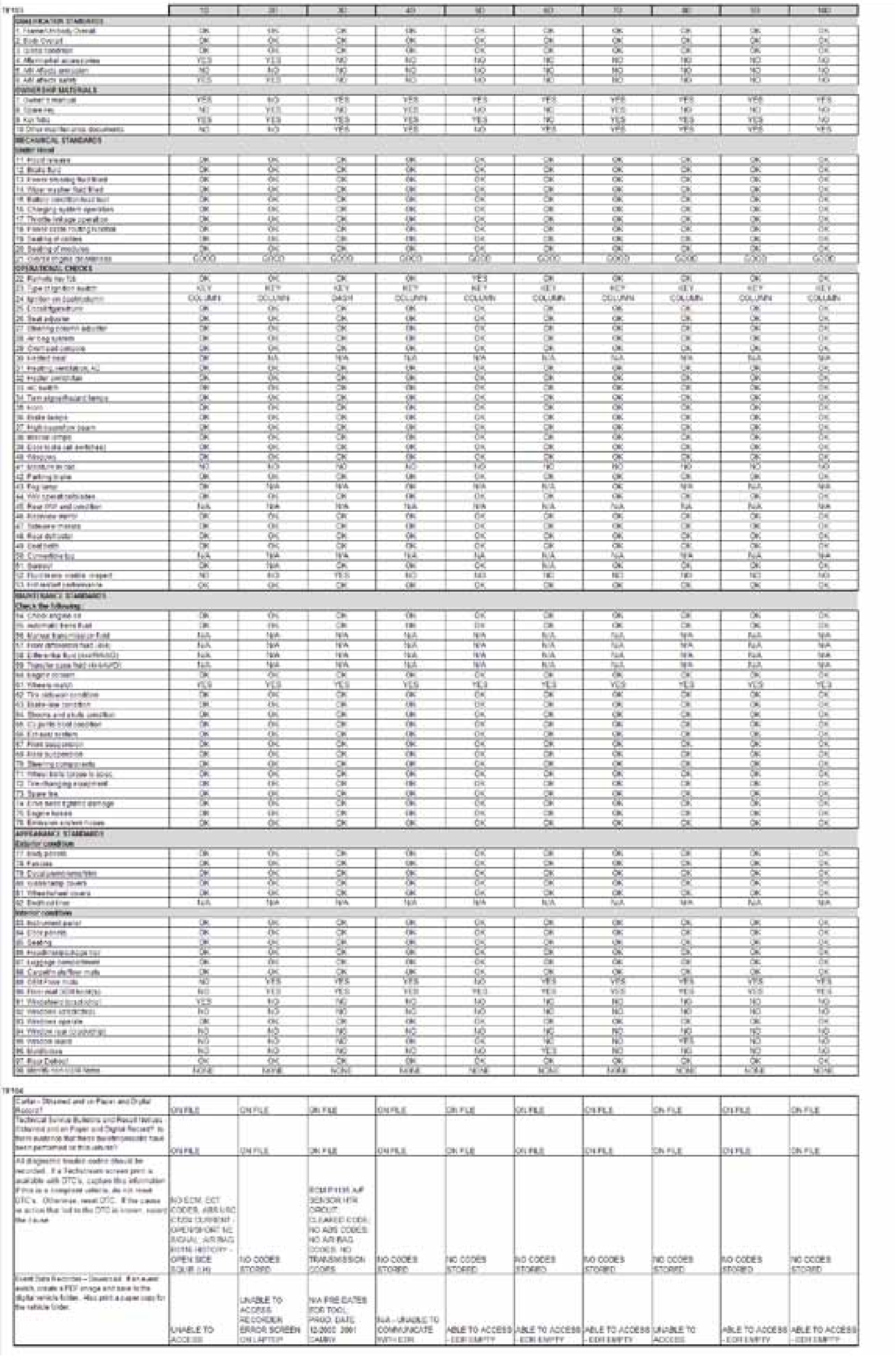


Vehicle	1D	2D	3D	4D	5D	6D	7D	8D	9D	10D
TF100										
VIN	4T1BF30K02U013716	4T1BE32K82U589851	JT2BG22K010572749	4T1BE46K57U061135	4T1BE32K96U747426	4T1BE46K57U524737	4T1BE30K05U558417	4T1BF28K31U967565	4T1BF32K55U617929	4T1BK46K97U552172
Mfr. Date	3/02	4/02	12/2000	06/2006	02/2006	04/2006	01/2005	01/2001	06/2005	05/2007
Model Year (EPA label)	2002	2002	2001	2007	2006	2007	2005	2001	2005	2007
Make	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota
Model	Camry	Camry	Camry	Camry	Camry	Camry	Camry	Camry	Camry	Camry
Engine type	V6	I4	I4	I4	I4	I4	I4	V6	V6	V6
Displacement	3.0L	2.4L	2.2L	2.4L	2.4L	2.4L	2.4L	3.0L	3.0L	3.5L
Transmission type	Automatic	Automatic	Automatic	Automatic	Automatic	Automatic	Automatic	Automatic	Automatic	Automatic
Speeds Fwd	4	4	3	5	5	5	5	4	5	6
Drive type	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD
Power Brakes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Assist type if applicable	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist
ABS	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ECU Cap Number if applicable	445-40-33060	BPT-CF80	N/A	580L5230106085	476L4271006085	580L3080106085	4761206:104	EBT-YF80	436L4060405085	580L4270107085
Number of Wheel speed sensors	4	4	N/A	4	4	4	4	4	4	4
Front Brake type	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor
Rear Brake type	Rotor	Rotor	Drum	Rotor	Drum	Rotor	Rotor	Rotor	Rotor	Rotor
Parking Brake type	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum
Parking Brake Accuator type	Hand	Foot	Hand	Foot	Hand	Foot	Hand	Hand	Hand	Foot
Wheelbase length	107 [inches]	107 [inches]	105 [inches]	109 [inches]	107 [inches]	109 [inches]	107.1 [inches]	105 [inches]	107.1 [inches]	109.3 [inches]
Roof height	58.7 [inches]	57.9 [inches	55 [inches]	57.5 [inches]	58.7 [inches]	57.5 [inches]	58.7[inches]	55.4[inches]	58.7[inches]	57.5[inches]
Estimated Center of Gravity (CG, 40% Roof Height)	23.5 [inches]	23.1 [inches]	22 [inches]	23 [inches]	23.5 [inches]	23 [inches]	23.5 [inches]	22.2 [inches]	23.5 [inches]	23 [inches]
Front Track width	60.7 [inches]	60.7 [inches]	61 [inches]	62 [inches]	60.8 [inches]	62 [inches]	60.8[inches	61 [inches]	60.8 [inches]	62 [inches]
Rear Track width	60.8 [inches]	60.4 [inches]	60 [inches]	61.6 [inches]	60.4 [inches]	61.6[inches]	60.4 [inches]	60 [inches]	60.4 [inches]	61.6[inches]
Gallons of fuel added to tank	10	16.2	17.3	14.4	10.7	3	none	16	14.4	14.1
Curb weight Left Front Wheel	1033 [lb]	903 [lb]	985 [lb]	1023 [lb]	978 [lb]	1005 [lb]	988 [lb]	1010 [lb]	1048 [lb]	1074 [lb]
Curb weight Right Front Wheel	1048 [lb]	946 [lb]	938 [lb]	979 [lb]	938 [lb]	972 [lb]	961 [lb]	1032 [lb]	1031 [lb]	1051 [lb]
Curb Weight Left Rear Wheel	594 [lb]	661 [lb]	612 [lb]	674 [lb]	652 [lb]	660 [lb]	679 [lb]	644 [lb]	671 [lb]	664 [lb]
Curb weight Right Rear Wheel	557 [lb]	676 [lb]	640 [lb]	694 [lb]	663 [lb]	658 [lb]	682 [lb]	644 [lb]	656 [lb]	681 [lb]
Curb weight Total	3435 [lb]	3279 [lb]	3175 [lb]	3370 [lb]	3231 [lb]	3297 [lb]	3313 [lb]	3330 [lb]	3408 [lb]	3471 [lb]
GVWR	4387 [lb]	4189 [lb]	4180 [lb]	4400 [lb]	4200 [lb]	4345 [lb]	4244 [lb]	4275 [lb]	4276 [lb]	4490 [lb]
Front GAWR	2668 [lb]	2608 [lb]	2400 [lb]	2668 [lb]	2608 [lb]	2668 [lb]	2668 [lb]	2665 [lb]	2668 [lb]	2668 [lb]
Rear GAWR	2668 [lb]	2608 [lb]	2400 [lb]	2359 [lb]	2282[lb]	2359[lb]	2282 [lb]	2665 [lb]	2282 [lb]	2359 [lb]
Vehicle Mfr.'s recommended inflation pressure: Front	29 [psi]	29 [psi]	29 [psi]	32 [psi]	29 [psi]	30[psi]	29 [psi]	31 [psi]	29 [psi]	30 [psi]
Vehicle Mfr.'s recommended inflation pressure: Rear	29 [psi]	29 [psi]	29 [psi]	32 [psi]	29 [psi]	30 [psi]	29 [psi]	31 [psi]	29 [psi]	30 [psi]
Vehicle Mfr.'s recommended tire size	P215/60R16	P215/60R16	P205/65R15	P225/45R18	P205/65R15	P215/60R16	P215/60R16	P205/65R15	P205/65R15	P215/60R16
TF101										
Traction Control	Yes	No	No	No	No	No	No	Yes	No	No
ABS Braking	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ESC Stability Control System	Yes	No	No	No	No	No	No	Yes	No	No
TPM Tire Pressure Monitor	No	No	No	Yes	No	Yes	No	No	No	Yes
Air Conditioning	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cruise Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Backing Assist Video	No	No	No	No	No	No	No	No	No	No
Dual Airbags	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rear Defrost	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cell Phone	No	No	No	Yes	No	No	No	No	No	Yes
TV/VCR/DVD	No	No	No	No	No	No	No	No	No	No
Stereo System	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Power Antenna	No	No	No	No	No	No	No	No	No	No
Speed Proportional Power Steering	No	No	No	No	No	No	No	No	No	No
Power Tilt Steering Wheel	No	No	No	No	No	No	No	No	No	No
Power Adjustable Pedals	No	No	No	No	No	No	No	No	No	No
Power Door Locks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Keyless Entry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Power Windows	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Power Driver Seat	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Power Passenger Seat	No	Yes	No	No	No	No	Yes	Yes	No	No
Seat Heater	Yes	No	Yes	No	No	No	No	No	No	No
Interval Wipers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Power Mirrors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Power Sun Roof	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
TF102										
Task 1: Locate the vehicle Owner's Manual.	OK	NOK	OK	OK	OK	OK	OK	OK	OK	OK
Task 2: Within the manual, find and copy the engine starting procedure.	OK	NOK	OK	OK	OK	OK	OK	OK	OK	OK
Pages Copied	108,109	none	92, 172	158 thru 160, 316 thru 322	128, 248	158 thru 160, 316 thru 319	136, 244 thru 245	92, 172	136, 244 thru 245	158 thru 160, 316 thru 322
Task 3: Within the manual, find and copy the engine stop procedure.	NOK	NOK	NOK	OK	NOK	OK	NOK	NOK	NOK	NOK
Pages Copied	OK	none	none	158 thru 160, 316 thru 322	none	158 thru 160, 316 thru 319	none	none	none	none
Task 4: Within the manual, find and copy information for cruise control operation.	OK	NOK	OK	OK	OK	OK	OK	OK	OK	OK
Pages Copied	109 thru 111	none	98 thru 100	181 thru 184	140 thru 142	181 thru 184	138 thru 140	98 thru 100	138 thru 140	181 thru 184
Task 5: Within the manual, find and copy information for transmission gearshift operation.	OK	NOK	OK	OK	OK	OK	OK	OK	OK	OK
Pages Copied	109 thru 113	none	93 thru 96	161 thru 168	129 thru 133	161 thru 168	127 thru 131	93 thru 97	127 thru 131	161 thru 168

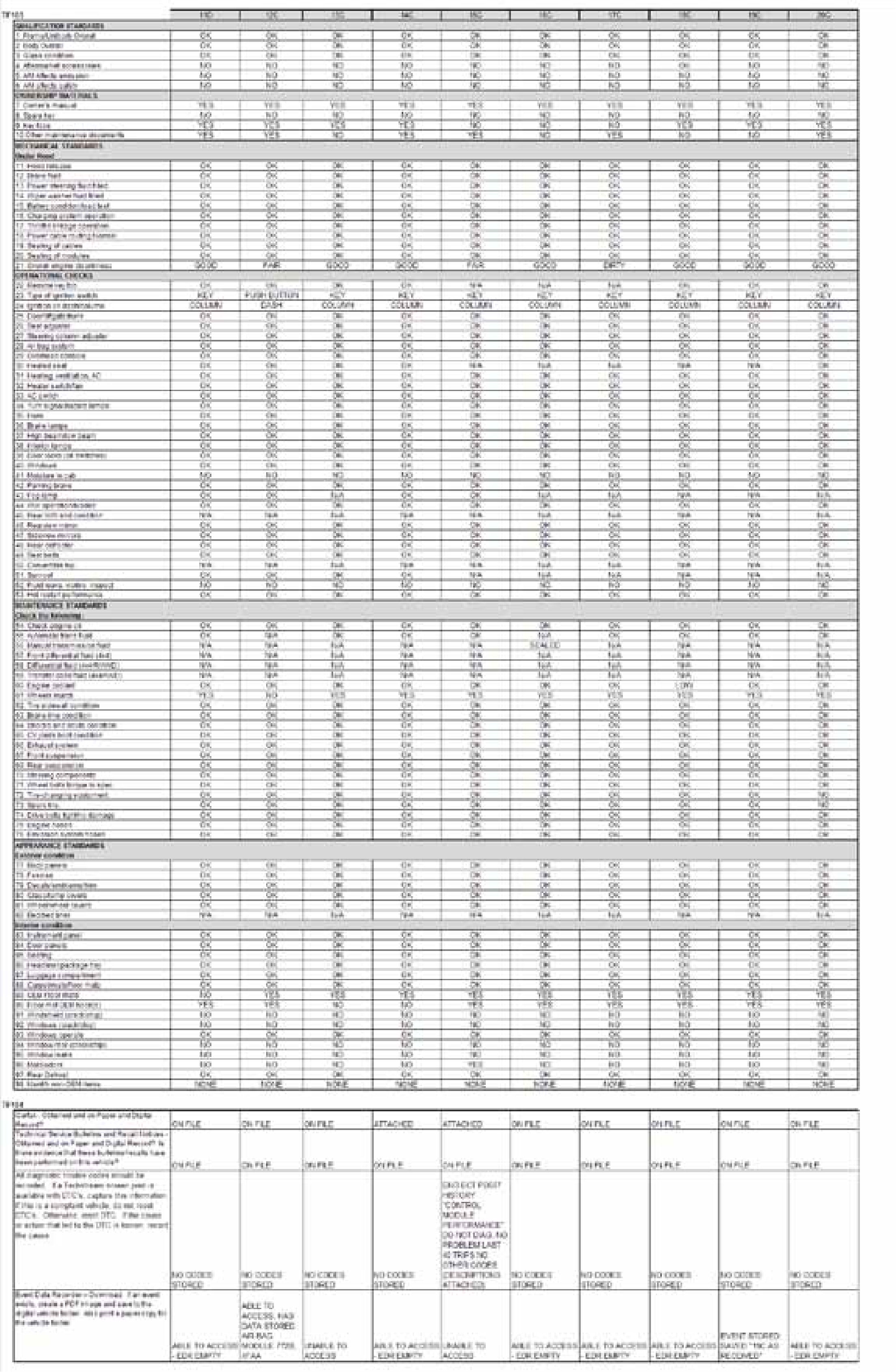
APPENDIX E1 - Module 1 - Level 1-Preliminary Inspection and Visual Verification Cont.(Vehicles 11-20)

	Vehicle	11D	12C	13C	14C	15C	16C	17C	18C	19C	20C
TF100											
	VIN	4T1BF30K55U107020	JTNBK46K073004749	4T1BF30K92U017963	4T1BF30K34U071178	4T1BE32K33U0645132	4T1BE46K39U289597	4T1BE32K64U903452	4T1BE32K04U316003	4T1BE46K27U177089	4T1BE32K64U848162
	Mfr. Date	05/2005	04/2006	12/2001	01/2004	09/2002	03/2008	04/2004	01/2004	06/2007	01/2004
	Model Year (EPA label)	2005	2007	2002	2004	2003	2009	2004	2004	2007	2004
	Make	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota	Toyota
	Model	Camry	Camry	Camry	Camry	Camry	Camry	Camry	Camry	Camry	Camry
	Engine type:	V6	V6	V6	V6	L4	L4	L4	L4	L4	L4
	Displacement	3.0L	3.5L	3.0L	3.0L	2.4L	2.4L	2.4L	2.4L	2.4L	2.4L
	Transmission type	Automatic	Automatic	Automatic	Automatic	Automatic	Manual	Automatic	Automatic	Automatic	Automatic
	Speeds Fwd	5	6	4	5	4	5	4	4	5	4
	Drive type	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD
	Power Brakes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Assist type if applicable	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist	Vacuum Assist
	ABS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
	ECU Cap Number if appliclable	44540-33070	44540-33050	44540-33060	44540-33070	44510-06050	44510-060608	476L2220204	N/A	530 L6 190307 085	476 L3 081103 085
	Number of Wheel speed sensors	4	4	4	4	4	4	4	0	4	4
	Front Brake type	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor
	Rear Brake type	Rotor	Rotor	Rotor	Rotor	Rotor	Rotor	Drum	Drum	Drum	Drum
	Parking Brake type	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum	Drum
	Parking Brake Accuator type	Foot	Foot	Foot	Foot	Foot	Hand	Hand	Hand	Foot	Hand
	Wheelbase length	107.1 [inches]	109.3 [inches]	107 [inches]	107.1 [inches]	107 [inches]	109.3 [inches]	107.1 [inches]	107.1 [inches]	109.3 [inches]	107 [inches]
	Roof height	58.7[inches]	57.5 [inches]	57.9 [inches]	57.9 [inches]	57.9 [inches]	57.9 [inches]	57.9 [inches]	57.9 [inches]	57.5 [inches]	57.9 [inches]
	Estimated Center of Gravity (CG, 40% Roof Height)	23.5 [inches]	23 [inches]	23.2 [inches]	23.2 [inches]	23.2 [inches]	23.2 [inches]	23.16 [inches]	23.16 [inches]	23 [inches]	23.16 [inches]
	Front Track width	60.8 [inches]	62 [inches]	60.7 [inches]	60.8 [inches]	60.7 [inches]	62 [inches]	60.8 [inches]	60.8 [inches]	62 [inches]	60.8 [inches]
	Rear Track width	60.4[inches]	61.6 [inches]	60.4 [inches]	60.4 [inches]	60.4 [inches]	61.6 [inches]	60.4 [inches]	60.4 [inches]	61.6 [inches]	60.4 [inches]
	Gallons of fuel added to tank	2.4	none	10	11	7	0	4.1	5	5.7	13.5
	Curb weight Left Front Wheel	1080 [lb]	1081 [lb]	1063 [lb]	1077 [lb]	984 [lb]	958 [lb]	966 [lb]	968 [lb]	1008 [lb]	968 [lb]
	Curb weight Right Front Wheel	1045 [lb]	1048 [lb]	1037 [lb]	1035 [lb]	960 [lb]	957 [lb]	947 [lb]	916 [lb]	968 [lb]	938 [lb]
	Curb Weight Left Rear Wheel	673 [lb]	669 [lb]	671 [lb]	670 [lb]	669 [lb]	658 [lb]	652 [lb]	649 [lb]	652 [lb]	615 [lb]
	Curb weight Right Rear Wheel	685 [lb]	695 [lb]	678 [lb]	698 [lb]	679 [lb]	657 [lb]	648 [lb]	654 [lb]	654 [lb]	625 [lb]
	Curb weight Total	3484 [lb]	3495 [lb]	3449 [lb]	3482 [lb]	3287 [lb]	3136 [lb]	3215 [lb]	3188 [lb]	3284 [lb]	3147 [lb]
	GVWR	4442 [lb]	4515 [lb]	4587 [lb]	4442 [lb]	4255 [lb]	4300 [lb]	4189 [lb]	4189 [lb]	4545 [lb]	4189 [lb]
	Front GAWR	2668 [lb]	2668 [lb]	2668 [lb]	2668 [lb]	2668 [lb]	2668 [lb]	2668 [lb]	2668 [lb]	2668 [lb]	2668 [lb]
	Rear GAWR	2282 [lb]	2359 [lb]	2068 [lb]	2068 [lb]	2068 [lb]	2359 [lb]	2068 [lb]	2068 [lb]	2359 [lb]	2068 [lb]
	Vehicle Mfr.'s recommended inflation pressure: Front	29 [psi]	30 [psi]	29 [psi]	29 [psi]	29 [psi]	32 [psi]	29 [psi]	29 [psi]	30 [psi]	29 [psi]
	Vehicle Mfr.'s recommended inflation pressure: Rear	29 [psi]	30 [psi]	29 [psi]	29 [psi]	29 [psi]	32 [psi]	29 [psi]	29 [psi]	30 [psi]	29 [psi]
	Vehicle Mfr.'s recommended tire size	P215/60R16	P215/60R16	P215/60R16	P215/60R16	P215/60R16	P215/60R16	P205/65R15	P205/65R15	P215/60R16	P205/65R15
TF101											
	Traction Control	Yes	Yes	Yes	Yes	No	No	Yes	No	No	No
	ABS Braking	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
	ESC Stability Control System	Yes	No	Yes	Yes	No	No	No	No	No	No
	TPM Tire Pressure Monitor	No	Yes	No	No	No	Yes	No	No	Yes	No
	Air Conditioning	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Cruise Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Backing Assist Video	No	No	No	No	No	No	No	No	No	No
	Dual Airbags	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Rear Defrost	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Cell Phone	No	No	No	No	No	No	No	No	No	No
	TV/VCR/DVD	No	Yes	No	No	No	No	No	No	No	No
	Stereo System	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Power Antenna	No	No	No	No	No	No	No	Yes	No	No
	Speed Proportional Power Steering	No	No	No	No	No	No	No	No	No	No
	Power Tilt Steering Wheel	No	No	No	No	No	No	No	No	No	No
	Power Adjustable Pedals	No	No	No	No	No	No	No	No	No	No
	Power Door Locks	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Keyless Entry	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
	Power Windows	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Power Driver Seat	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
	Power Passenger Seat	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
	Seat Heater	Yes	Yes	Yes	Yes	No	No	No	No	No	No
	Interval Wipers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Power Mirrors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Power Sun Roof	Yes	Yes	Yes	Yes	No	No	No	No	No	No
TF102											
	Task 1: Locate the vehicle Owner's Manual.	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Task 2: Within the manual, find and copy the engine starting procedure.	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Pages Copied:	126, 244 thru 245	158 thru 160, 316 thru 319	107, 108	120,224	112, 203	130	224 thru 225	120, 224, 225	158 thru 160, 316 thru 320	223 thru 225
	Task 3: Within the manual, find and copy the engine stop procedure.	NOK	NOK	NOK	NOK	NOK	NOK	NOK	NOK	OK	NOK
	Pages Copied:	none	none	none	none	none	none	none	none	320	
	Task 4: Within the manual, find and copy information for cruise control operation.	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Pages Copied:	138 thru 140	181 thru 184	119 thru 121	135 thru 137	123 thru 125	159	135 thru 137	135 thru 137	181 thru 184	135 thru 137
	Task 5: Within the manual, find and copy information for transmission gearshift operation.	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
	Pages Copied:	127 thru 131	161 thru 168	109 thru 112	125 thru 128	113 thru 116	137	121 thru 128, 258	121 thru 128	161 thru 170	121 thru 128, 258

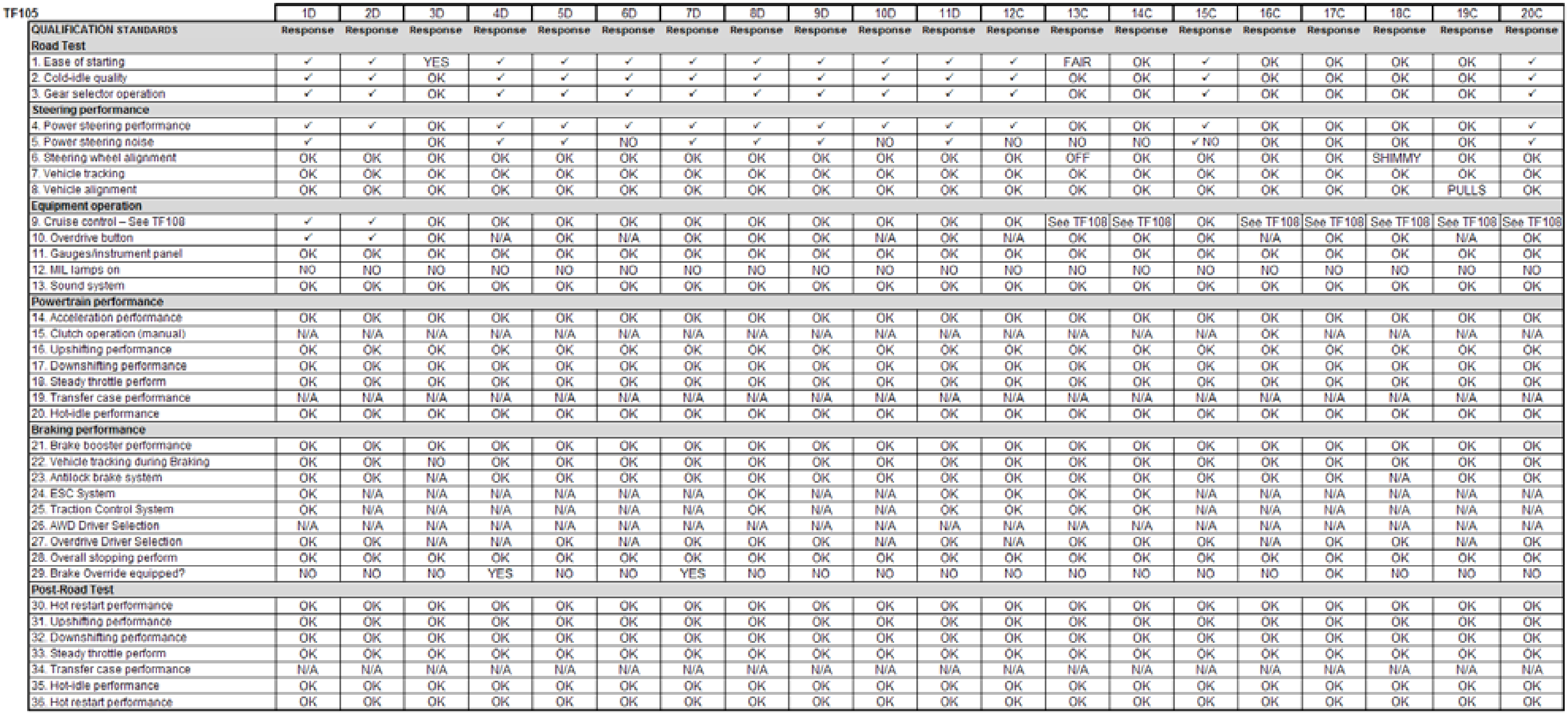
APPENDIX E2 - Module 2 - Level 2- Comprehensive Inspection and Electronic Interrogation (Vehicles 1-10)



APPENDIX E2 - Module 2 - Level 2- Comprehensive Inspection and Electronic Interrogation - Cont. (Vehicles 11-20)

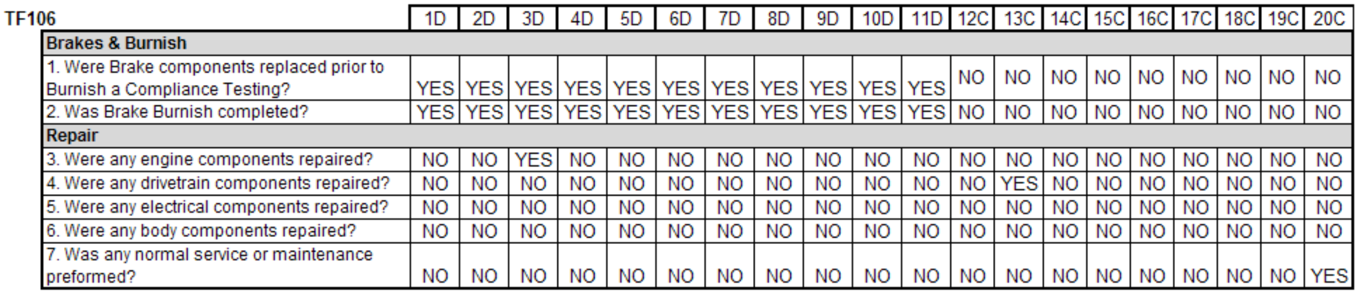


APPENDIX E3 - Module 3 – Drivability Fitness



TF105	1D	2D	3D	4D	5D	6D	7D	8D	9D	10D	11D	12C	13C	14C	15C	16C	17C	18C	19C	20C
QUALIFICATION STANDARDS	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**	**Response**
Road Test																				
1. Ease of starting	✓	✓	YES	✓	✓	✓	✓	✓	✓	✓	✓	✓	FAIR	OK	✓	OK	OK	OK	OK	✓
2. Cold-idle quality	✓	✓	OK	✓	✓	✓	✓	✓	✓	✓	✓	✓	OK	OK	✓	OK	OK	OK	OK	✓
3. Gear selector operation	✓	✓	OK	✓	✓	✓	✓	✓	✓	✓	✓	✓	OK	OK	✓	OK	OK	OK	OK	✓
Steering performance																				
4. Power steering performance	✓	✓	OK	✓	✓	✓	✓	✓	✓	✓	✓	✓	OK	OK	✓	OK	OK	OK	OK	✓
5. Power steering noise	✓		OK	✓	✓	NO	✓	✓	✓	NO	✓	NO	NO	NO	✓ NO	OK	OK	OK	OK	✓
6. Steering wheel alignment	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OFF	OK	OK	OK	OK	SHIMMY	OK	OK
7. Vehicle tracking	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
8. Vehicle alignment	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	PULLS	OK
Equipment operation																				
9. Cruise control – See TF108	✓	✓	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	See TF108	See TF108	OK	See TF108	See TF108	See TF108	See TF108	See TF108
10. Overdrive button	✓	✓	OK	N/A	OK	N/A	OK	OK	OK	N/A	OK	N/A	OK	OK	OK	N/A	OK	OK	N/A	OK
11. Gauges/instrument panel	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
12. MIL lamps on	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
13. Sound system	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Powertrain performance																				
14. Acceleration performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
15. Clutch operation (manual)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	OK	N/A	N/A	N/A	N/A
16. Upshifting performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
17. Downshifting performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
18. Steady throttle perform	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
19. Transfer case performance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20. Hot-idle performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Braking performance																				
21. Brake booster performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
22. Vehicle tracking during Braking	OK	OK	NO	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
23. Antilock brake system	OK	OK	N/A	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	N/A	OK	OK
24. ESC System	OK	N/A	N/A	N/A	N/A	N/A	N/A	OK	N/A	N/A	OK	OK	OK	OK	N/A	N/A	N/A	N/A	N/A	N/A
25. Traction Control System	OK	N/A	N/A	N/A	N/A	N/A	N/A	OK	N/A	N/A	OK	OK	OK	OK	N/A	N/A	N/A	N/A	N/A	N/A
26. AWD Driver Selection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27. Overdrive Driver Selection	OK	OK	N/A	N/A	OK	N/A	OK	OK	OK	N/A	OK	N/A	OK	OK	OK	N/A	OK	OK	N/A	OK
28. Overall stopping perform	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
29. Brake Override equipped?	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	OK	NO	NO	NO
Post-Road Test																				
30. Hot restart performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
31. Upshifting performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
32. Downshifting performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
33. Steady throttle perform	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
34. Transfer case performance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35. Hot-idle performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
36. Hot restart performance	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK

APPENDIX E4 - Module 4 – Repairs and Restoration

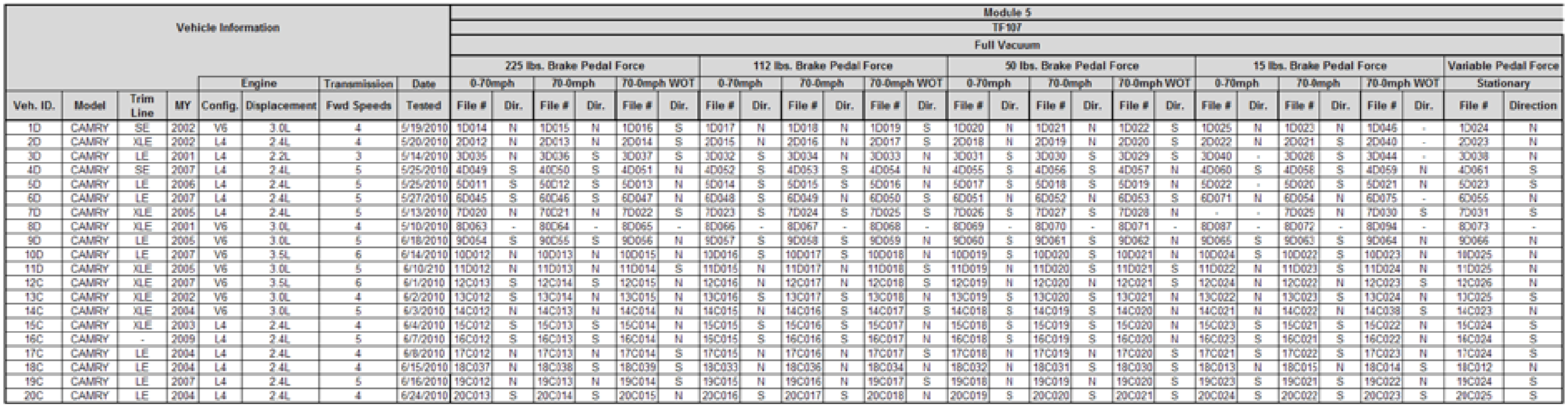


TF106	1D	2D	3D	4D	5D	6D	7D	8D	9D	10D	11D	12C	13C	14C	15C	16C	17C	18C	19C	20C
Brakes & Burnish																				
1. Were Brake components replaced prior to Burnish a Compliance Testing?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Was Brake Burnish completed?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
Repair																				
3. Were any engine components repaired?	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Were any drivetrain components repaired?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
5. Were any electrical components repaired?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Were any body components repaired?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Was any normal service or maintenance preformed?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

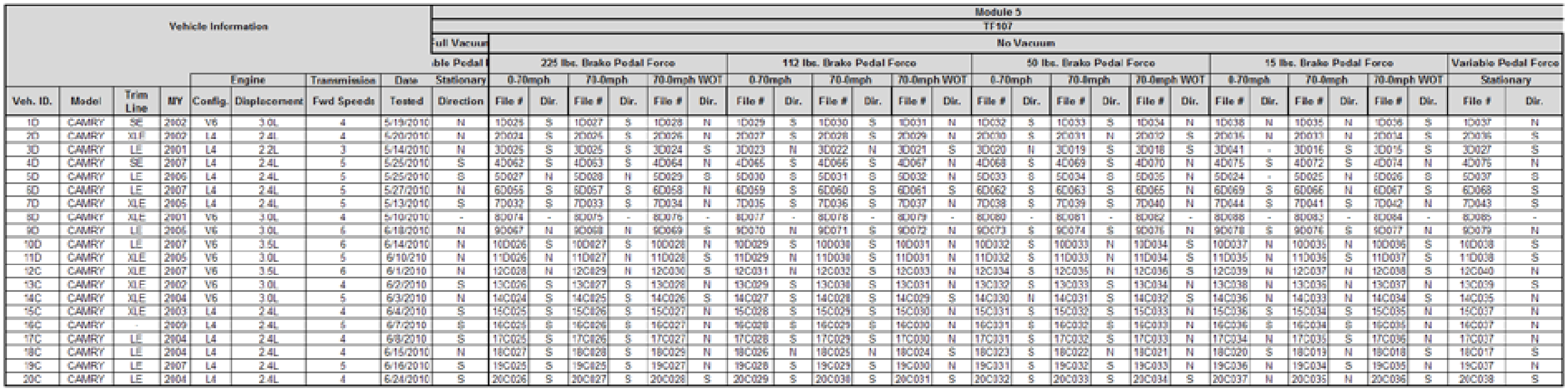
APPENDIX E5A - Module 5 – Acceleration and Braking Summary (Page 1 of 2)

Vehicle Information								Module 5													
								TF107													
								Full Vacuum										Full Vacuum			
								Best Effort		No Braking								Best Effort		Best Effort	
				Engine		Transmission	Date	100-0 mph #1		0-100mph #1		0-100mph #2		0-100mph #3		0-70mph		100-0 mph #2		100-0 mph #3	
Veh. ID.	Model	Trim Line	MY	Config.	Displacement	Fwd Speeds	Tested	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.
1D	CAMRY	SE	2002	V6	3.0L	4	5/19/2010	1D008	S	1D009	N	1D010	S	1D011	N	1D013	S	1D040	S	1D041	N
2D	CAMRY	XLE	2002	L4	2.4L	4	5/20/2010	2D007	S	2D008	N	2D009	S	2D010	N	2D011	S	2D038	S	2D039	S
3D	CAMRY	LE	2001	L4	2.2L	3	5/14/2010	3D008	S	3D010	N	3D011	S	3D013	S	3D014	N	3D039	S	3D043	S
4D	CAMRY	SE	2007	L4	2.4L	5	5/25/2010	4D044	S	4D045	N	4D046	S	4D047	N	4D048	S	4D077	S	4D078	N
5D	CAMRY	LE	2006	L4	2.4L	5	5/25/2010	5D006	S	5D007	N	5D008	S	5D009	N	5D010	S	5D038	S	5D039	-
6D	CAMRY	LE	2007	L4	2.4L	5	5/27/2010	6D040	N	6D041	S	6D042	N	6D043	S	6D044	N	-	-	6D072	S
7D	CAMRY	XLE	2005	L4	2.4L	5	5/13/2010	7D015	S	7D016	N	7D017	S	7D018	N	7D019	S	7D046	S	-	-
8D	CAMRY	XLE	2001	V6	3.0L	4	5/10/2010	8D057	-	8D058	-	8D059	-	8D060	-	8D061	-	8D086	-	8D091	-
9D	CAMRY	LE	2005	V6	3.0L	5	6/18/2010	9D053	S	9D008	N	9D008	S	9D010	N	9D011	S	9D080	N	9D081	S
10D	CAMRY	LE	2007	V6	3.5L	6	6/14/2010	10D007	S	100D08	N	10D009	S	10D010	N	10D011	S	10D039	S	10D040	N
11D	CAMRY	XLE	2005	V6	3.0L	5	6/10/210	11D007	S	11D008	N	11D009	S	11D010	N	11D011	S	11D039	S	11D040	N
12C	CAMRY	XLE	2007	V6	3.5L	6	6/1/2010	12C008	S	12C009	N	12C010	S	12C011	N	12C012	S	12C041	S	12C042	N
13C	CAMRY	XLE	2002	V6	3.0L	4	6/2/2010	13C007	S	13C008	N	13C009	S	13C010	N	13C011	S	13C040	S	13C041	N
14C	CAMRY	XLE	2004	V6	3.0L	5	6/3/2010	14C007	S	14C008	N	14C009	S	14C010	N	14C011	S	14C037	S	14C039	N
15C	CAMRY	XLE	2003	L4	2.4L	4	6/4/2010	15C007	S	15C008	N	15C009	S	15C010	N	15C011	S	15C038	S	15C039	N
16C	CAMRY	-	2009	L4	2.4L	5	6/7/2010	16C007	S	16C008	N	16C009	S	16C010	N	16C011	S	16C038	S	16C039	N
17C	CAMRY	LE	2004	L4	2.4L	4	6/8/2010	17C007	S	17C008	N	17C009	S	17C010	N	17C011	S	17C038	S	17C039	N
18C	CAMRY	LE	2004	L4	2.4L	4	6/15/2010	18C011	S	18C007	S	18C008	N	18C009	S	18C010	N	18C016	S	18C040	N
19C	CAMRY	LE	2007	L4	2.4L	5	6/16/2010	19C011	S	19C003	S	19C004	N	19C005	S	19C006	N	19C038	S	19C039	N
20C	CAMRY	LE	2004	L4	2.4L	4	6/24/2010	20C007	S	20C008	N	20C009	S	20C010	N	20C011	S	20C039	S	20C040	N

APPENDIX E5A - Module 5 – Acceleration and Braking Summary (Page 2 of 2)



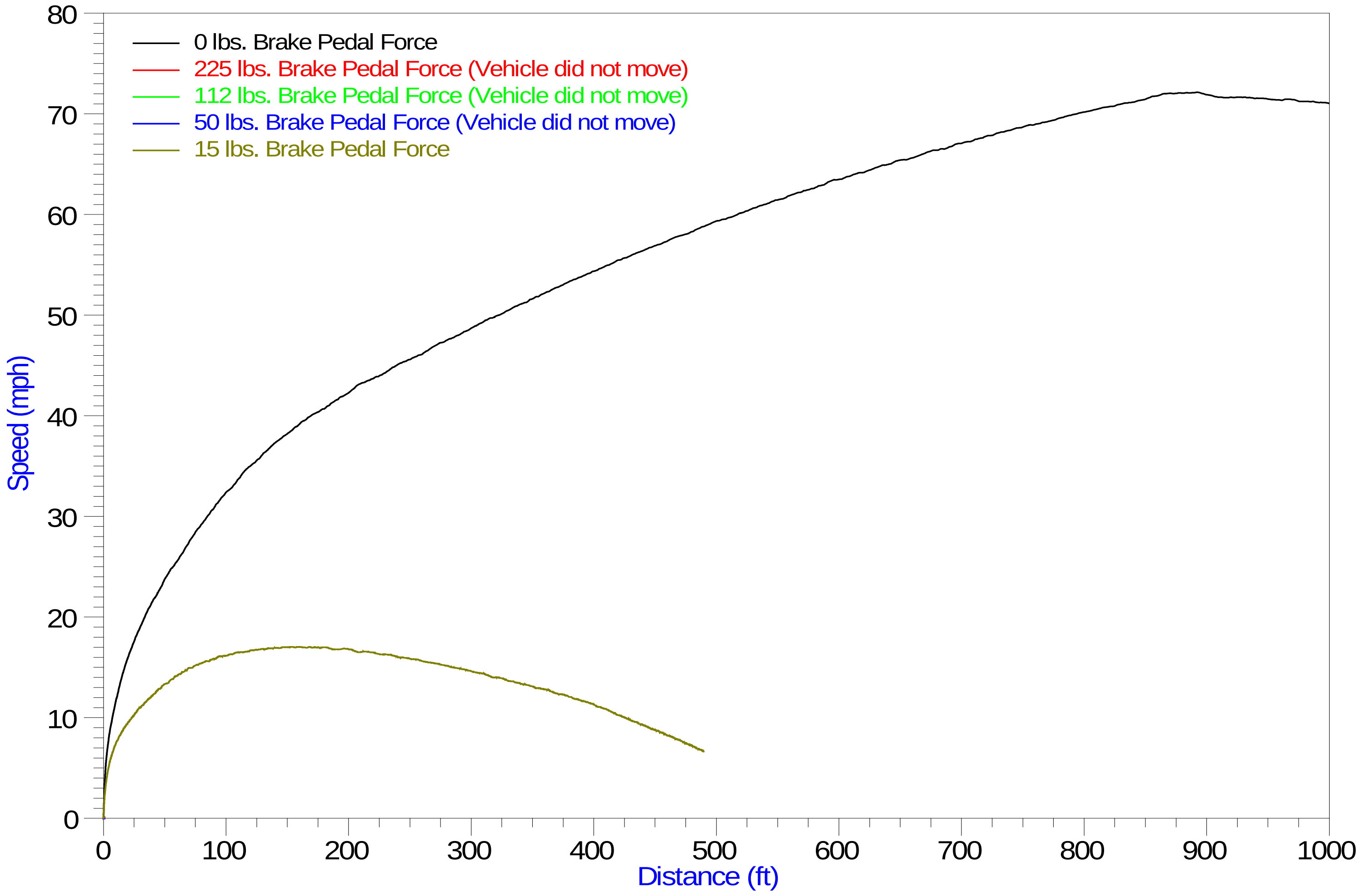
Vehicle Information									Module 5																									
									TF107																									
									Full Vacuum																									
									225 lbs. Brake Pedal Force						112 lbs. Brake Pedal Force						50 lbs. Brake Pedal Force						15 lbs. Brake Pedal Force						Variable Pedal Force	
				Engine		Transmission	Date		0-70mph		70-0mph		70-0mph WOT		0-70mph		70-0mph		70-0mph WOT		0-70mph		70-0mph		70-0mph WOT		0-70mph		70-0mph		70-0mph WOT		Stationary	
Veh. ID.	Model	Trim Line	MY	Config.	Displacement	Fwd Speeds	Tested		File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Direction
1D	CAMRY	SE	2002	V6	3.0L	4	5/19/2010		1D014	N	1D015	N	1D016	S	1D017	N	1D018	N	1D019	S	1D020	N	1D021	N	1D022	S	1D025	N	1D023	N	1D046	-	1D024	N
2D	CAMRY	XLE	2002	L4	2.4L	4	5/20/2010		2D012	N	2D013	N	2D014	S	2D015	N	2D016	N	2D017	S	2D018	N	2D019	N	2D020	S	2D022	N	2D021	S	2D040	-	2D023	N
3D	CAMRY	LE	2001	L4	2.2L	3	5/14/2010		3D035	N	3D036	S	3D037	S	3D032	S	3D034	N	3D033	N	3D031	S	3D030	S	3D029	S	3D040	-	3D028	S	3D044	-	3D038	N
4D	CAMRY	SE	2007	L4	2.4L	5	5/25/2010		4D049	S	40D50	S	4D051	N	4D052	S	4D053	S	4D054	N	4D055	S	4D056	S	4D057	N	4D060	S	4D058	S	4D059	N	4D061	S
5D	CAMRY	LE	2006	L4	2.4L	5	5/25/2010		5D011	S	50D12	S	5D013	N	5D014	S	5D015	S	5D016	N	5D017	S	5D018	S	5D019	N	5D022	-	5D020	S	5D021	N	5D023	S
6D	CAMRY	LE	2007	L4	2.4L	5	5/27/2010		6D045	S	60D46	S	6D047	N	6D048	S	6D049	N	6D050	S	6D051	N	6D052	N	6D053	S	6D071	N	6D054	N	6D075	-	6D055	N
7D	CAMRY	XLE	2005	L4	2.4L	5	5/13/2010		7D020	N	70D21	N	7D022	S	7D023	S	7D024	S	7D025	S	7D026	S	7D027	S	7D028	N	-	-	7D029	N	7D030	S	7D031	S
8D	CAMRY	XLE	2001	V6	3.0L	4	5/10/2010		8D063	-	80D64	-	8D065	-	8D066	-	8D067	-	8D068	-	8D069	-	8D070	-	8D071	-	8D087	-	8D072	-	8D094	-	8D073	-
9D	CAMRY	LE	2006	V6	3.0L	5	6/18/2010		9D054	S	90D55	S	9D056	N	9D057	S	9D058	S	9D059	N	9D060	S	9D061	S	9D062	N	9D065	S	9D063	S	9D064	N	9D066	N
10D	CAMRY	LE	2007	V6	3.5L	6	6/14/2010		10D012	N	10D013	N	10D015	N	10D016	S	10D017	S	10D018	N	10D019	S	10D020	S	10D021	N	10D024	S	10D022	S	10D023	N	10D025	N
11D	CAMRY	XLE	2005	V6	3.0L	5	6/10/210		11D012	N	11D013	N	11D014	S	11D015	N	11D017	N	11D018	S	11D019	N	11D020	S	11D021	S	11D022	N	11D023	S	11D024	N	11D025	N
12C	CAMRY	XLE	2007	V6	3.5L	6	6/1/2010		12C013	S	12C014	S	12C015	N	12C016	N	12C017	N	12C018	S	12C019	N	12C020	N	12C021	S	12C024	N	12C022	N	12C023	S	12C026	N
13C	CAMRY	XLE	2002	V6	3.0L	4	6/2/2010		13C012	S	13C014	N	13C015	N	13C016	S	13C017	S	13C018	N	13C019	S	13C020	S	13C021	N	13C022	N	13C023	S	13C024	N	13C025	S
14C	CAMRY	XLE	2004	V6	3.0L	5	6/3/2010		14C012	N	14C013	N	14C014	N	14C015	N	14C016	S	14C017	S	14C018	S	14C019	S	14C020	N	14C021	N	14C022	N	14C038	S	14C023	N
15C	CAMRY	XLE	2003	L4	2.4L	4	6/4/2010		15C012	S	15C013	S	15C014	N	15C015	S	15C016	S	15C017	N	15C018	S	15C019	S	15C020	N	15C023	S	15C021	S	15C022	N	15C024	S
16C	CAMRY	-	2009	L4	2.4L	5	6/7/2010		16C012	S	16C013	S	16C014	N	15C015	S	16C016	S	16C017	N	16C018	S	16C019	S	16C020	N	16C023	S	16C021	S	16C022	N	16C024	S
17C	CAMRY	LE	2004	L4	2.4L	4	6/8/2010		17C012	N	17C013	N	17C014	S	17C015	N	17C016	N	17C017	S	17C018	N	17C019	N	17C020	S	17C021	S	17C022	S	17C023	N	17C024	S
18C	CAMRY	LE	2004	L4	2.4L	4	6/15/2010		18C037	N	18C038	S	18C039	S	13C033	N	18C036	N	18C034	N	18C032	N	18C031	S	18C030	S	18C013	N	18C015	N	18C014	S	18C012	N
19C	CAMRY	LE	2007	L4	2.4L	5	6/16/2010		19C012	N	19C013	N	19C014	S	19C015	N	19C016	N	19C017	S	19C018	N	19C019	N	19C020	S	19C023	S	19C021	S	19C022	N	19C024	S
20C	CAMRY	LE	2004	L4	2.4L	4	6/24/2010		20C013	S	20C014	S	20C015	N	20C016	S	20C017	S	20C018	N	20C019	S	20C020	S	20C021	S	20C024	S	20C022	S	20C023	S	20C025	S



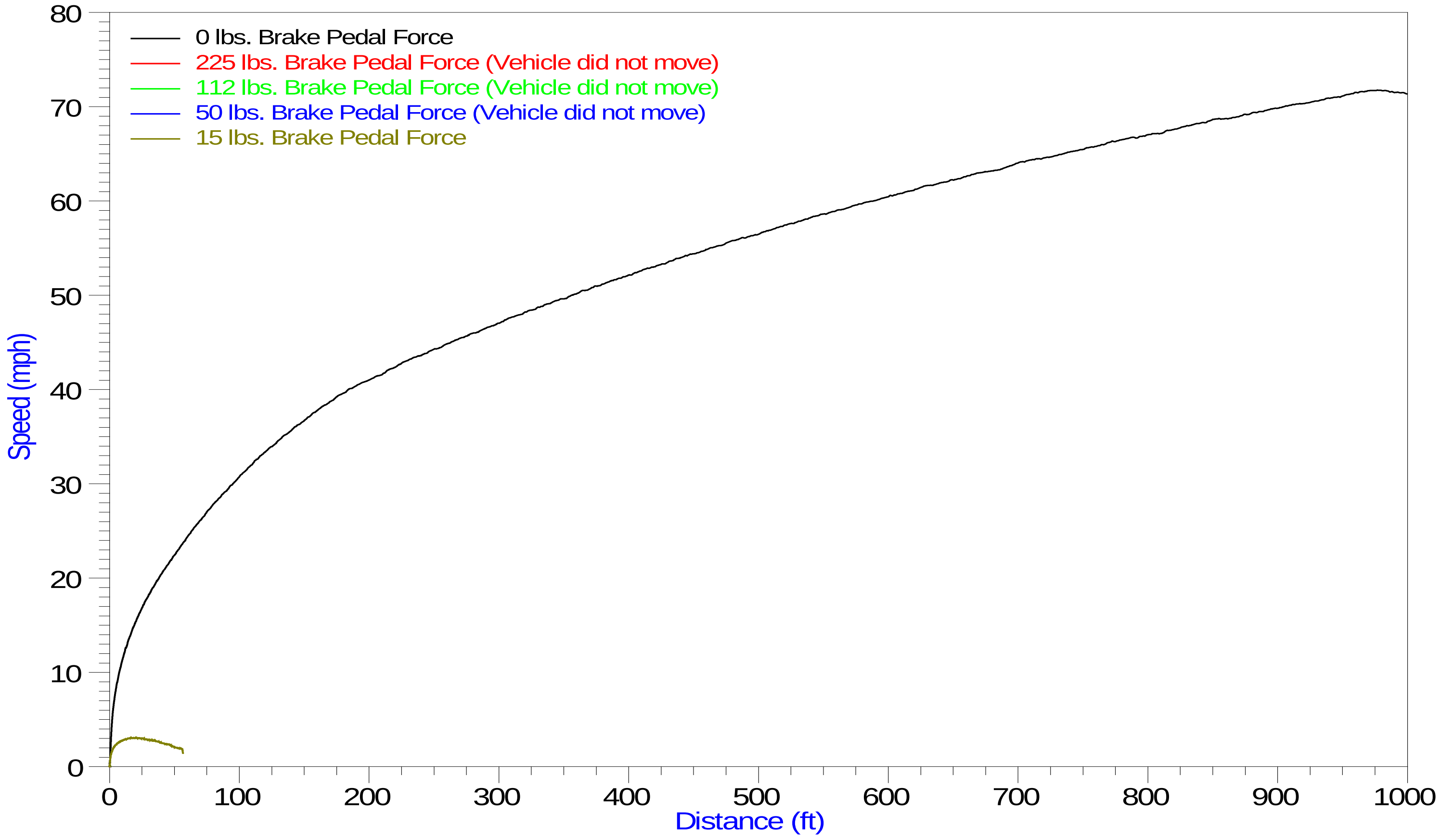
Vehicle Information									Module 5																										
									TF107																										
									ull Vacuu	No Vacuum																									
									able Pedal	225 lbs. Brake Pedal Force						112 lbs. Brake Pedal Force						50 lbs. Brake Pedal Force						15 lbs. Brake Pedal Force						Variable Pedal Force	
				Engine		Transmission	Date		Stationary	0-70mph		70-0mph		70-0mph WOT		0-70mph		70-0mph		70-0mph WOT		0-70mph		70-0mph		70-0mph WOT		0-70mph		70-0mph		70-0mph WOT		Stationary	
Veh. ID.	Model	Trim Line	MY	Config.	Displacement	Fwd Speeds	Tested		Direction	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.	File #	Dir.
1D	CAMRY	SE	2002	V6	3.0L	4	5/19/2010		N	1D026	S	1D027	S	1D028	N	1D029	S	1D030	S	1D031	N	1D032	S	1D033	S	1D034	N	1D038	N	1D035	N	1D036	S	1D037	N
2D	CAMRY	XLE	2002	L4	2.4L	4	5/20/2010		N	2D024	S	2D025	S	2D026	N	2D027	S	2D028	S	2D029	N	2D030	S	2D031	N	2D032	S	2D035	N	2D033	N	2D034	S	2D036	S
3D	CAMRY	LE	2001	L4	2.2L	3	5/14/2010		N	3D026	S	3D025	S	3D024	S	3D023	N	3D022	N	3D021	S	3D020	N	3D019	S	3D018	S	3D041	-	3D016	S	3D015	S	3D027	S
4D	CAMRY	SE	2007	L4	2.4L	5	5/25/2010		S	4D062	S	4D063	S	4D064	N	4D065	S	4D066	S	4D067	N	4D068	S	4D069	S	4D070	N	4D075	S	4D072	S	4D074	N	4D076	N
5D	CAMRY	LE	2006	L4	2.4L	5	5/25/2010		S	5D027	N	5D028	N	5D029	S	5D030	S	5D031	S	5D032	N	5D033	S	5D034	S	5D035	N	5D024	-	5D025	N	5D026	S	5D037	S
6D	CAMRY	LE	2007	L4	2.4L	5	5/27/2010		N	6D056	S	6D057	S	6D058	N	6D059	S	6D060	S	6D061	S	6D062	S	6D063	S	6D065	N	6D069	S	6D066	N	6D067	S	6D068	S
7D	CAMRY	XLE	2005	L4	2.4L	5	5/13/2010		S	7D032	S	7D033	S	7D034	N	7D035	S	7D036	S	7D037	N	7D038	S	7D039	S	7D040	N	7D044	S	7D041	S	7D042	N	7D043	S
8D	CAMRY	XLE	2001	V6	3.0L	4	5/10/2010		-	8D074	-	8D075	-	8D076	-	8D077	-	8D078	-	8D079	-	8D080	-	8D081	-	8D082	-	8D088	-	8D083	-	8D084	-	8D085	-
9D	CAMRY	LE	2006	V6	3.0L	5	6/18/2010		N	9D067	N	9D068	N	9D069	S	9D070	N	9D071	S	9D072	N	9D073	S	9D074	S	9D075	N	9D078	S	9D076	S	9D077	N	9D079	N
10D	CAMRY	LE	2007	V6	3.5L	6	6/14/2010		N	10D026	S	10D027	S	10D028	N	10D029	S	10D030	S	10D031	N	10D032	S	10D033	N	10D034	S	10D037	N	10D035	N	10D036	S	10D038	S
11D	CAMRY	XLE	2005	V6	3.0L	5	6/10/210		N	11D026	N	11D027	N	11D028	S	11D029	N	11D030	S	11D031	N	11D032	S	11D033	N	11D034	S	11D035	N	11D036	S	11D037	S	11D038	S
12C	CAMRY	XLE	2007	V6	3.5L	6	6/1/2010		N	12C028	N	12C029	N	12C030	S	12C031	N	12C032	S	12C033	N	12C034	S	12C035	N	12C036	S	12C039	N	12C037	N	12C038	S	12C040	N
13C	CAMRY	XLE	2002	V6	3.0L	4	6/2/2010		S	13C026	S	13C027	S	13C028	N	13C029	S	13C030	S	13C031	N	13C032	S	13C033	S	13C034	N	13C038	N	13C036	N	13C037	N	13C039	S
14C	CAMRY	XLE	2004	V6	3.0L	5	6/3/2010		N	14C024	S	14C025	S	14C026	S	14C027	S	14C028	S	14C029	S	14C030	N	14C031	S	14C032	S	14C036	N	14C033	N	14C034	S	14C035	N
15C	CAMRY	XLE	2003	L4	2.4L	4	6/4/2010		S	15C025	S	15C026	S	15C027	N	15C028	S	15C029	S	15C030	N	15C031	S	15C032	S	15C033	N	15C036	S	15C034	S	15C035	N	15C037	N
16C	CAMRY	-	2009	L4	2.4L	5	6/7/2010		S	16C025	S	16C026	S	16C027	N	16C028	S	16C029	S	16C030	N	16C031	S	16C032	S	16C033	N	16C036	S	16C034	S	16C035	N	16C037	N
17C	CAMRY	LE	2004	L4	2.4L	4	6/8/2010		S	17C025	S	17C026	S	17C027	N	17C028	S	17C029	S	17C030	N	17C031	S	17C032	S	17C033	N	17C034	N	17C035	S	17C036	N	17C037	N
18C	CAMRY	LE	2004	L4	2.4L	4	6/15/2010		N	18C027	S	18C028	S	18C029	N	18C026	N	18C025	N	18C024	S	18C023	S	18C022	N	18C021	N	18C020	S	18C019	N	18C018	S	18C017	S
19C	CAMRY	LE	2007	L4	2.4L	5	6/16/2010		S	19C025	S	19C025	S	19C027	N	19C028	S	19C029	S	19C030	N	19C031	S	19C032	S	19C033	N	19C036	N	19C034	S	19C035	N	19C037	N
20C	CAMRY	LE	2004	L4	2.4L	4	6/24/2010		S	20C026	S	20C027	S	20C028	S	20C029	S	20C030	S	20C031	S	20C032	S	20C033	S	20C034	S	20C037	N	20C035	N	20C036	S	20C038	S

0 to 70 mph Acceleration With Full Vacuum And Varying Brake Pedal Force Testing

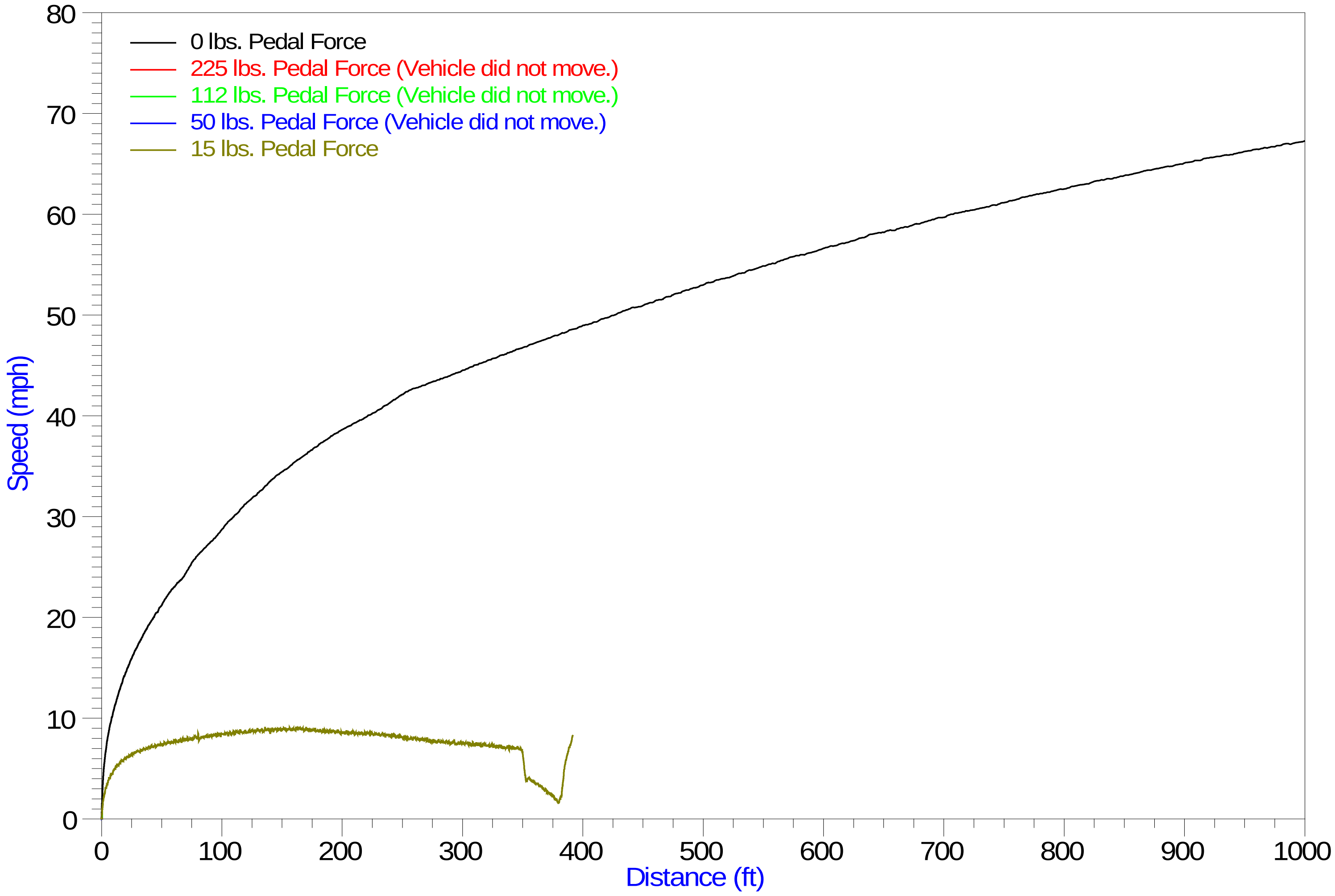
2002 Toyota Camry 1D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



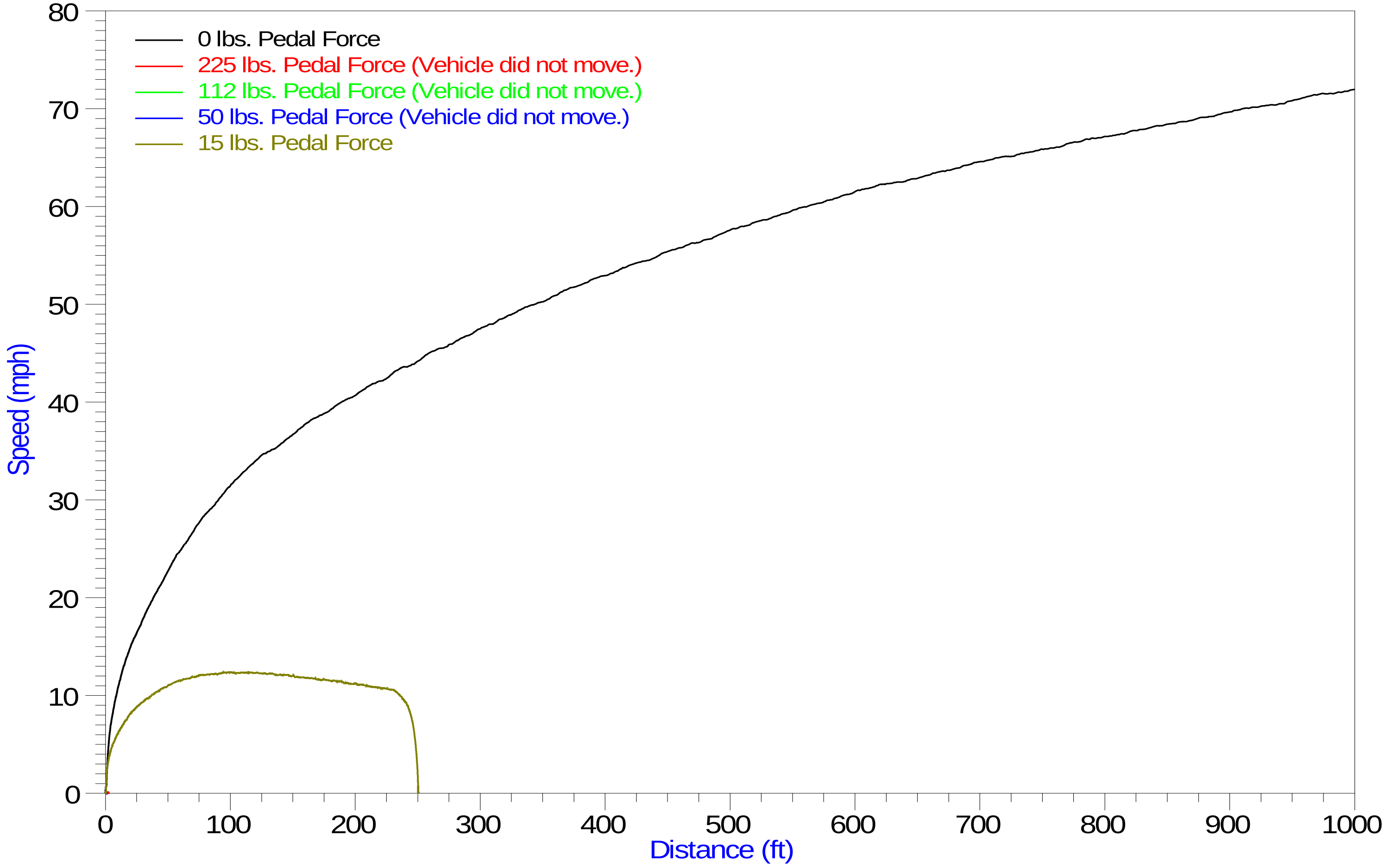
2002 Toyota Camry 2D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



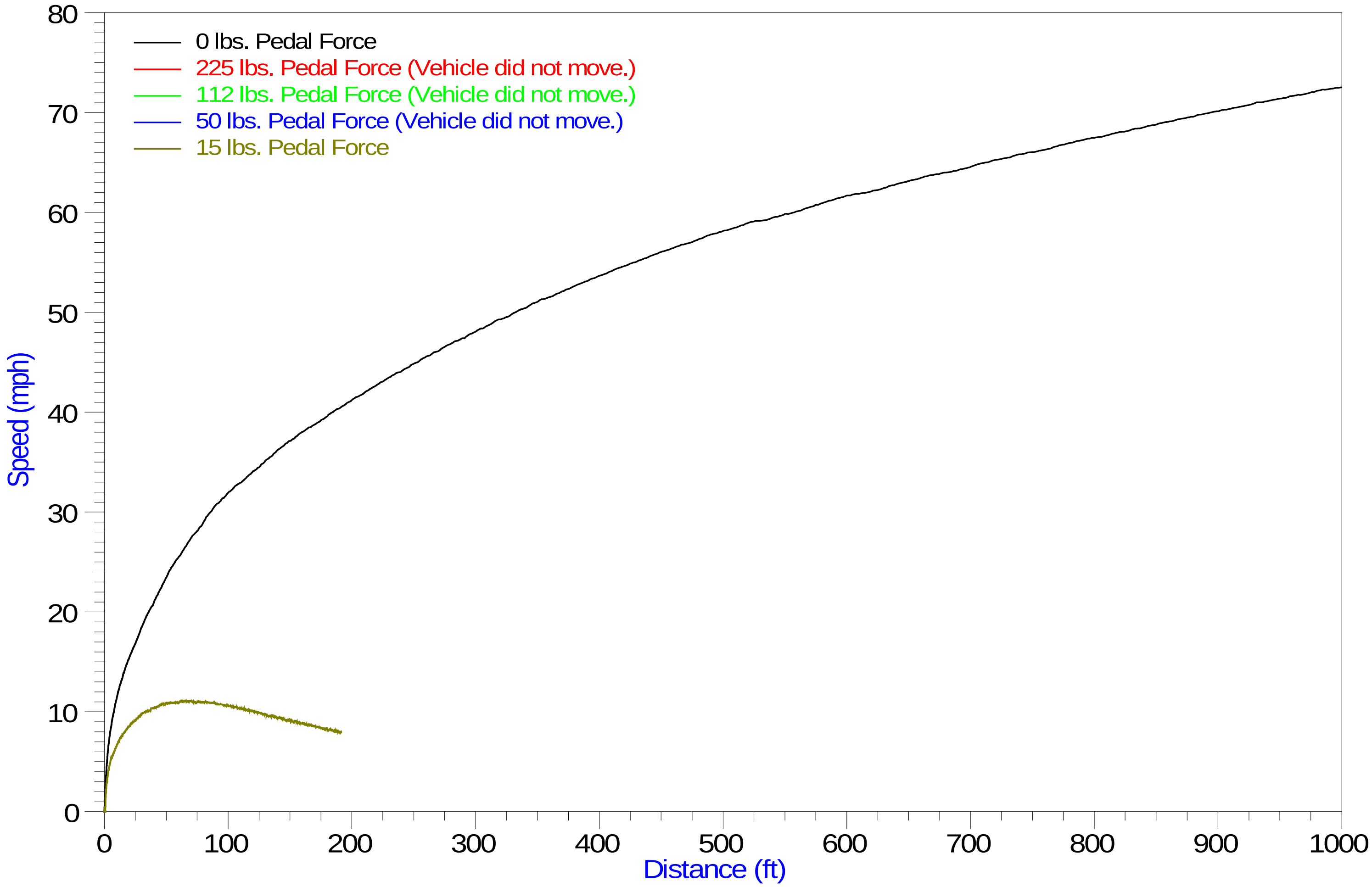
2001 Toyota Camry 3D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



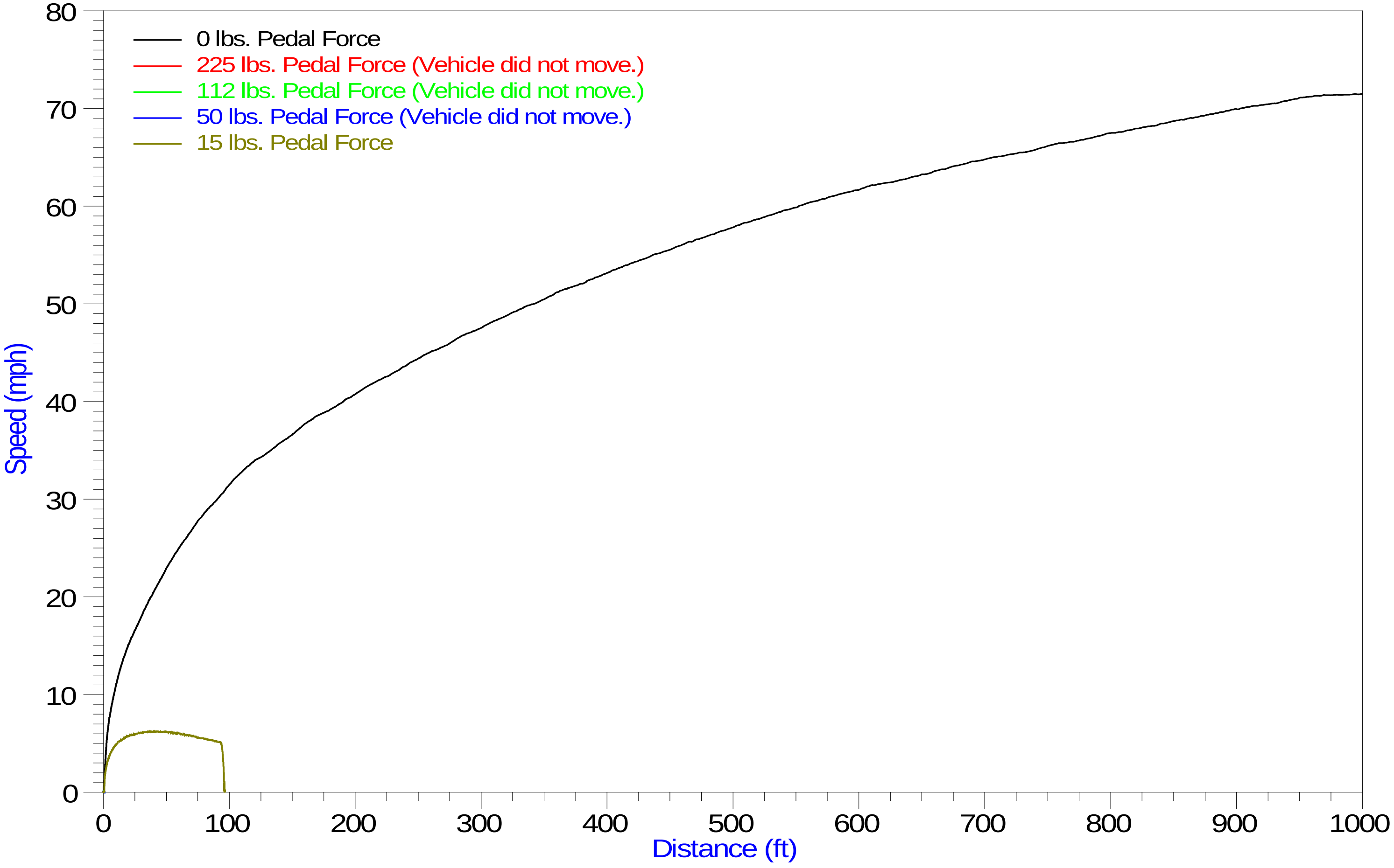
2007 Toyota Camry 4D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



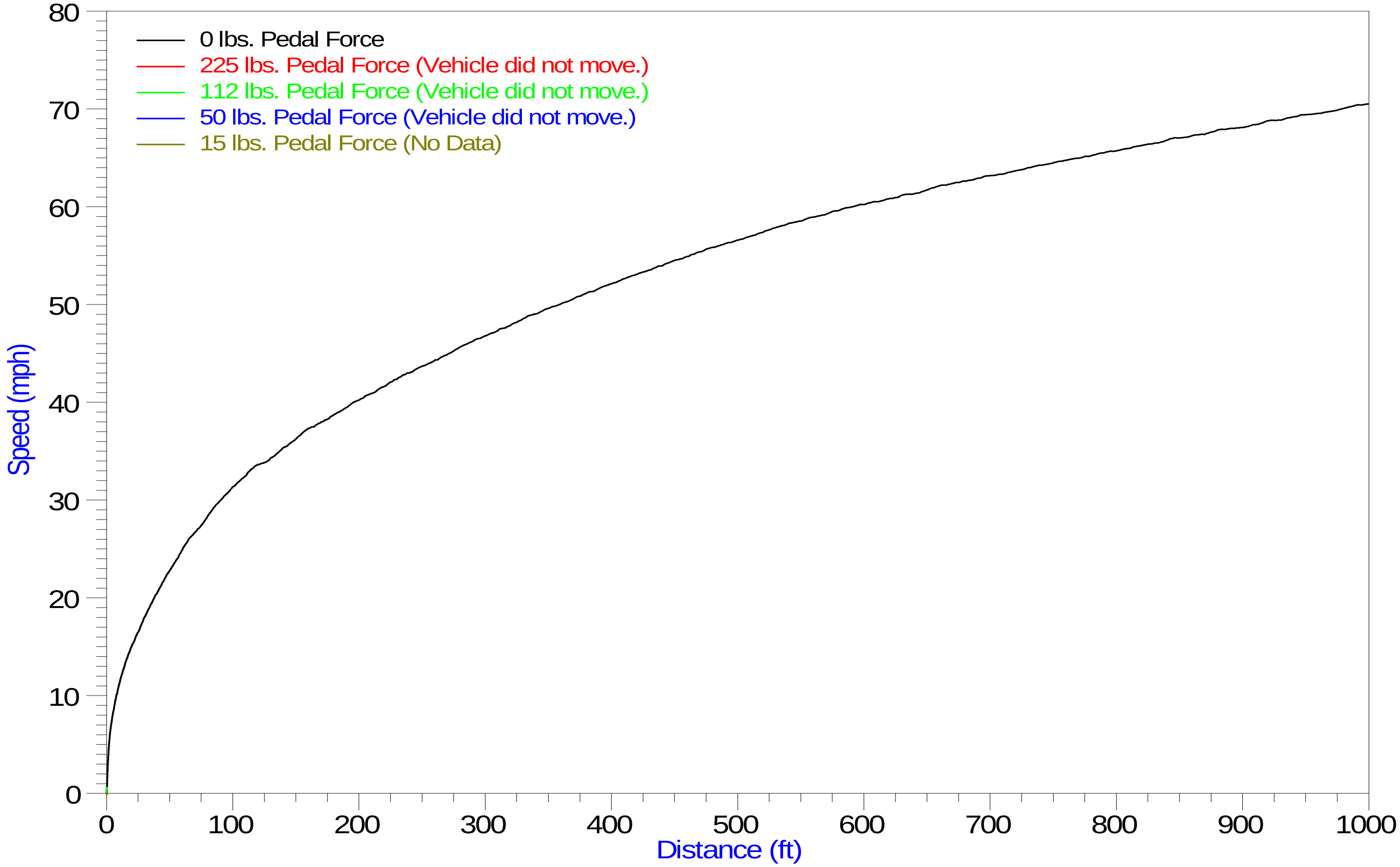
2006 Toyota Camry 5D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

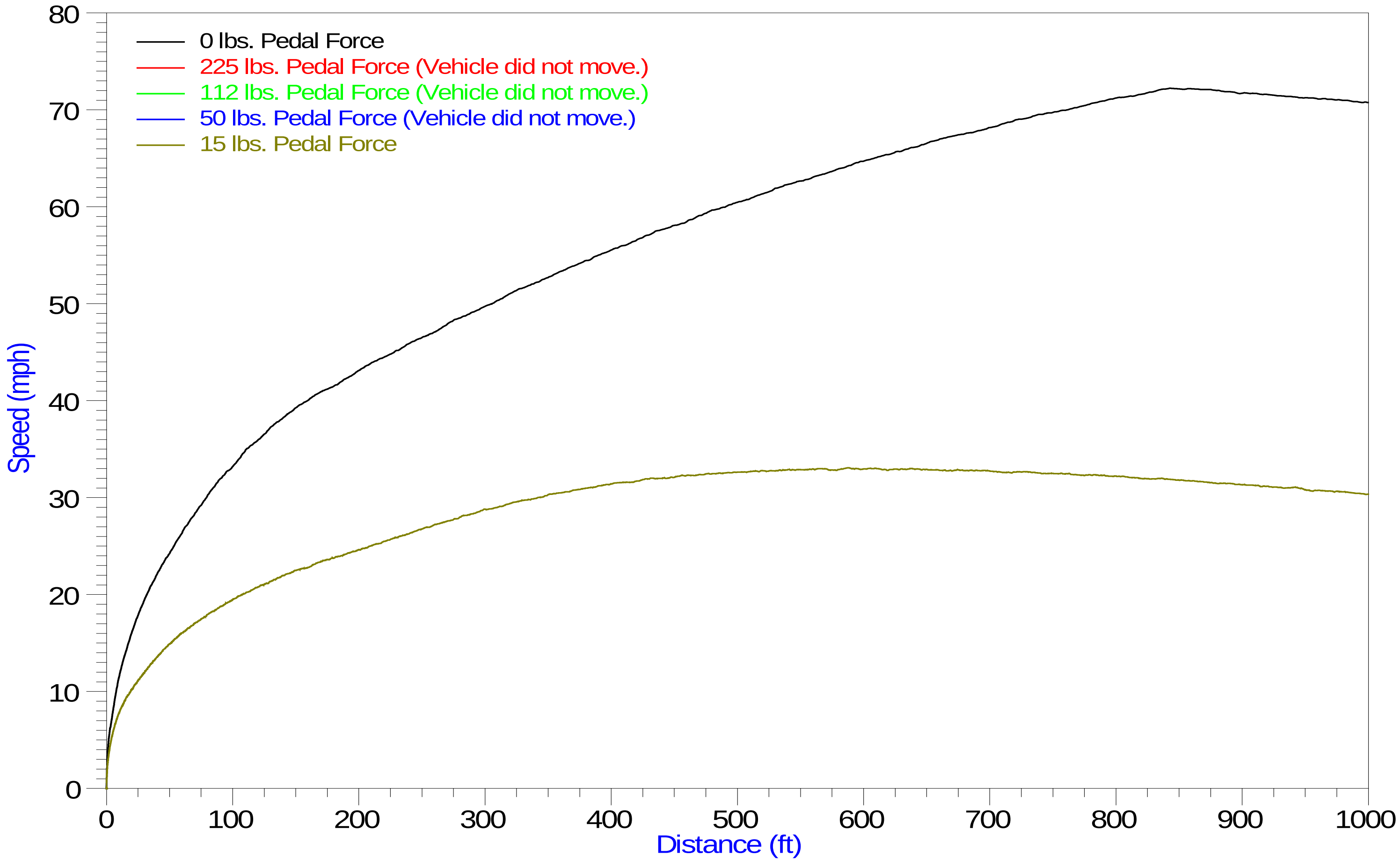


2007 Toyota Camry 6D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



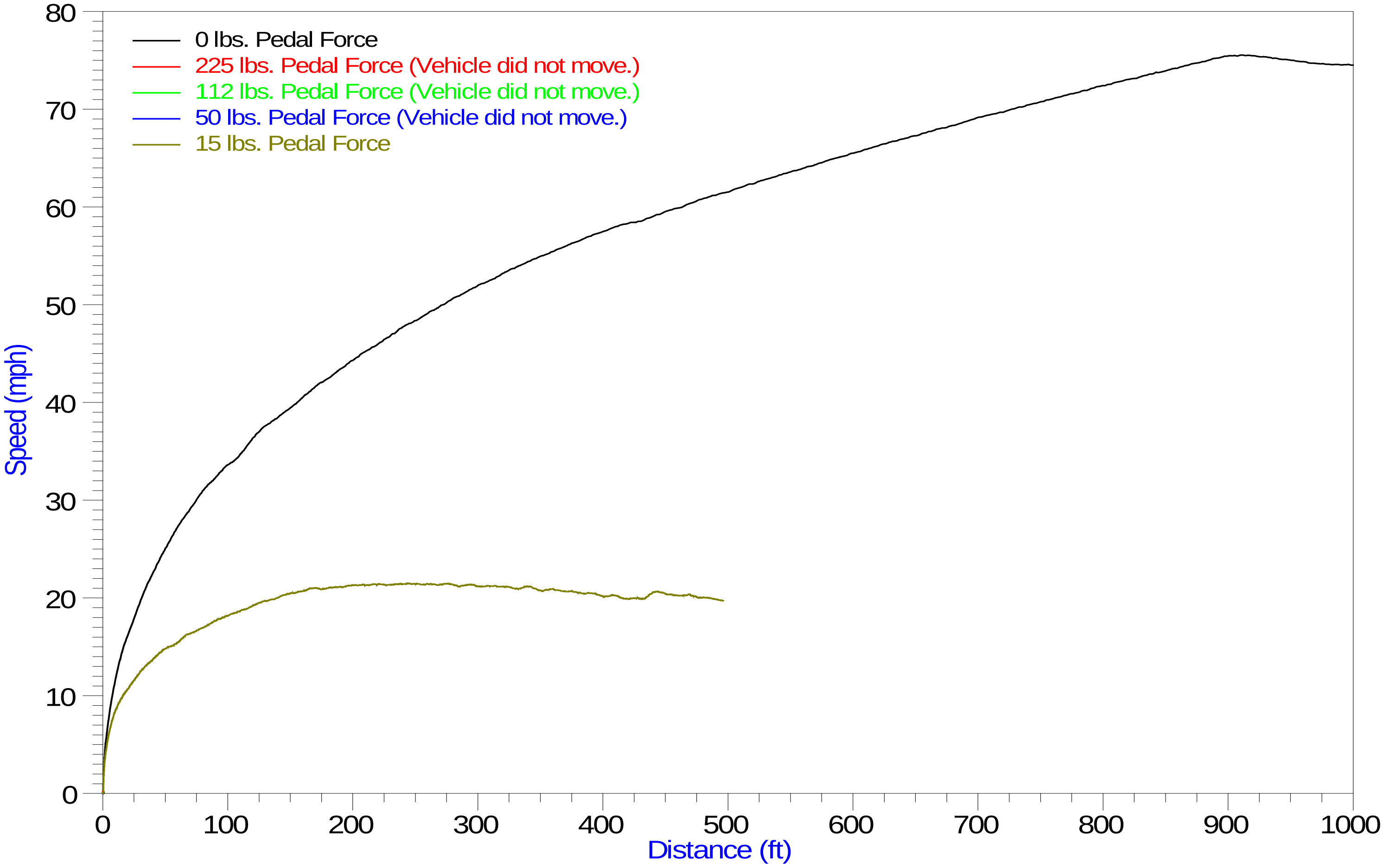
2005 Toyota Camry 7D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



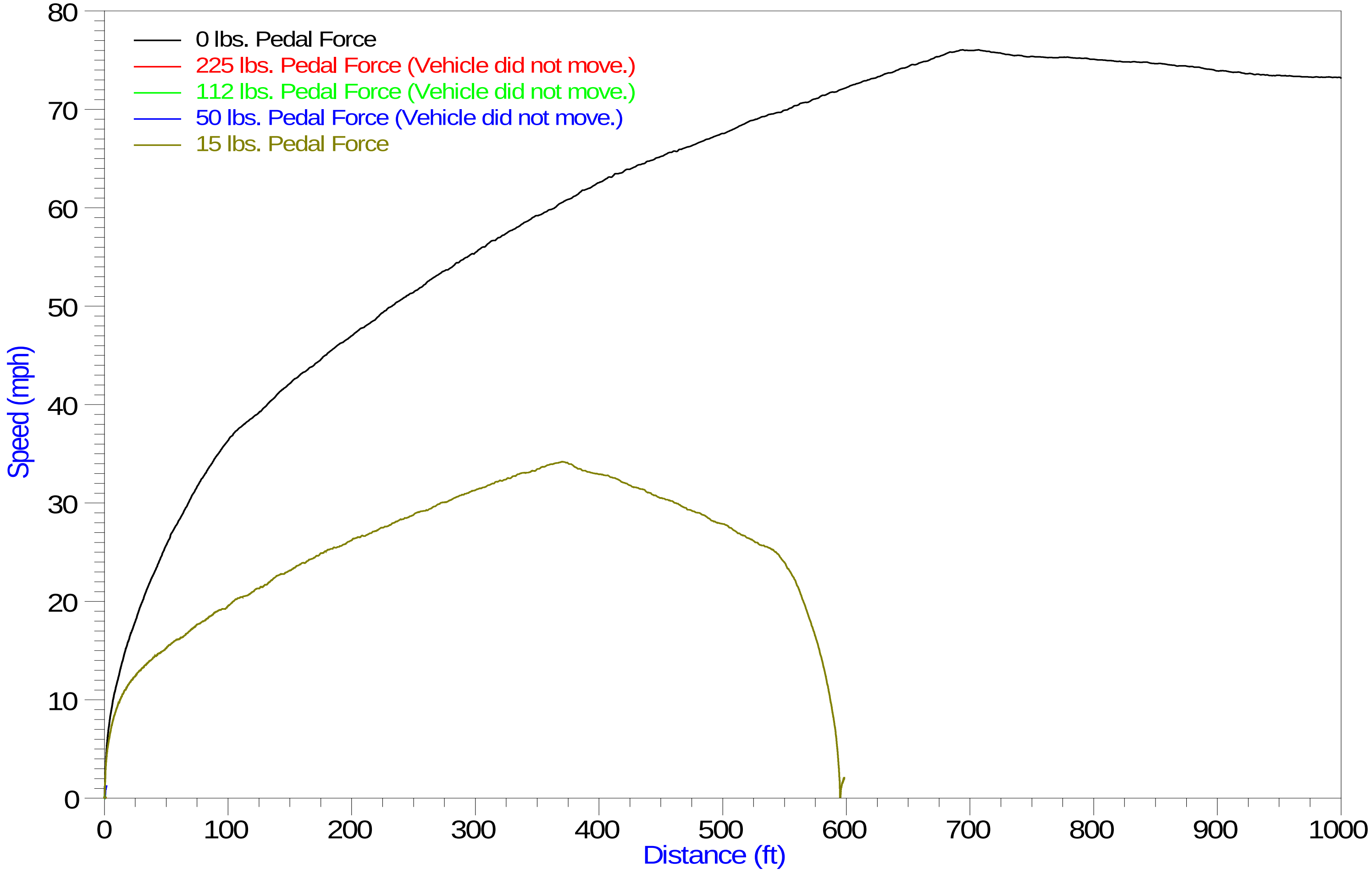


2001 Toyota Camry 8D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

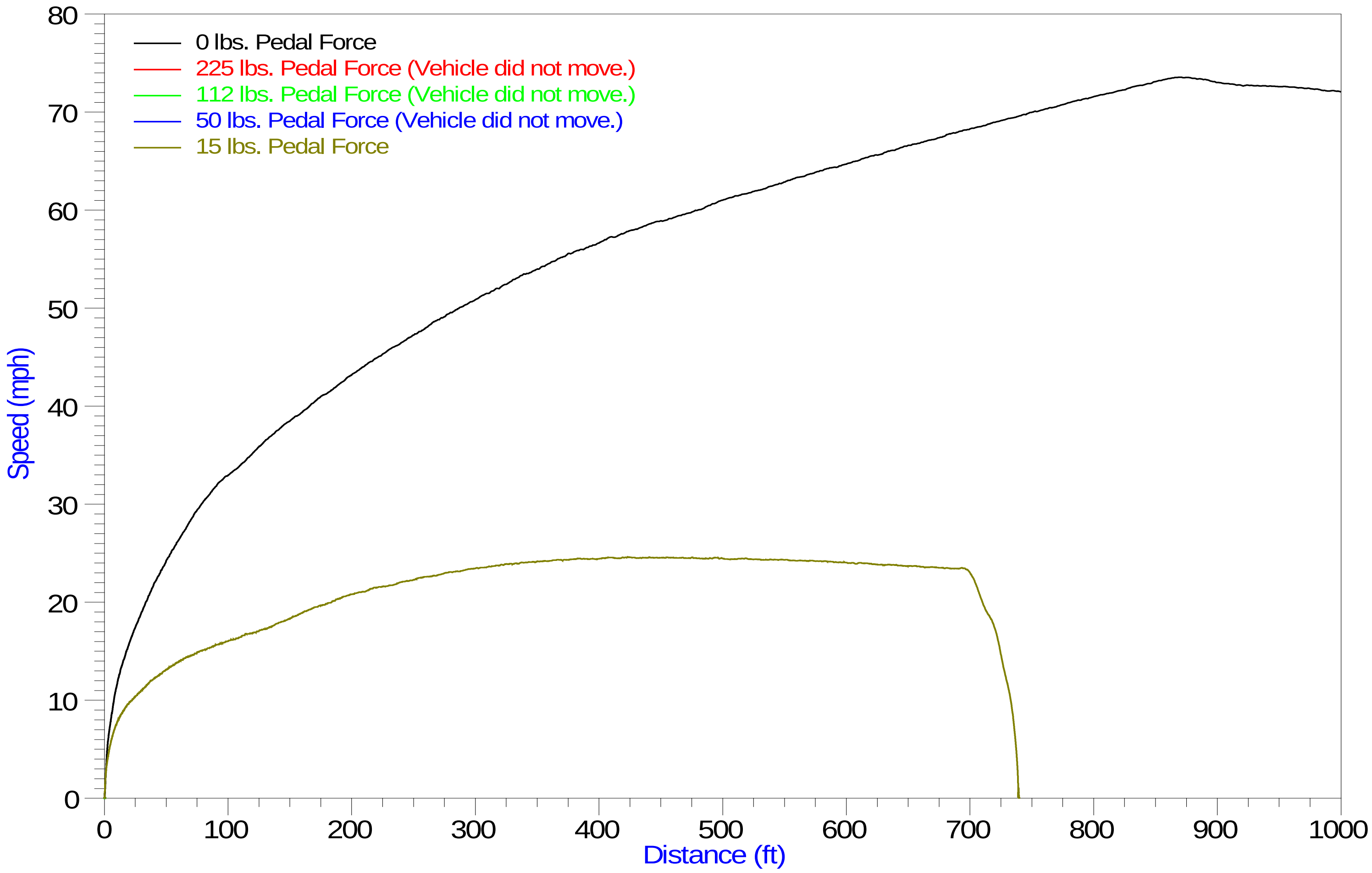
2005 Toyota Camry 9D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

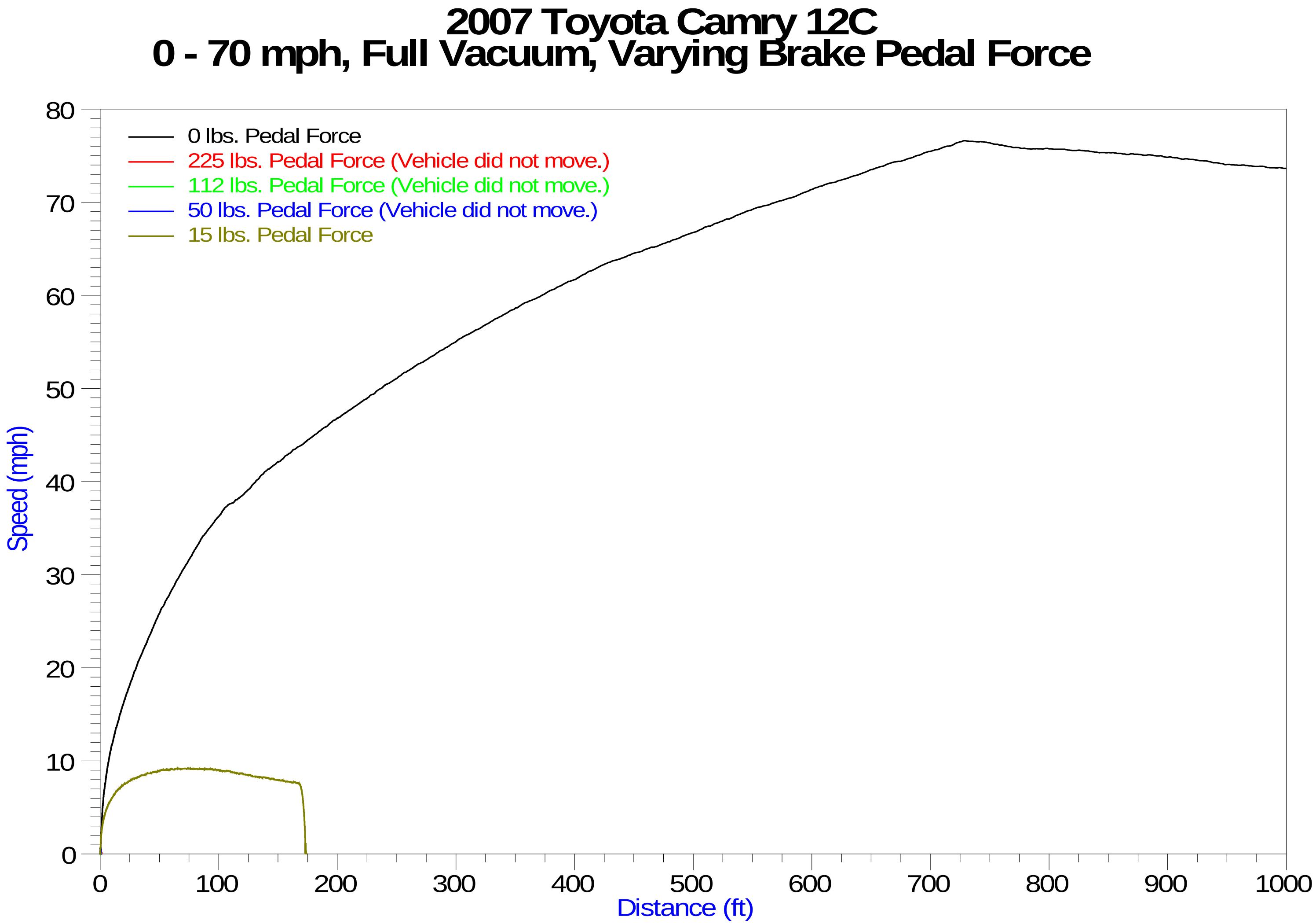


2007 Toyota Camry 10D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

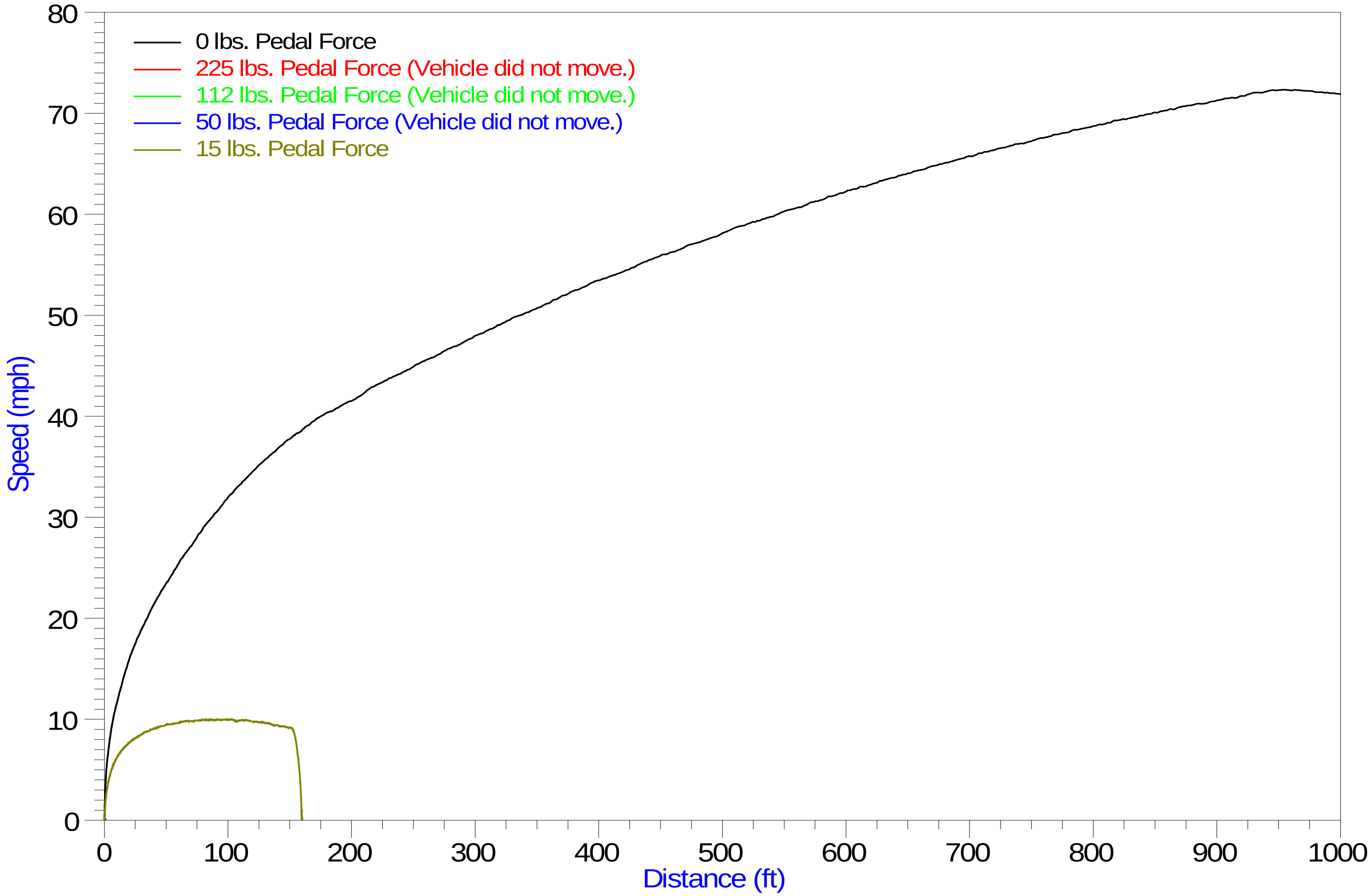


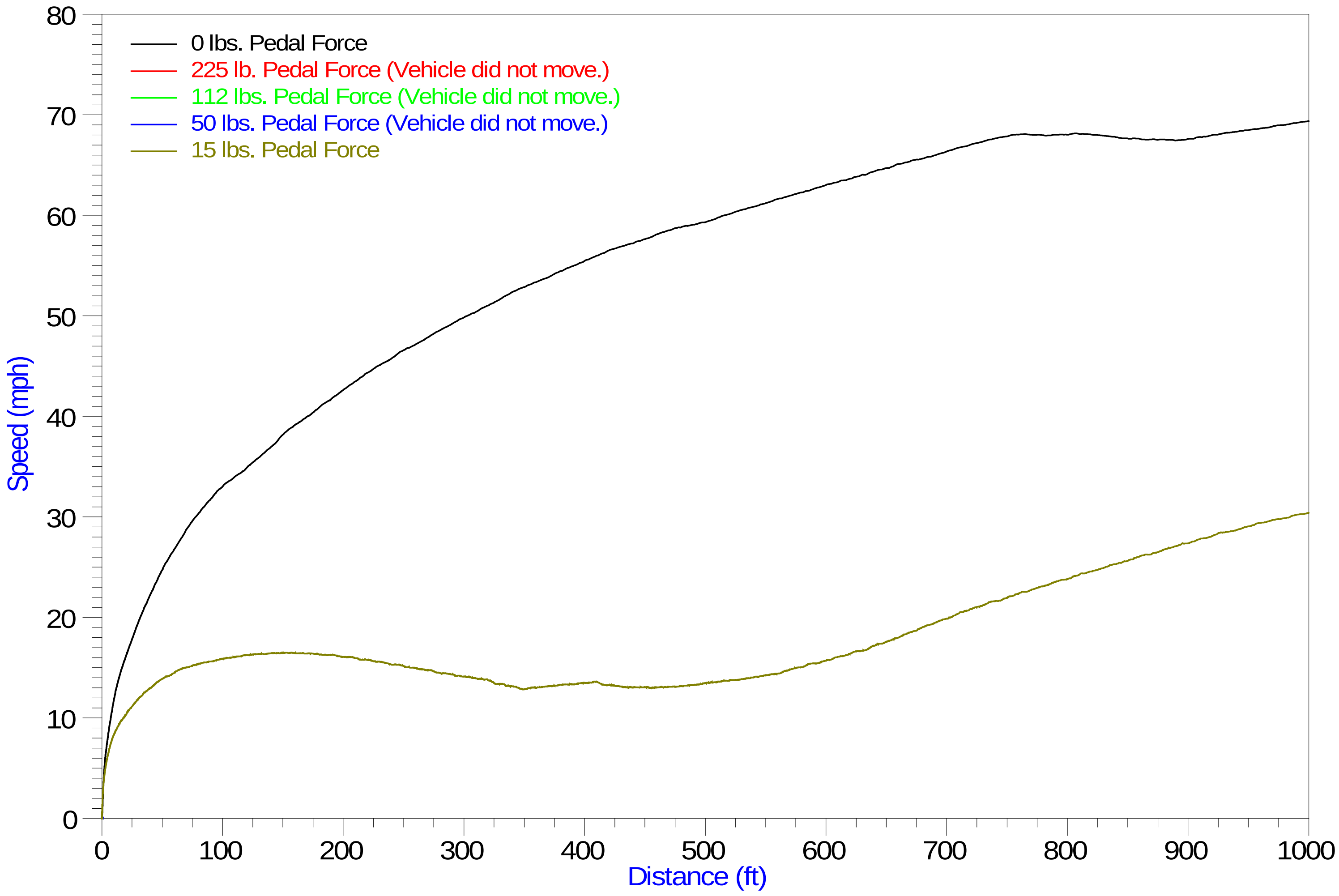
2005 Toyota Camry 11D
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force




2007 Toyota Camry 12C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force
0 lbs. Pedal Force
225 lbs. Pedal Force (Vehicle did not move.)
112 lbs. Pedal Force (Vehicle did not move.)
50 lbs. Pedal Force (Vehicle did not move.)
15 lbs. Pedal Force
Speed (mph)
0
10
20
30
40
50
60
70
80
Distance (ft)
0
100
200
300
400
500
600
700
800
900
1000

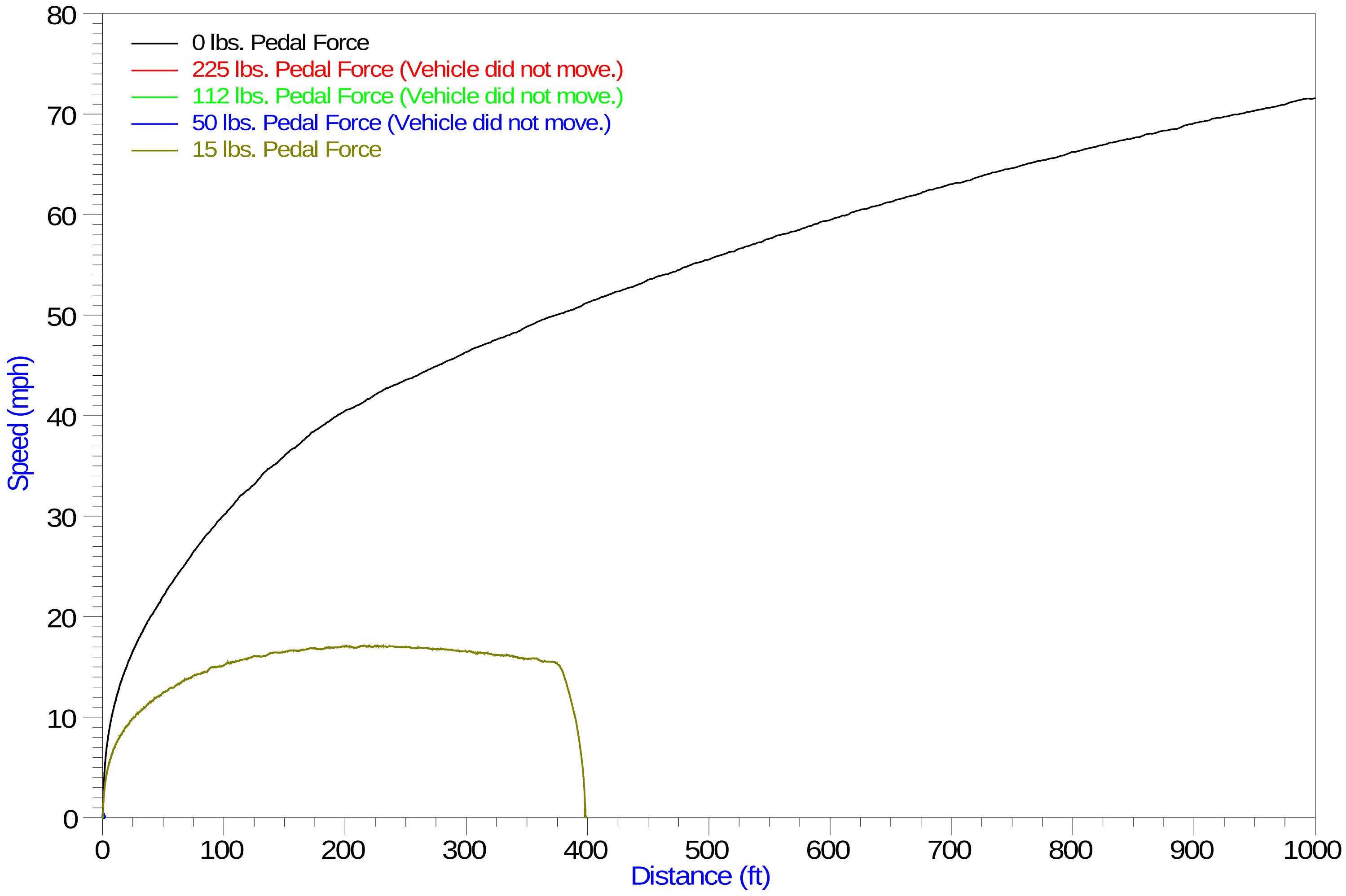
2002 Toyota Camry 13C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



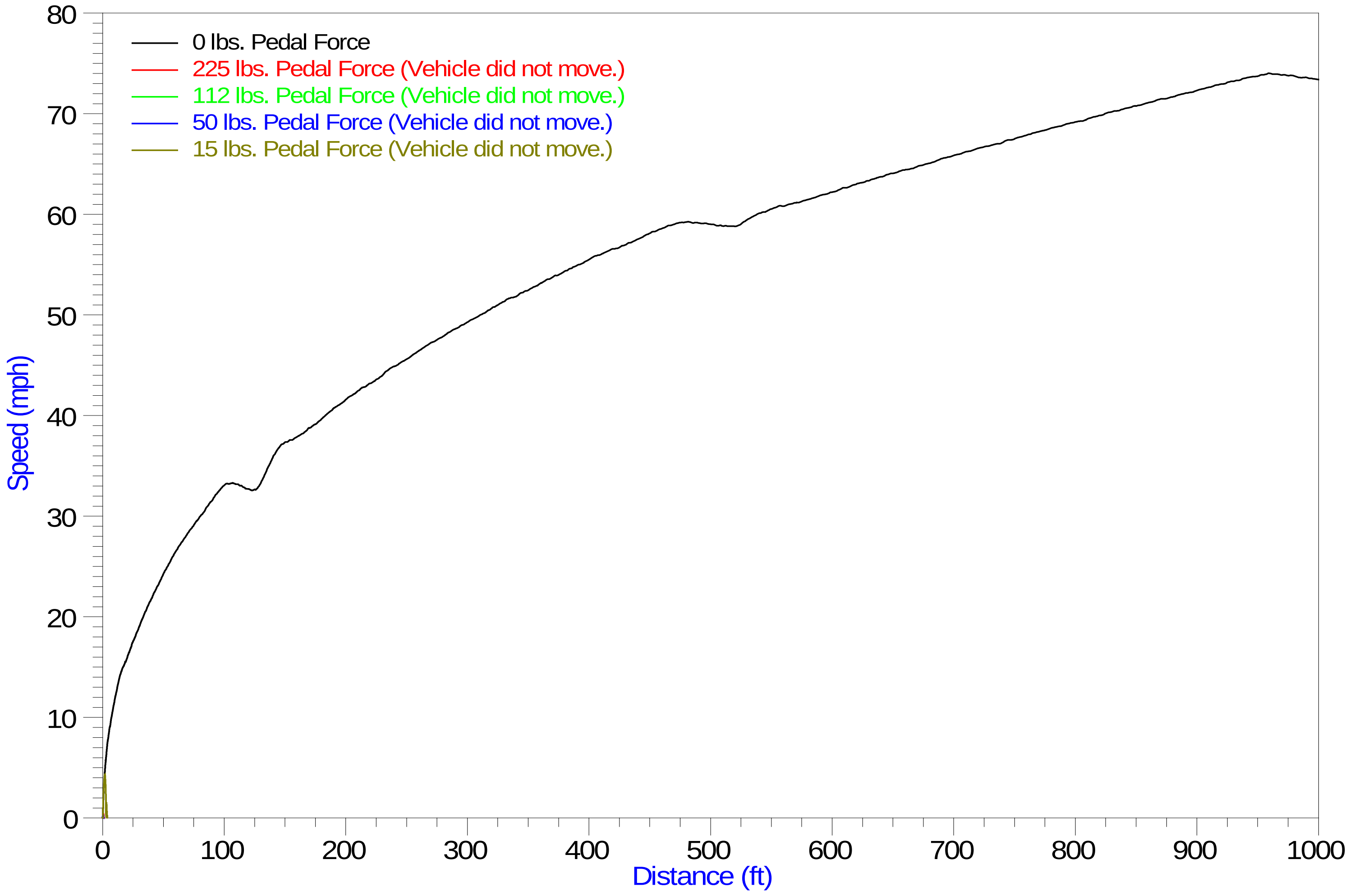


2004 Toyota Camry 14C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

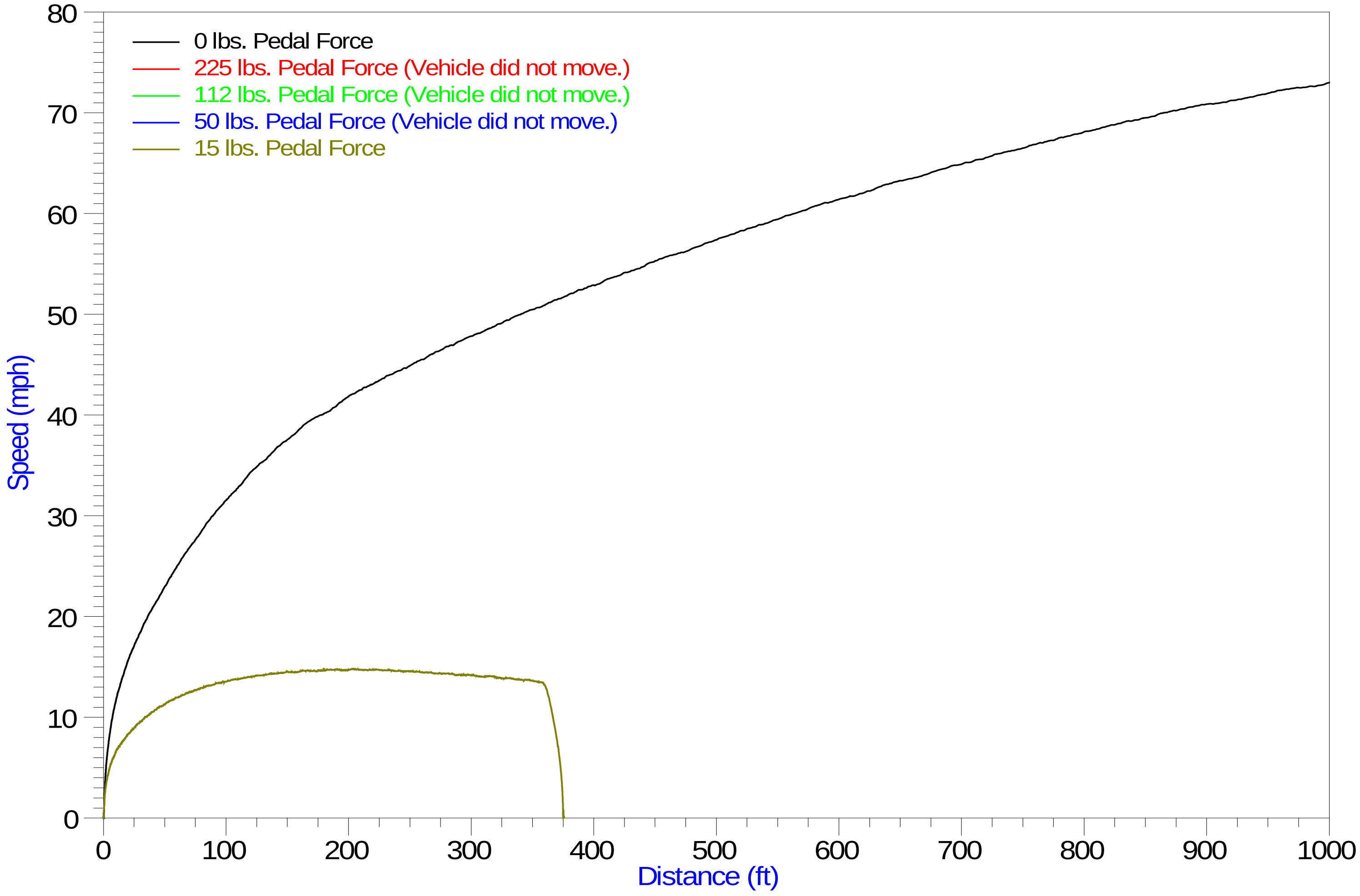
2003 Toyota Camry 15C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

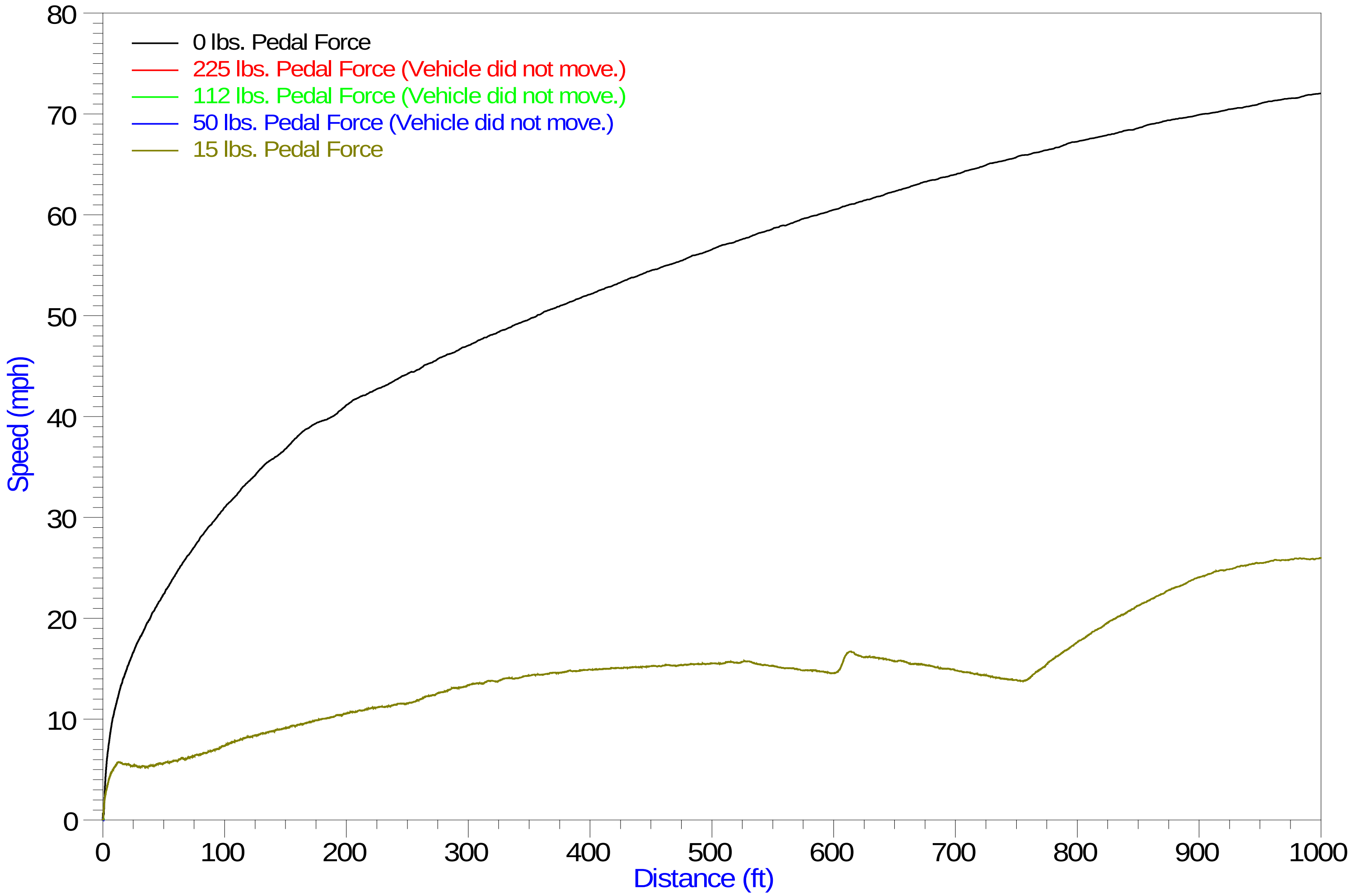


2009 Toyota Camry 16C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



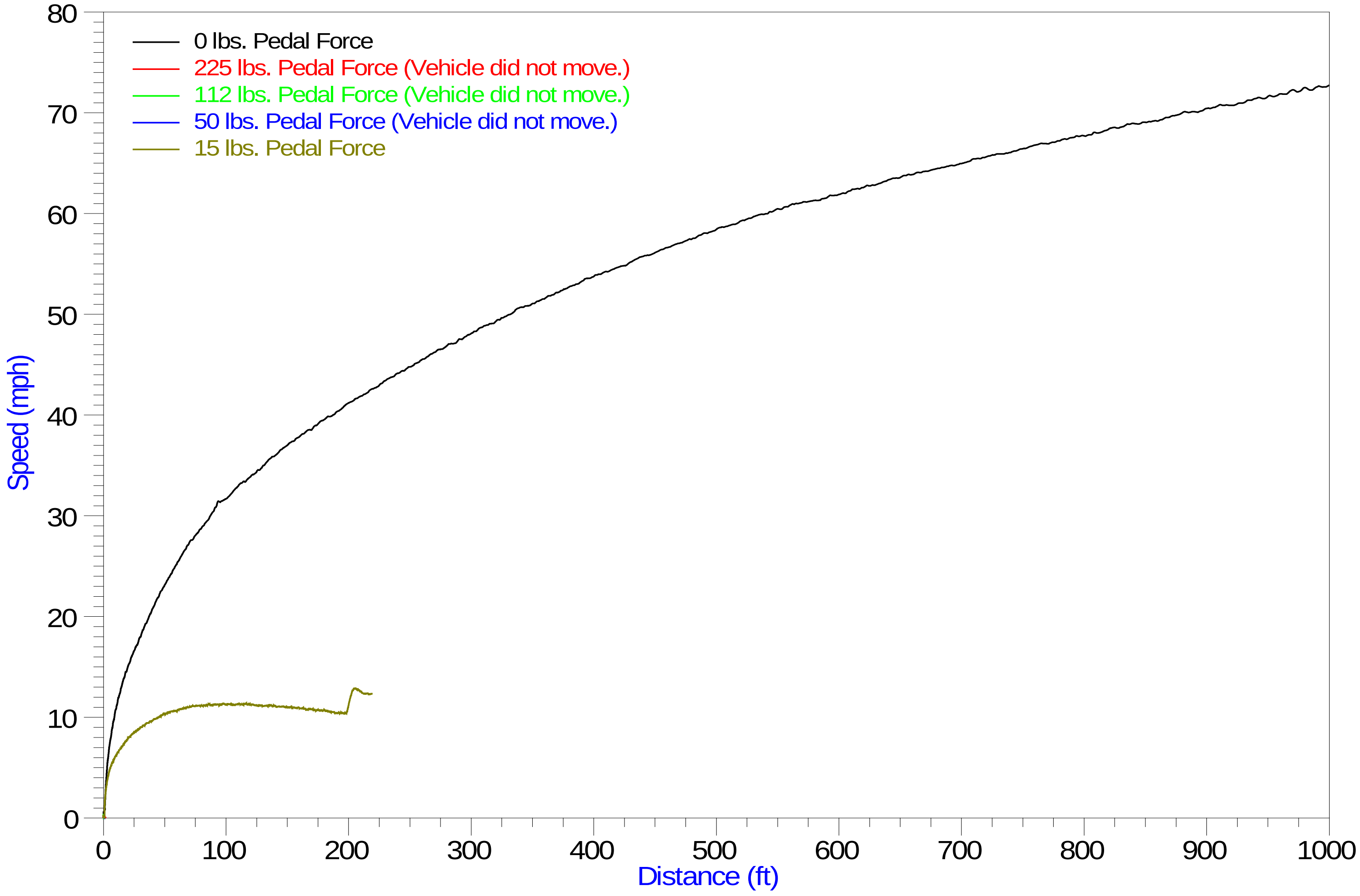
2004 Toyota Camry 17C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force



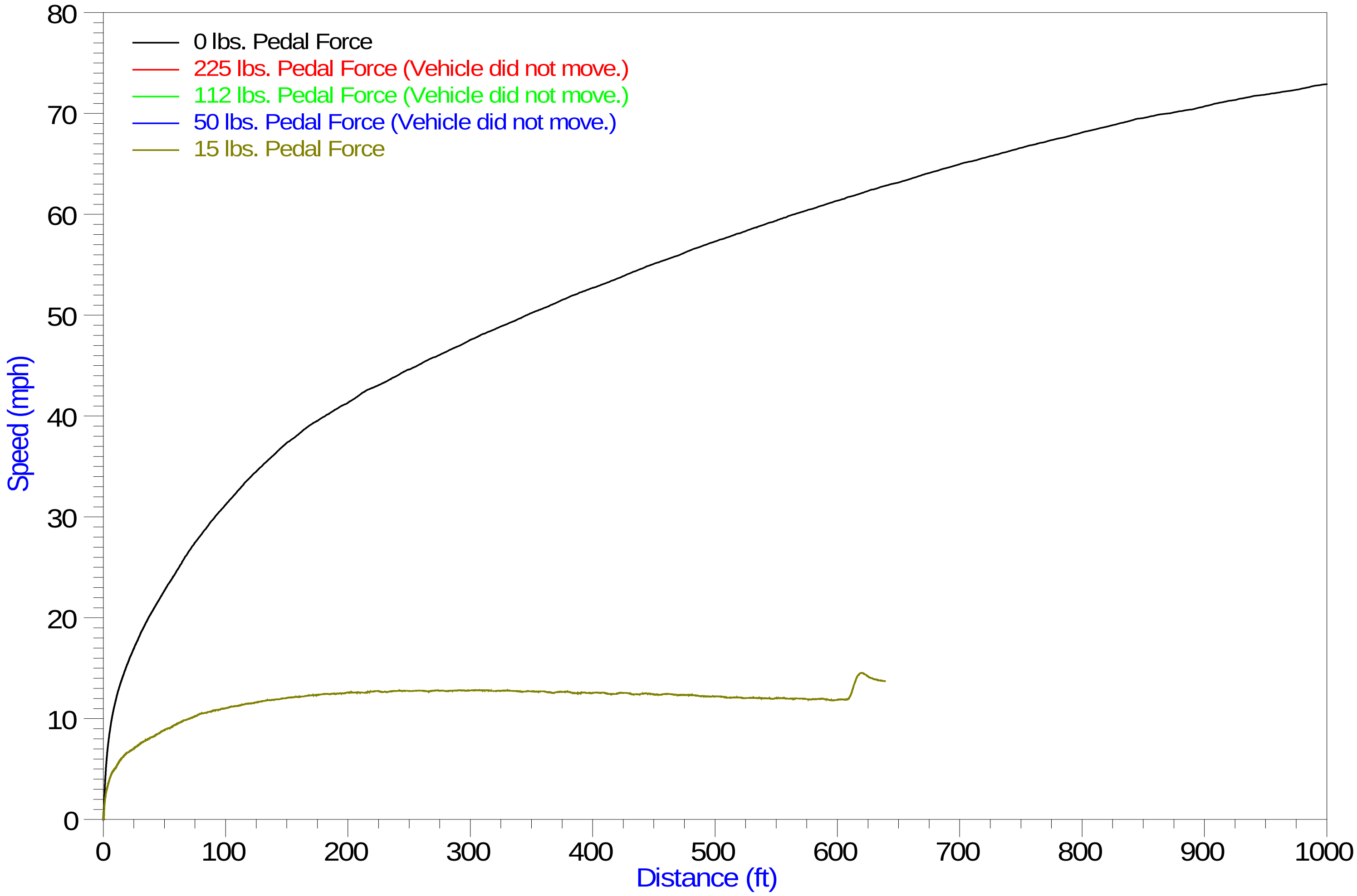


2004 Toyota Camry 18C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

2007 Toyota Camry 19C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

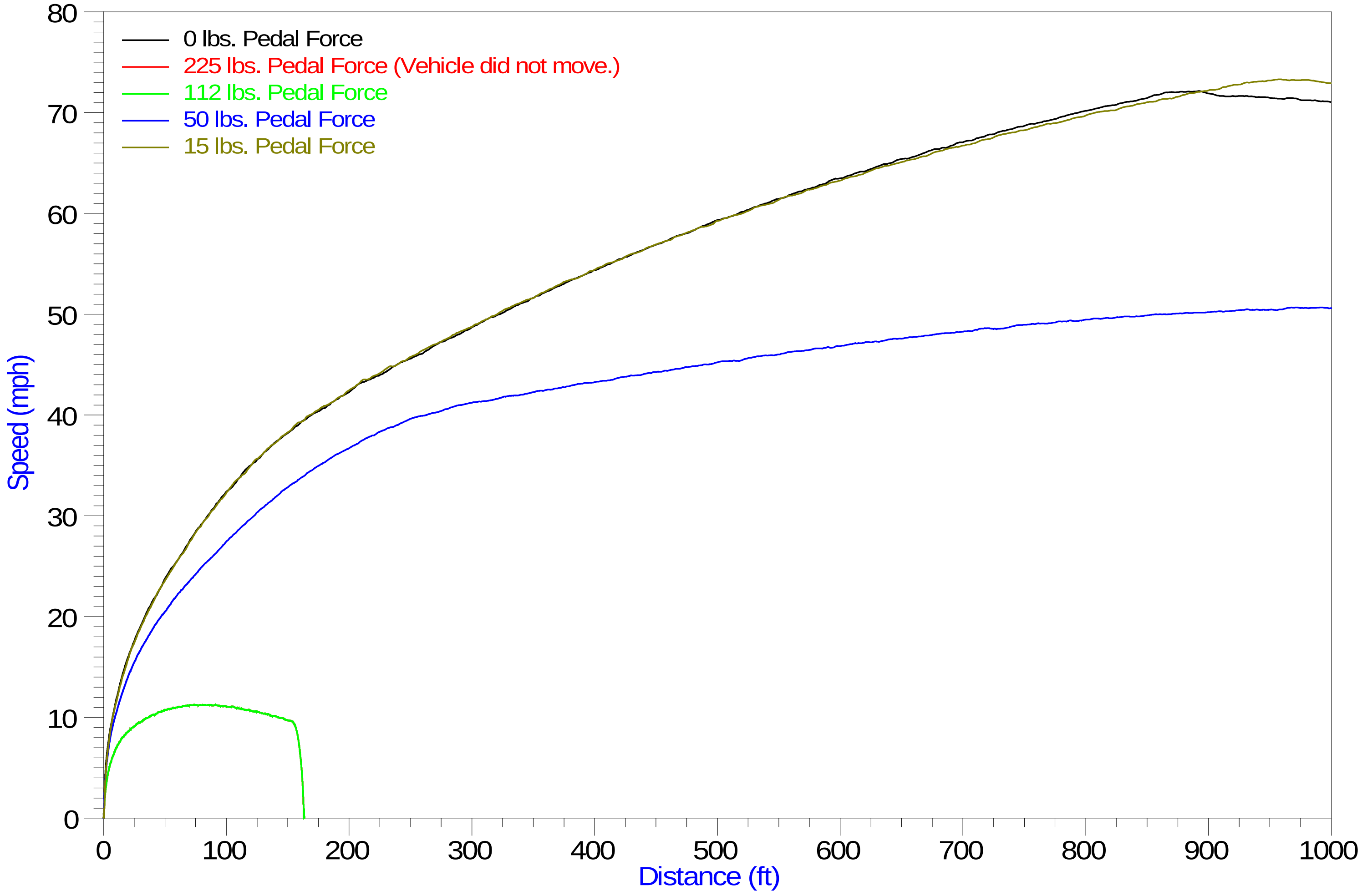


2004 Toyota Camry 20C
0 - 70 mph, Full Vacuum, Varying Brake Pedal Force

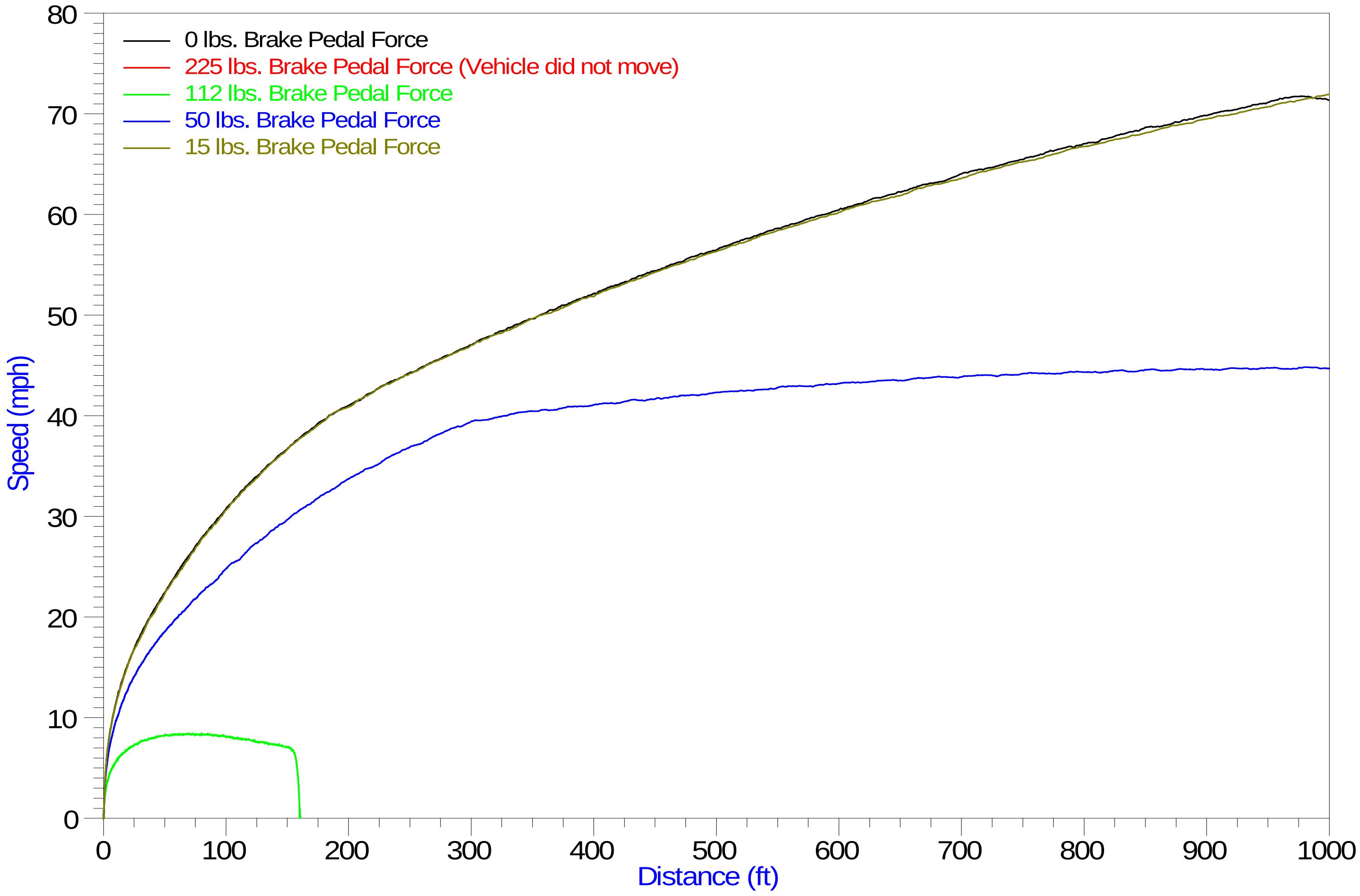


0 to 70 mph Acceleration
With No Vacuum
And Varying Brake Pedal Force
Testing

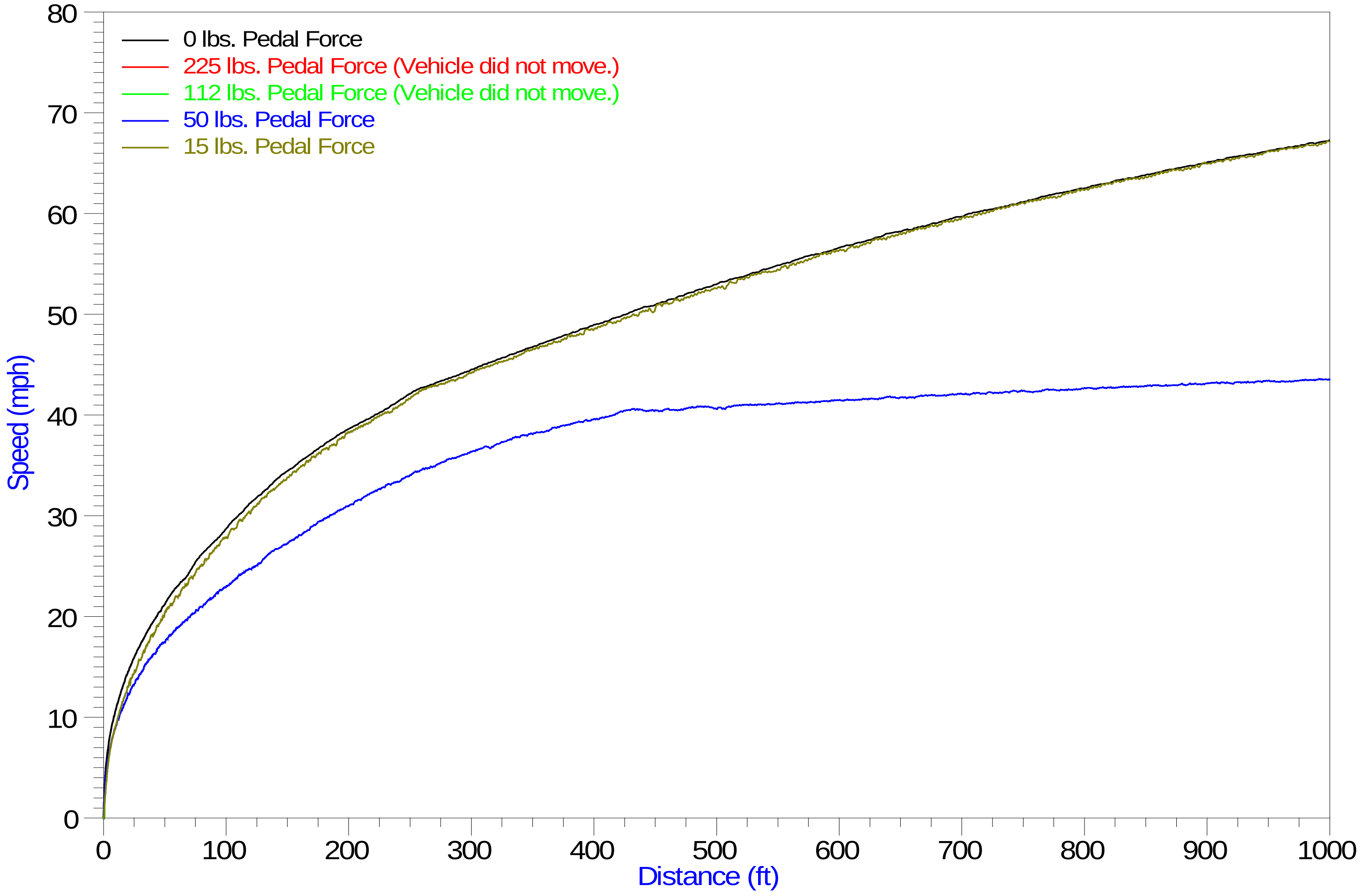
2002 Toyota Camry 1D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



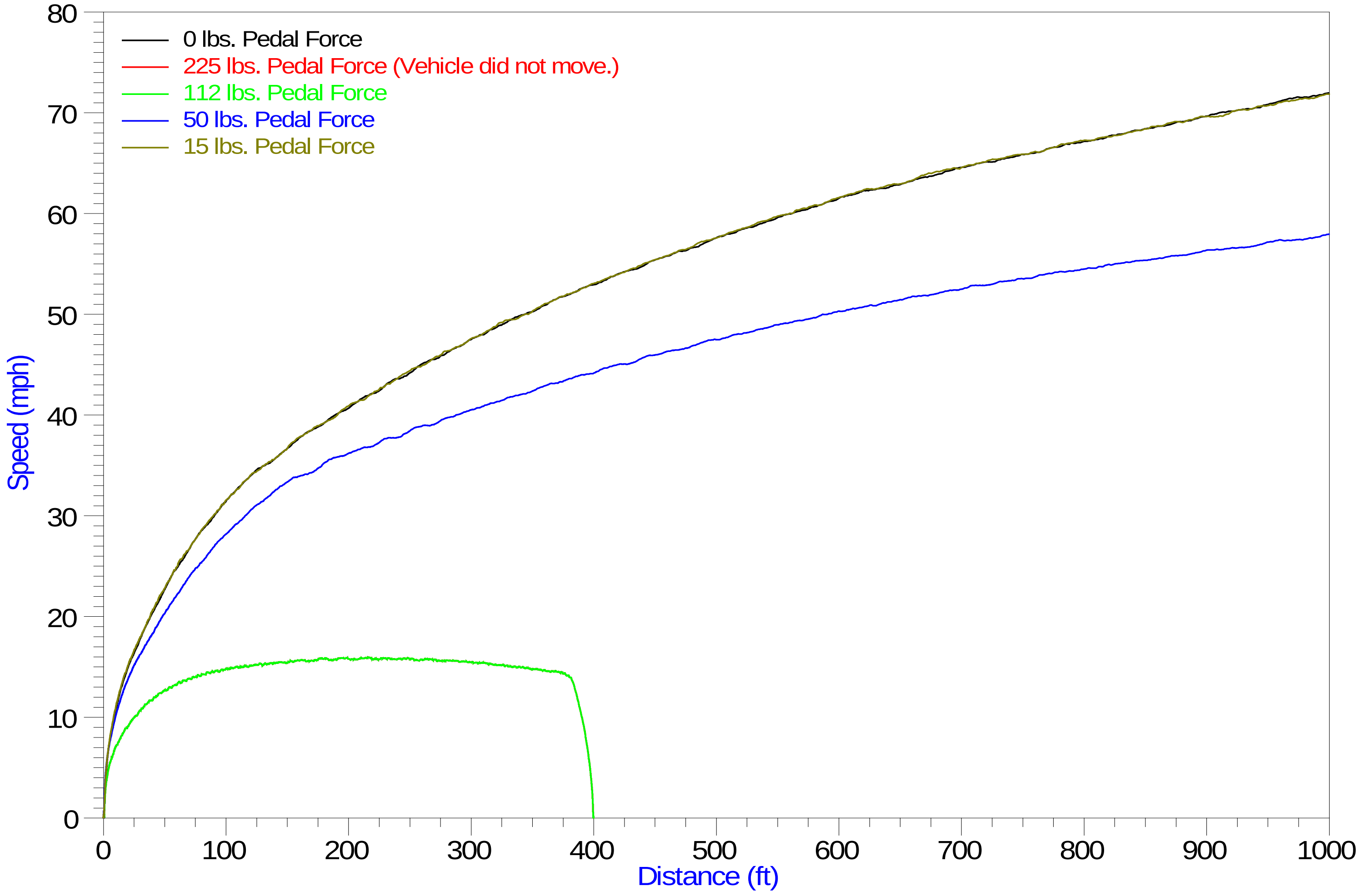
2002 Toyota Camry 2D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



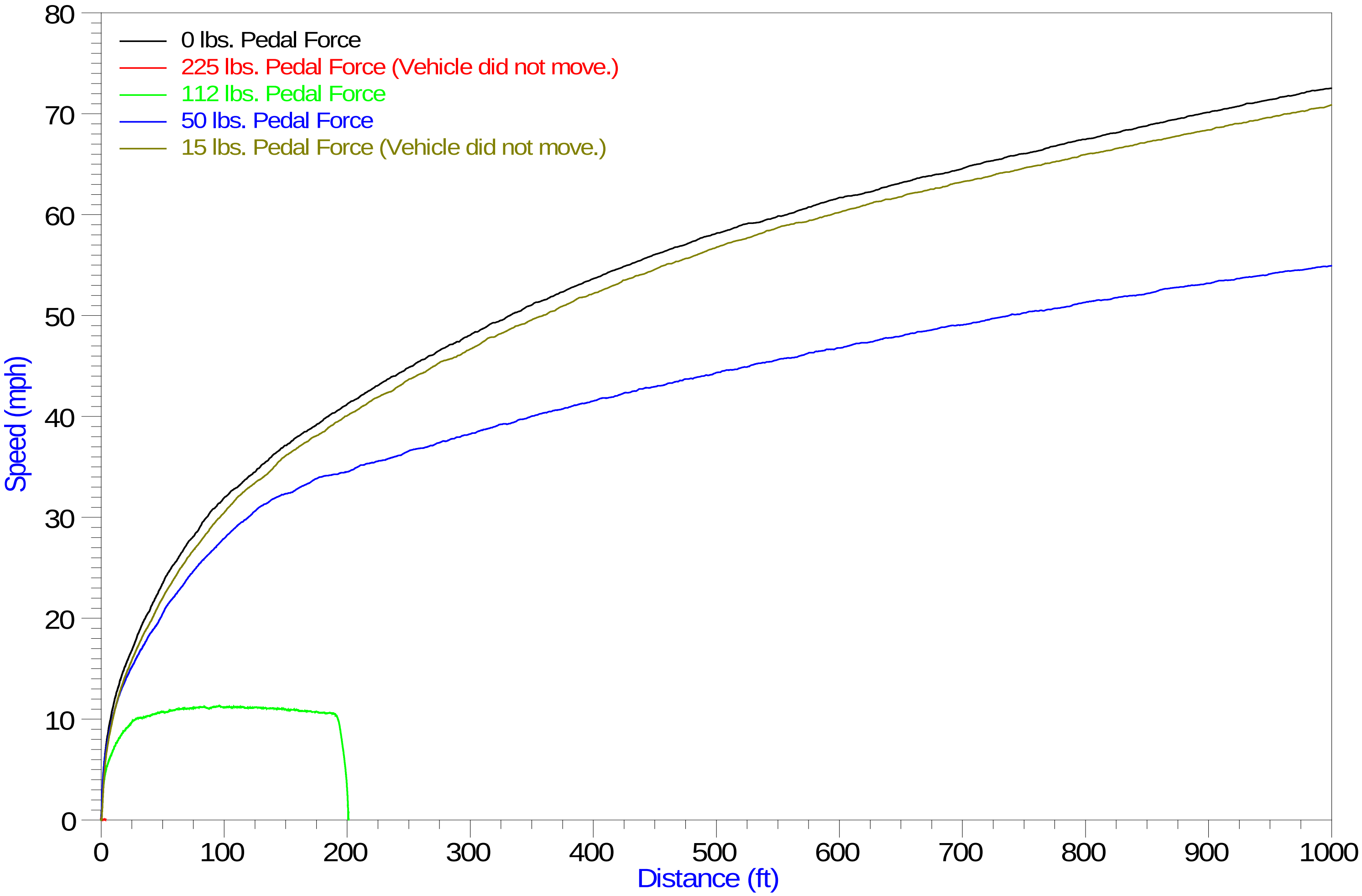
2001 Toyota Camry 3D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



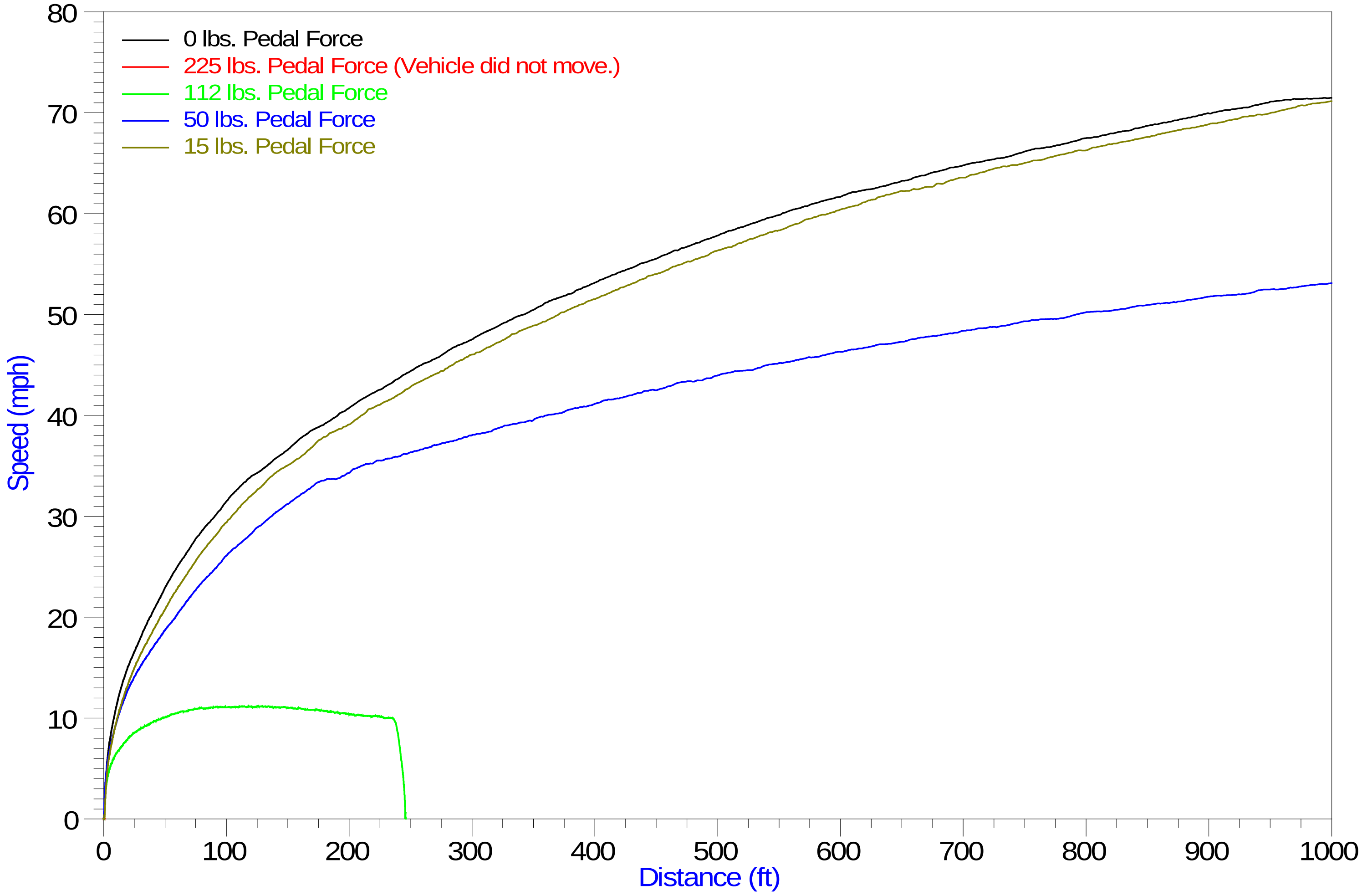
2007 Toyota Camry 4D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



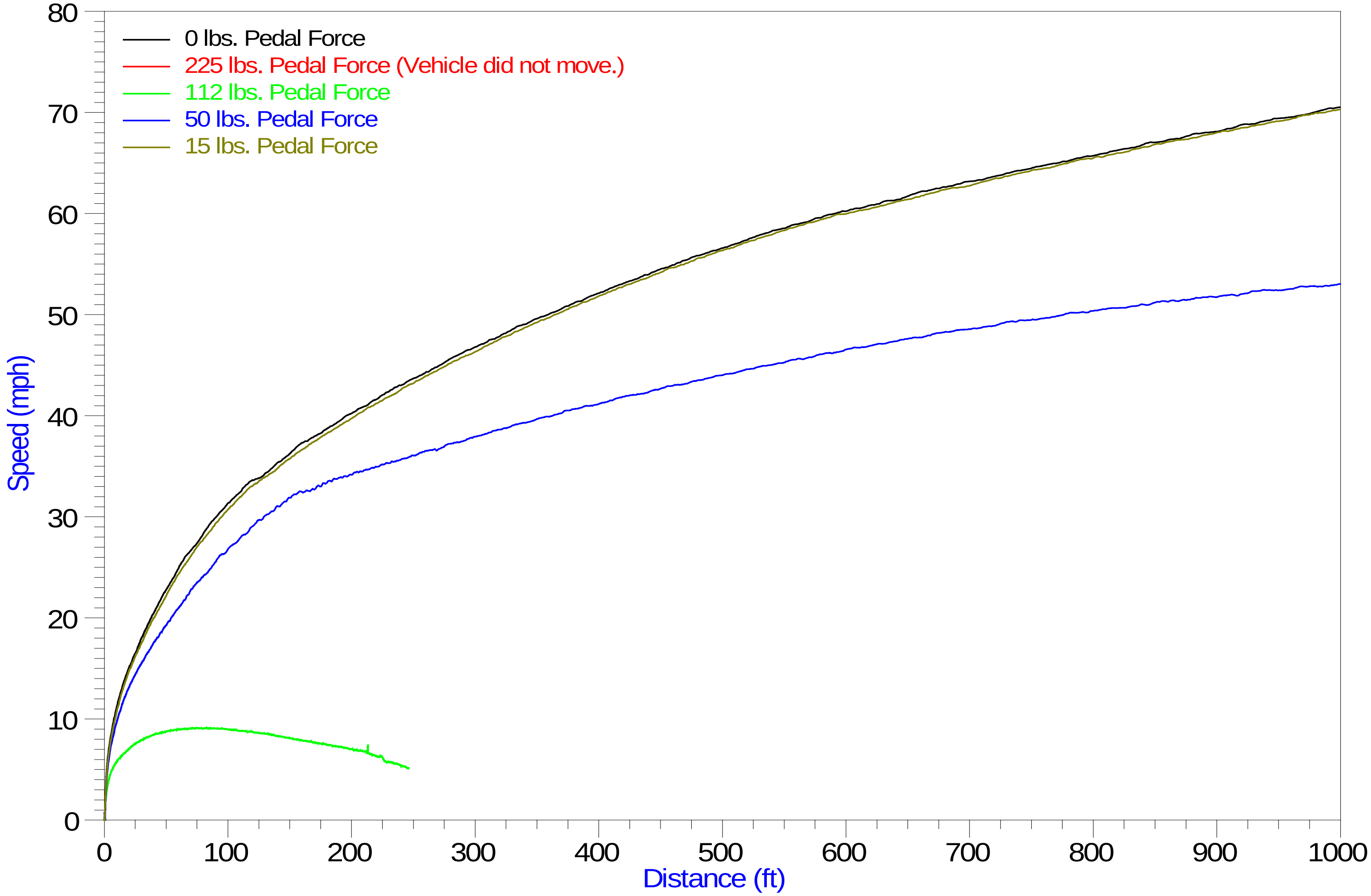
2006 Toyota Camry 5D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



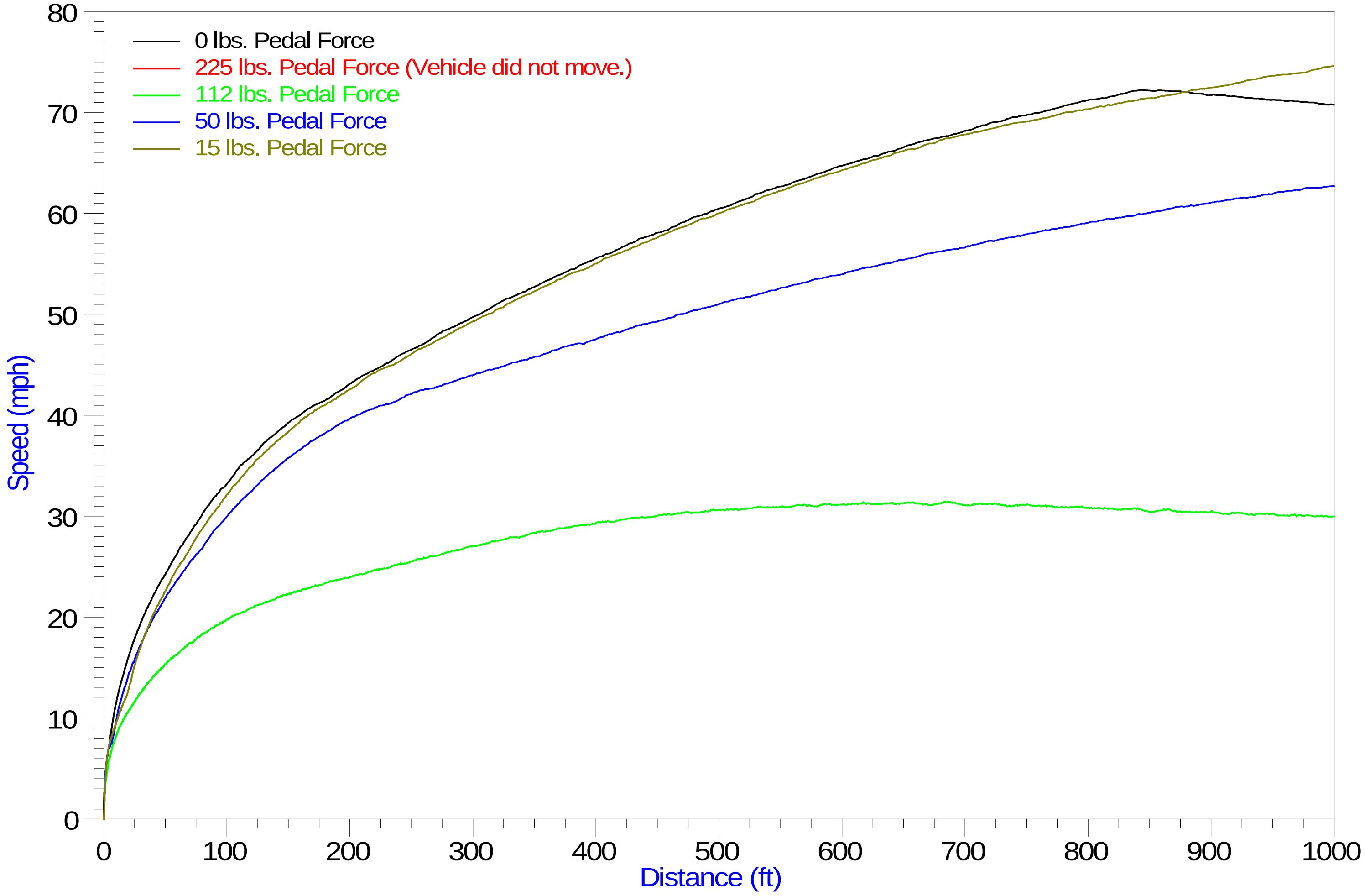
2007 Toyota Camry 6D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



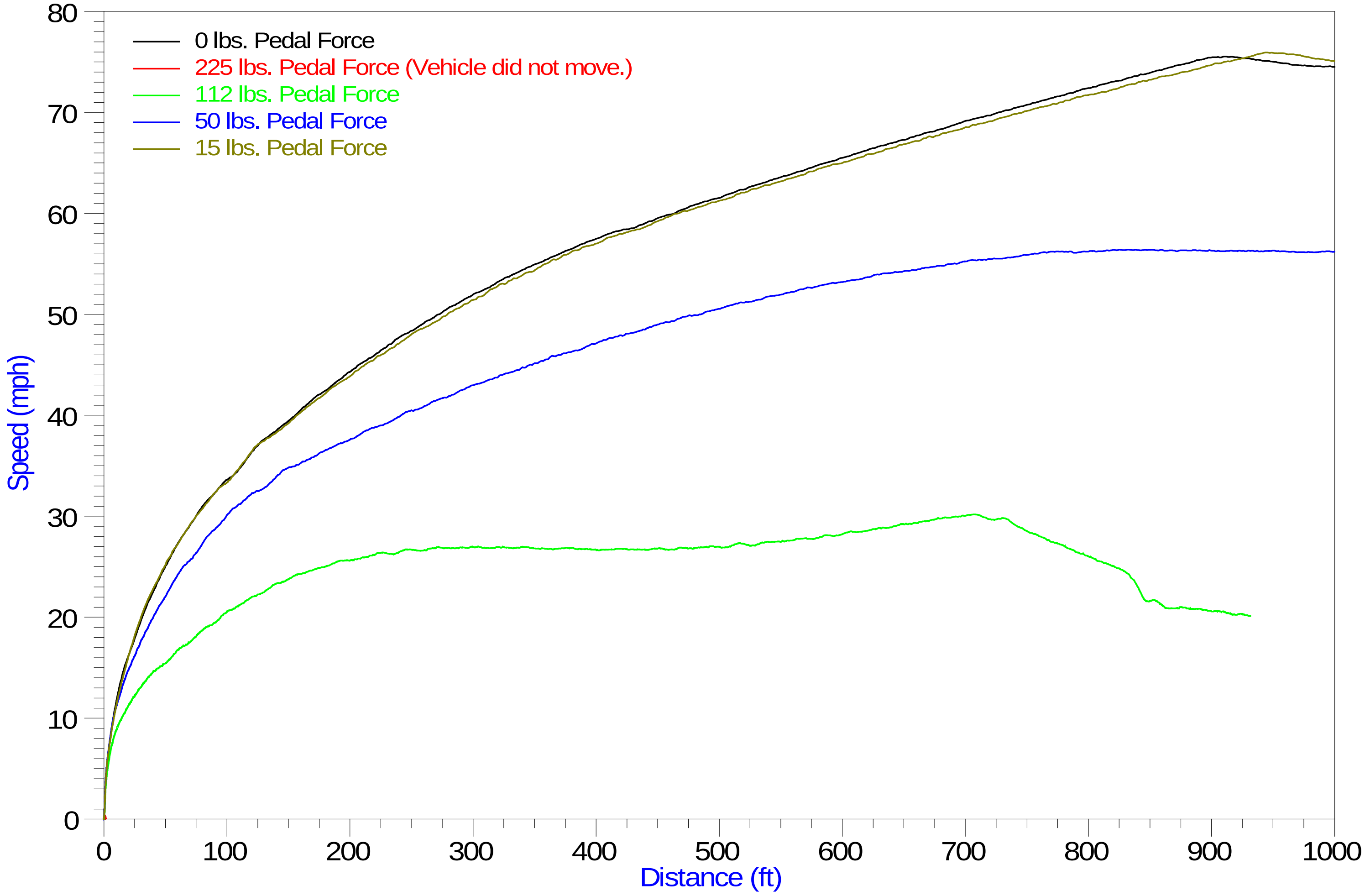
2005 Toyota Camry 7D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



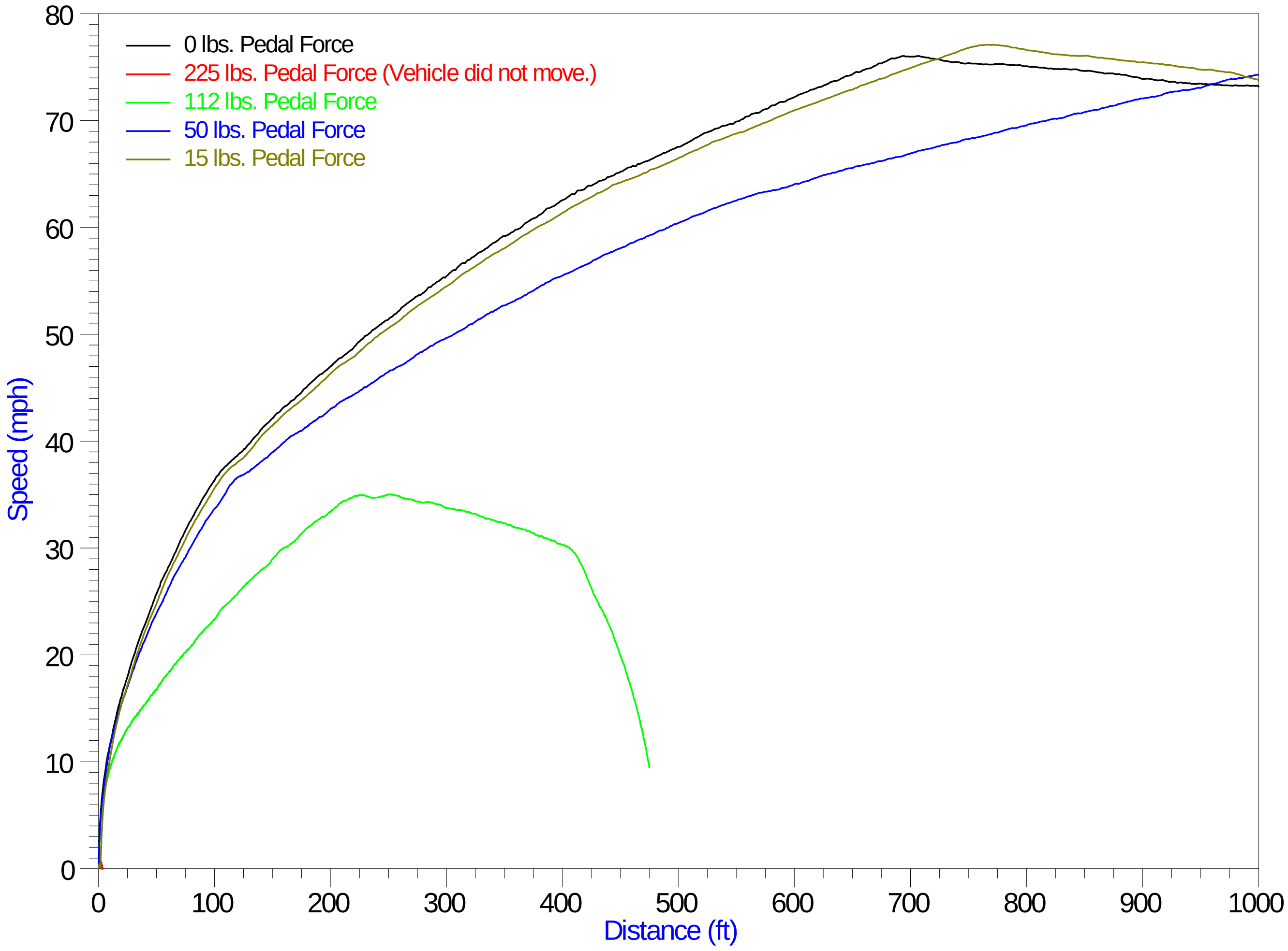
2001 Toyota Camry 8D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



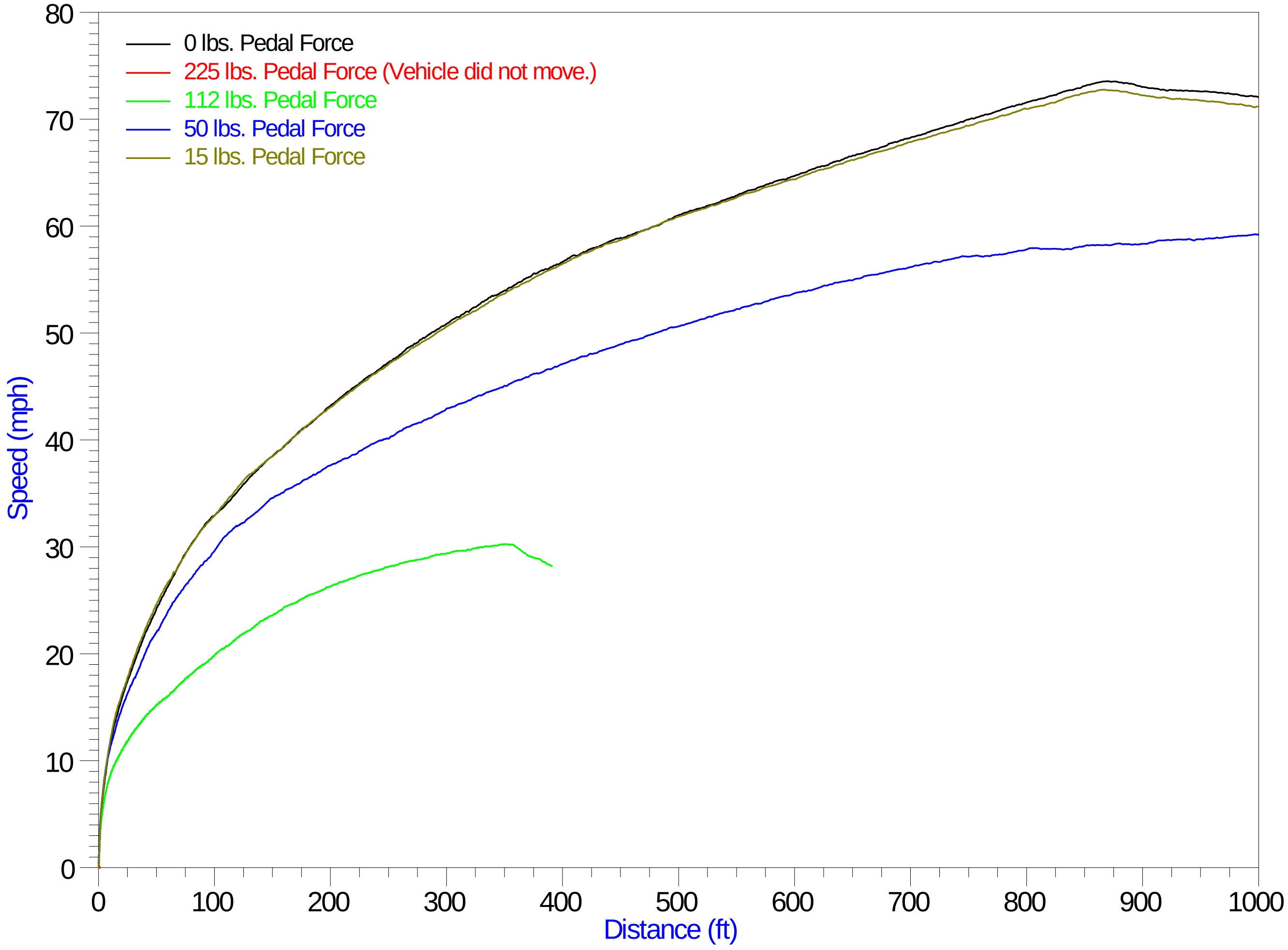
2005 Toyota Camry 9D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



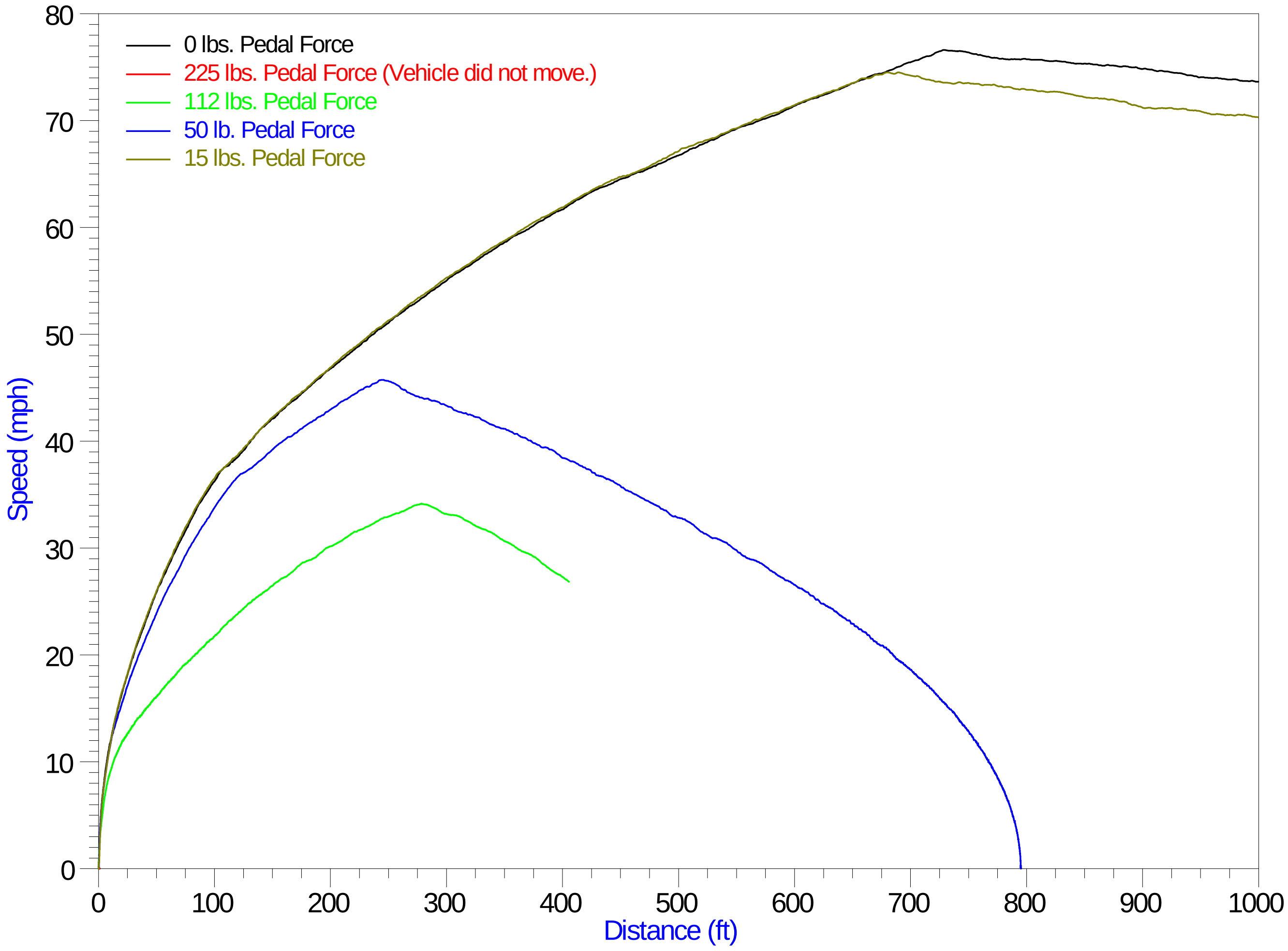
2007 Toyota Camry 10D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



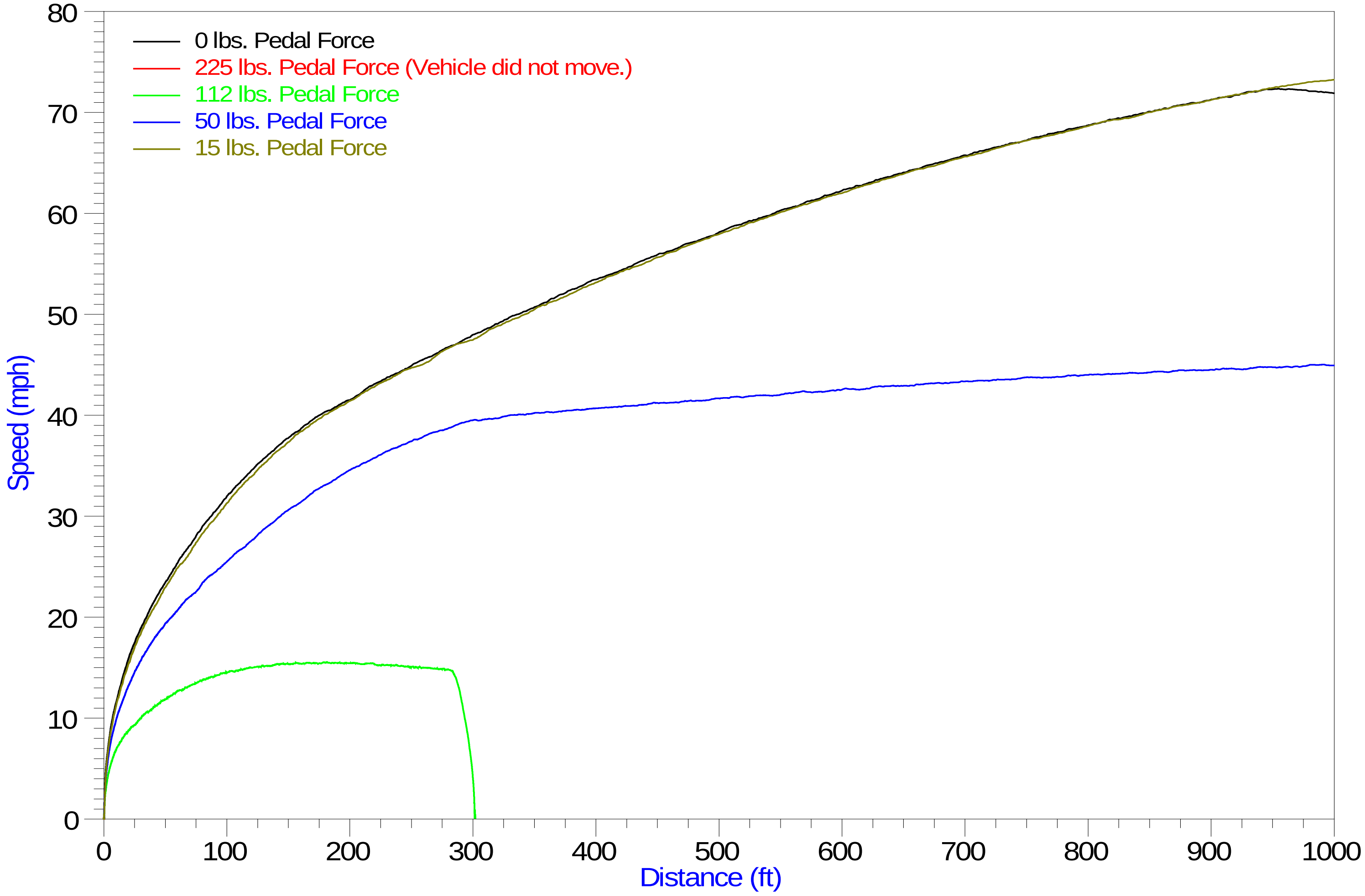
2005 Toyota Camry 11D
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



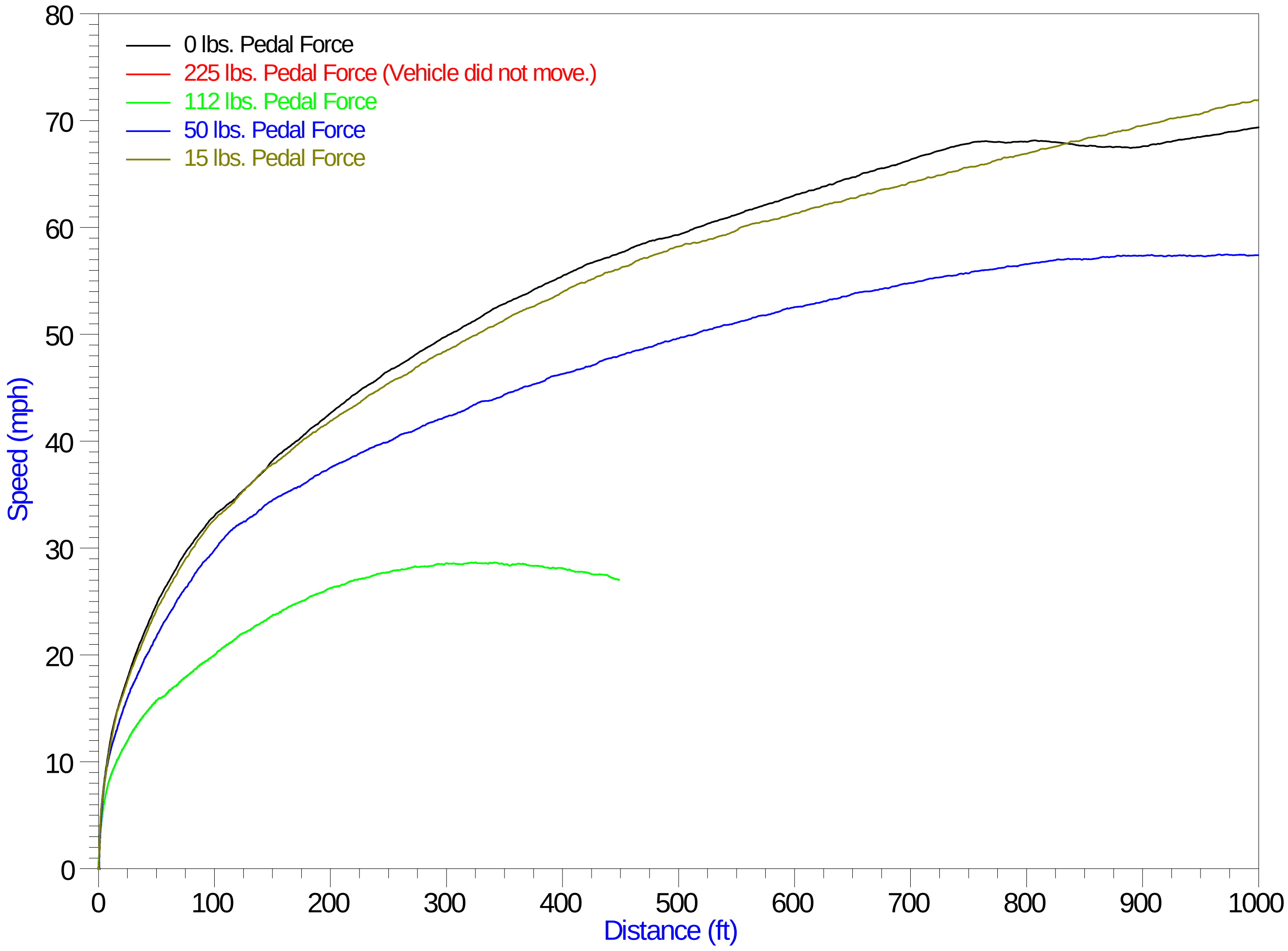
2007 Toyota Camry 12C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



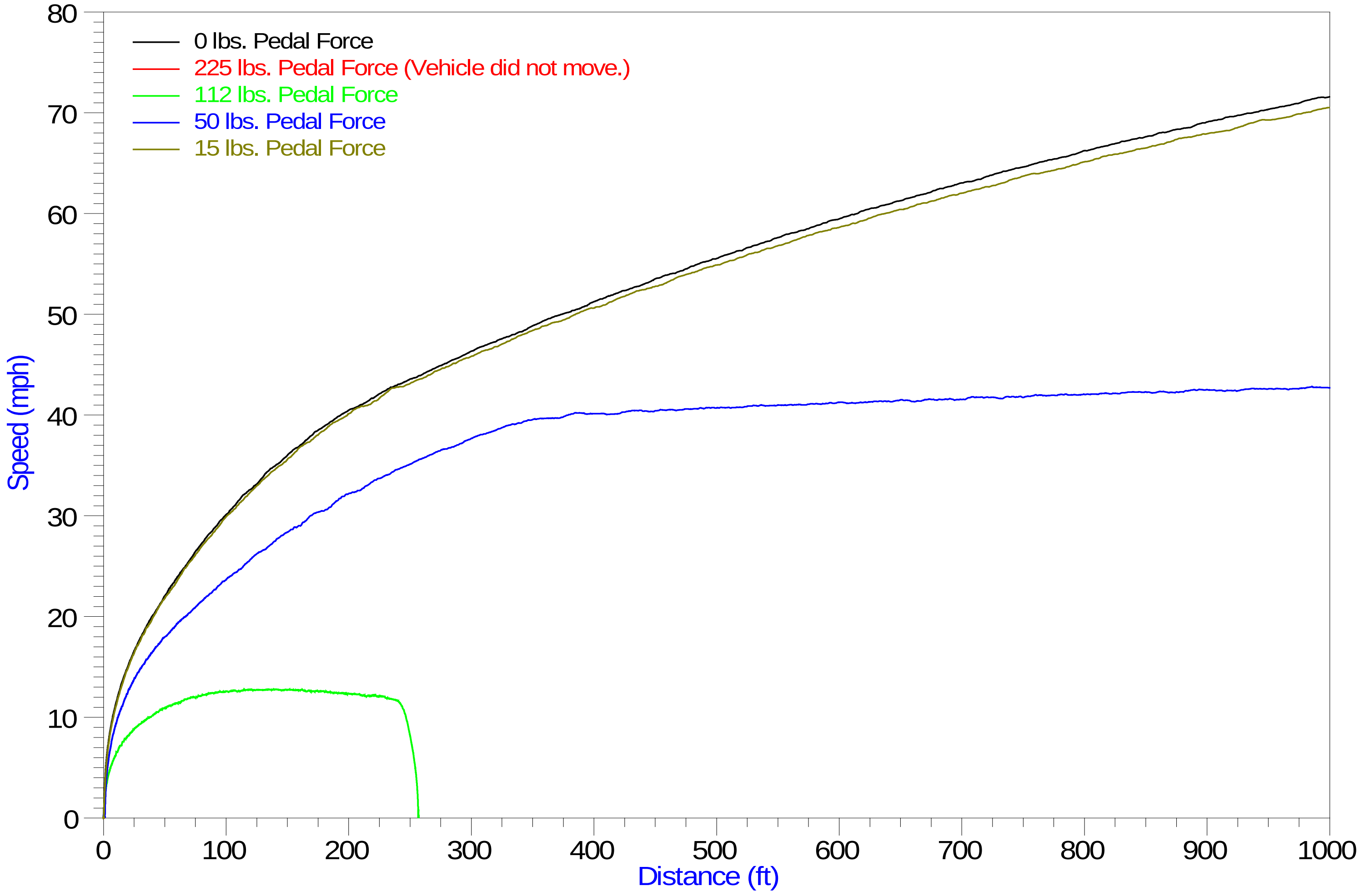
2002 Toyota Camry 13C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



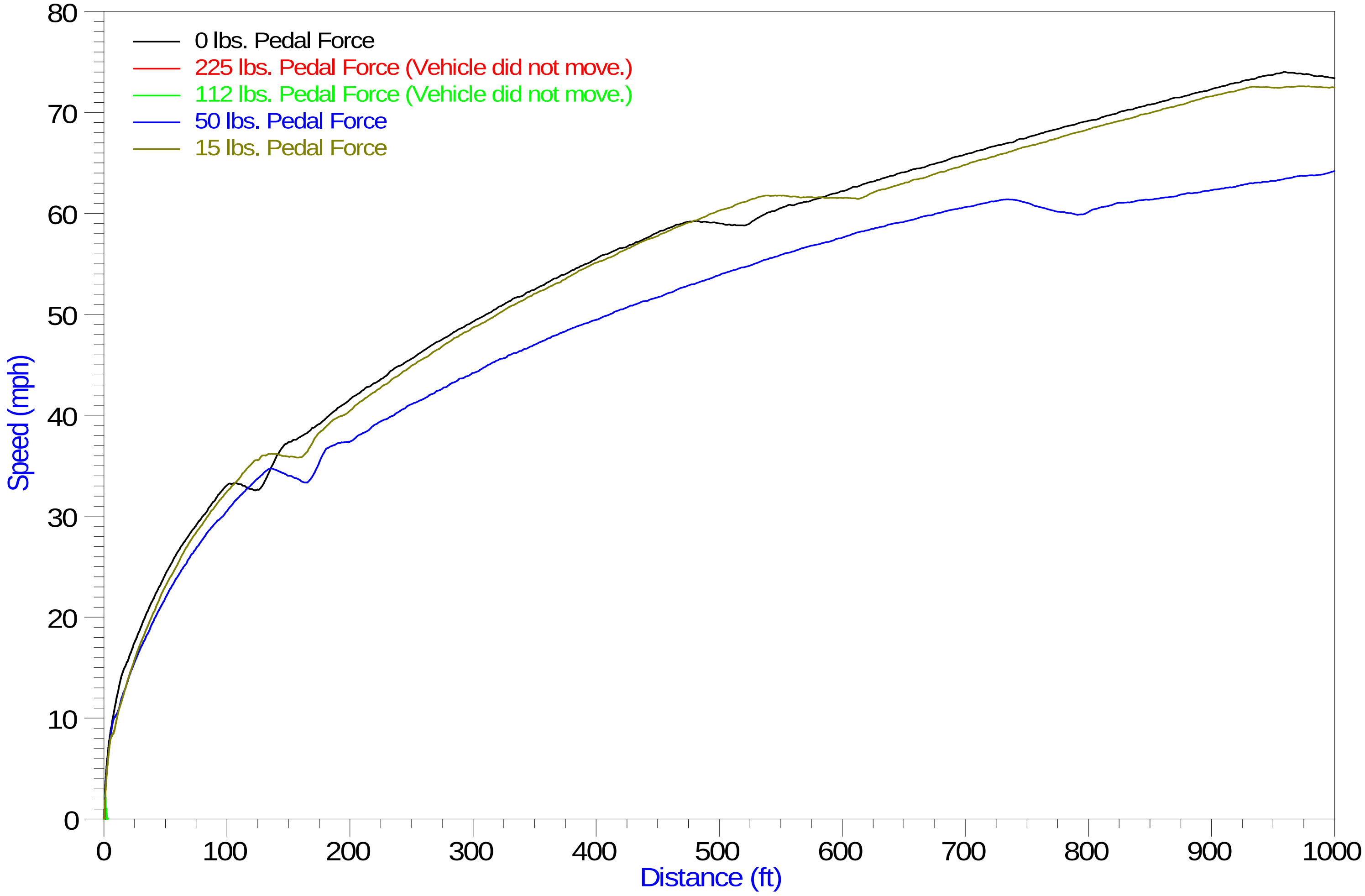
2004 Toyota Camry 14C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



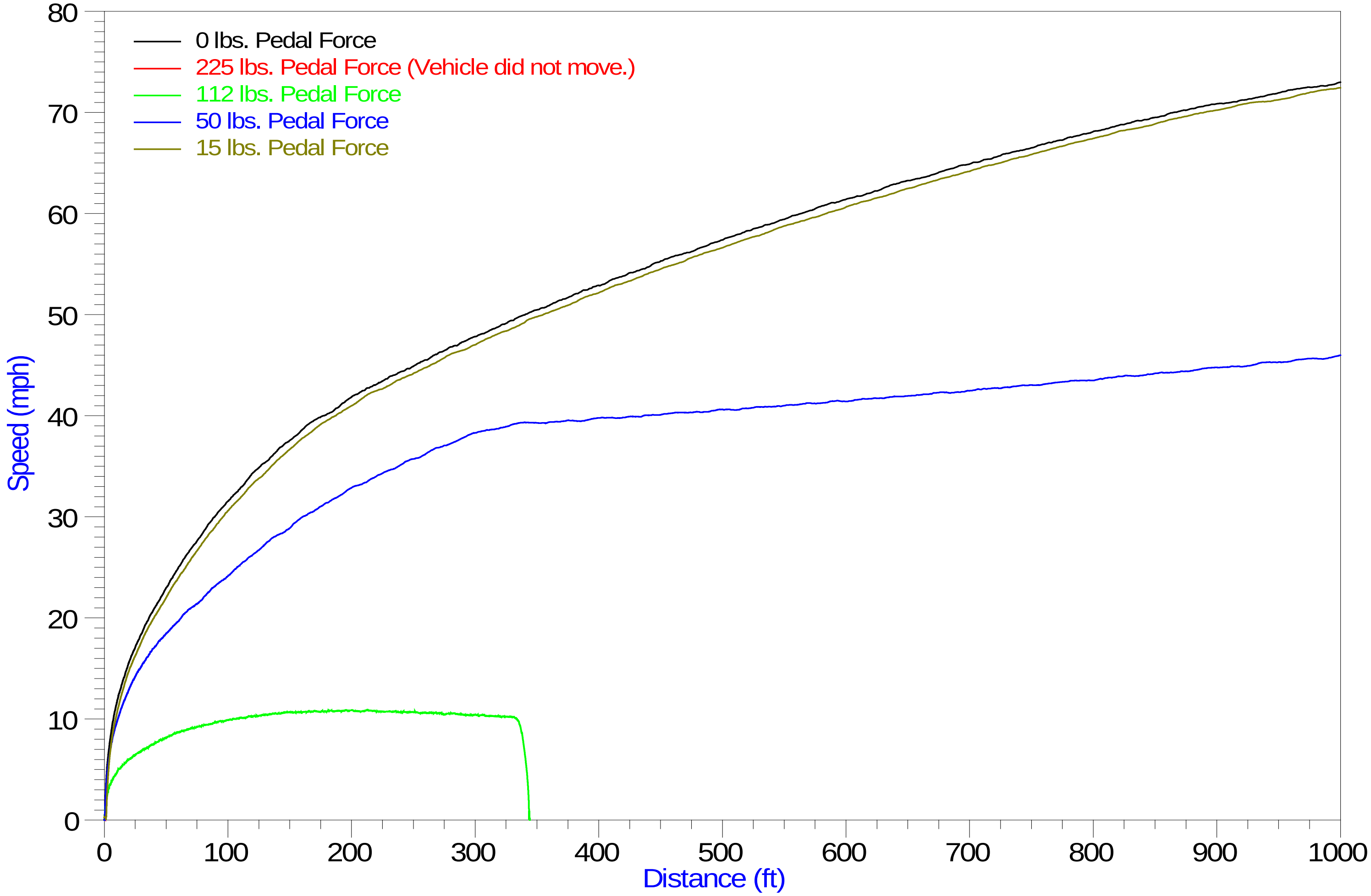
2003 Toyota Camry 15C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



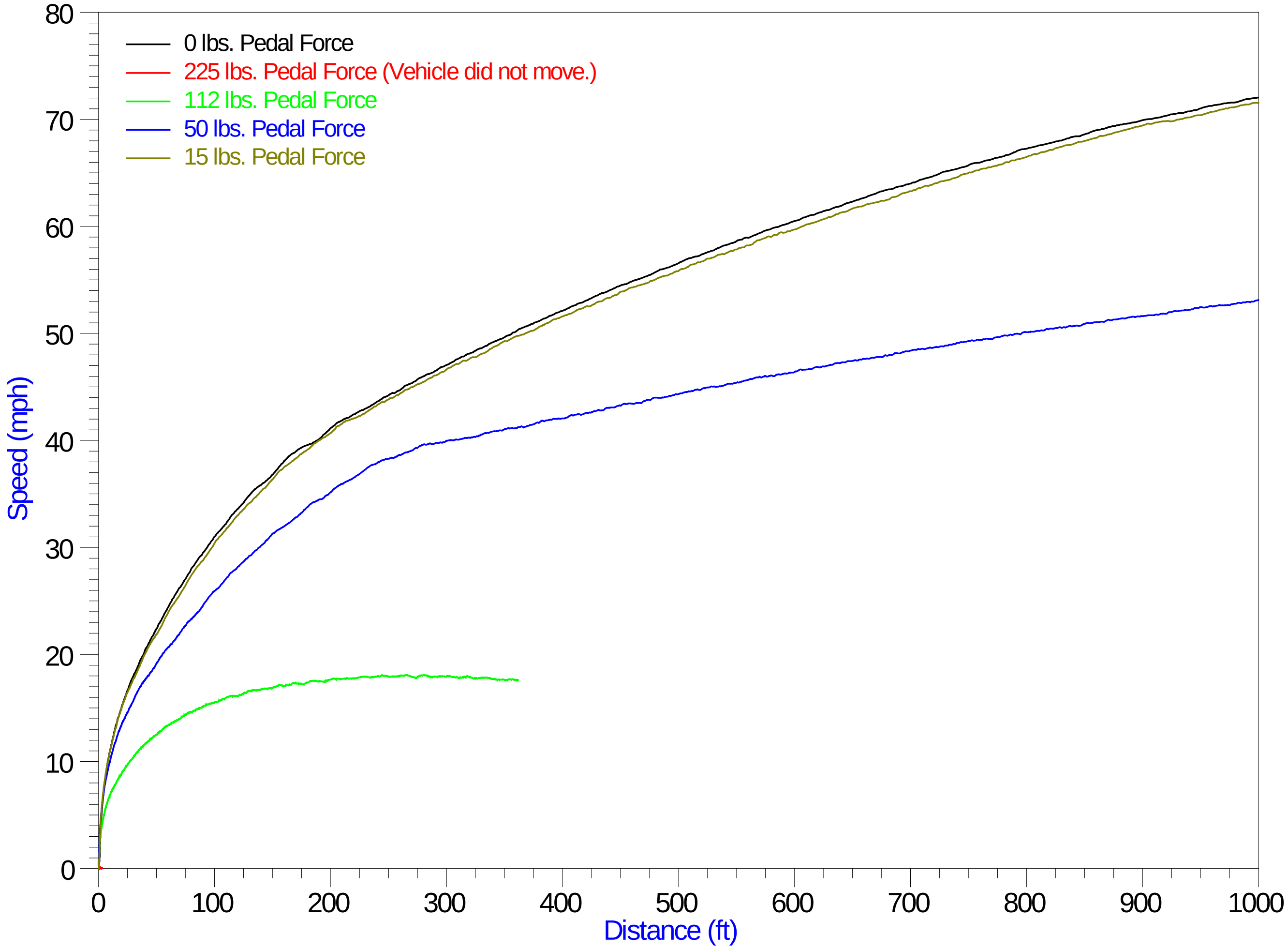
2009 Toyota Camry 16C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



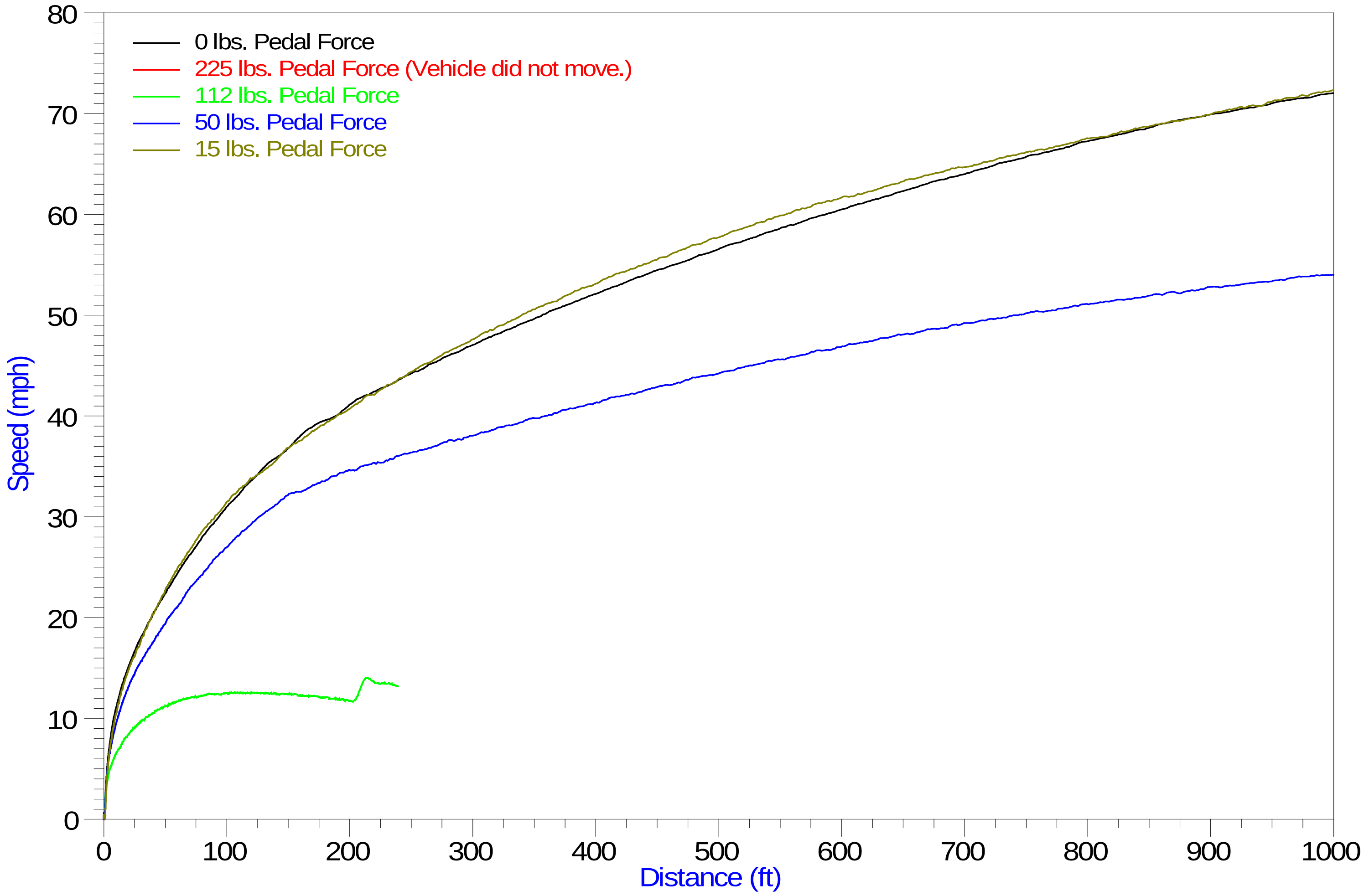
2004 Toyota Camry 17C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



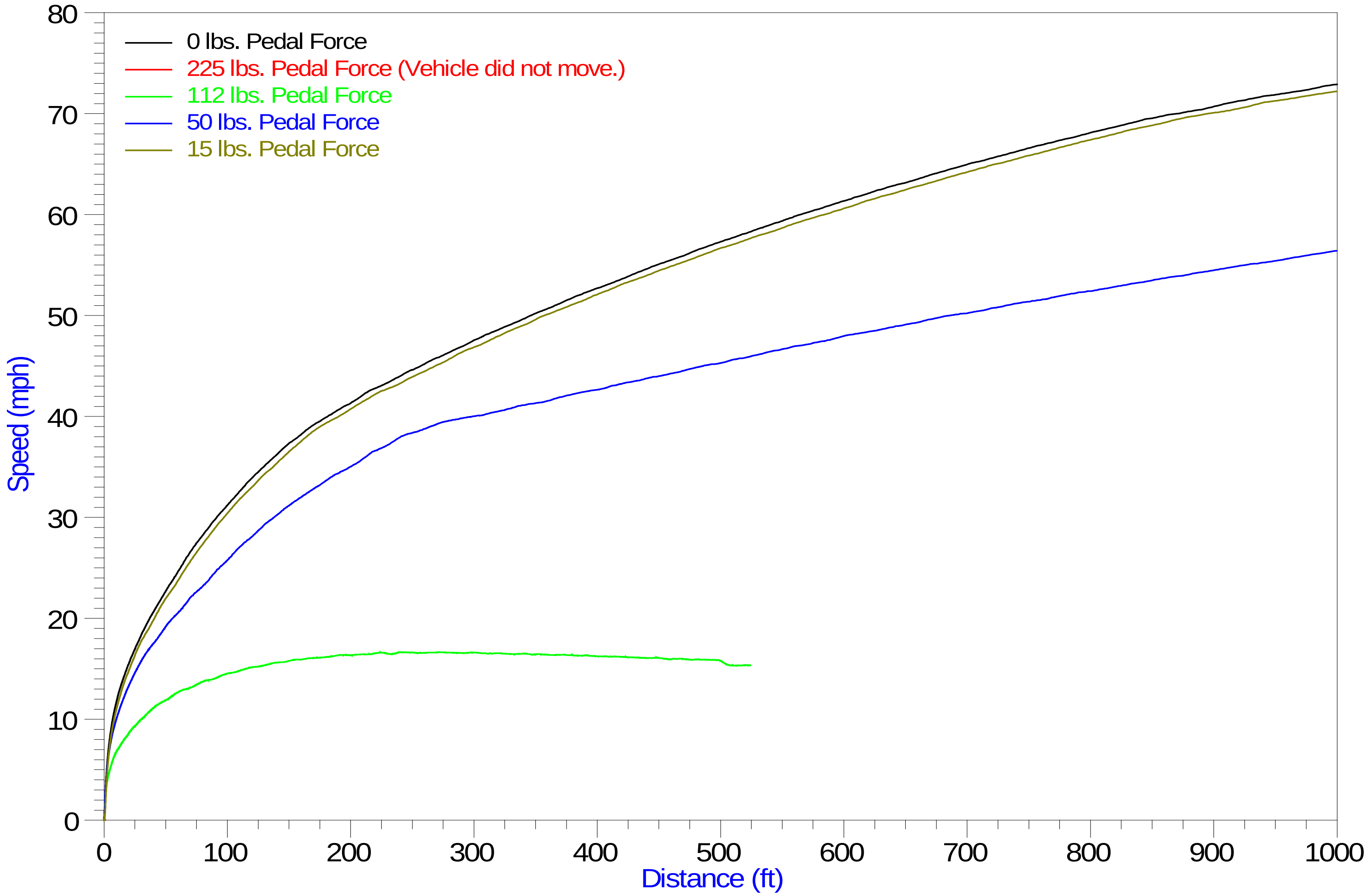
2004 Toyota Camry 18C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force



2007 Toyota Camry 19C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force

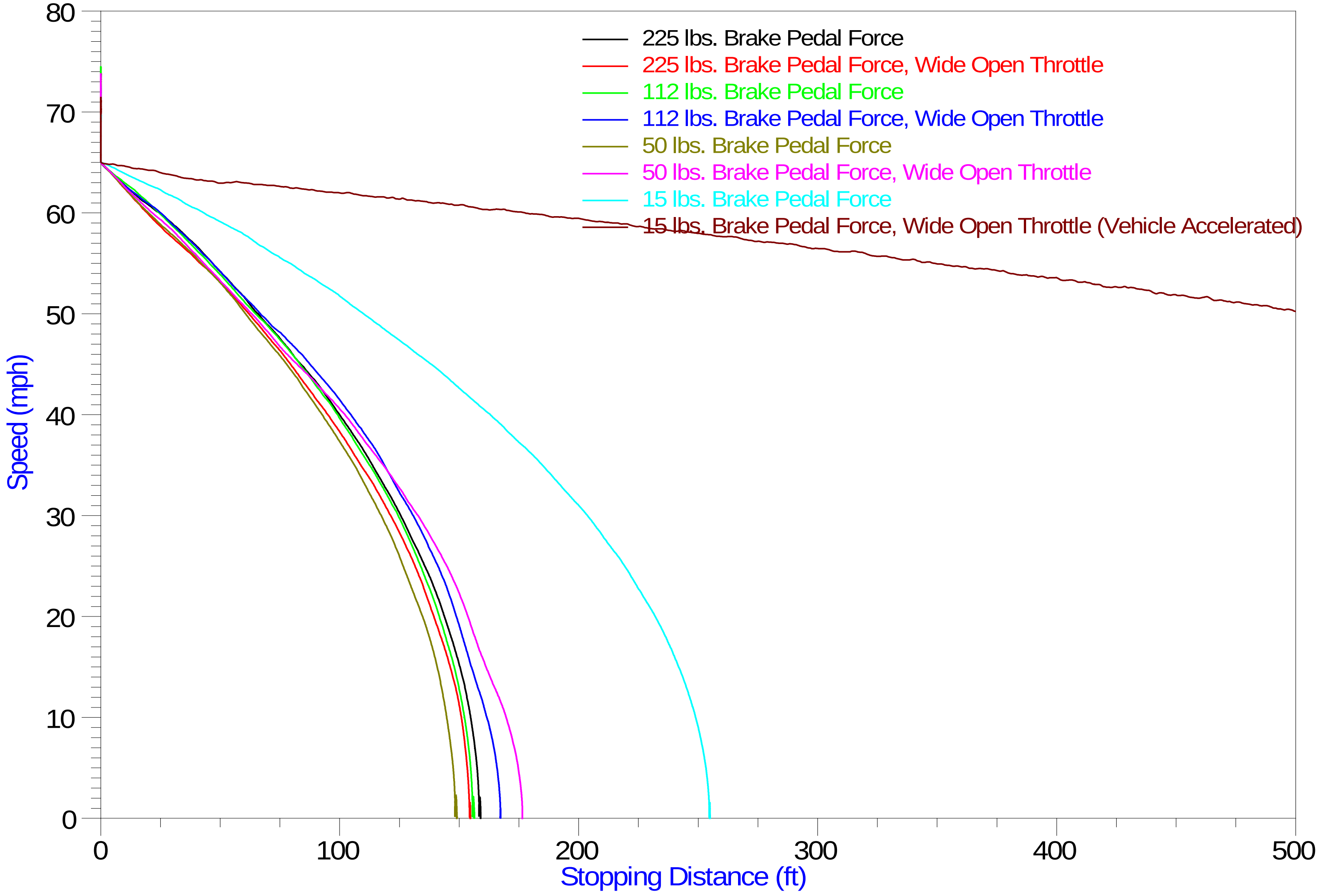


2004 Toyota Camry 20C
0 - 70 mph, No Vacuum, Varying Brake Pedal Force

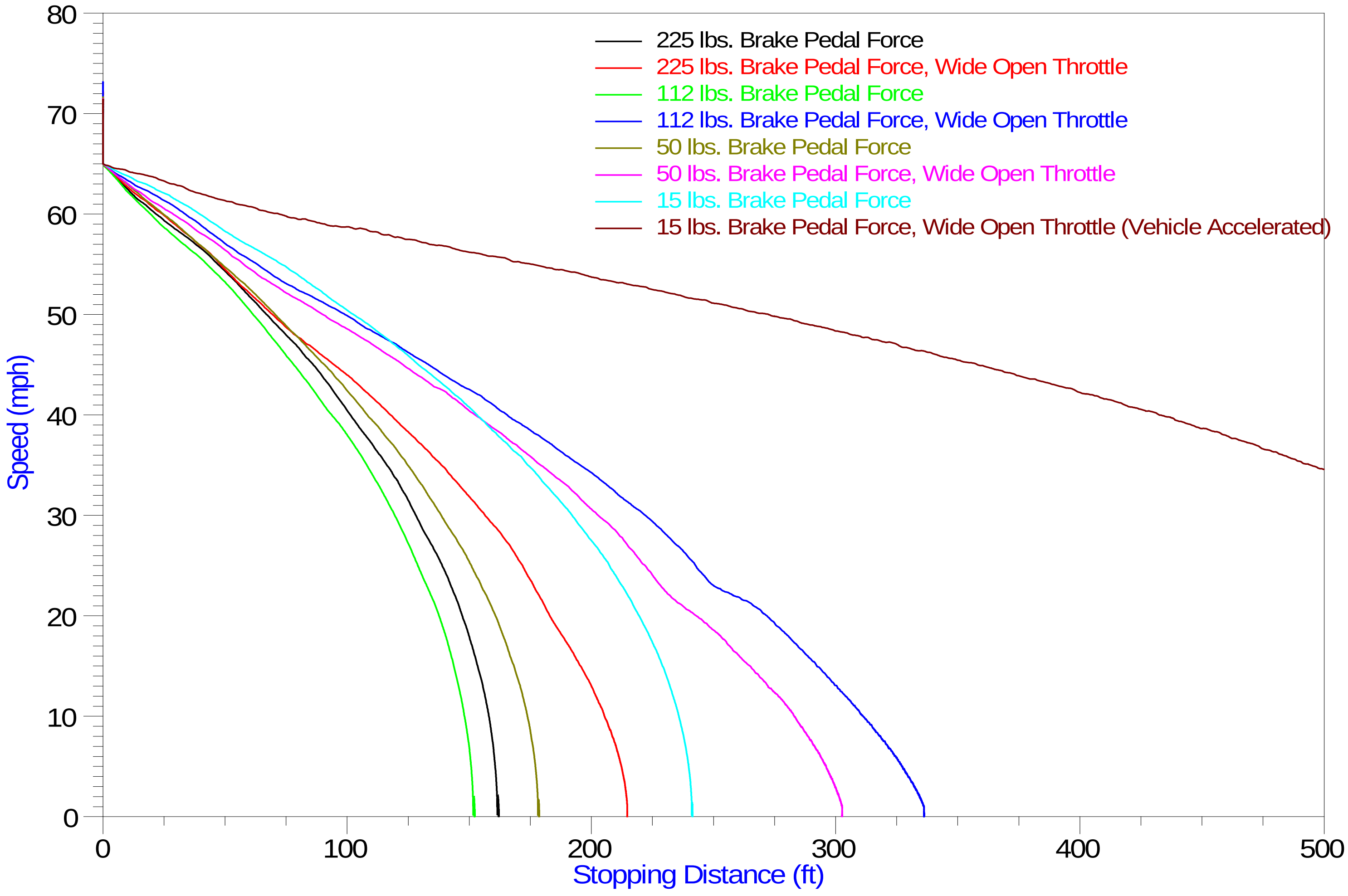


65 to 0 mph Brake Test
With Full Vacuum
Varying Brake Pedal Force
With and Without Wide Open Throttle

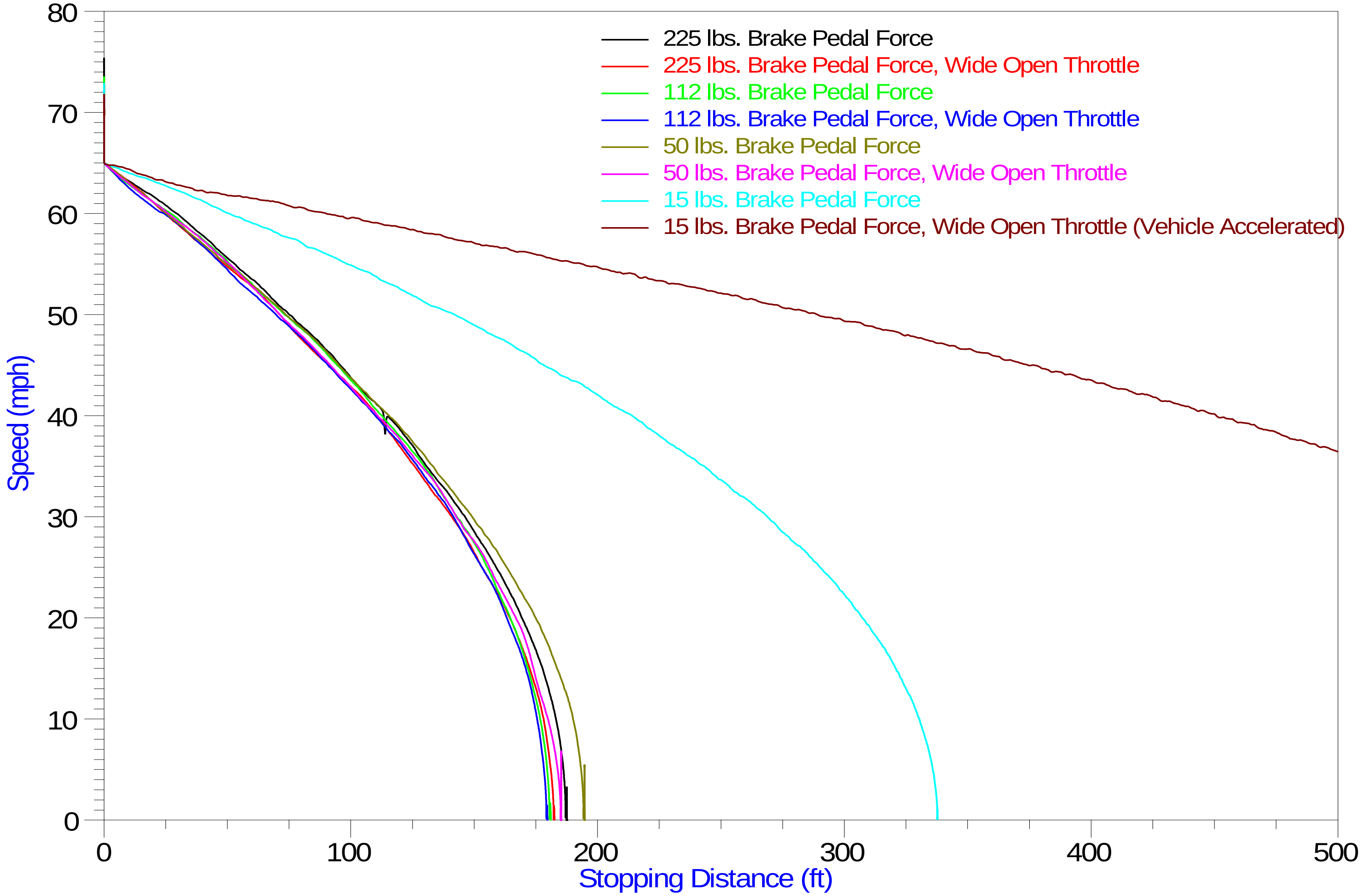
2002 Toyota Camry 1D
Full Vacuum Brake Tests



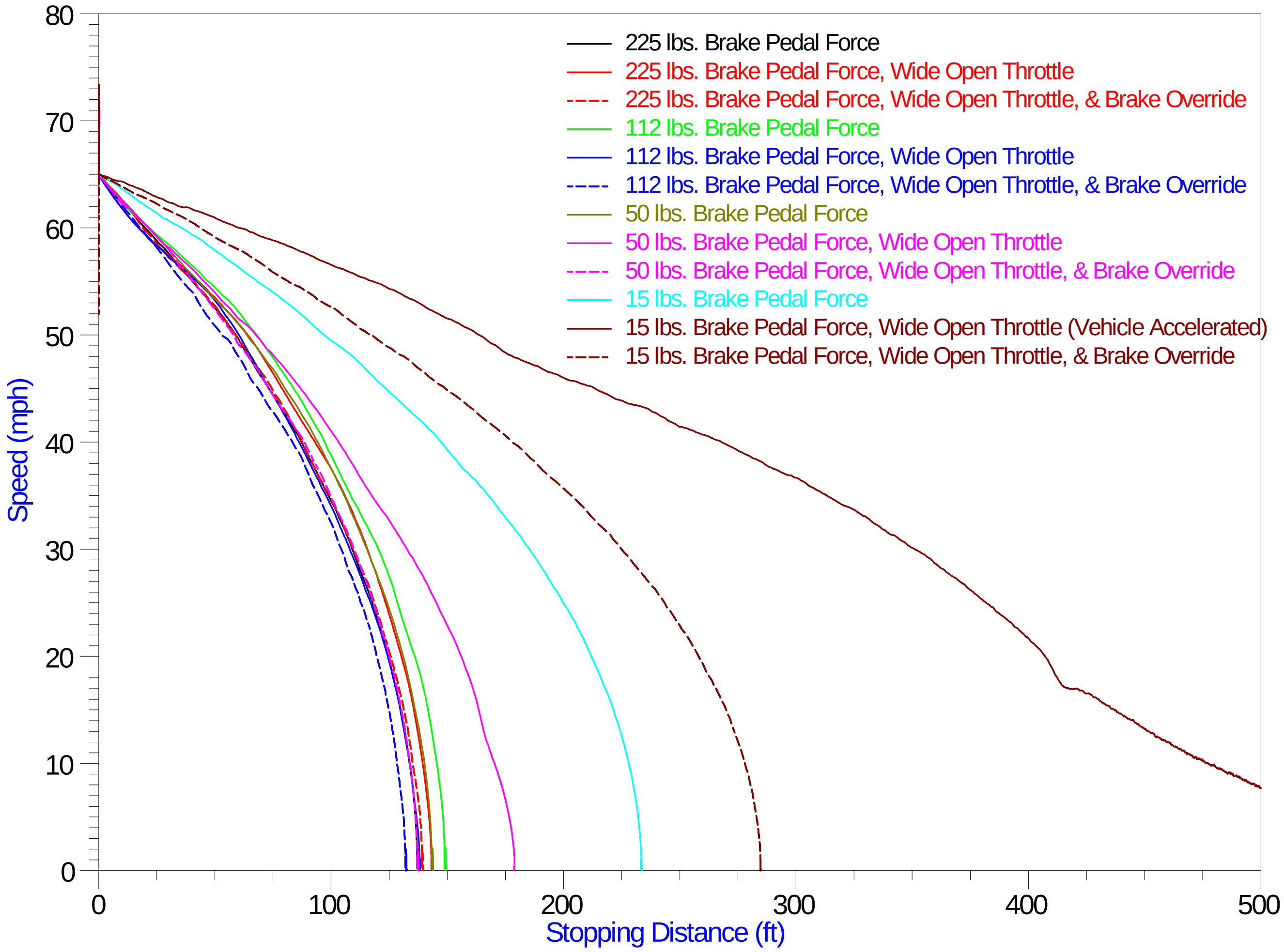
2002 Toyota Camry 2D
Full Vacuum Brake Tests



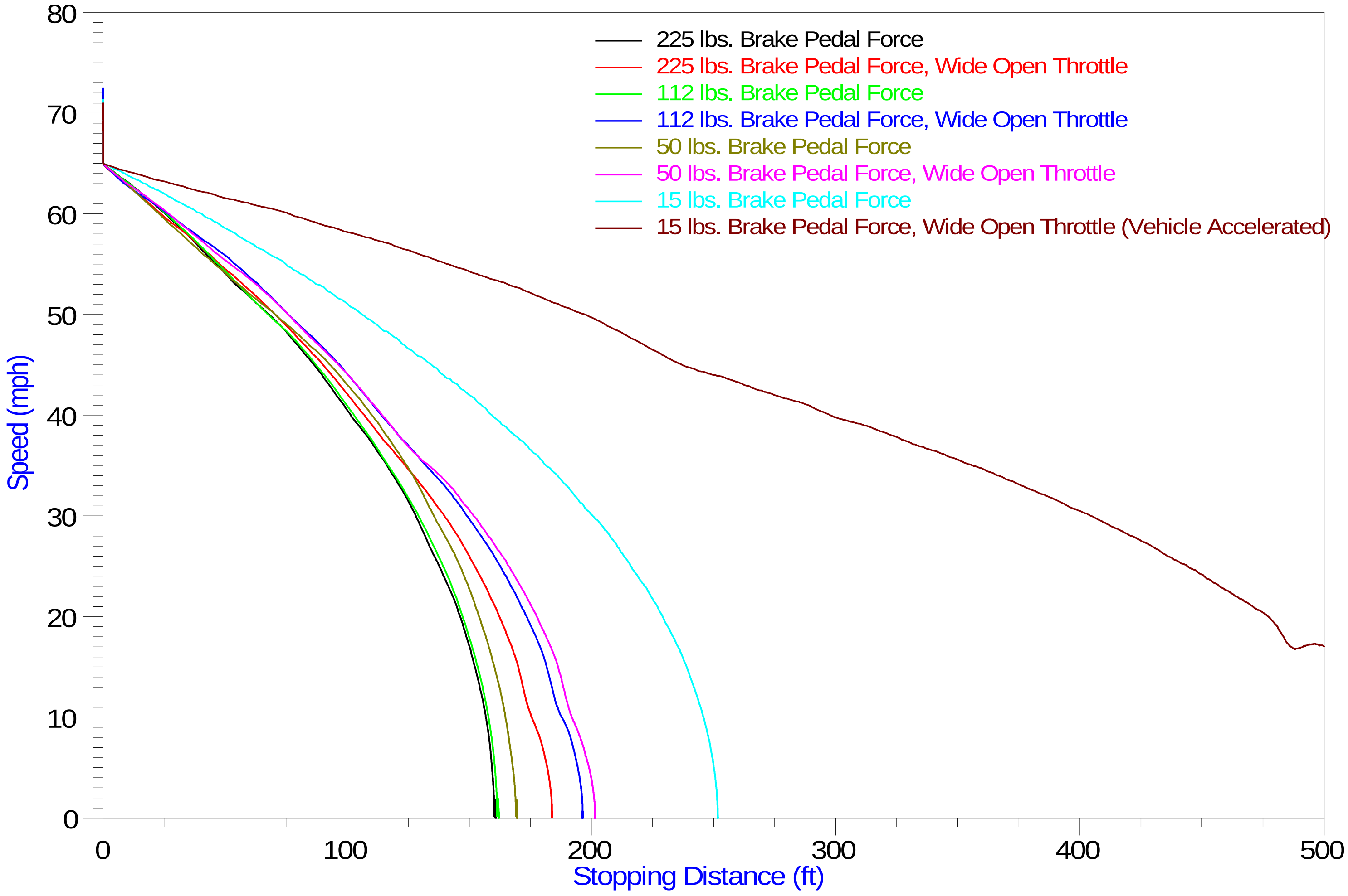
2001 Toyota Camry 3D
Full Vacuum Brake Tests

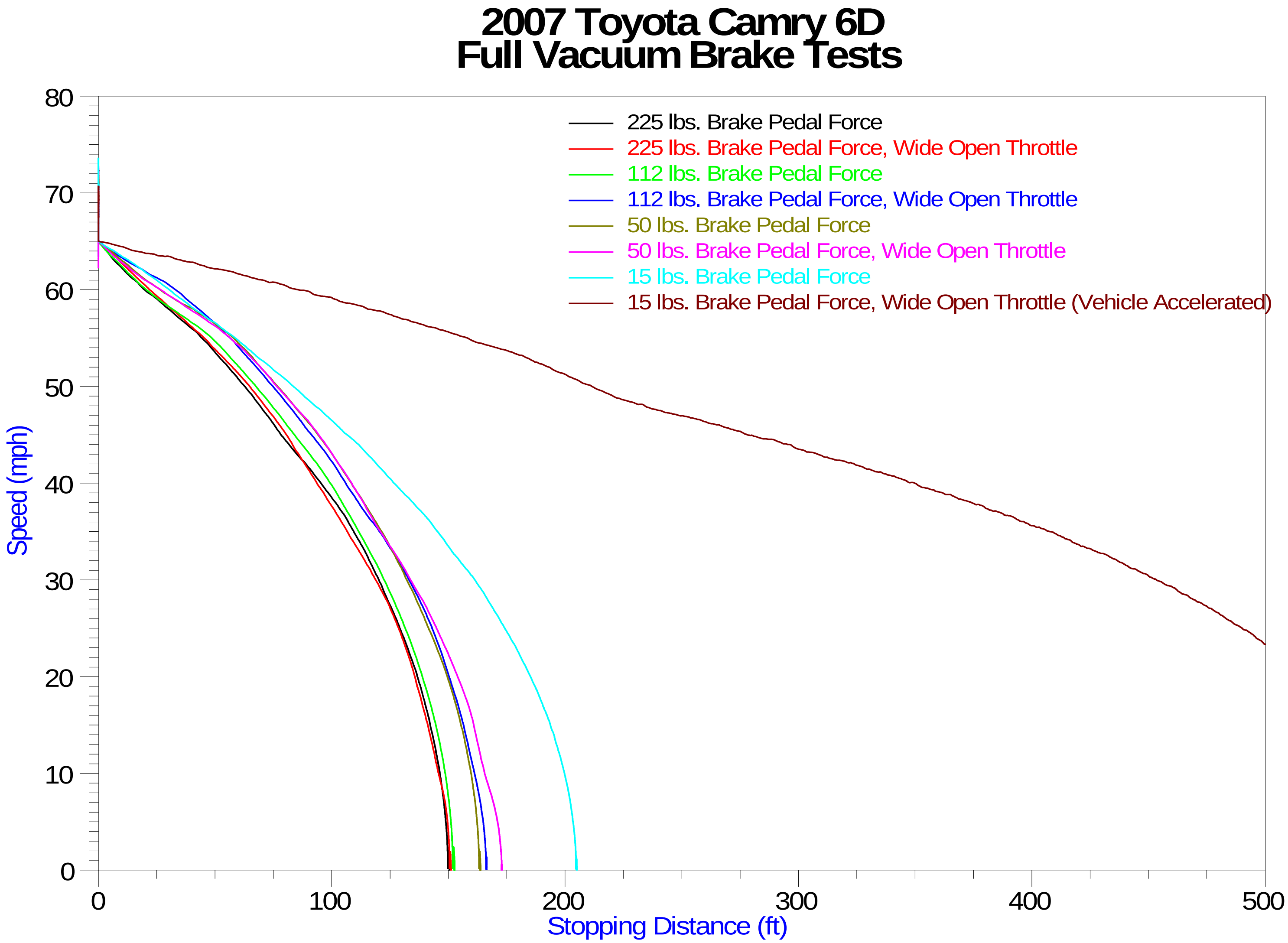


2007 Toyota Camry 4D
Full Vacuum Brake Tests



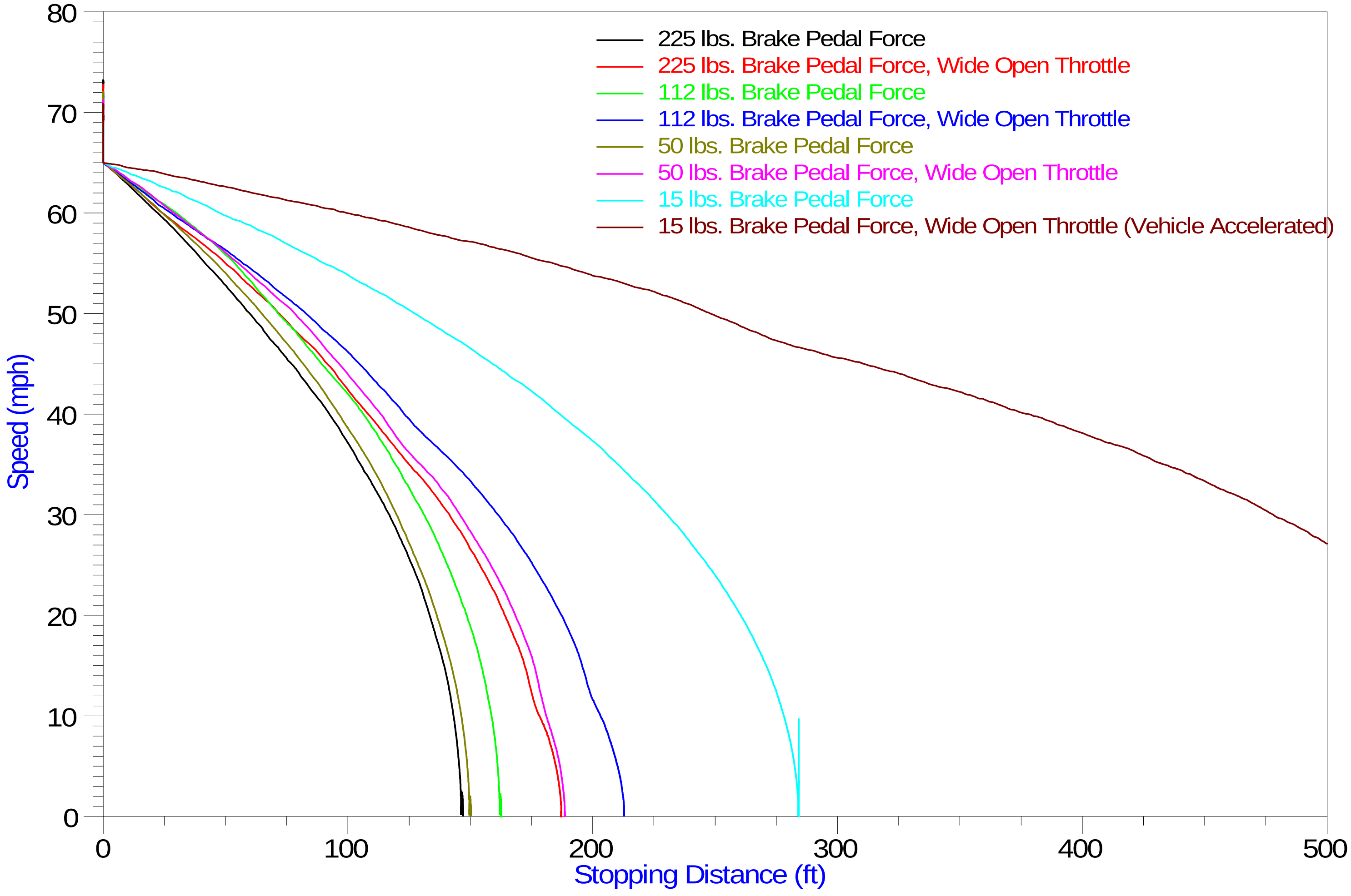
2006 Toyota Camry 5D
Full Vacuum Brake Tests



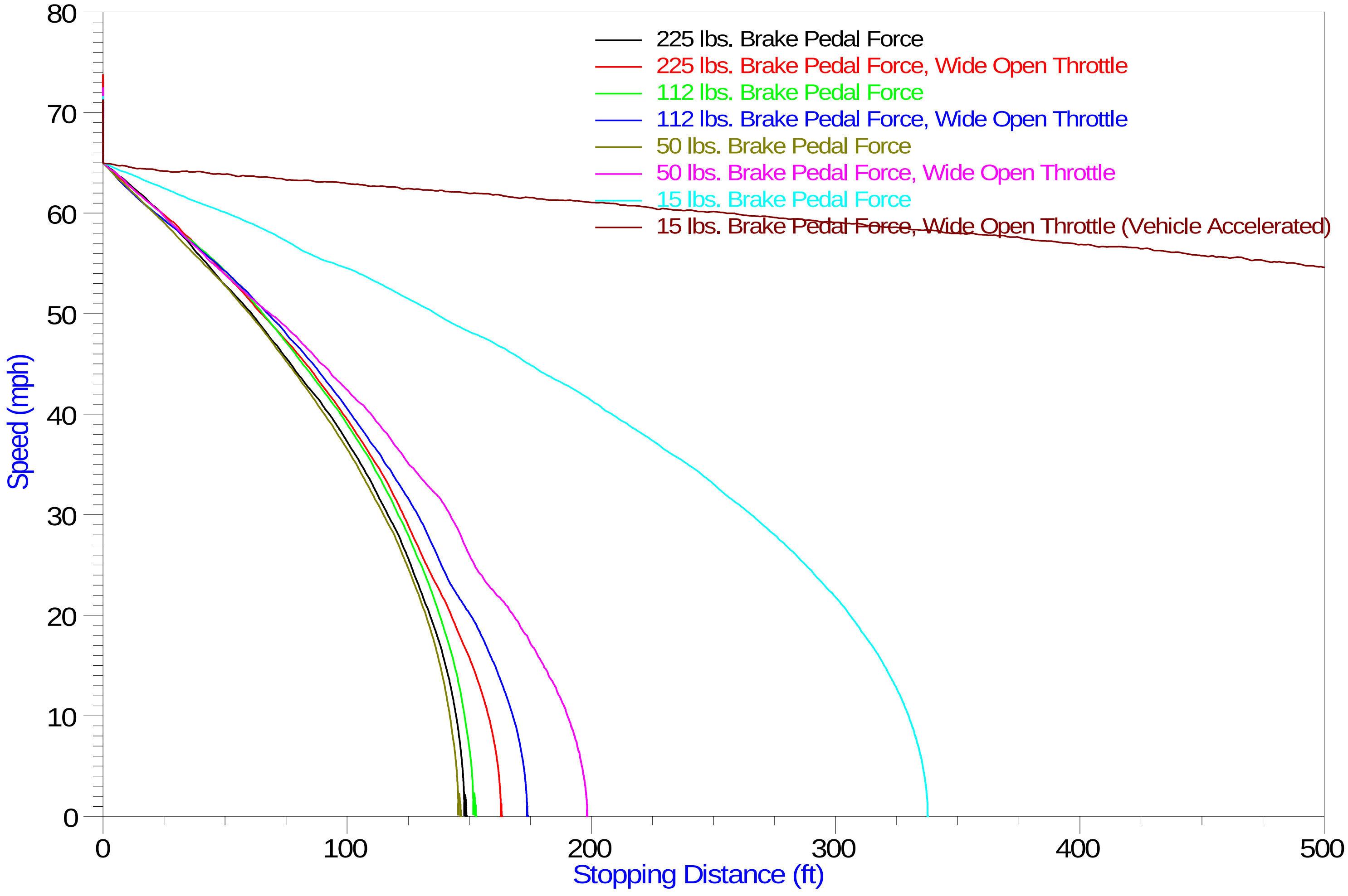


2007 Toyota Camry 6D
Full Vacuum Brake Tests

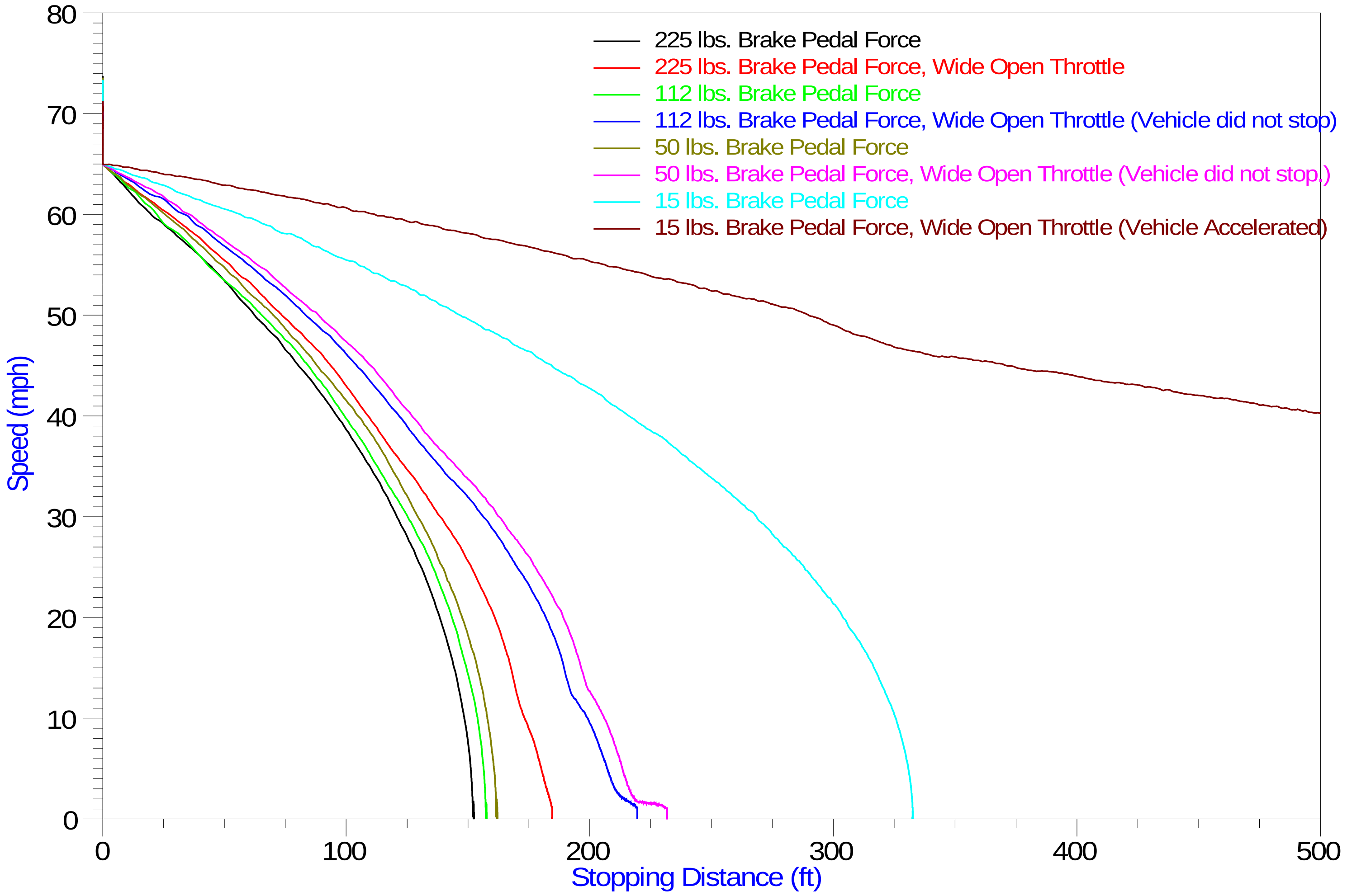
2005 Toyota Camry 7D
Full Vacuum Brake Tests



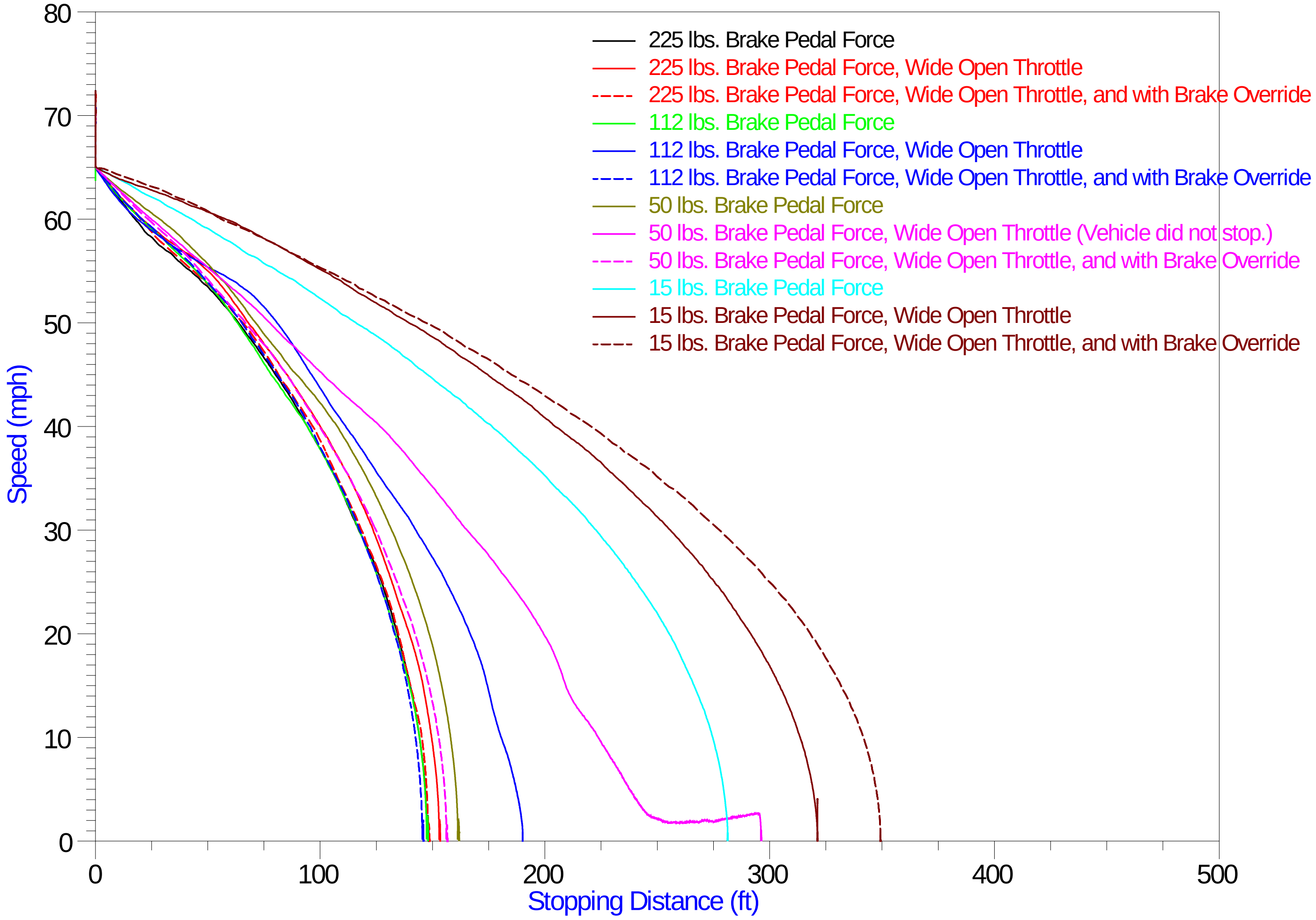
2001 Toyota Camry 8D
Full Vacuum Brake Tests



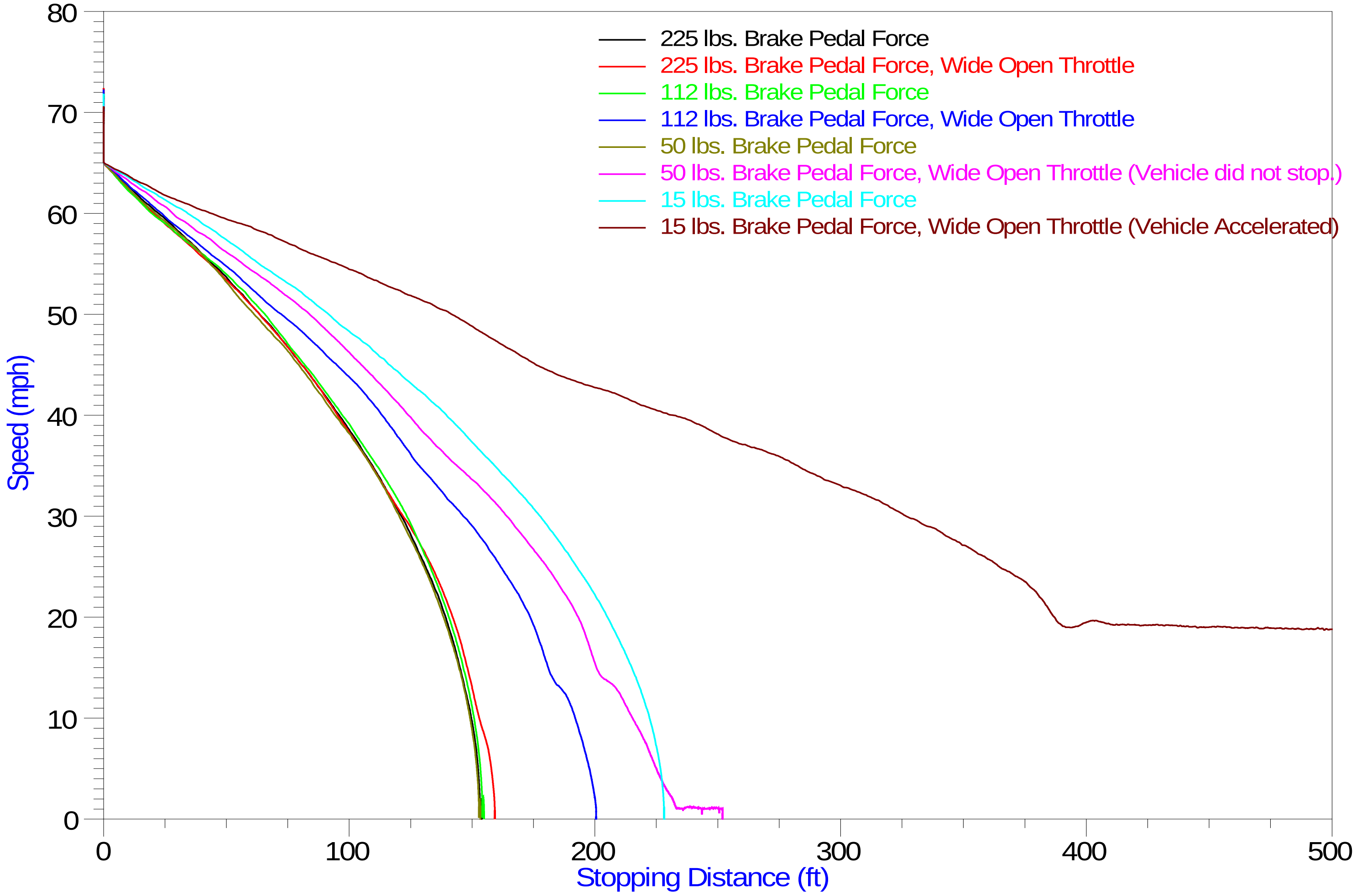
2005 Toyota Camry 9D
Full Vacuum Brake Tests



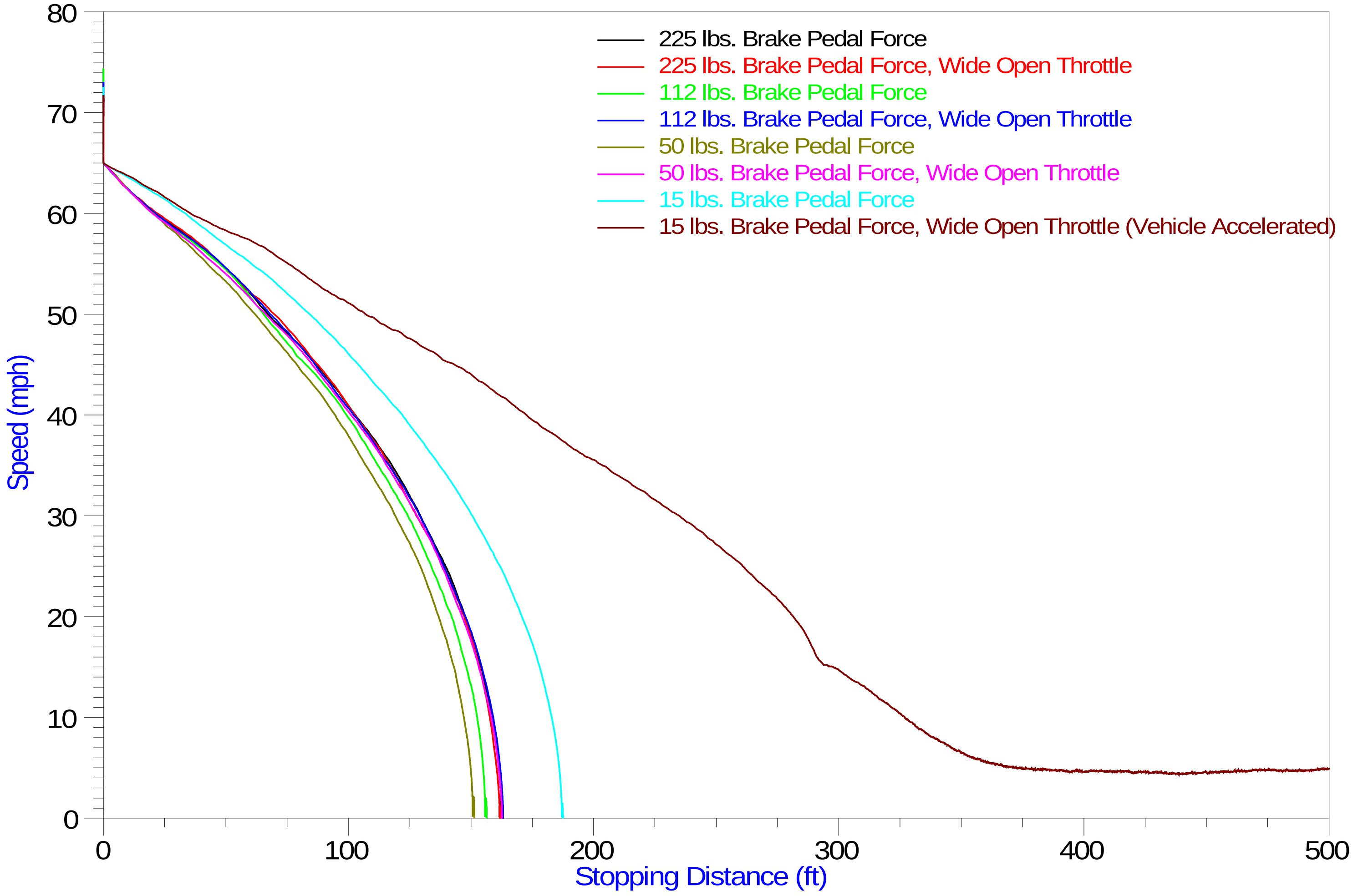
2007 Toyota Camry 10D
Full Vacuum Brake Tests



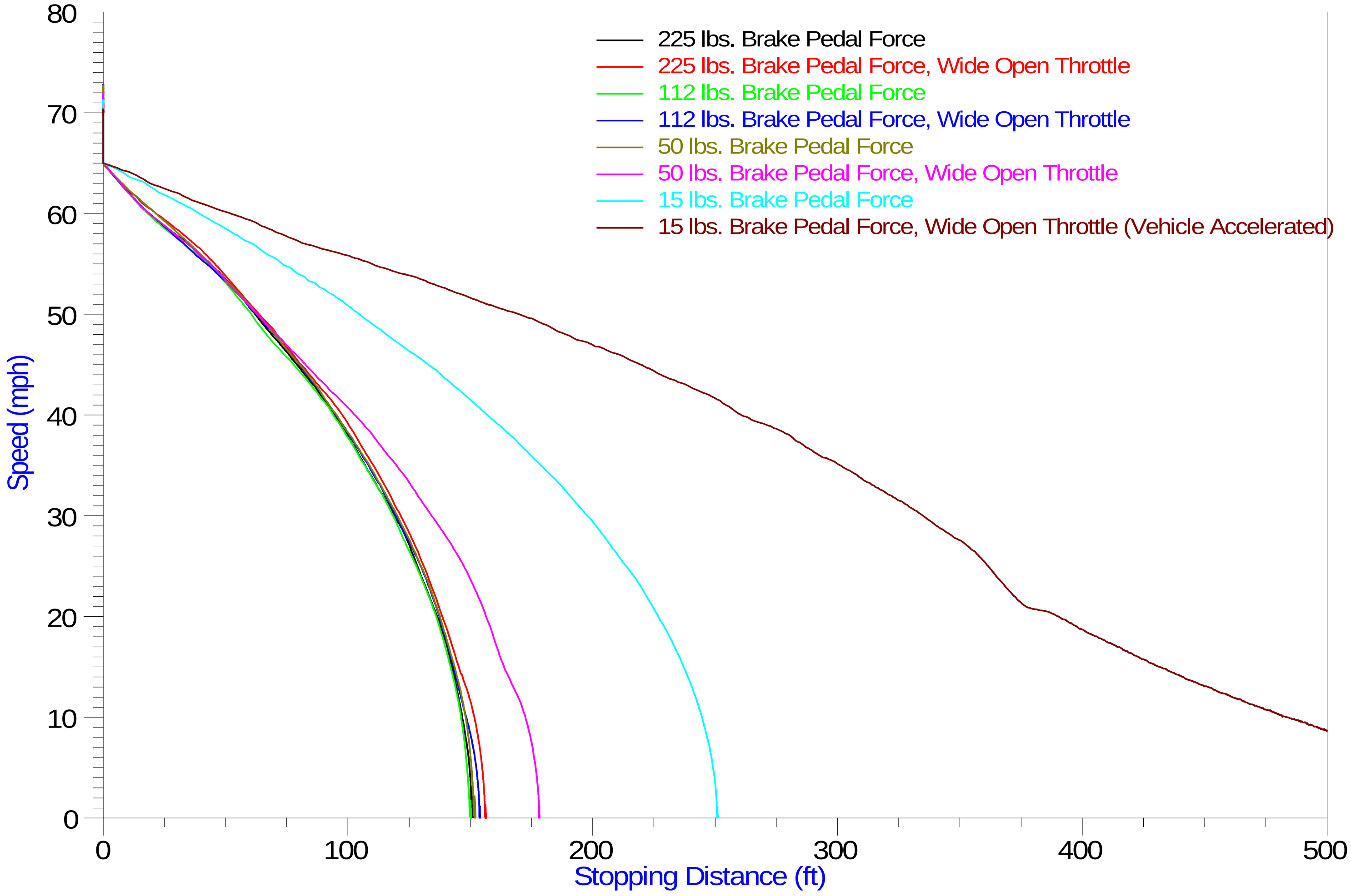
2005 Toyota Camry 11D
Full Vacuum Brake Tests



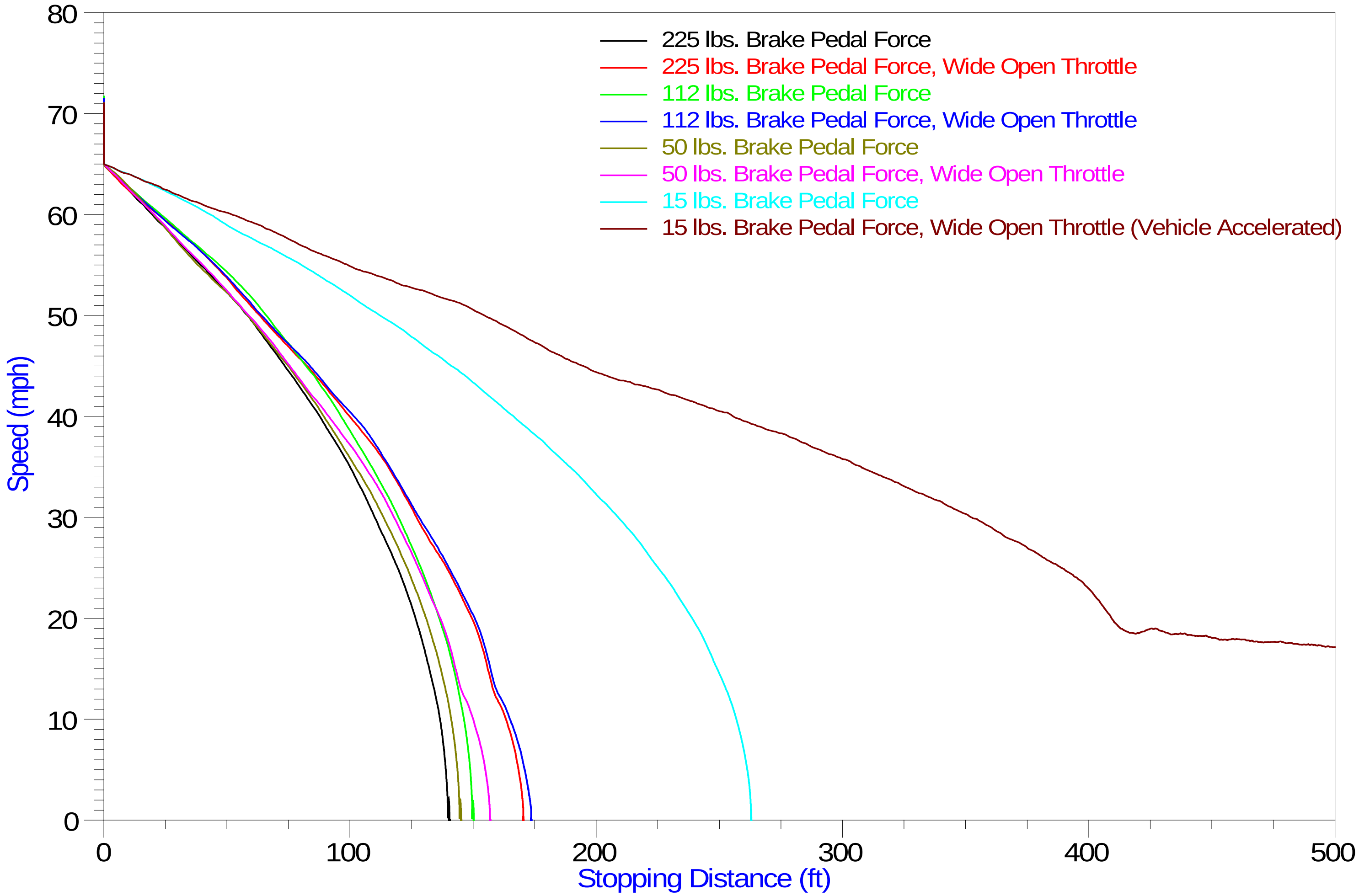
2007 Toyota Camry 12C
Full Vacuum Brake Tests



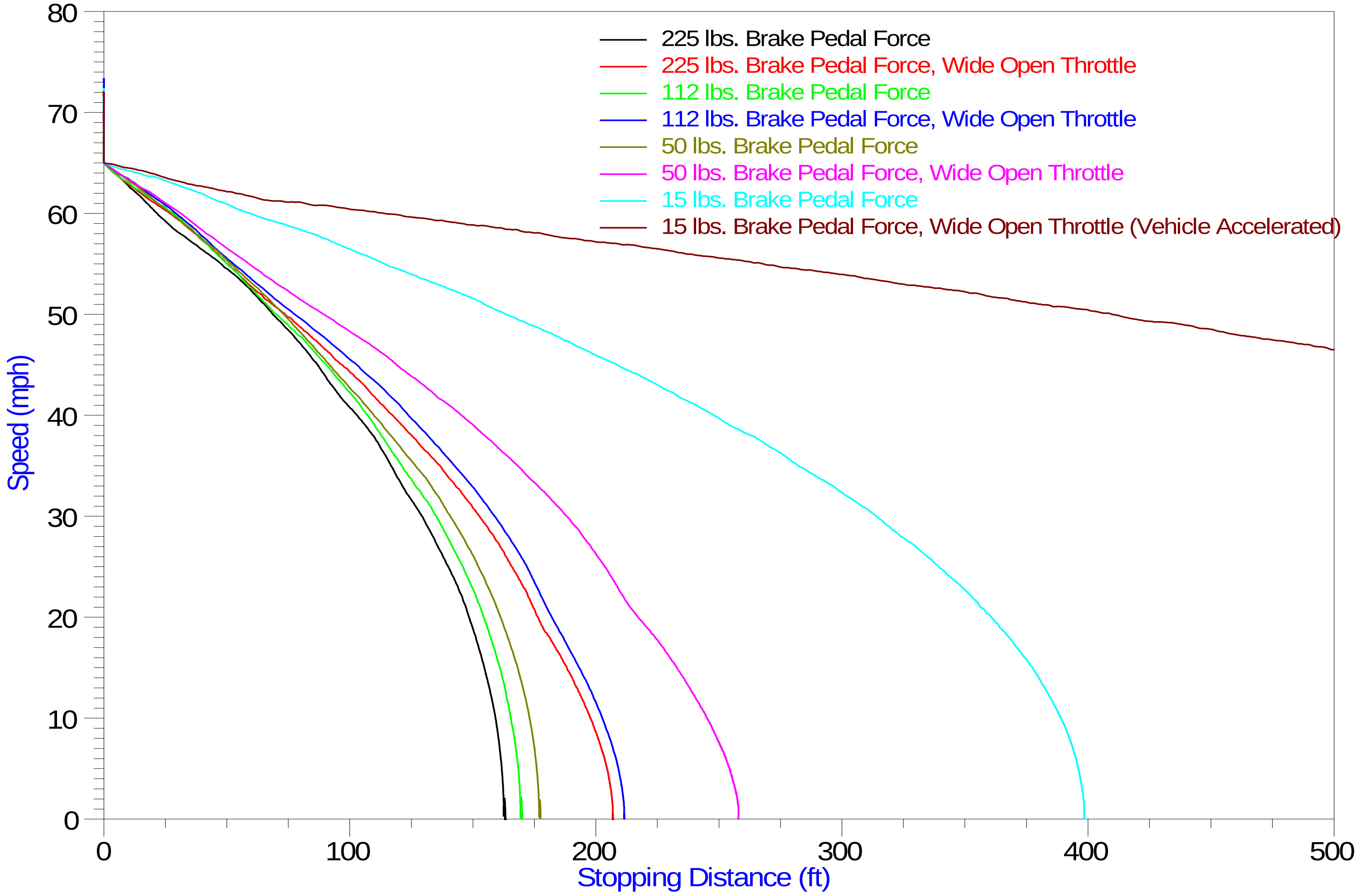
2002 Toyota Camry 13C
Full Vacuum Brake Tests

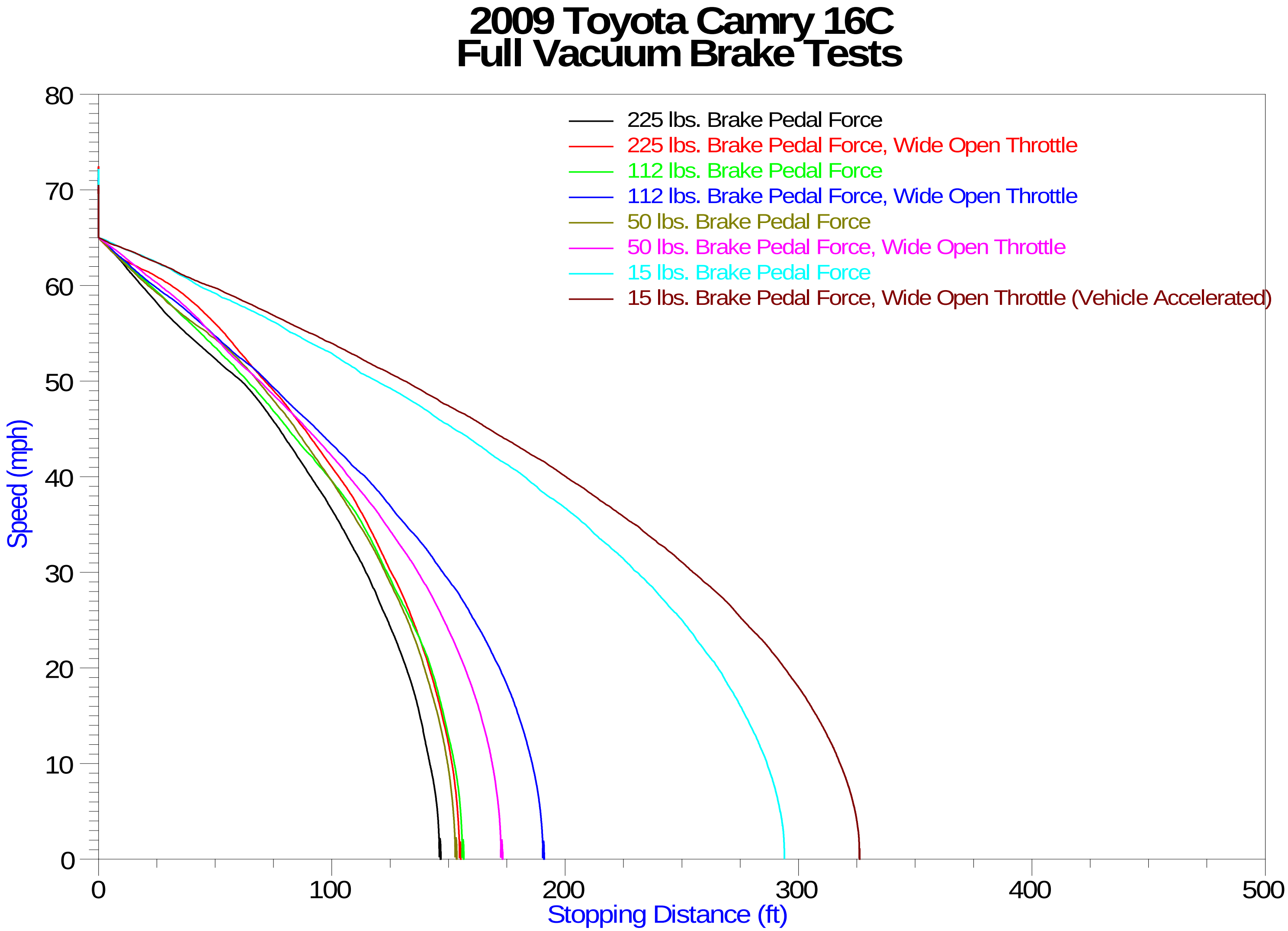


2004 Toyota Camry 14C
Full Vacuum Brake Tests

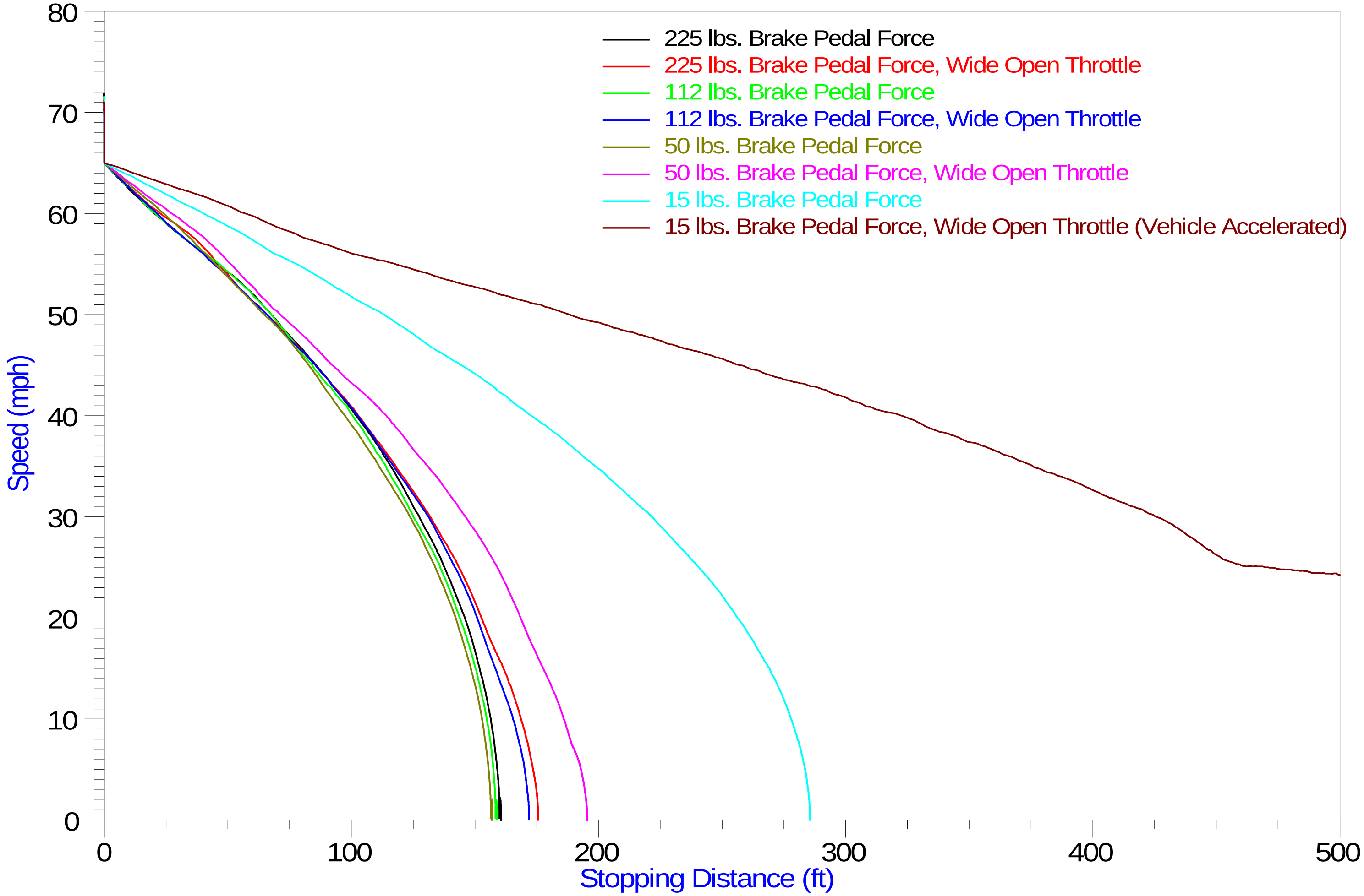


2003 Toyota Camry 15C
Full Vacuum Brake Tests

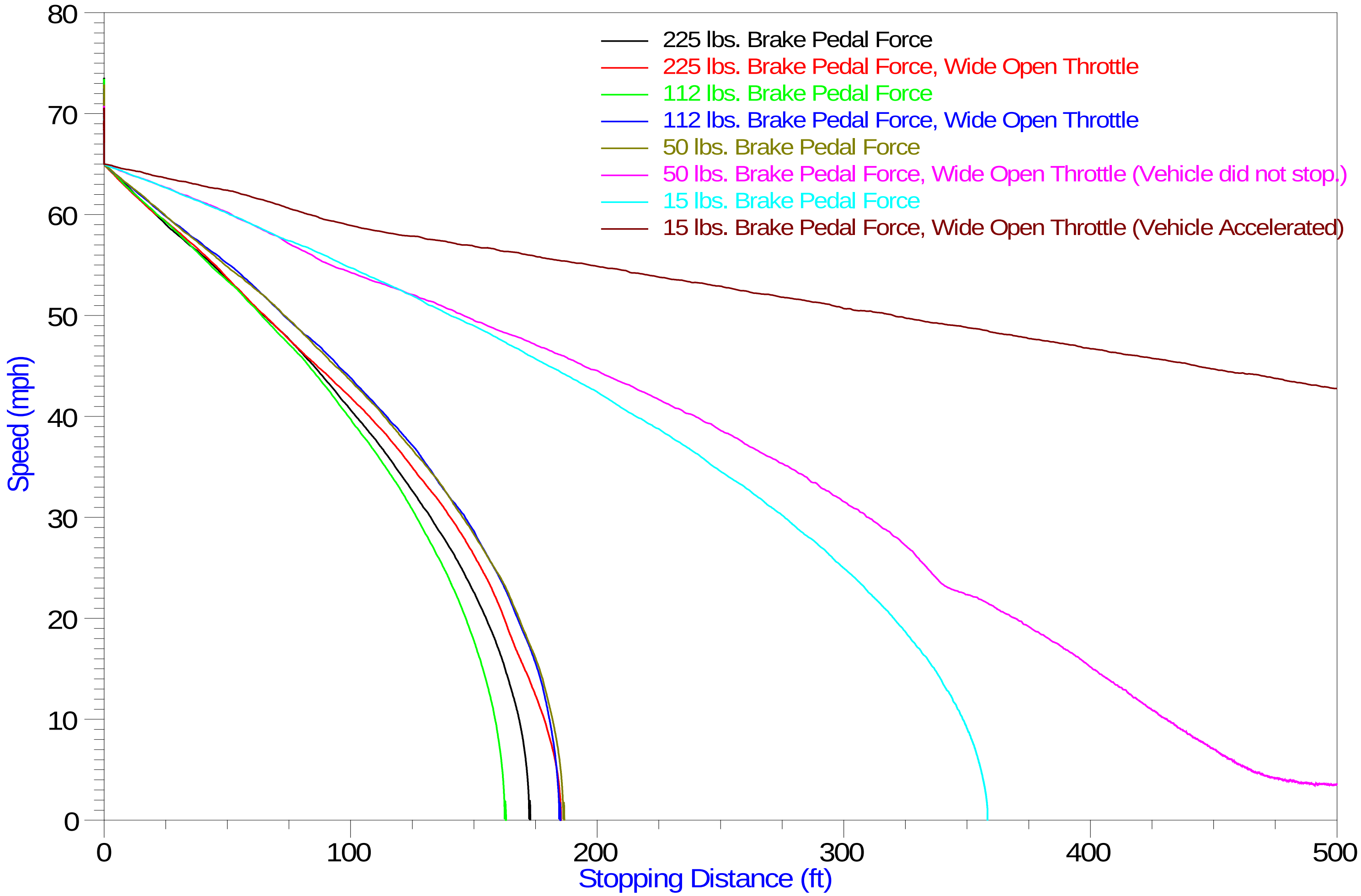



2009 Toyota Camry 16C
Full Vacuum Brake Tests
Speed (mph)
80
70
60
50
40
30
20
10
0
Stopping Distance (ft)
0
100
200
300
400
500
225 lbs. Brake Pedal Force
225 lbs. Brake Pedal Force, Wide Open Throttle
112 lbs. Brake Pedal Force
112 lbs. Brake Pedal Force, Wide Open Throttle
50 lbs. Brake Pedal Force
50 lbs. Brake Pedal Force, Wide Open Throttle
15 lbs. Brake Pedal Force
15 lbs. Brake Pedal Force, Wide Open Throttle (Vehicle Accelerated)

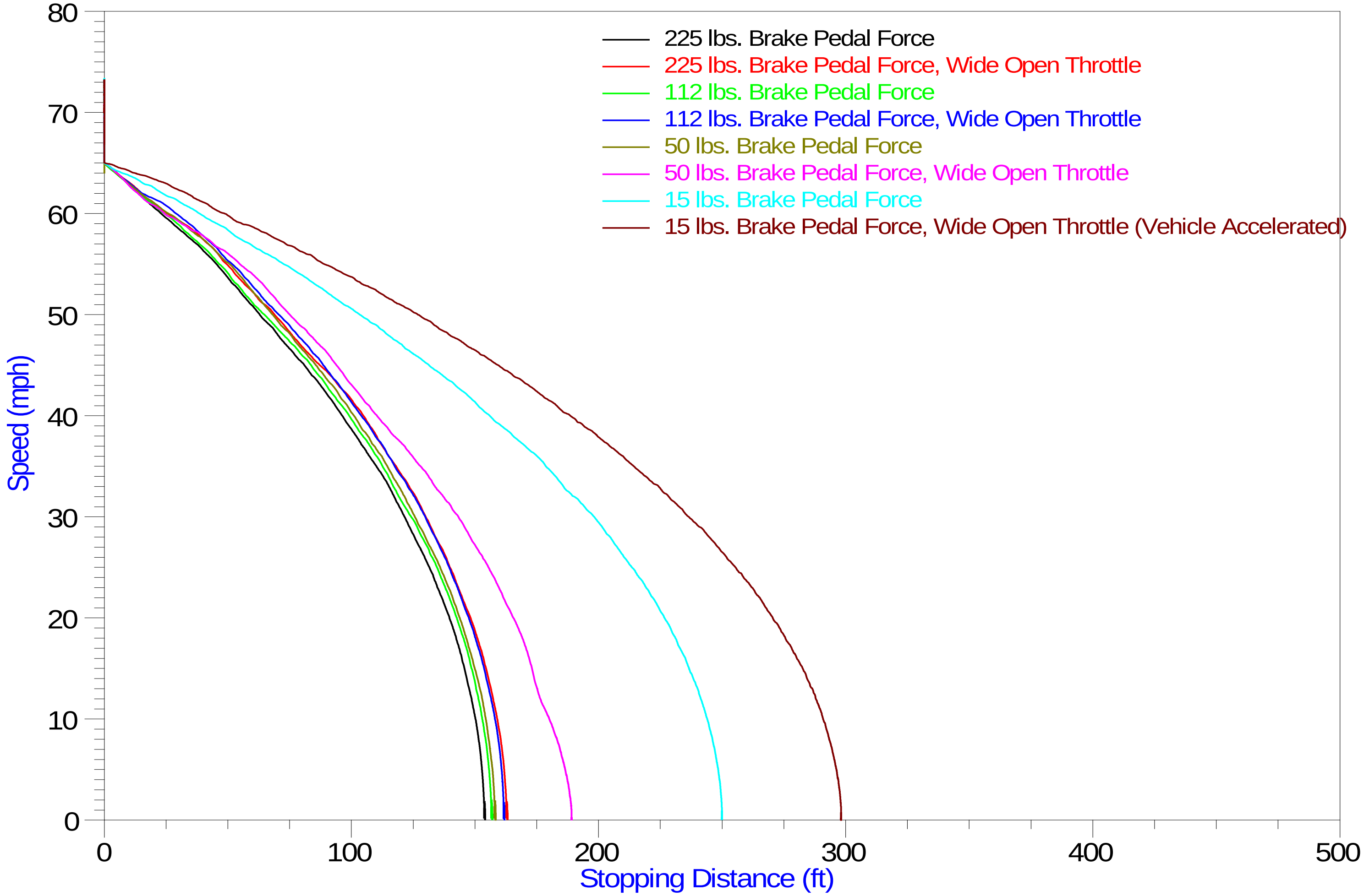
2004 Toyota Camry 17C
Full Vacuum Brake Tests



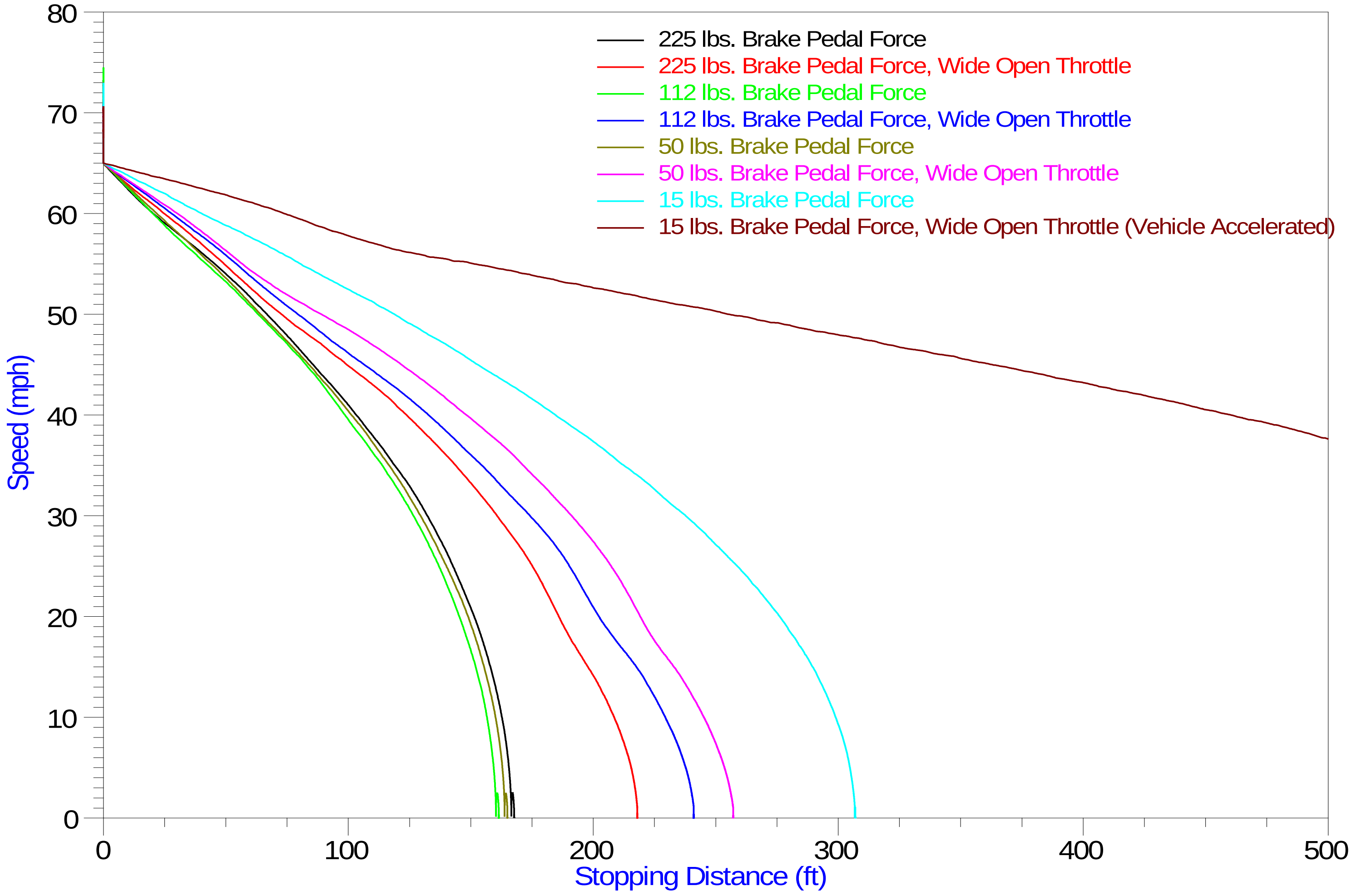
2004 Toyota Camry 18C
Full Vacuum Brake Tests



2007 Toyota Camry 19C
Full Vacuum Brake Tests

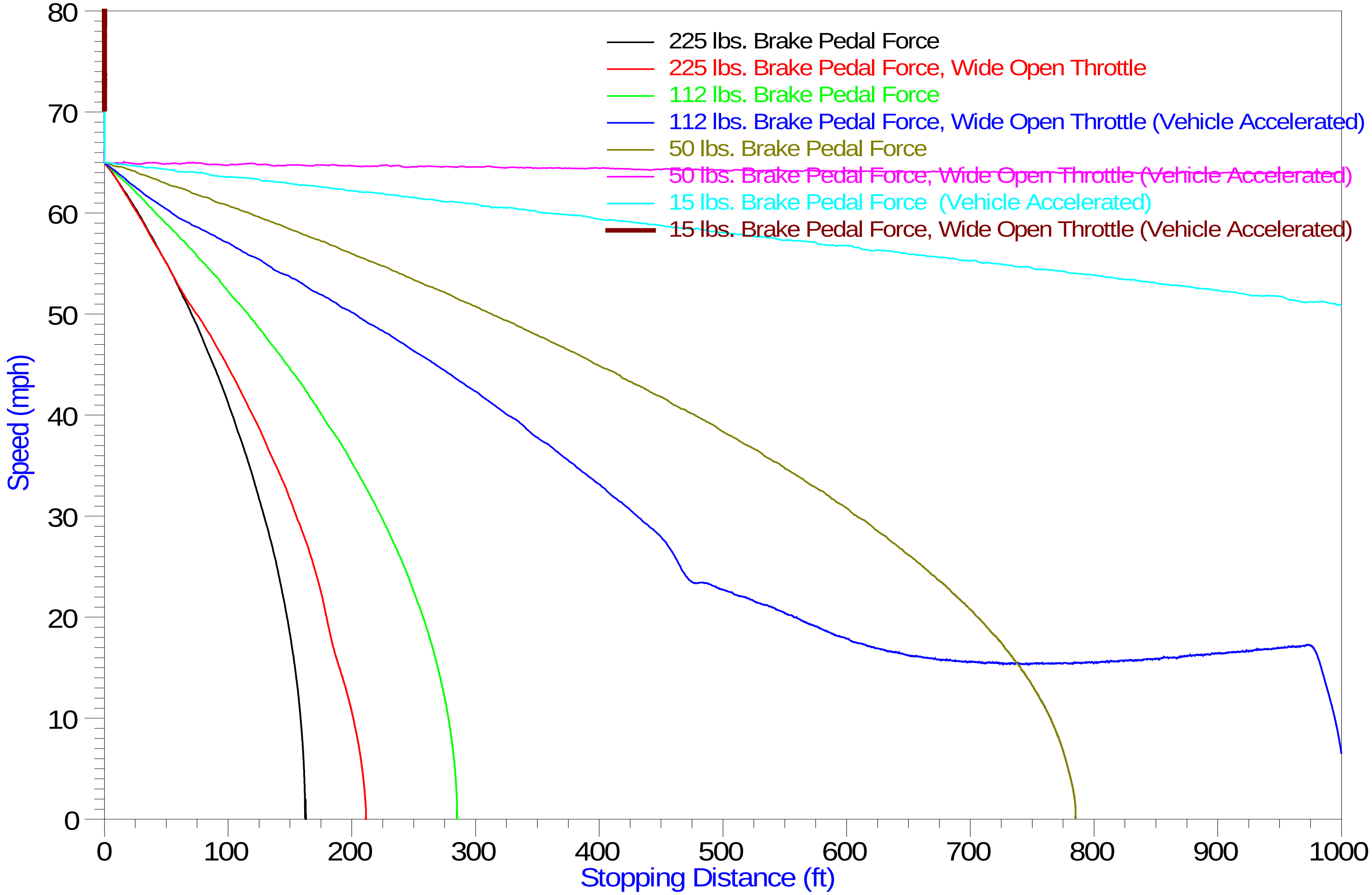


2004 Toyota Camry 20C
Full Vacuum Brake Tests

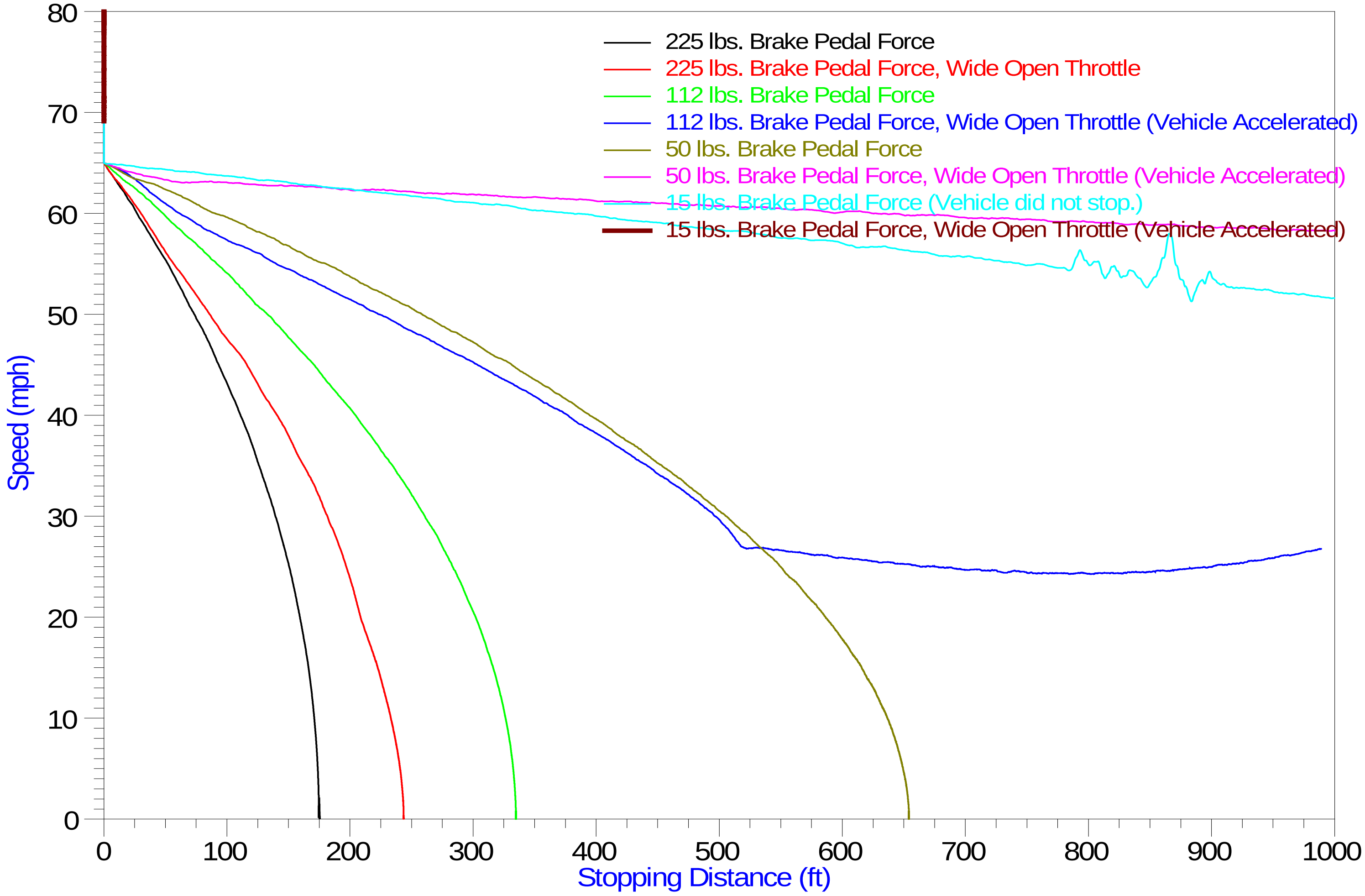


65 to 0 mph Brake Test
With No Vacuum
Varying Brake Pedal Force
With and Without Wide Open Throttle

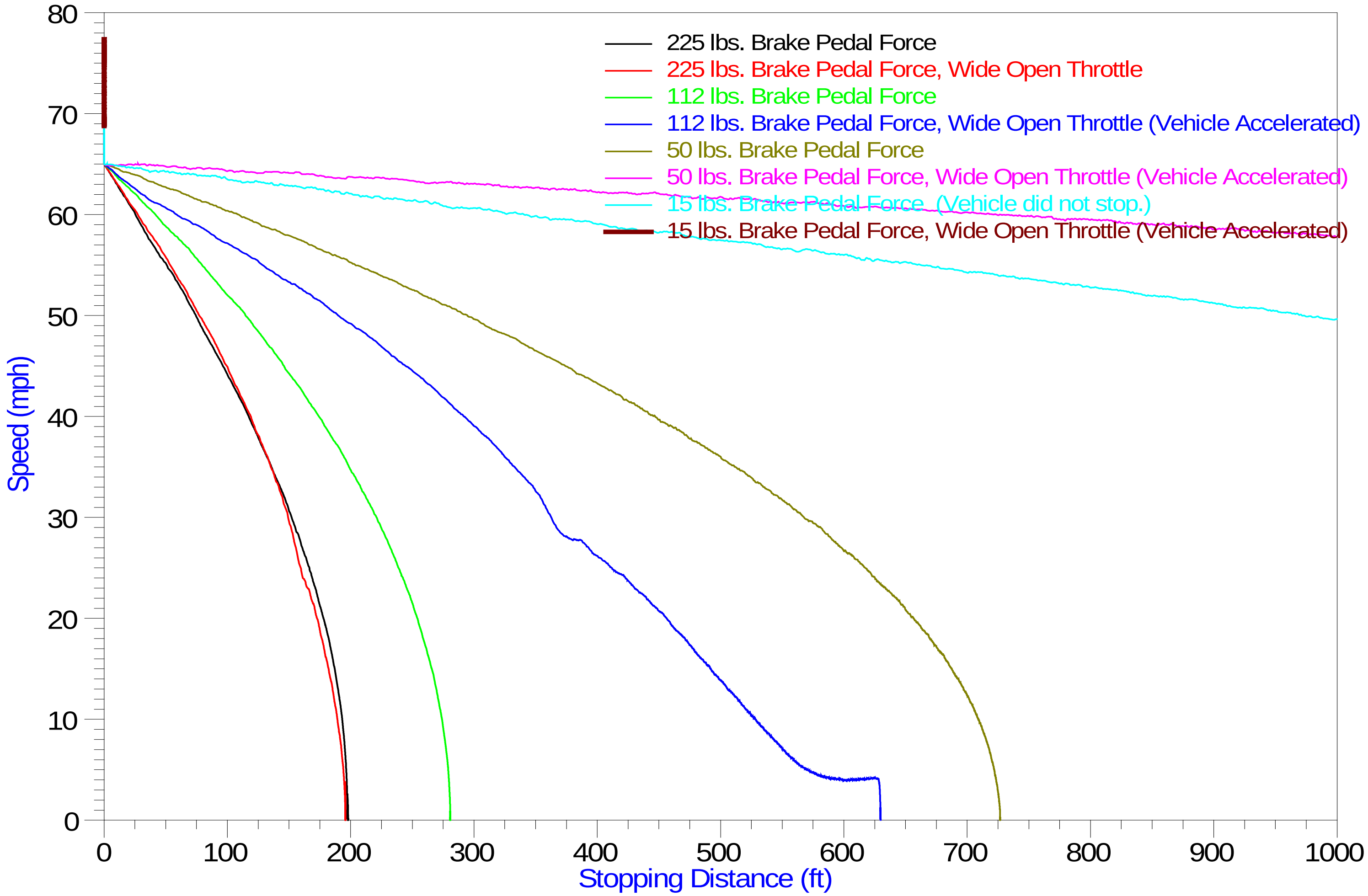
2002 Toyota Camry 01
No Vacuum Brake Tests



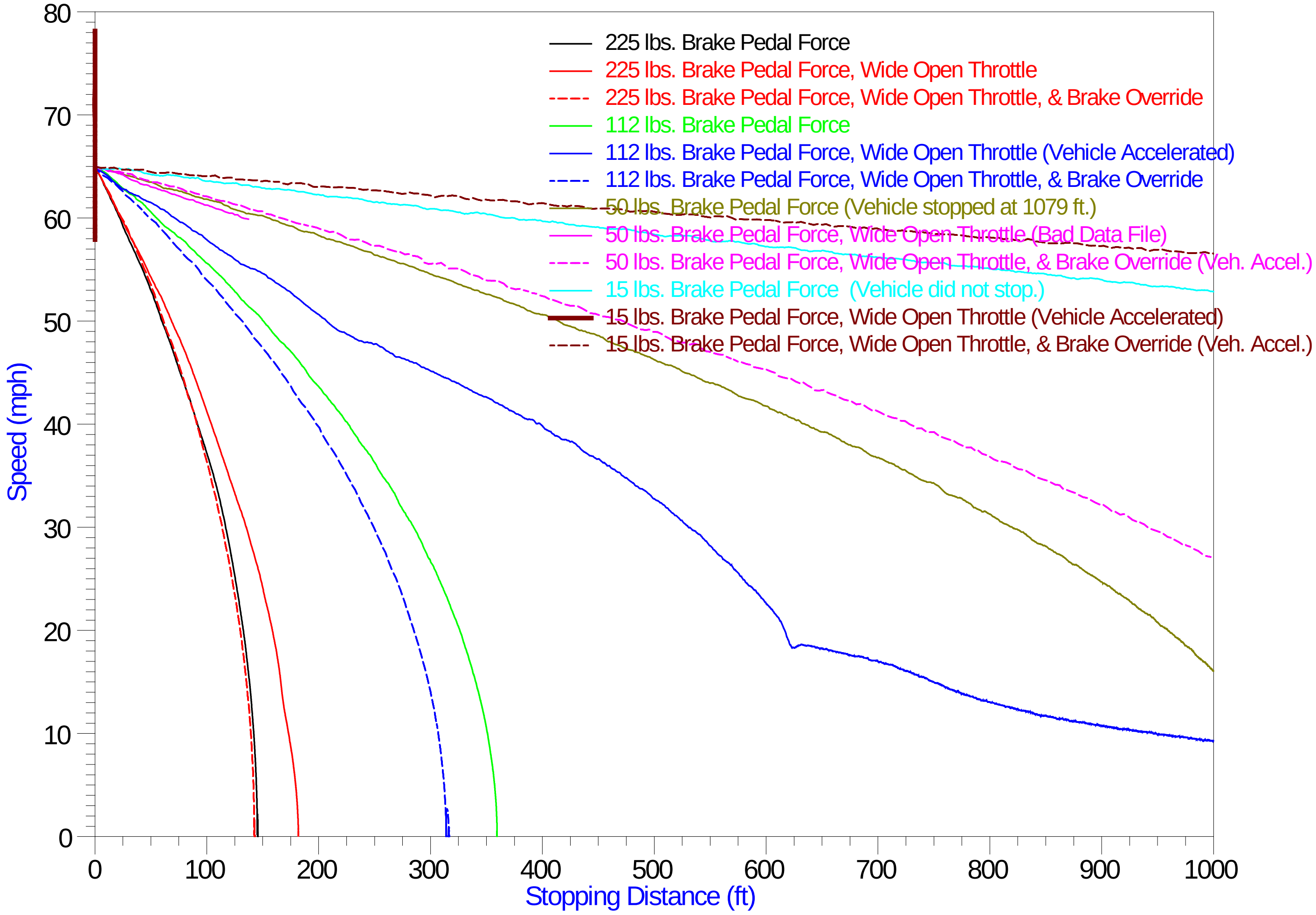
2002 Toyota Camry 02
No Vacuum Brake Tests



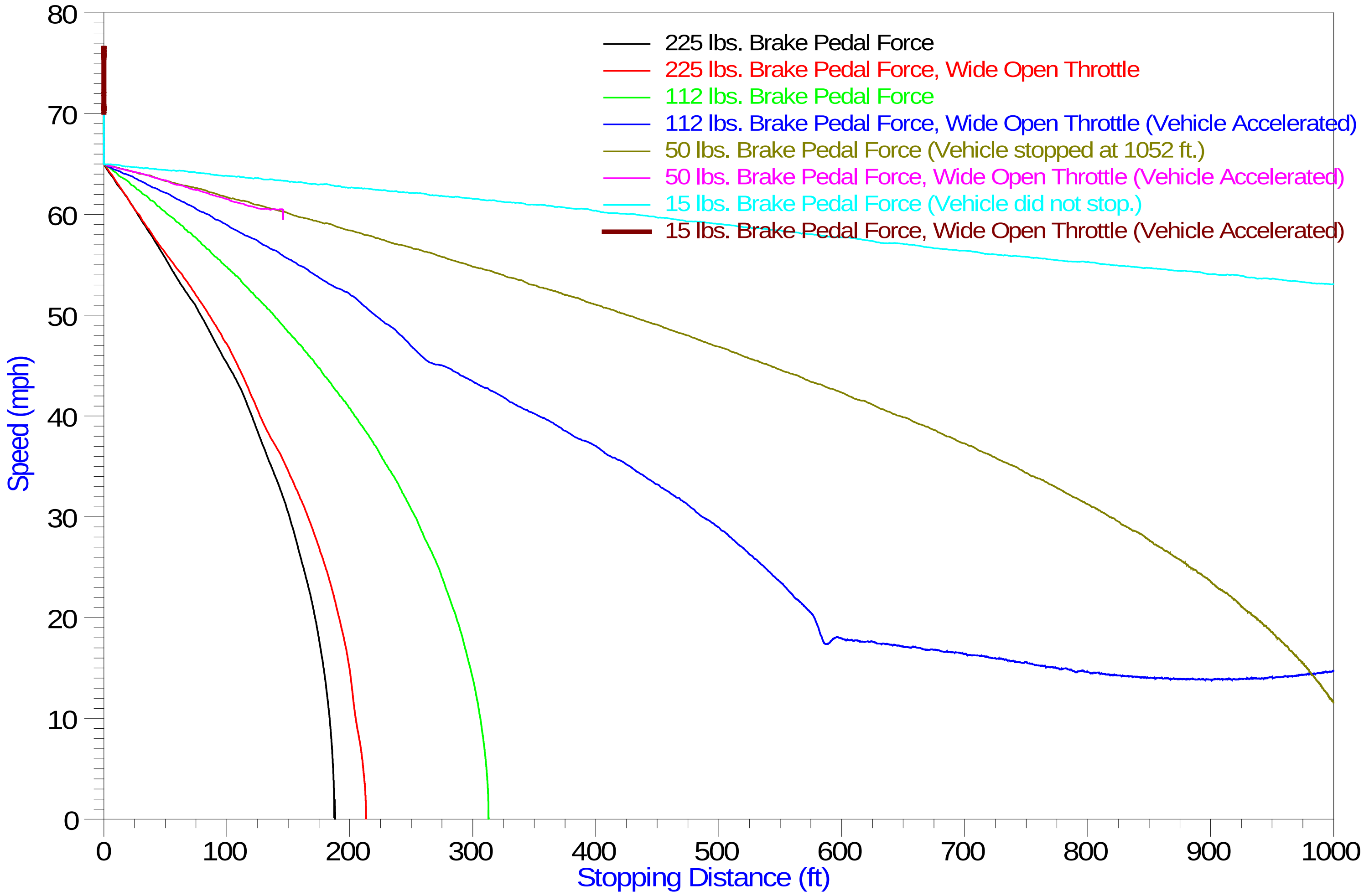
2001 Toyota Camry 3D
No Vacuum Brake Tests

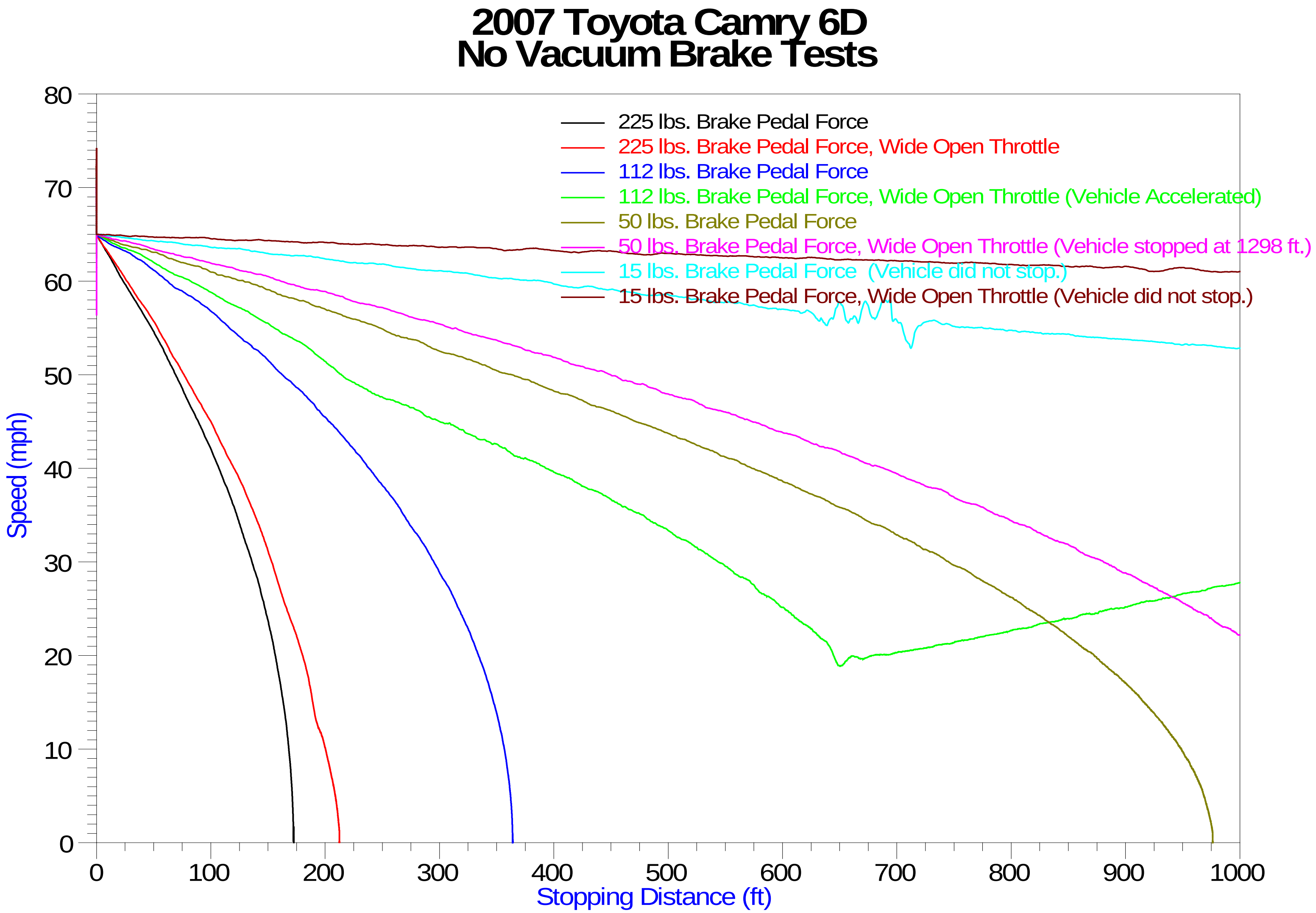


2007 Toyota Camry 4D
No Vacuum Brake Tests



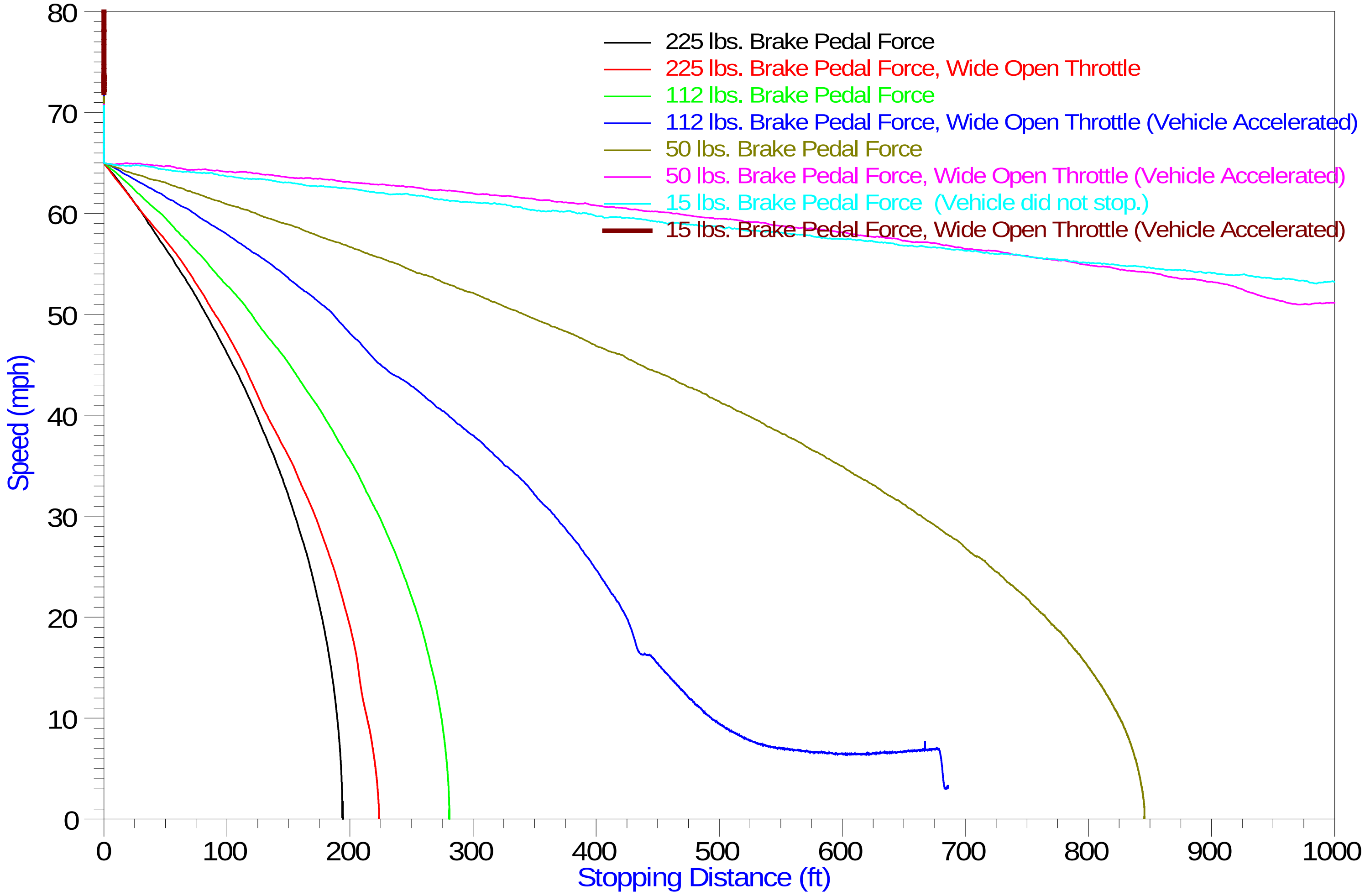
2006 Toyota Camry 5D
No Vacuum Brake Tests



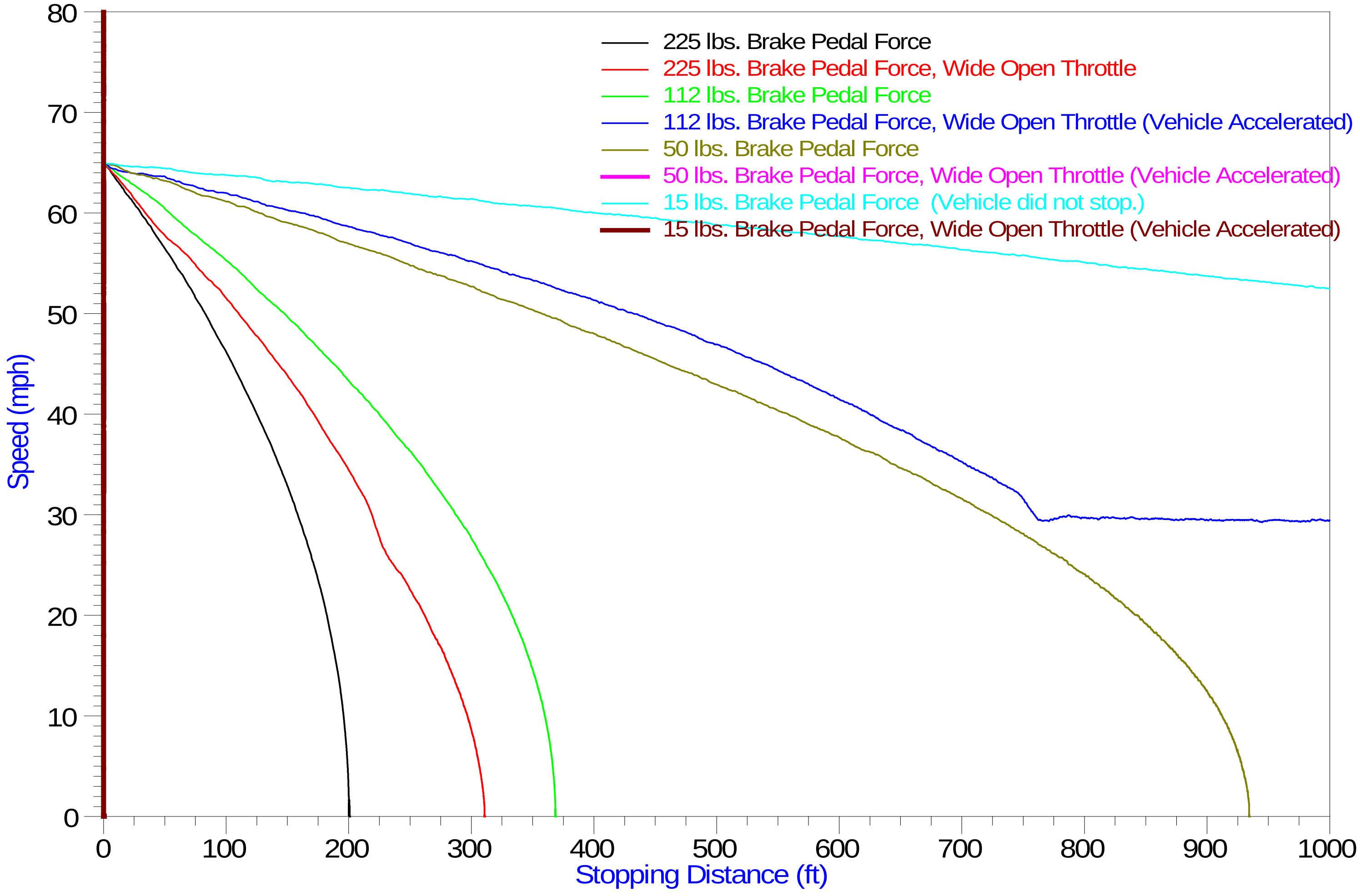


2007 Toyota Camry 6D
No Vacuum Brake Tests

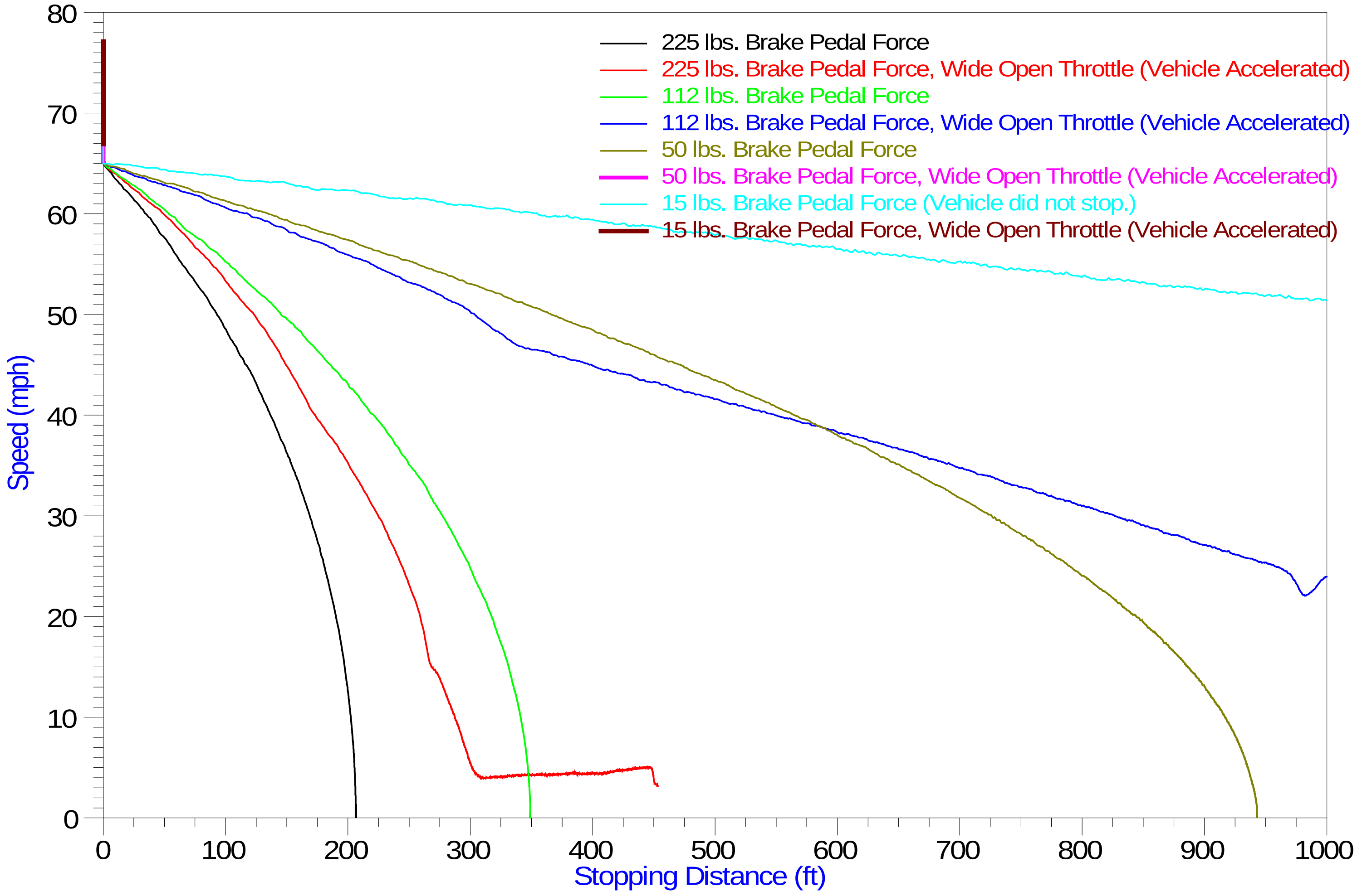
2005 Toyota Camry 7D
No Vacuum Brake Tests



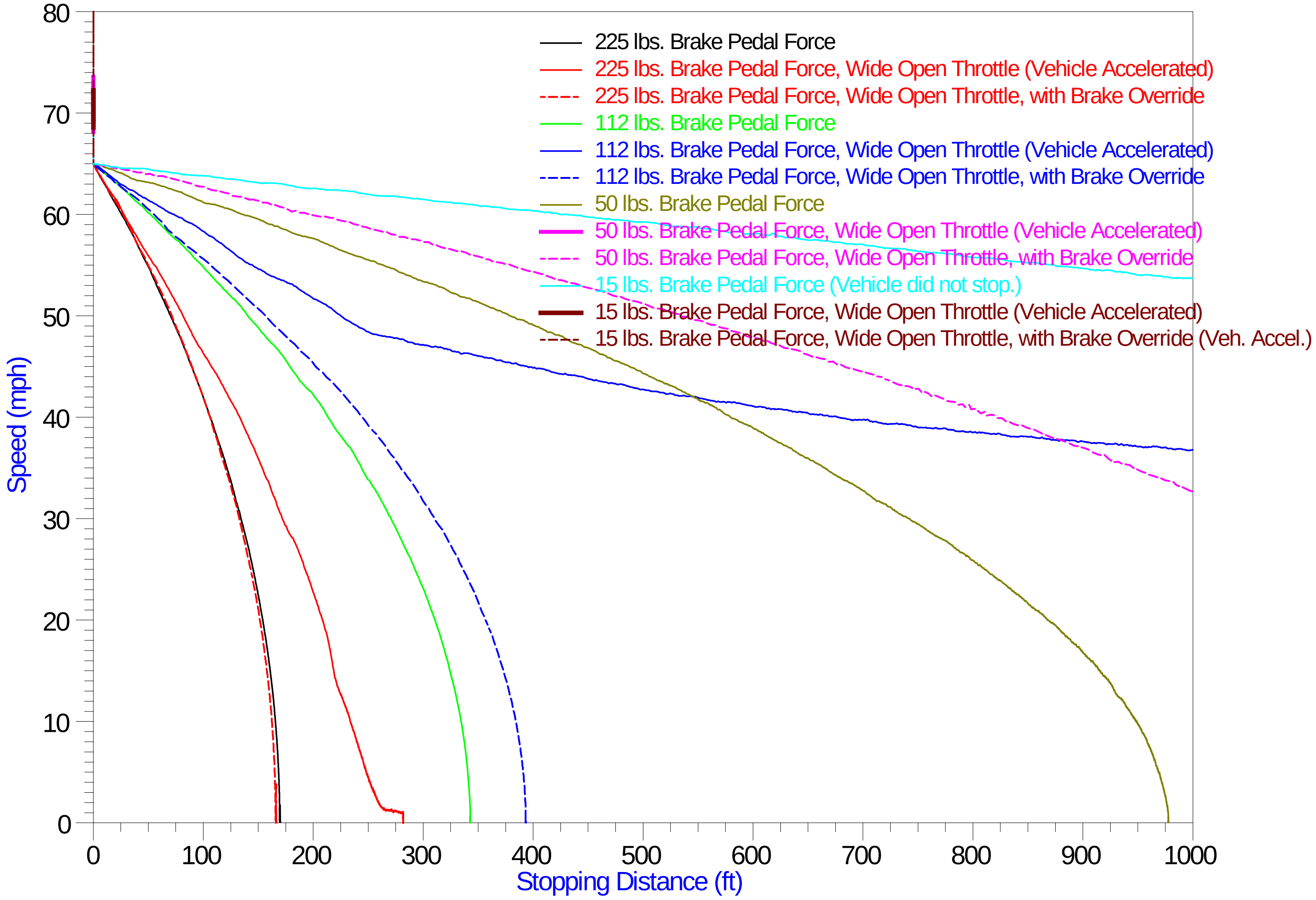
2001 Toyota Camry 8D
No Vacuum Brake Tests



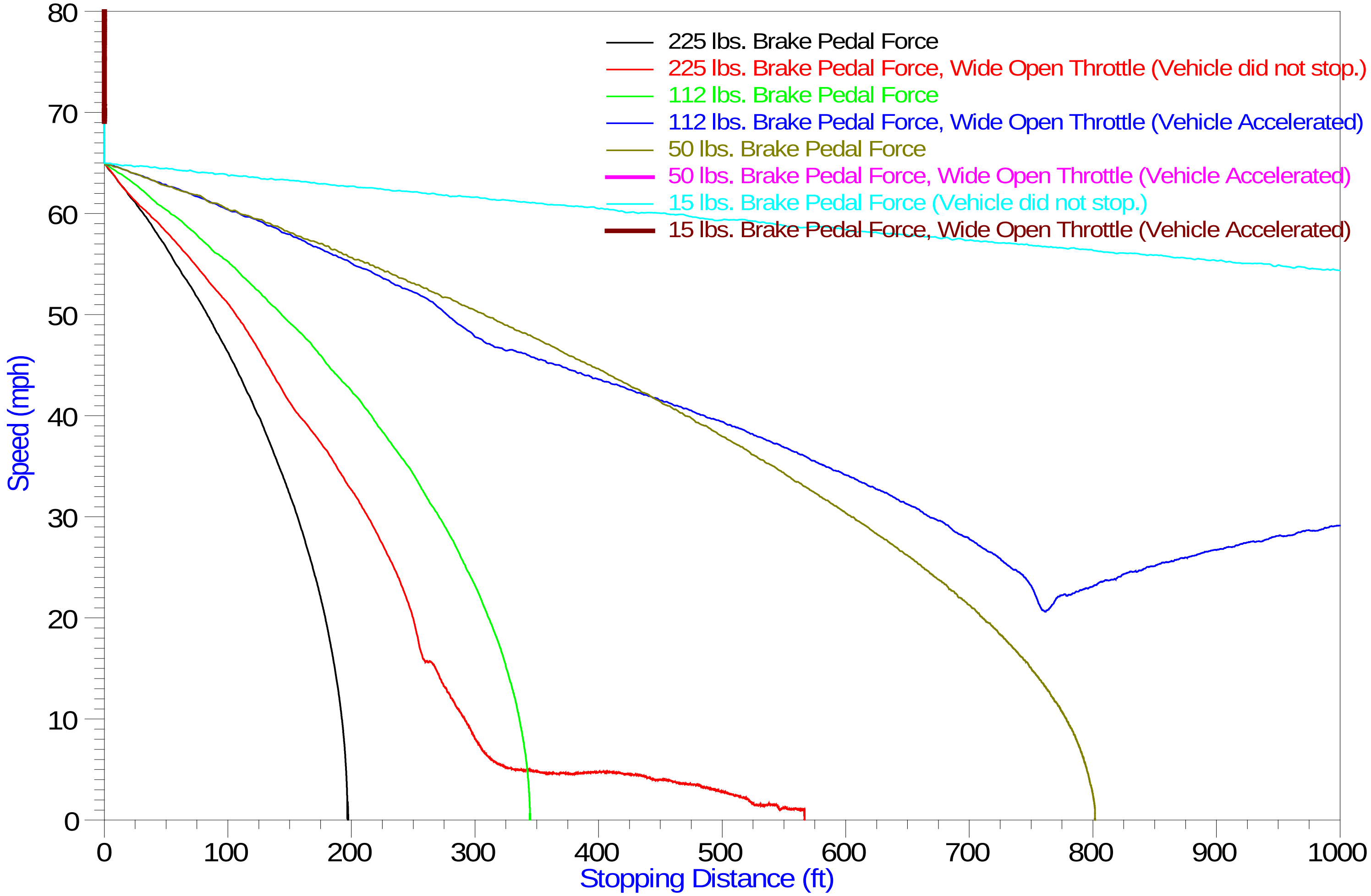
2005 Toyota Camry 9D
No Vacuum Brake Tests



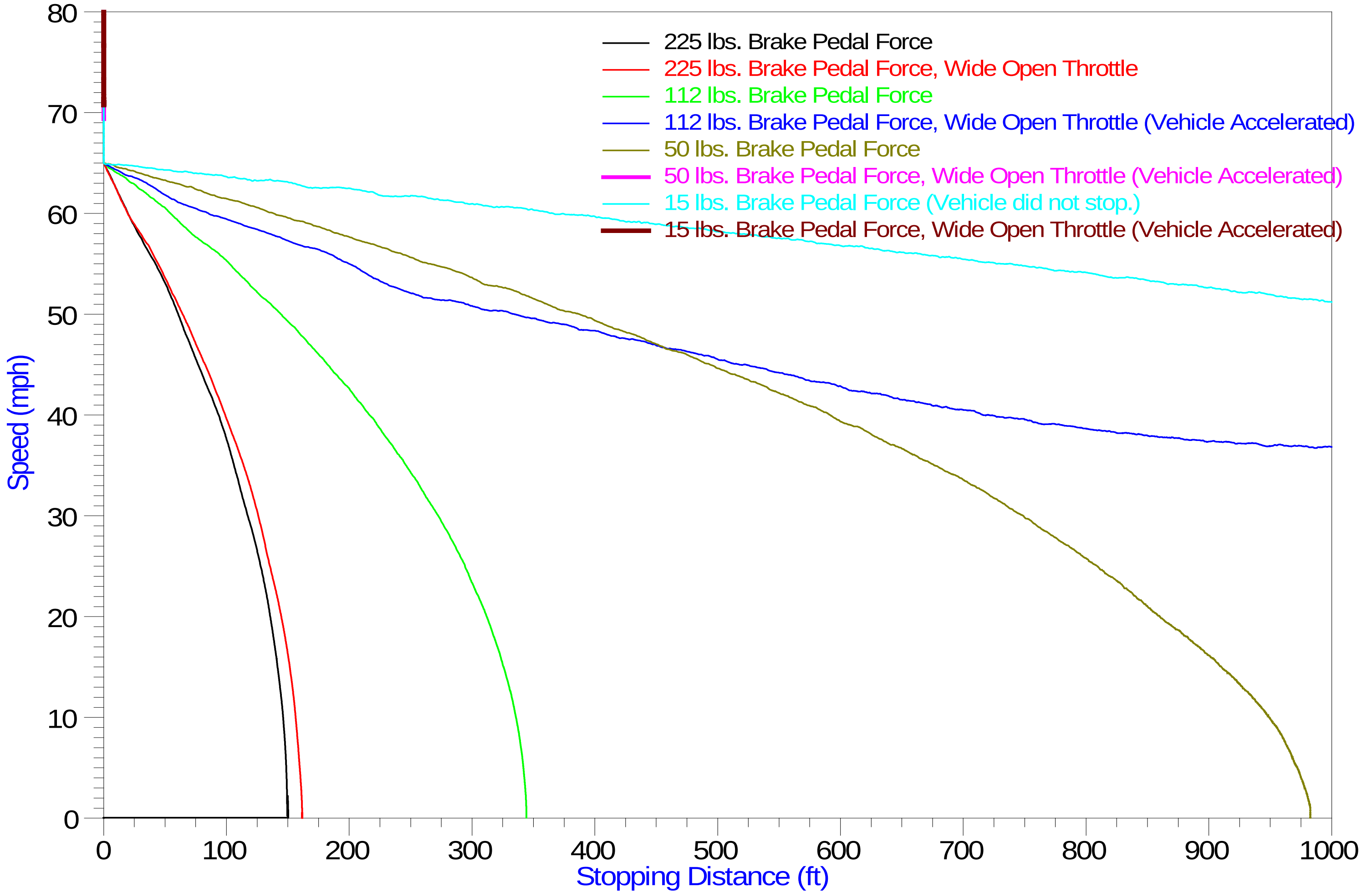
2007 Toyota Camry 10D
No Vacuum Brake Tests



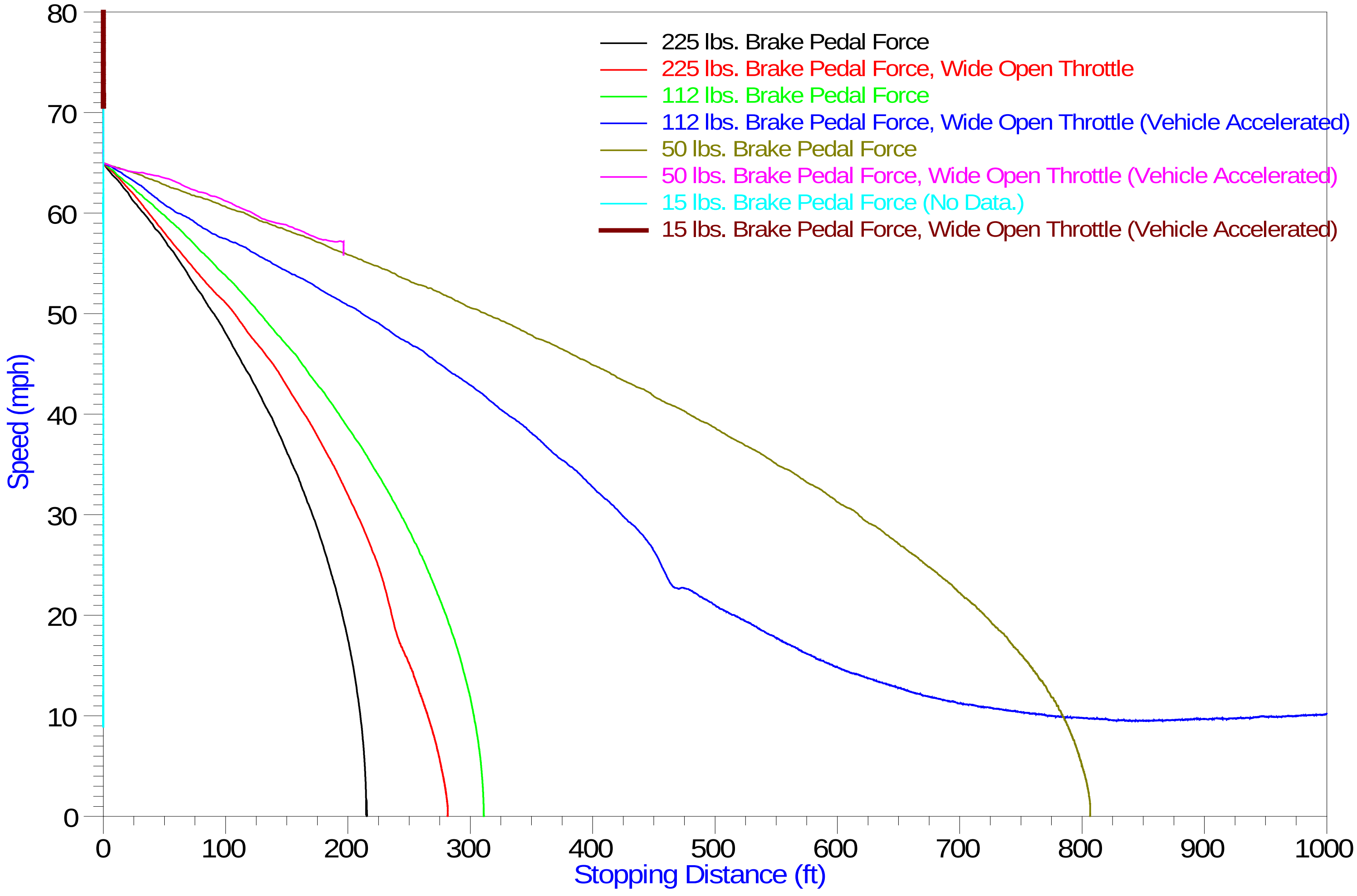
2005 Toyota Camry 11D
No Vacuum Brake Tests



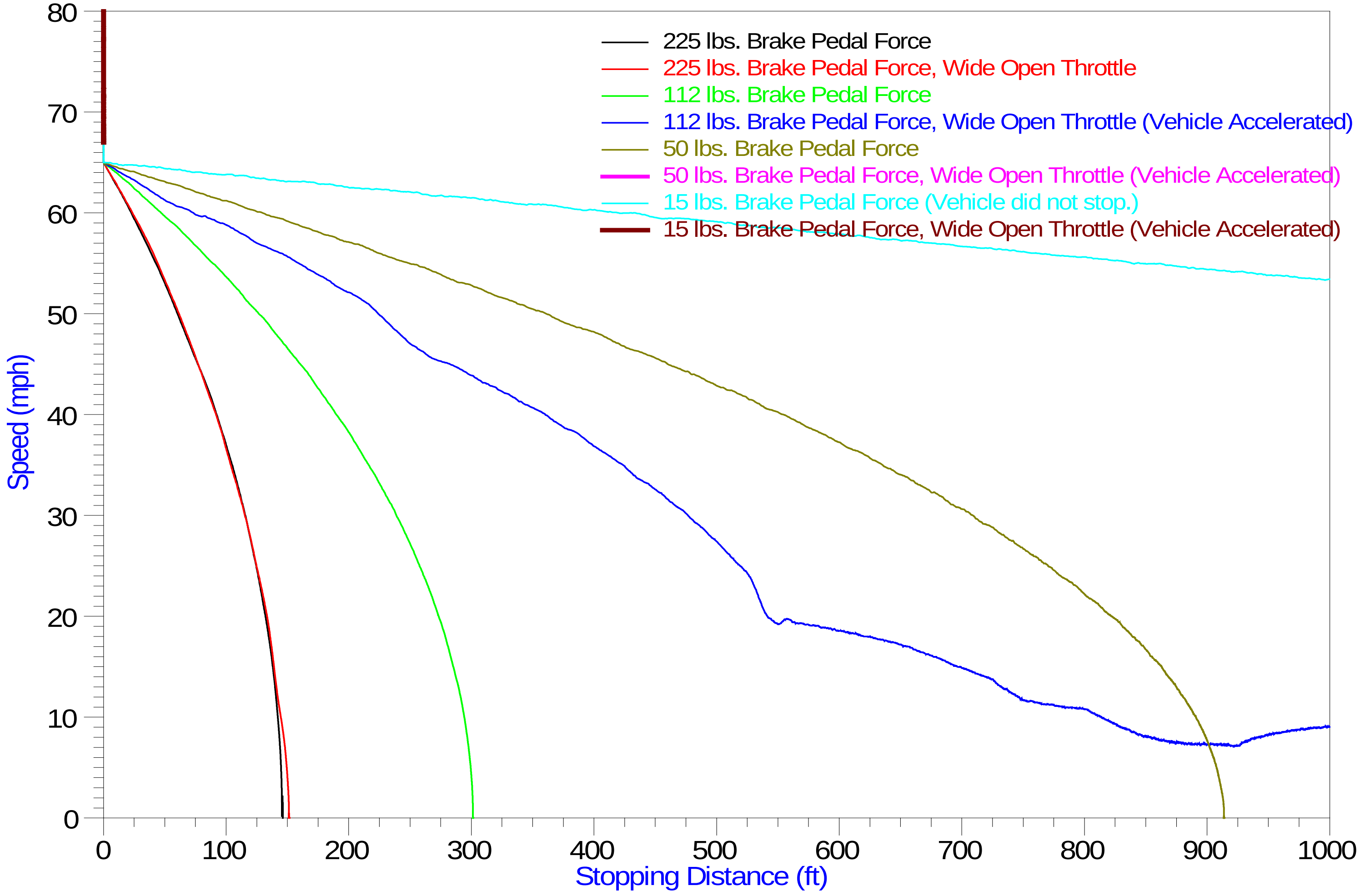
2007 Toyota Camry 12C
No Vacuum Brake Tests



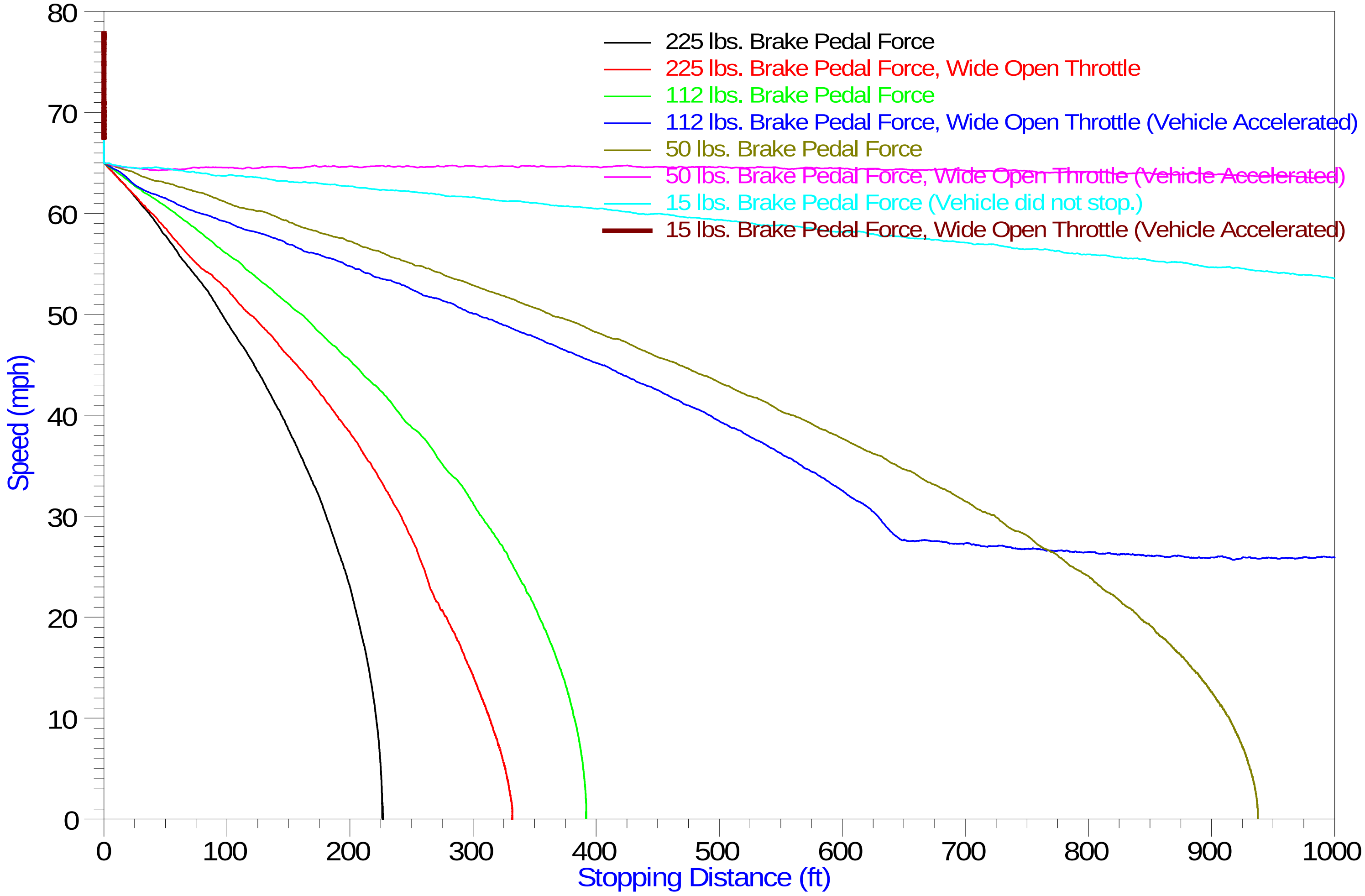
2002 Toyota Camry 13C
No Vacuum Brake Tests



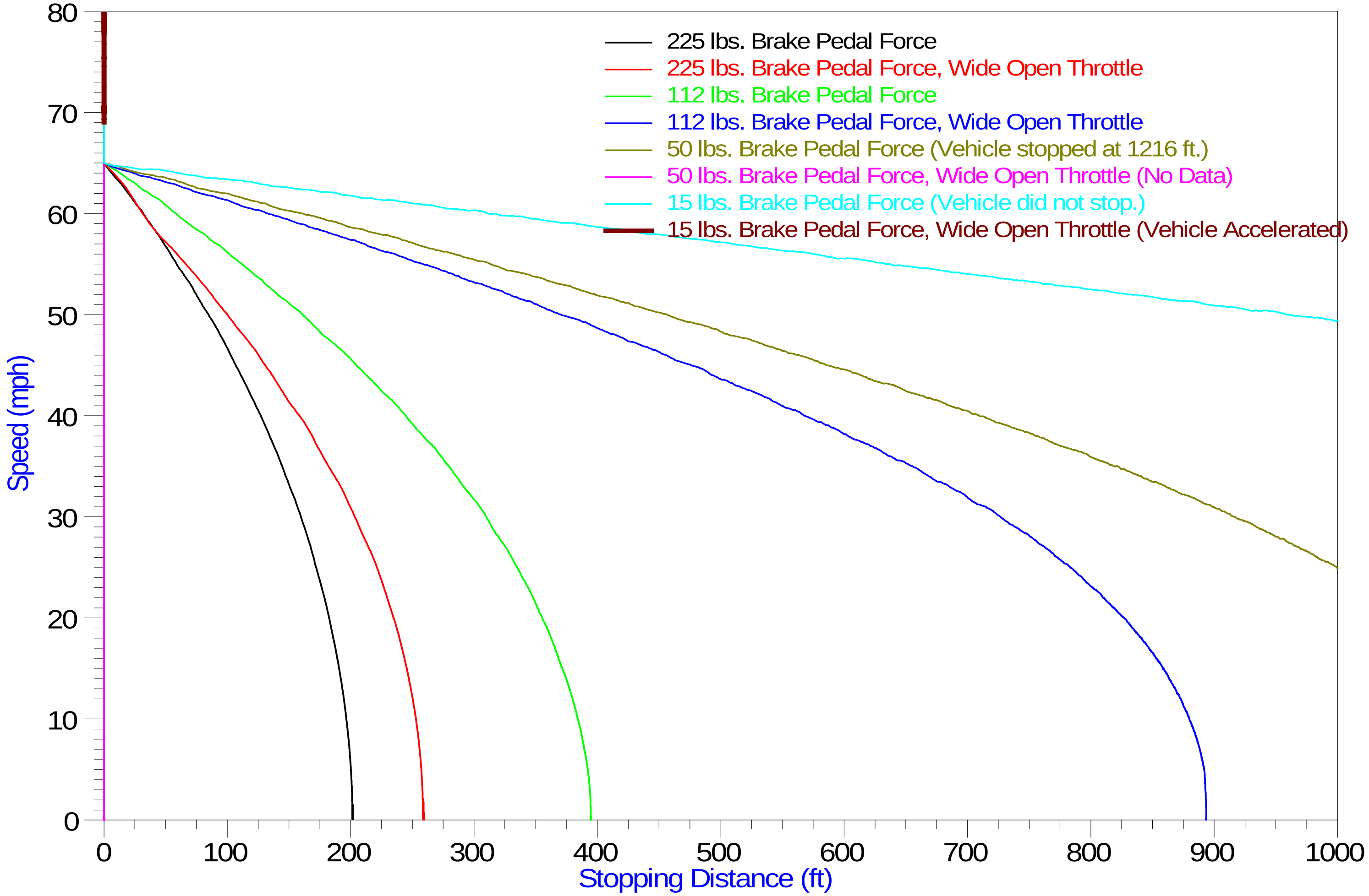
2004 Toyota Camry 14C
No Vacuum Brake Tests



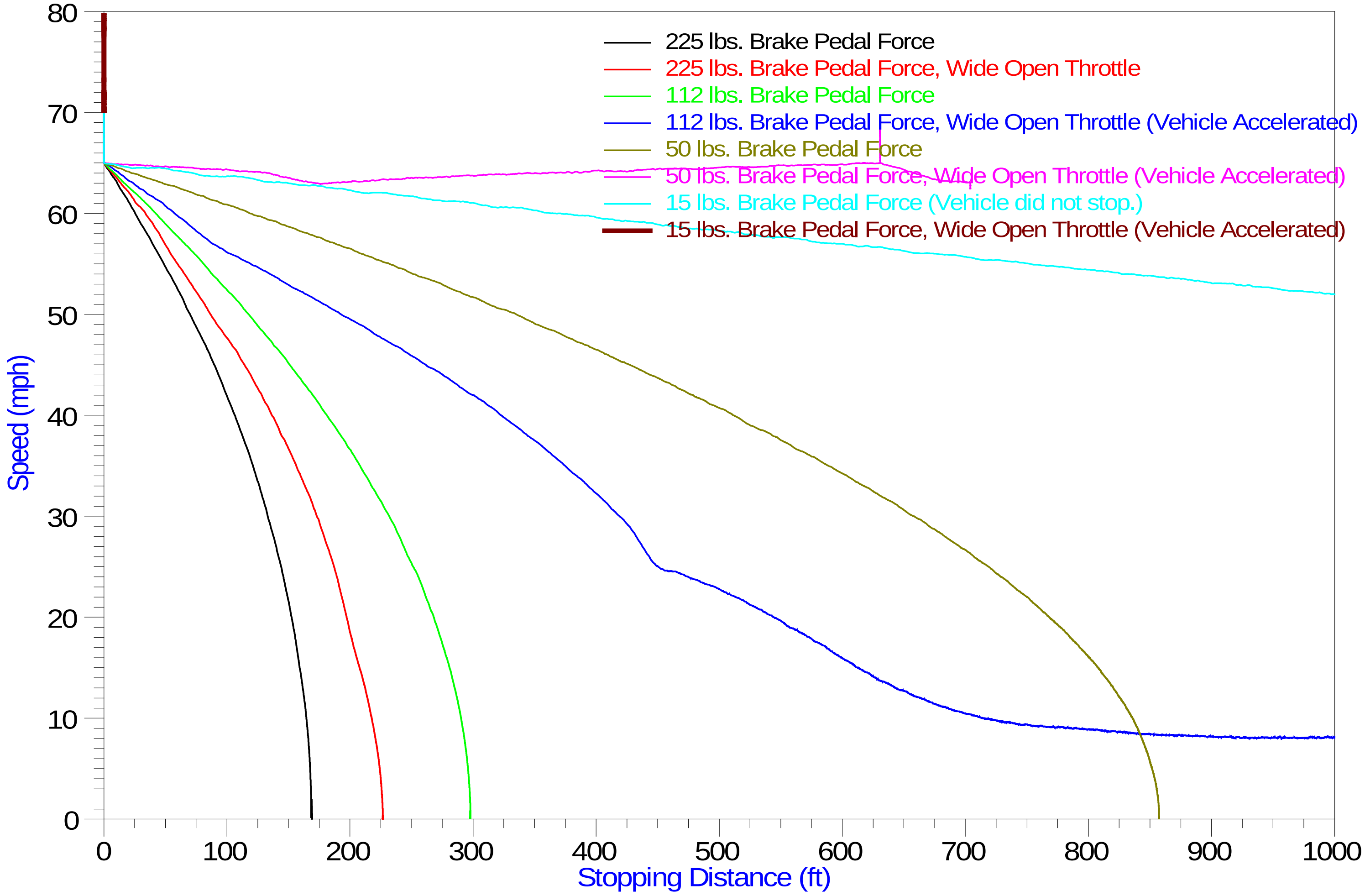
2003 Toyota Camry 15C
No Vacuum Brake Tests



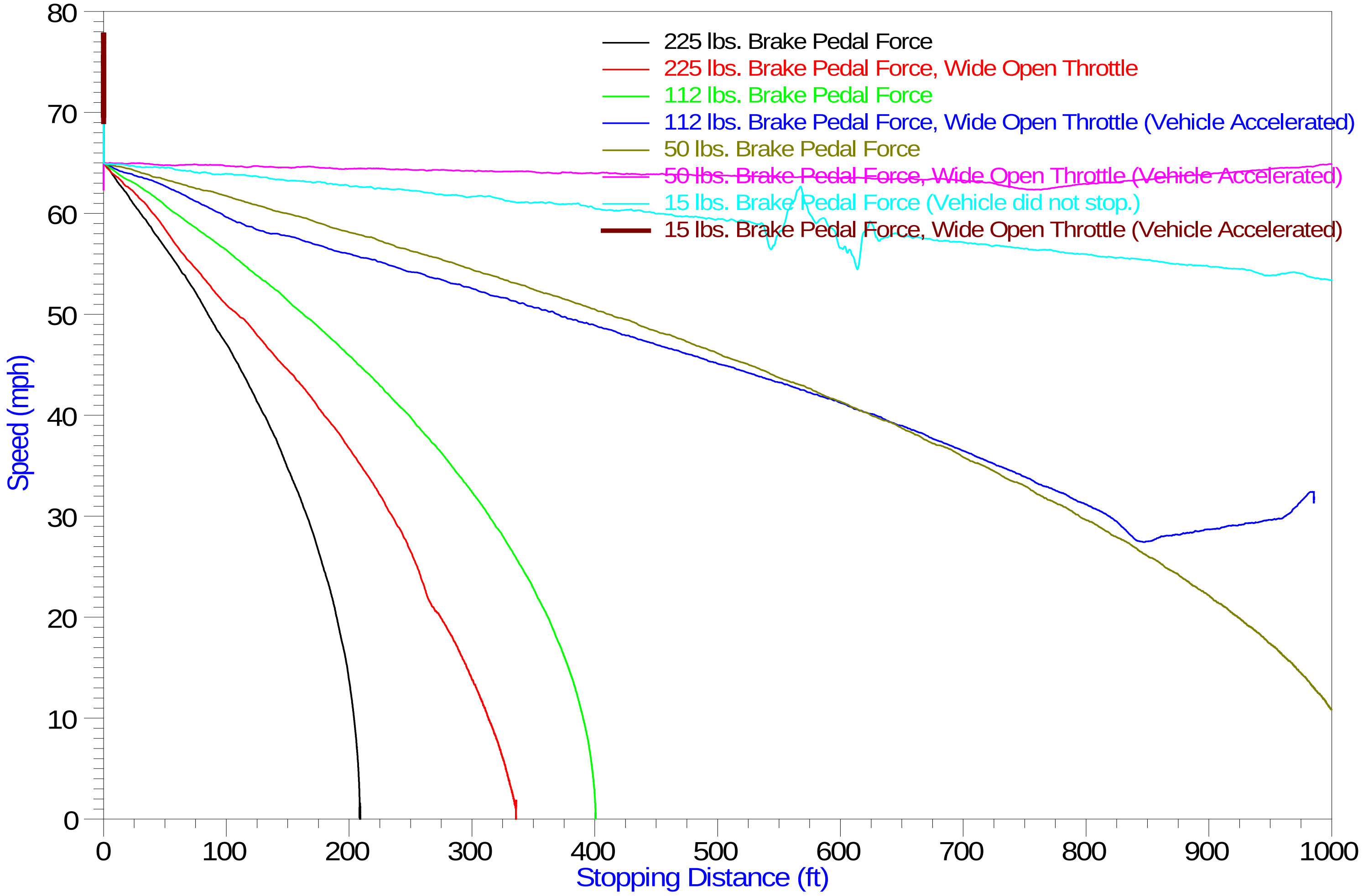
2009 Toyota Camry 16C
No Vacuum Brake Tests



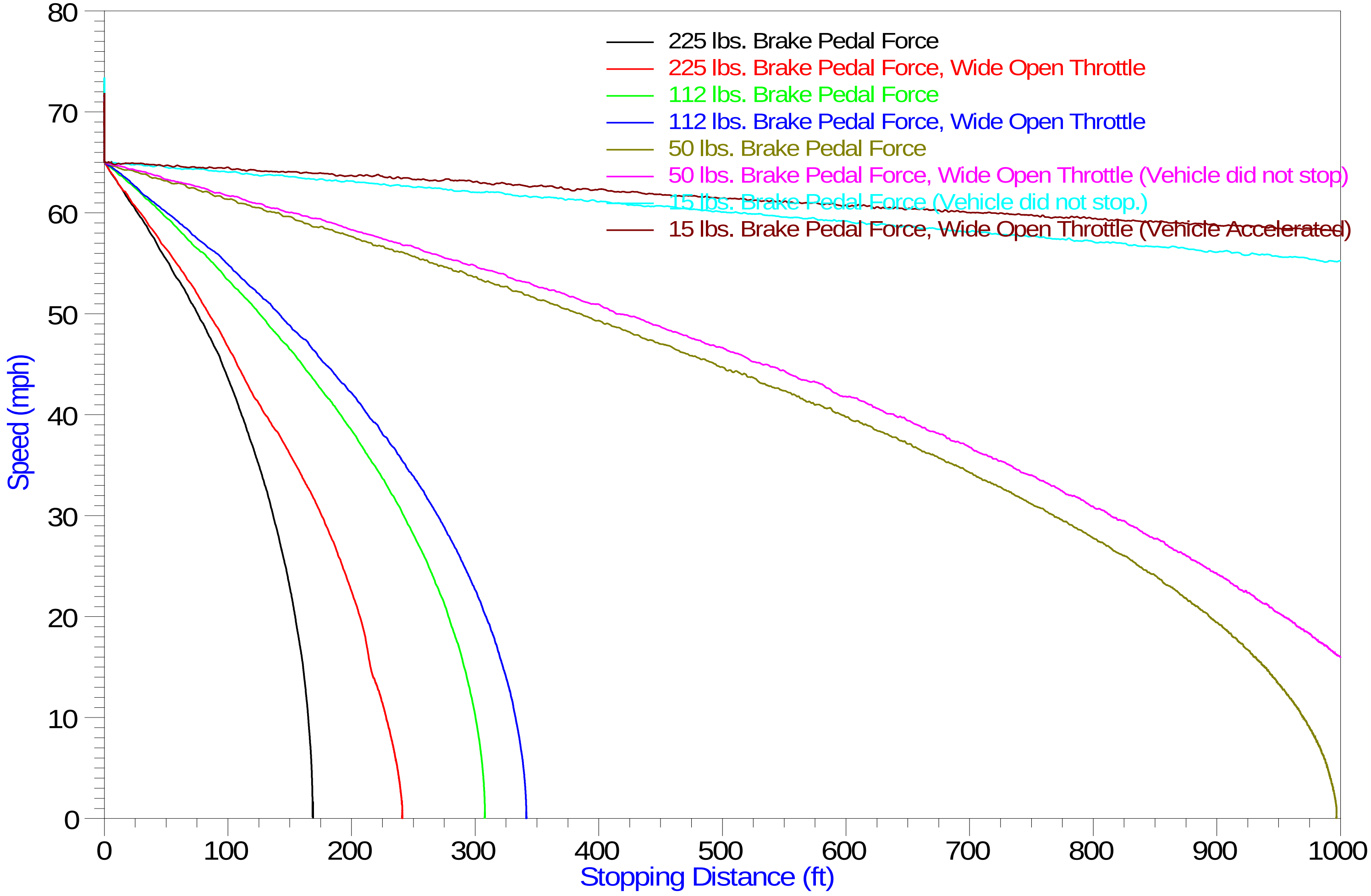
2004 Toyota Camry 17C
No Vacuum Brake Tests



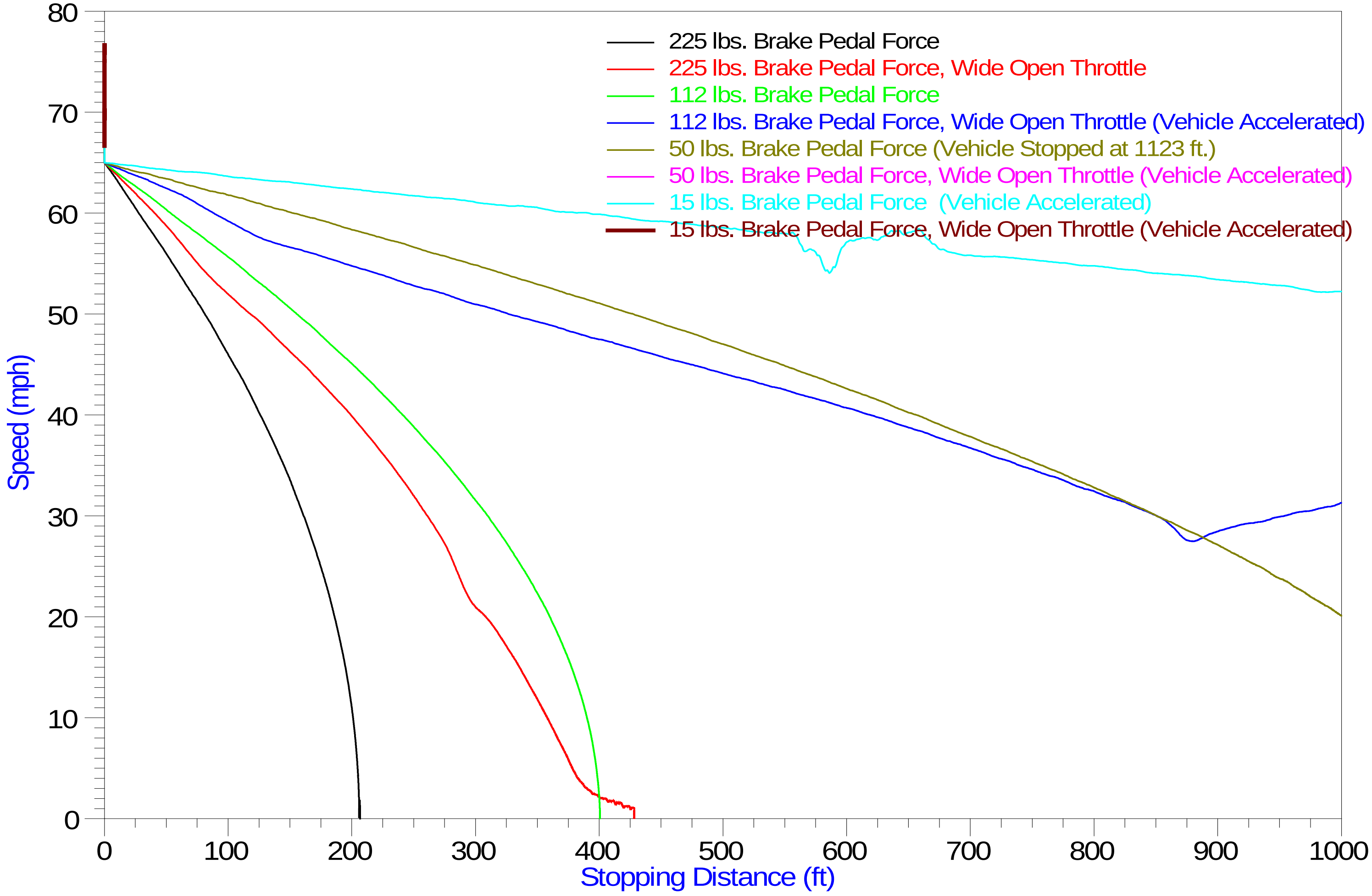
2004 Toyota Camry 18C
No Vacuum Brake Tests



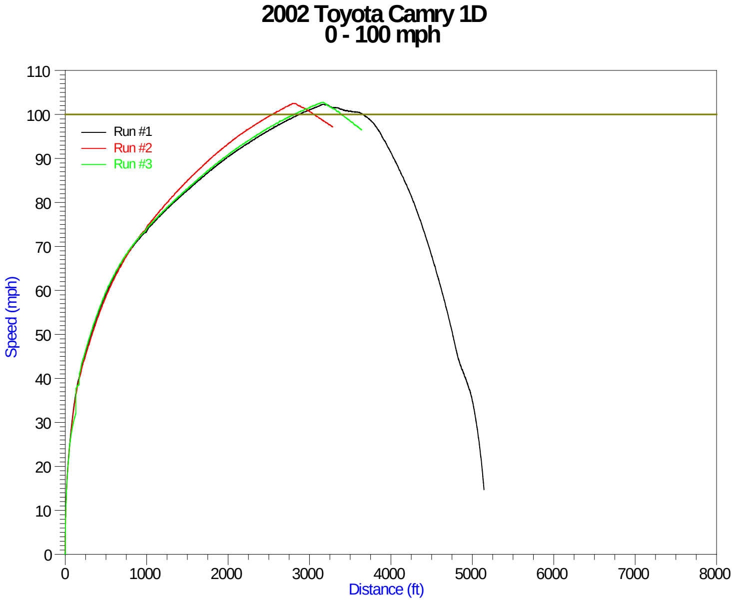
2007 Toyota Camry 19C
No Vacuum Brake Tests

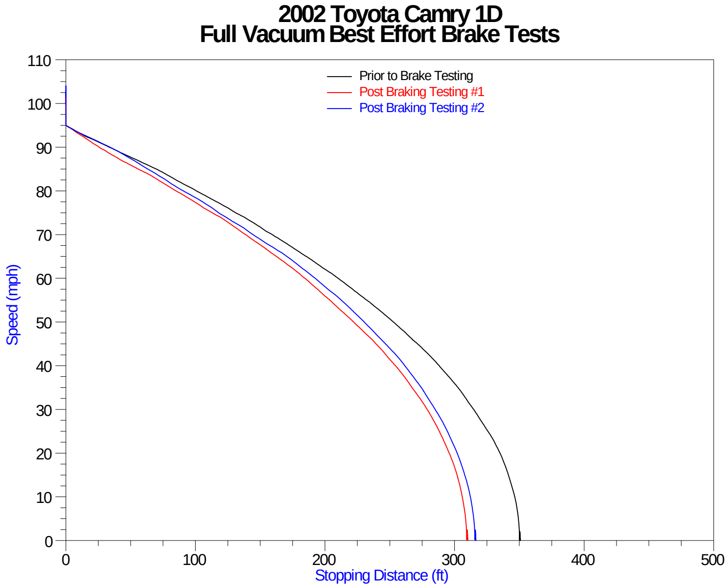


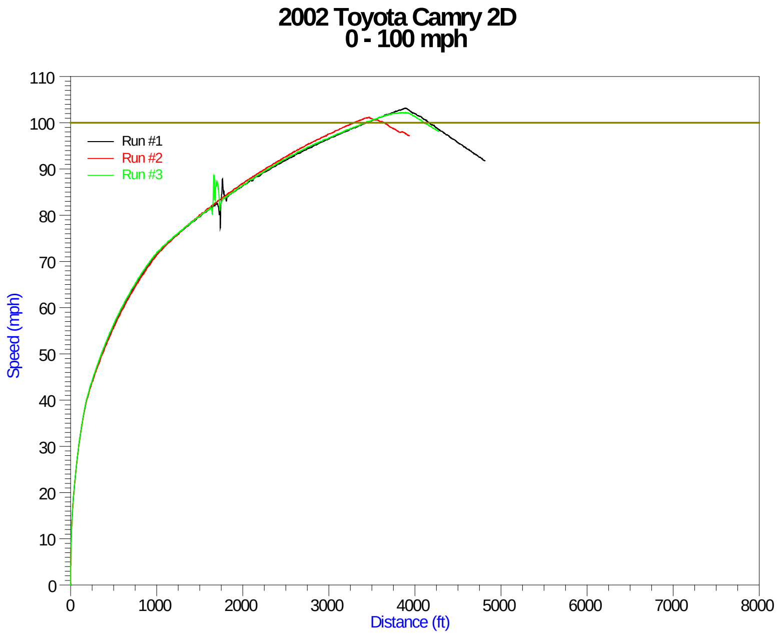
2004 Toyota Camry 20C
No Vacuum Brake Tests



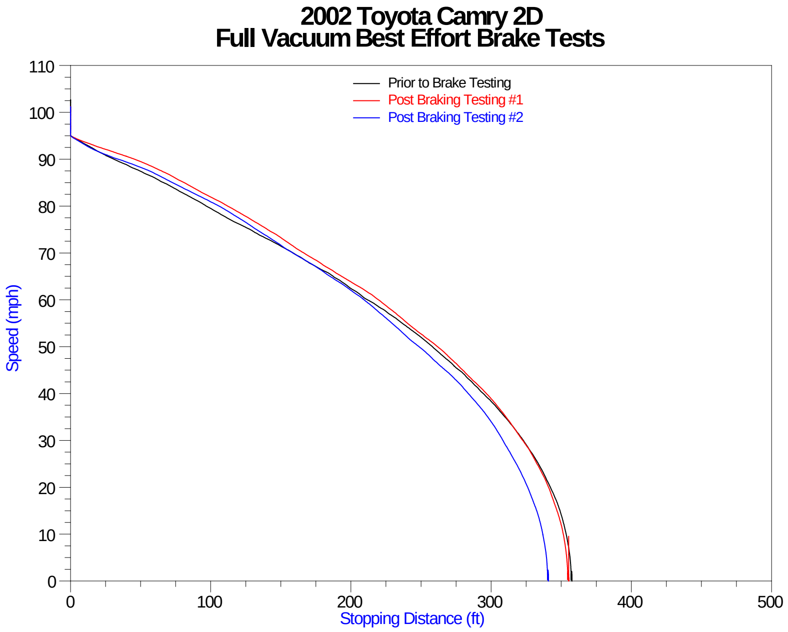
APPENDIX E5C – 0-100 and 100-0 MPH Brake Performance Tests Before and After Brake Testing



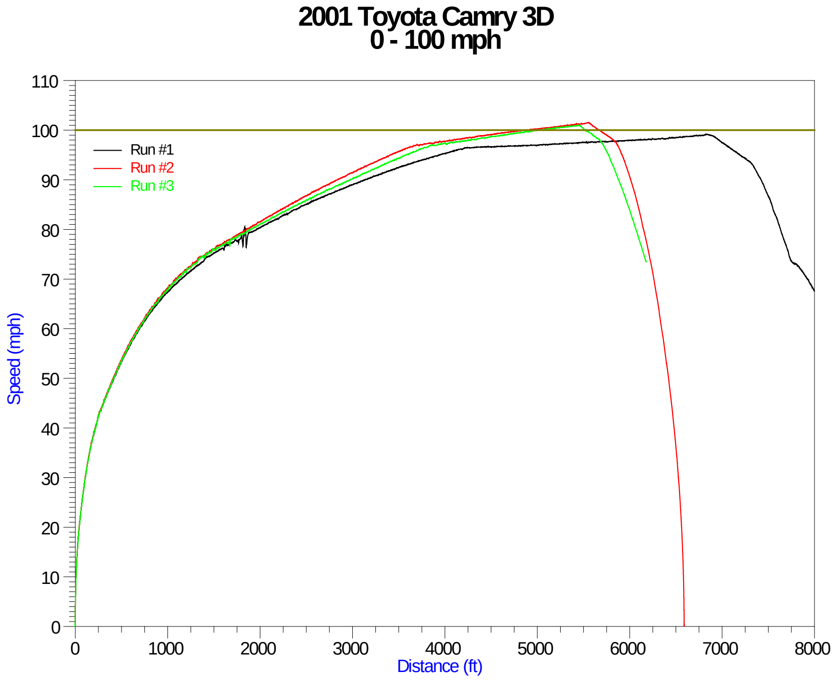




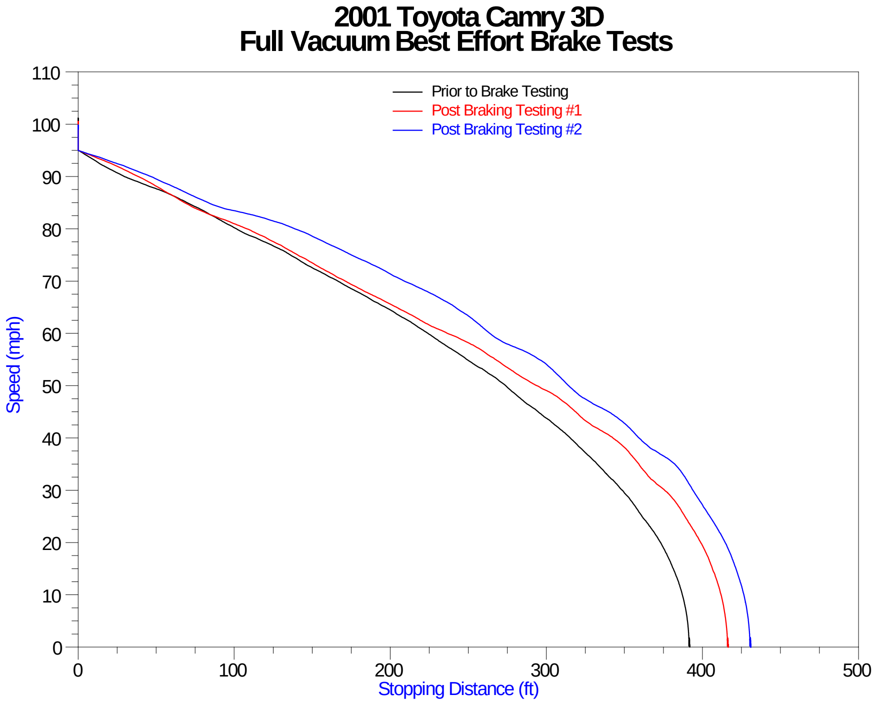
2002 Toyota Camry 2D
0 - 100 mph



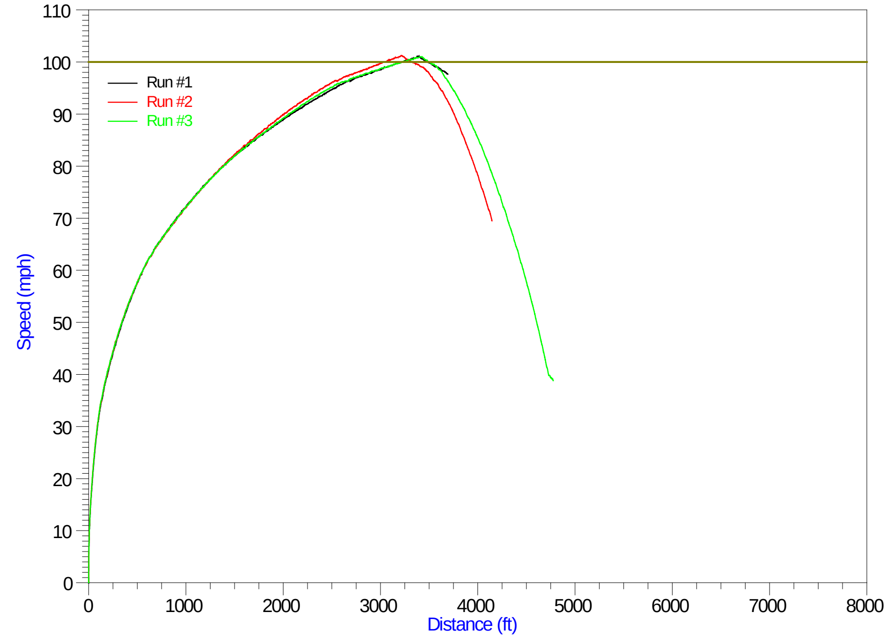
2002 Toyota Camry 2D
Full Vacuum Best Effort Brake Tests



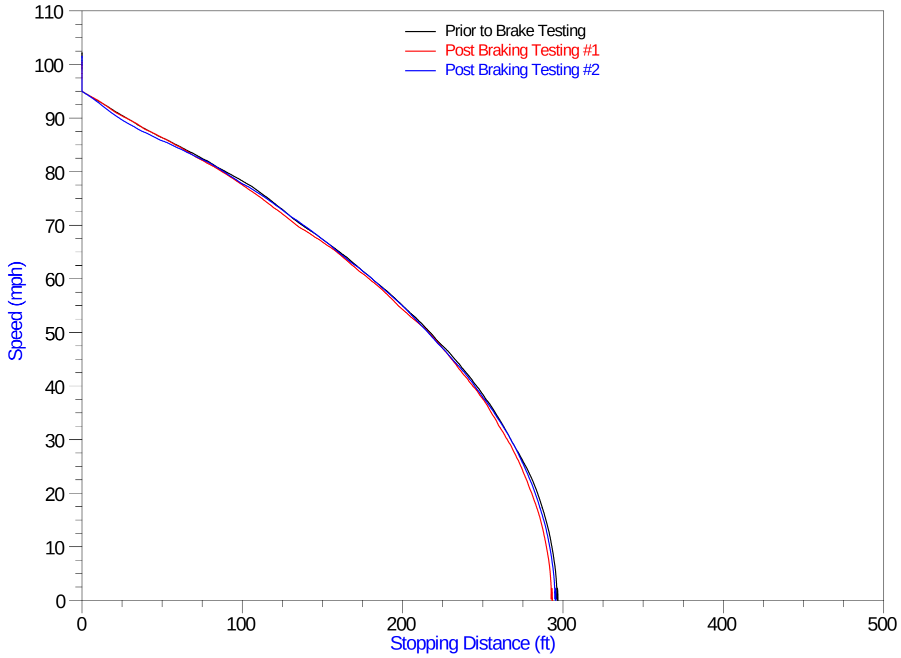
2001 Toyota Camry 3D
0 - 100 mph



2001 Toyota Camry 3D
Full Vacuum Best Effort Brake Tests

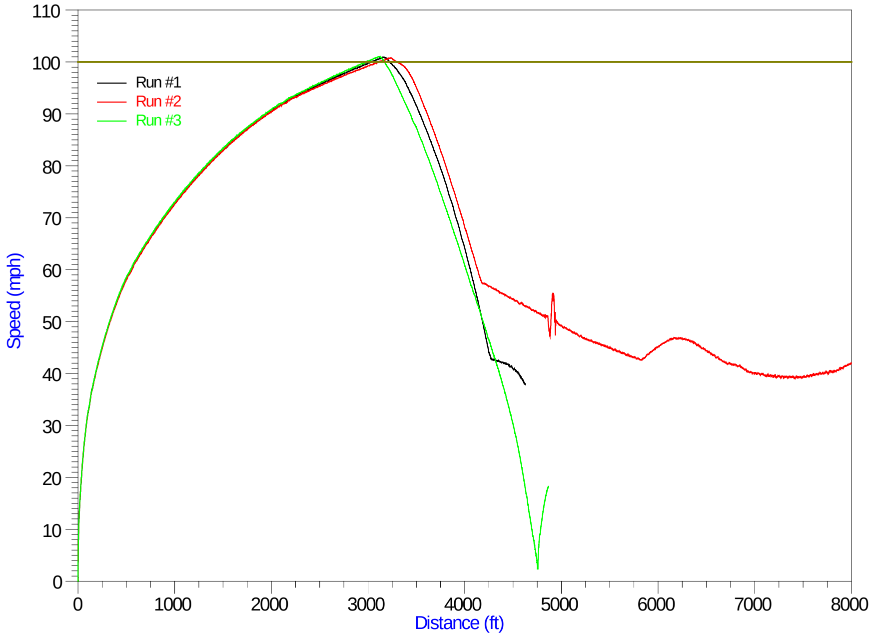


2007 Toyota Camry 4D
0 - 100 mph

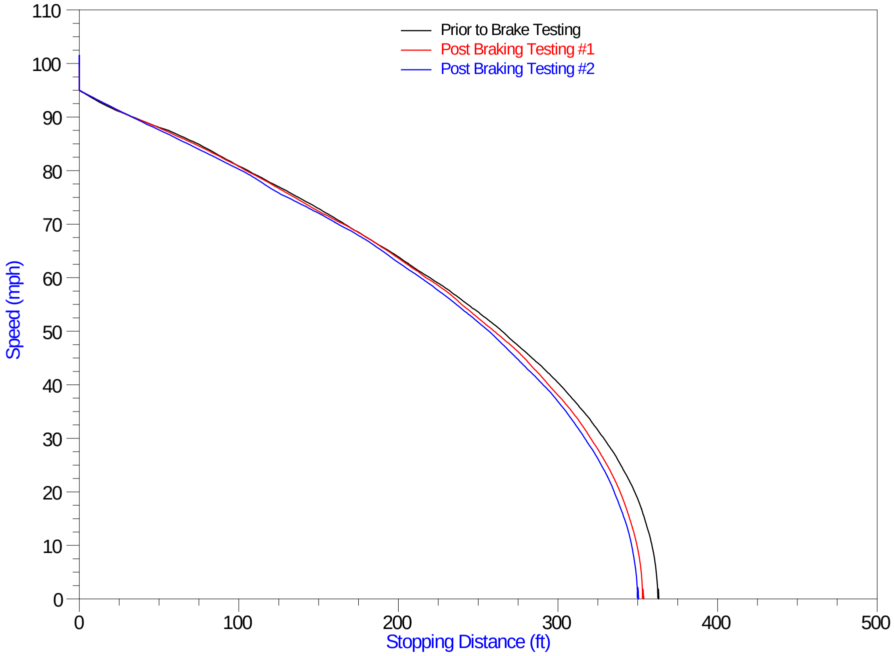


2007 Toyota Camry 4D
Full Vacuum Best Effort Brake Tests

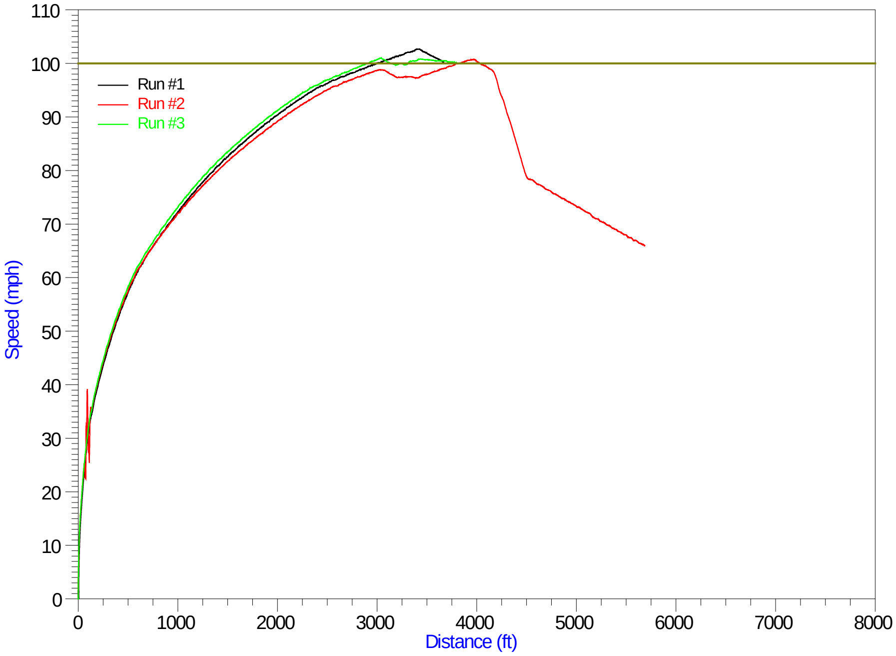
2006 Toyota Camry 5D
0 - 100 mph



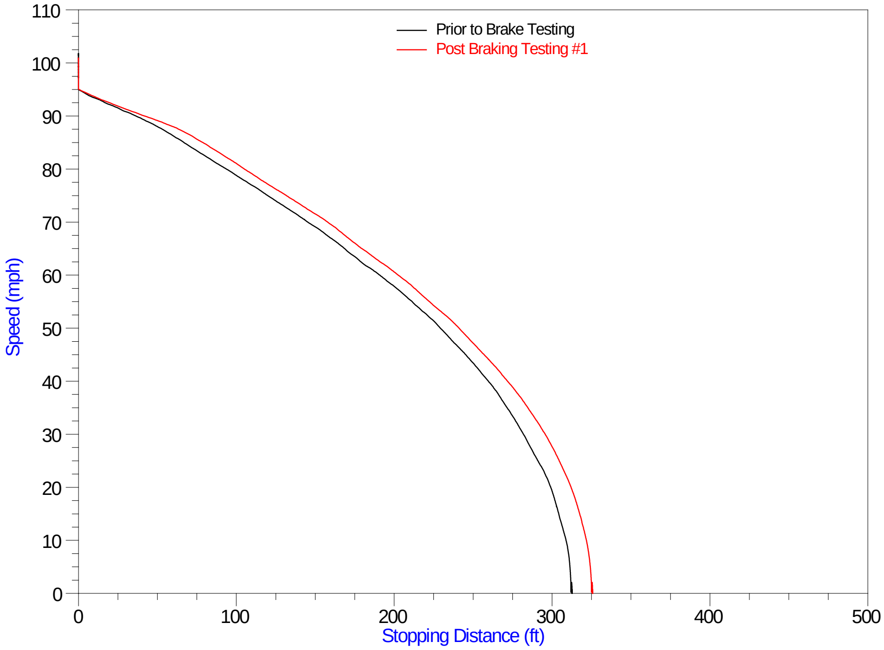
2006 Toyota Camry 5D
Full Vacuum Best Effort Brake Tests

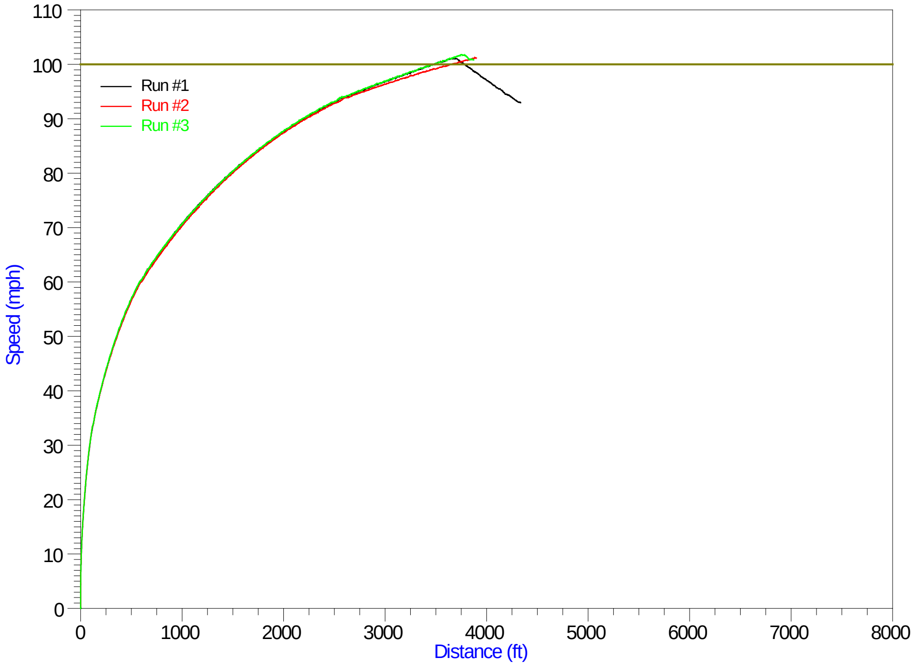


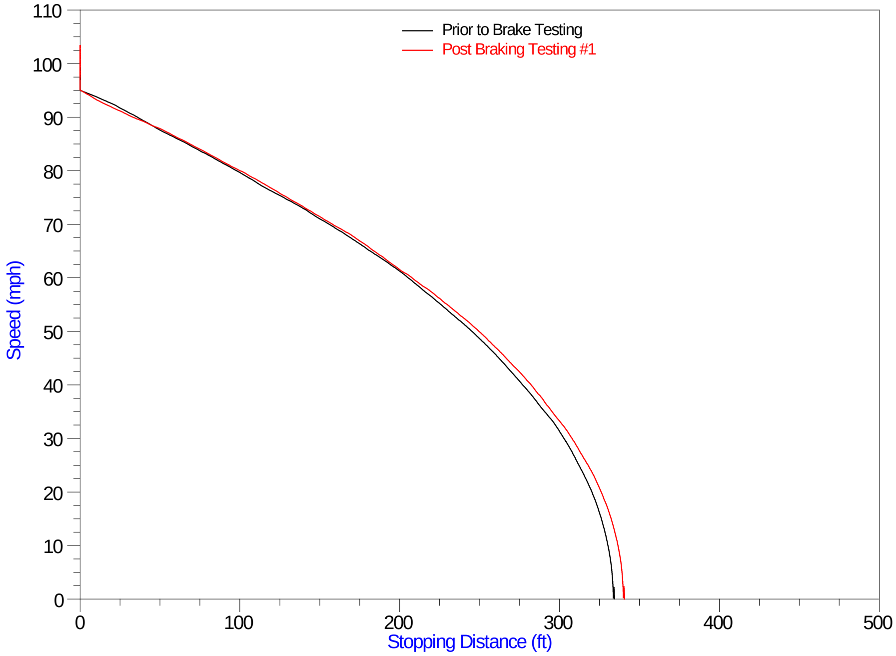
2007 Toyota Camry 6D
0 - 100 mph

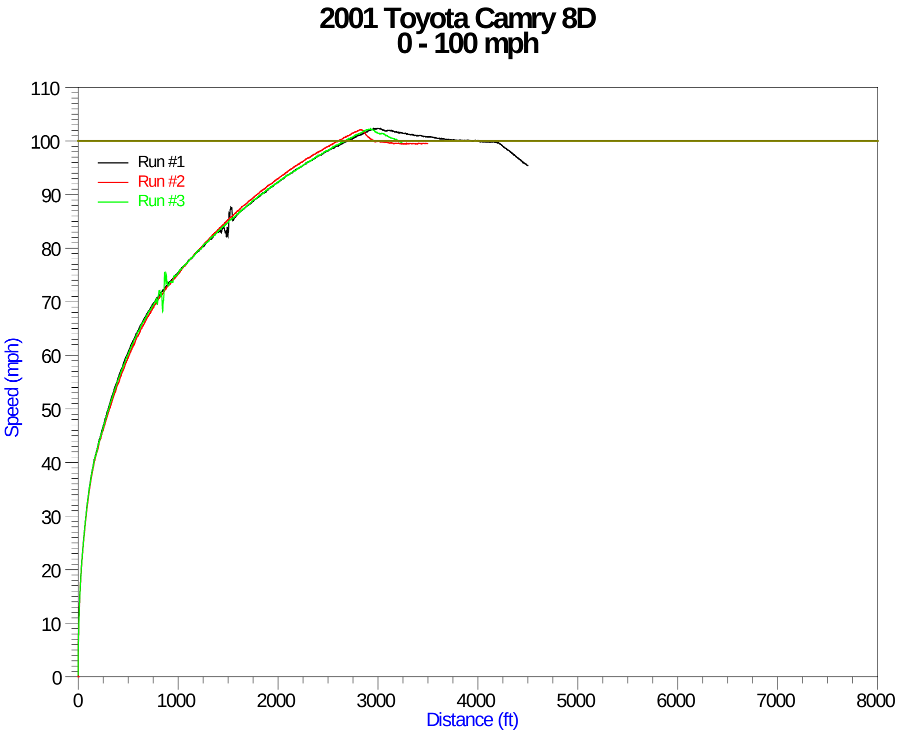


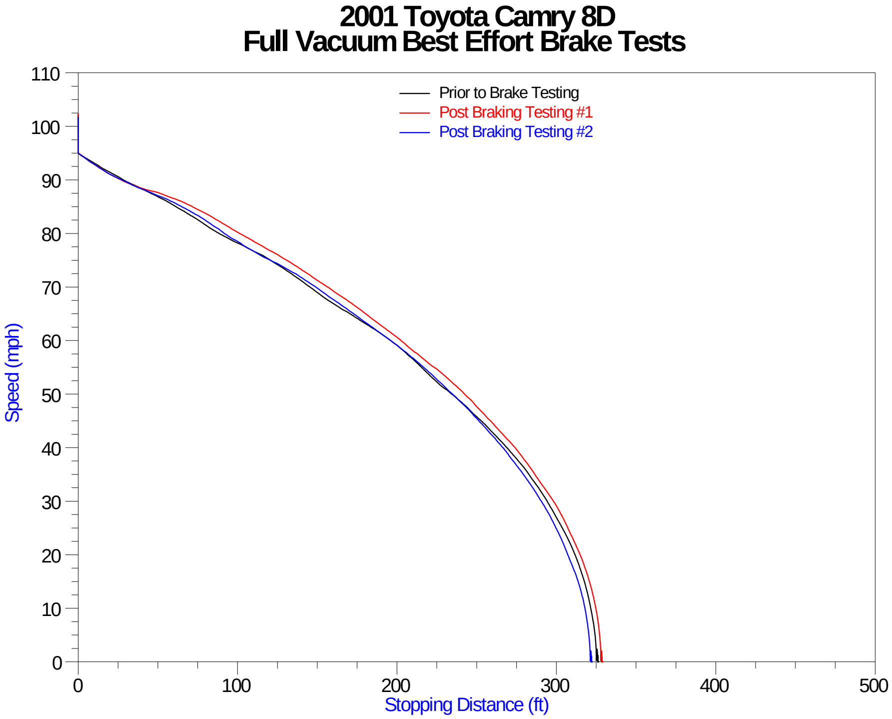
2007 Toyota Camry 6D
Full Vacuum Best Effort Brake Tests

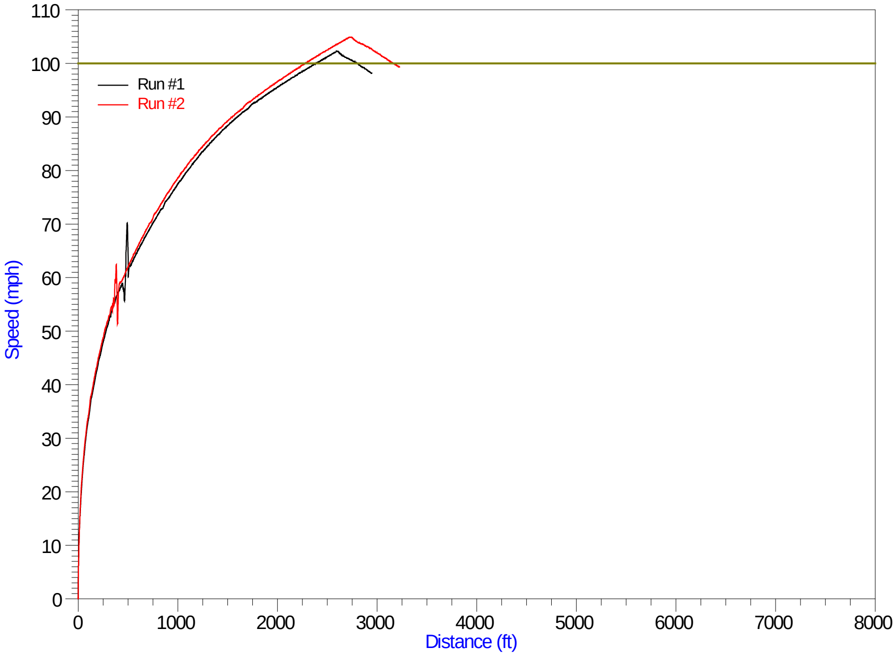



2005 Toyota Camry 7D
0 - 100 mph

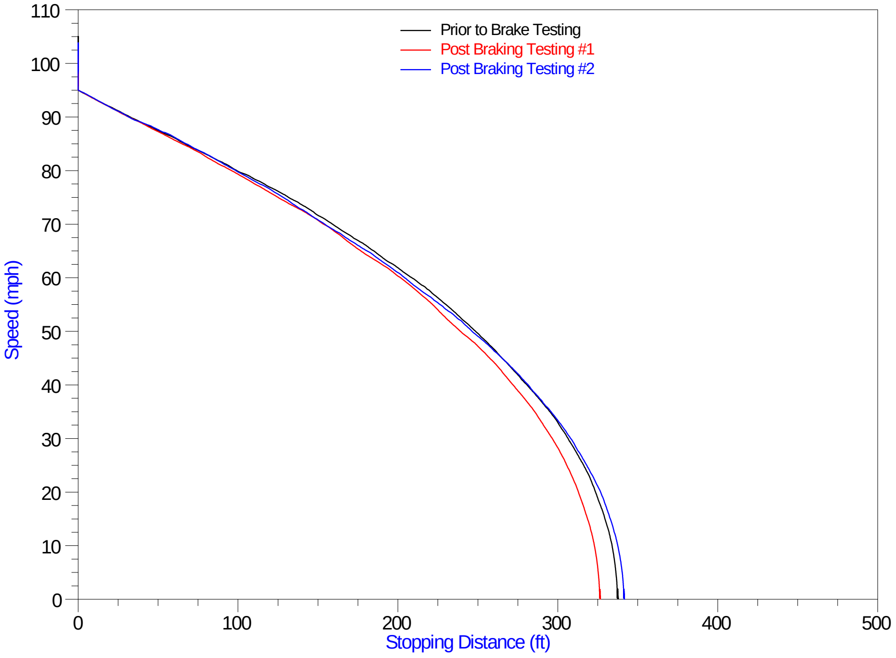

2005 Toyota Camry 7D
Full Vacuum Best Effort Brake Tests


2001 Toyota Camry 8D
0 - 100 mph
Run #1
Run #2
Run #3
Speed (mph)
0
10
20
30
40
50
60
70
80
90
100
110
Distance (ft)
0
1000
2000
3000
4000
5000
6000
7000
8000


2001 Toyota Camry 8D
Full Vacuum Best Effort Brake Tests
Prior to Brake Testing
Post Braking Testing #1
Post Braking Testing #2
Speed (mph)
0
10
20
30
40
50
60
70
80
90
100
110
Stopping Distance (ft)
0
100
200
300
400
500

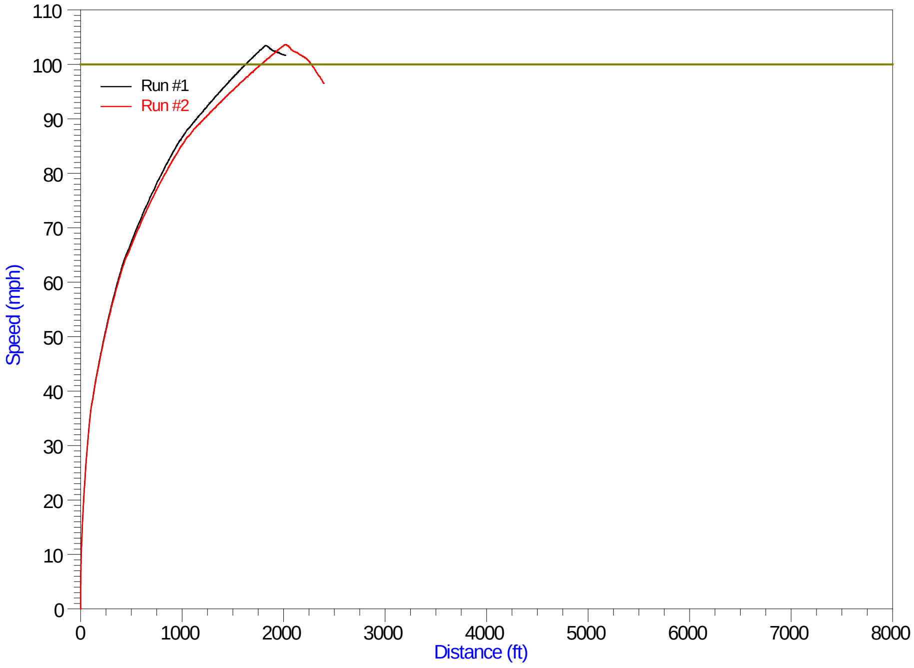


2005 Toyota Camry 9D
0 - 100 mph

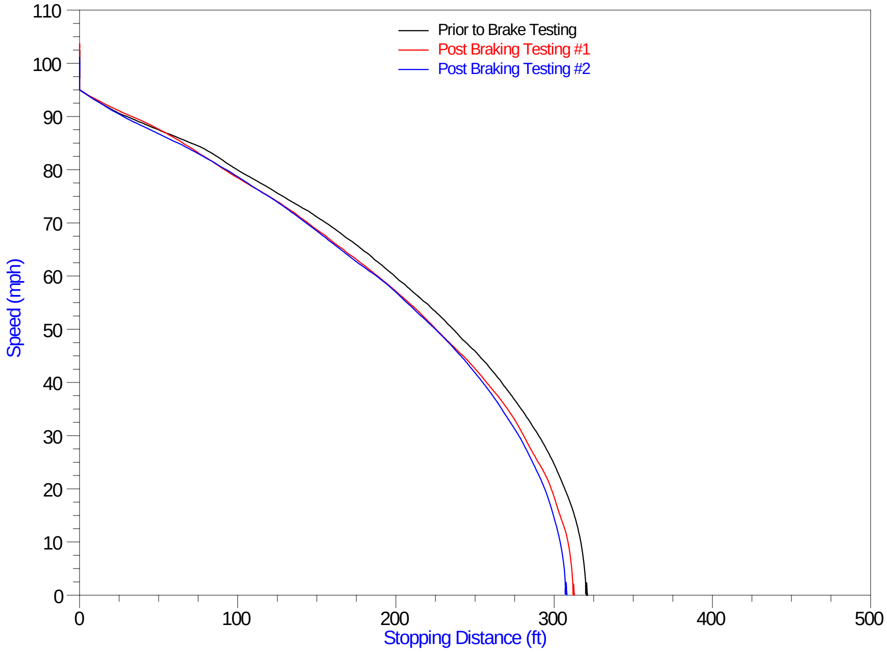


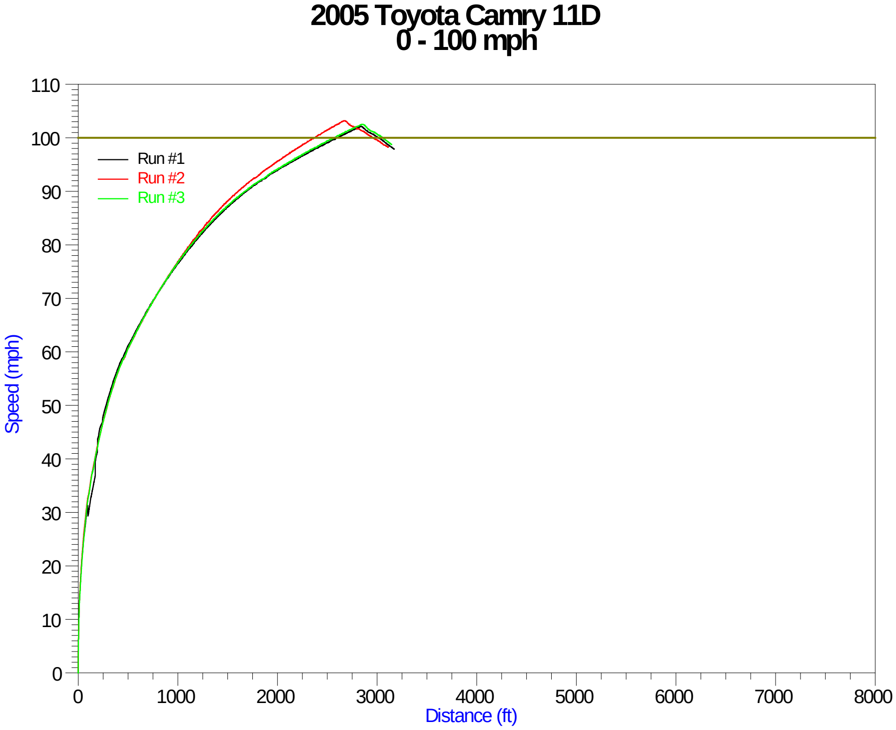
2005 Toyota Camry 9D
Full Vacuum Best Effort Brake Tests

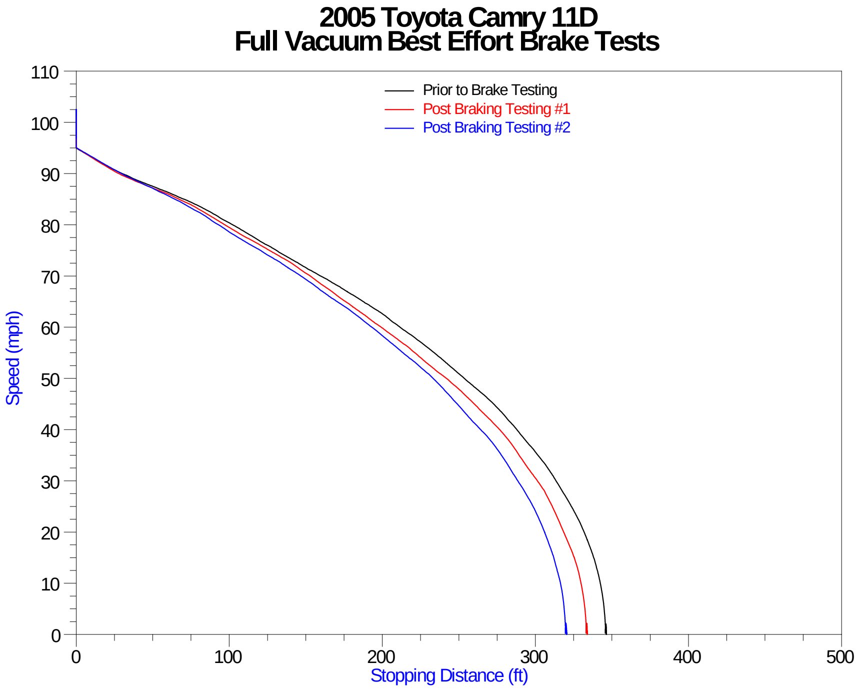
2007 Toyota Camry 10D
0 - 100 mph

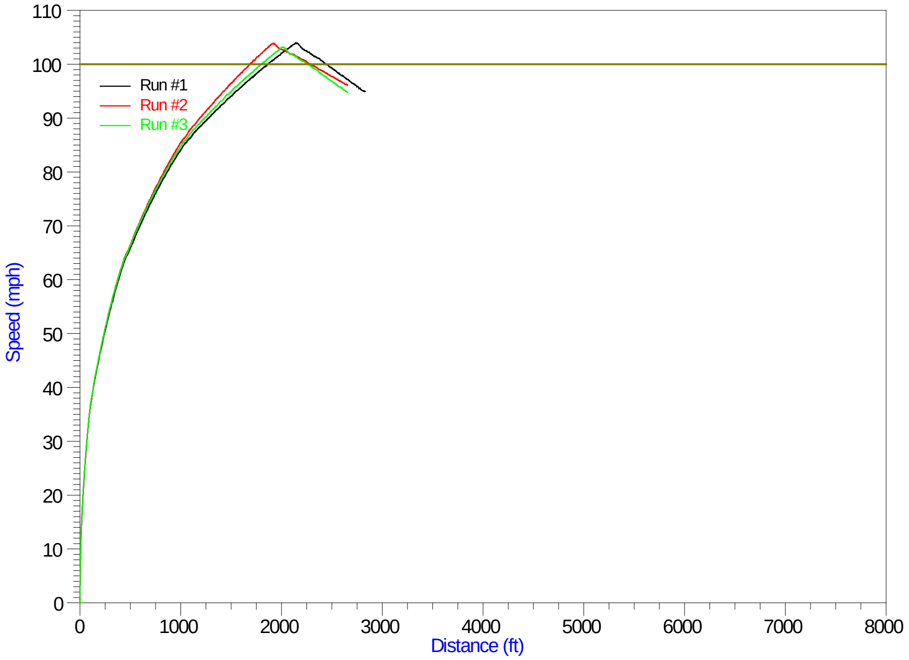


2007 Toyota Camry 10D
Full Vacuum Best Effort Brake Tests

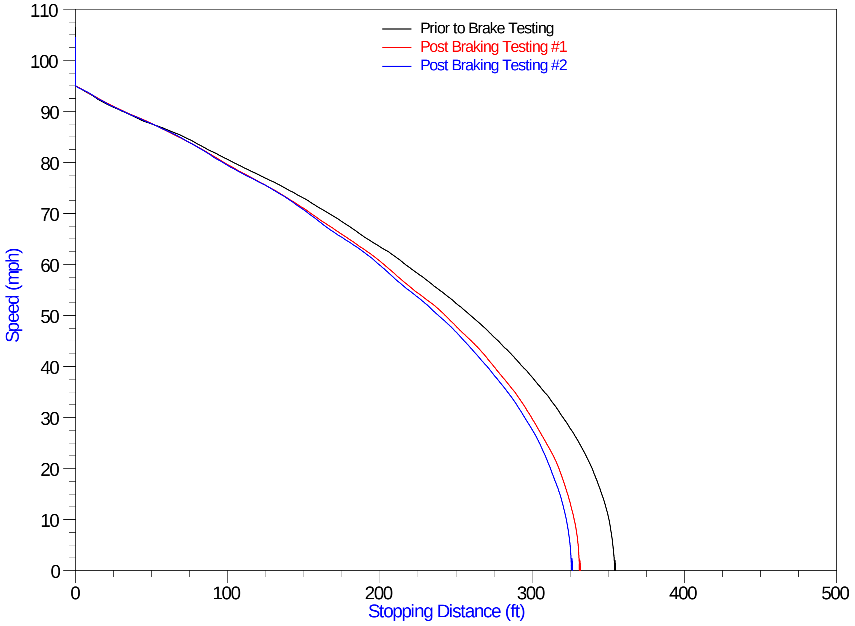



2005 Toyota Camry 11D
0 - 100 mph
Speed (mph)
Distance (ft)
Run #1
Run #2
Run #3
0
10
20
30
40
50
60
70
80
90
100
110
0
1000
2000
3000
4000
5000
6000
7000
8000


2005 Toyota Camry 11D
Full Vacuum Best Effort Brake Tests
Speed (mph)
Stopping Distance (ft)
Prior to Brake Testing
Post Braking Testing #1
Post Braking Testing #2
0
10
20
30
40
50
60
70
80
90
100
110
0
100
200
300
400
500

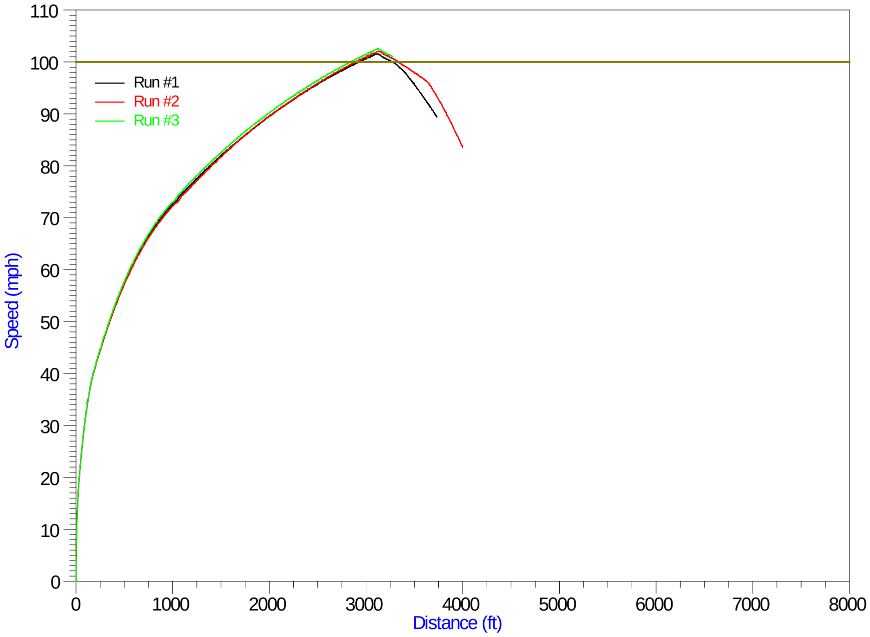


2007 Toyota Camry 12C
0 - 100 mph

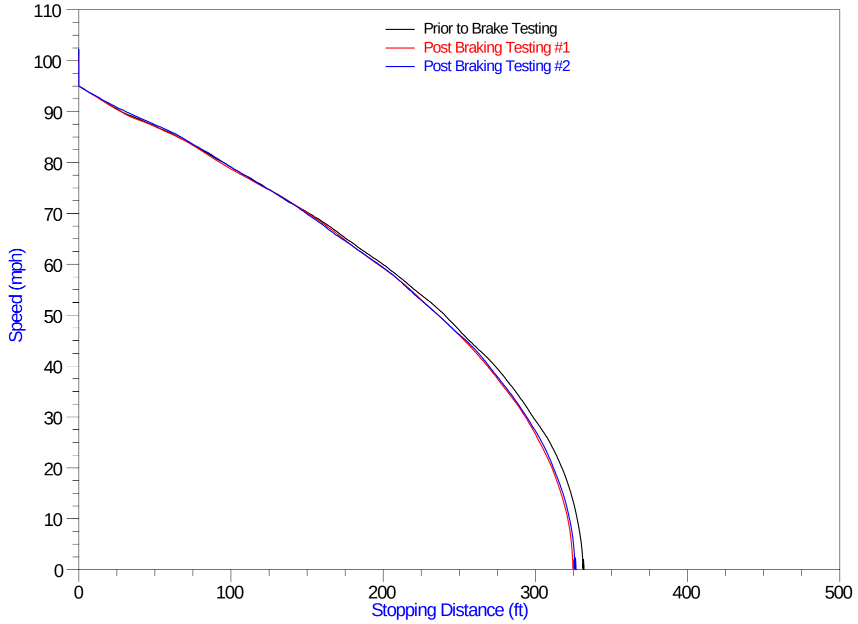


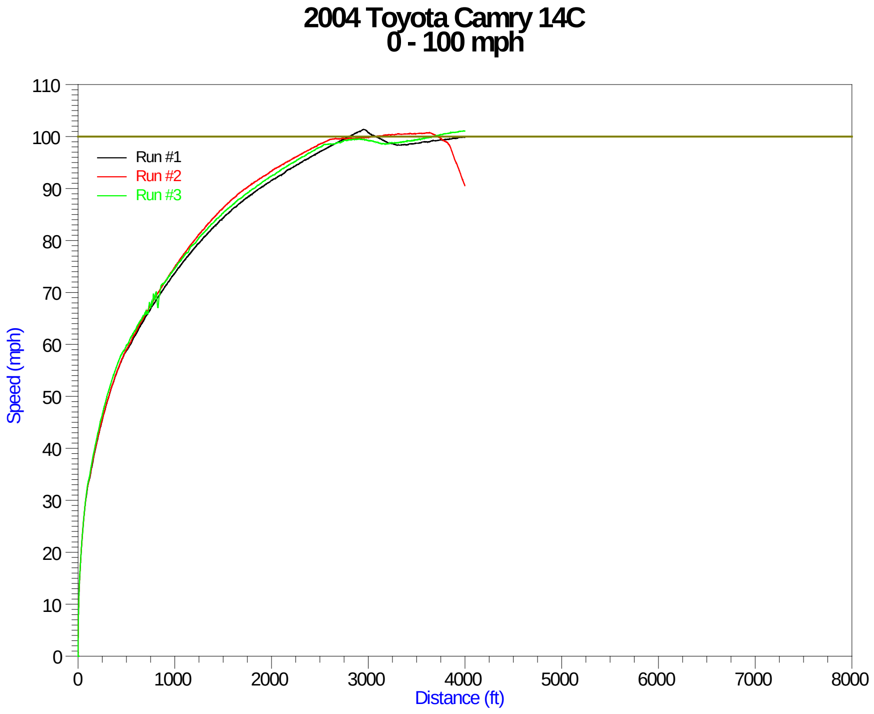
2007 Toyota Camry 12C
Full Vacuum Best Effort Brake Tests

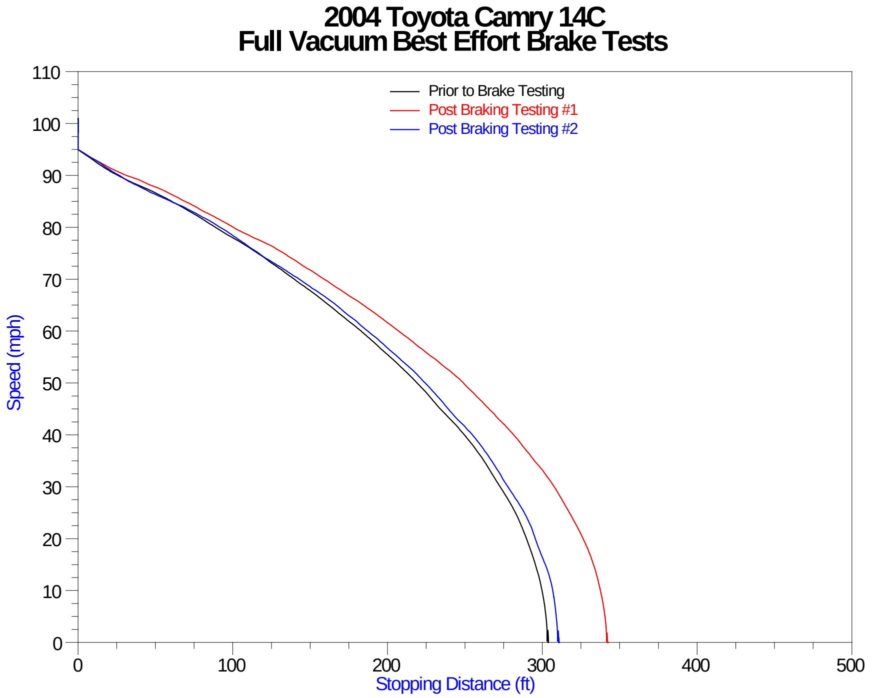
2002 Toyota Camry 13C
0 - 100 mph



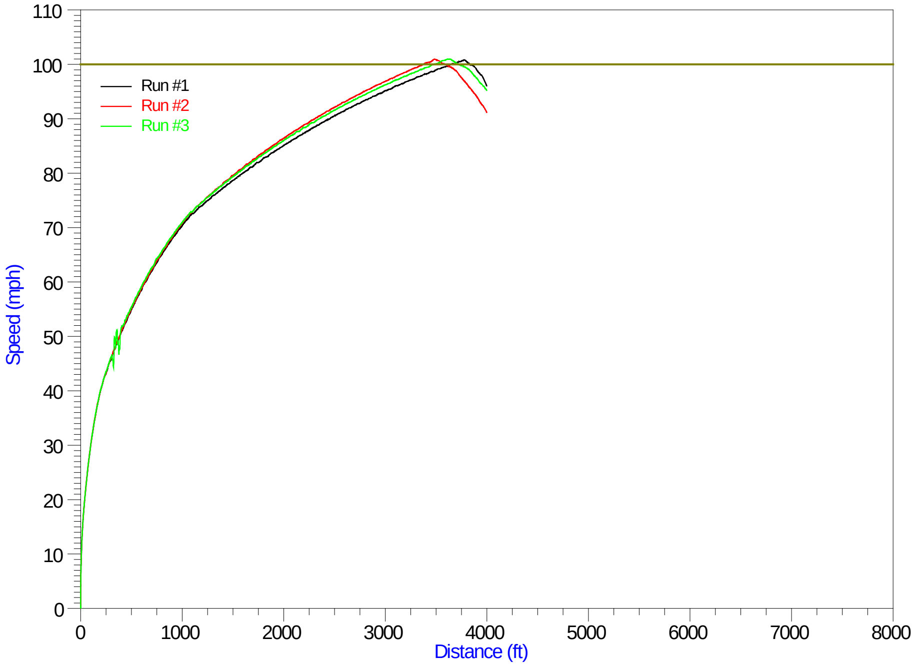
2002 Toyota Camry 13C
Full Vacuum Best Effort Brake Tests



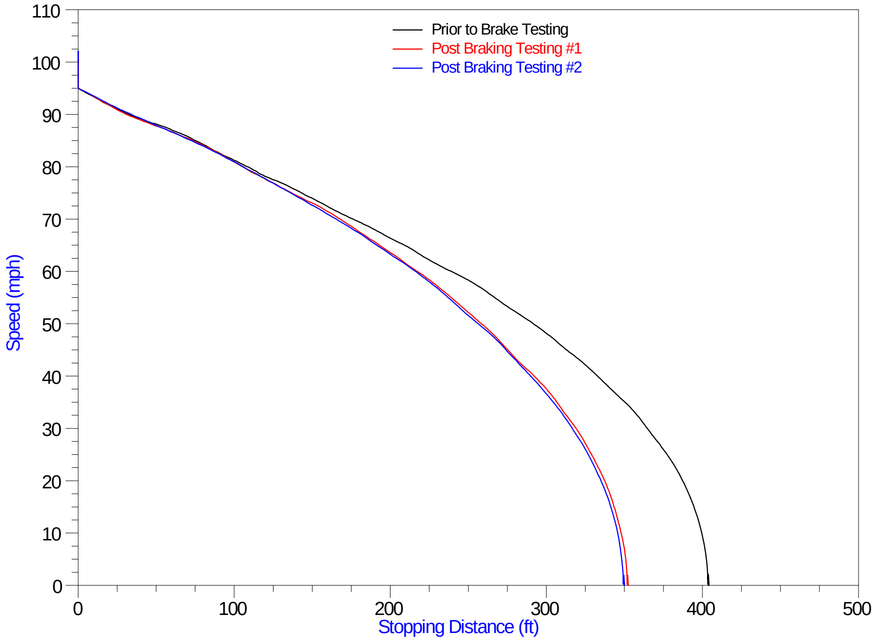

2004 Toyota Camry 14C
0 - 100 mph
Speed (mph)
Distance (ft)
0
10
20
30
40
50
60
70
80
90
100
110
0
1000
2000
3000
4000
5000
6000
7000
8000
Run #1
Run #2
Run #3


2004 Toyota Camry 14C
Full Vacuum Best Effort Brake Tests
Speed (mph)
Stopping Distance (ft)
0
10
20
30
40
50
60
70
80
90
100
110
0
100
200
300
400
500
Prior to Brake Testing
Post Braking Testing #1
Post Braking Testing #2

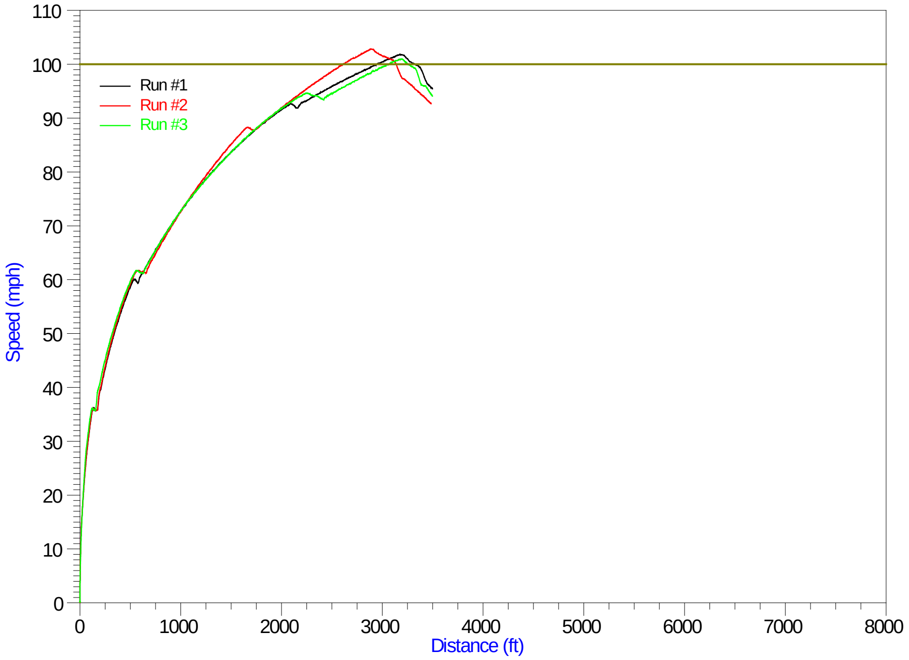
2003 Toyota Camry 15C
0 - 100 mph



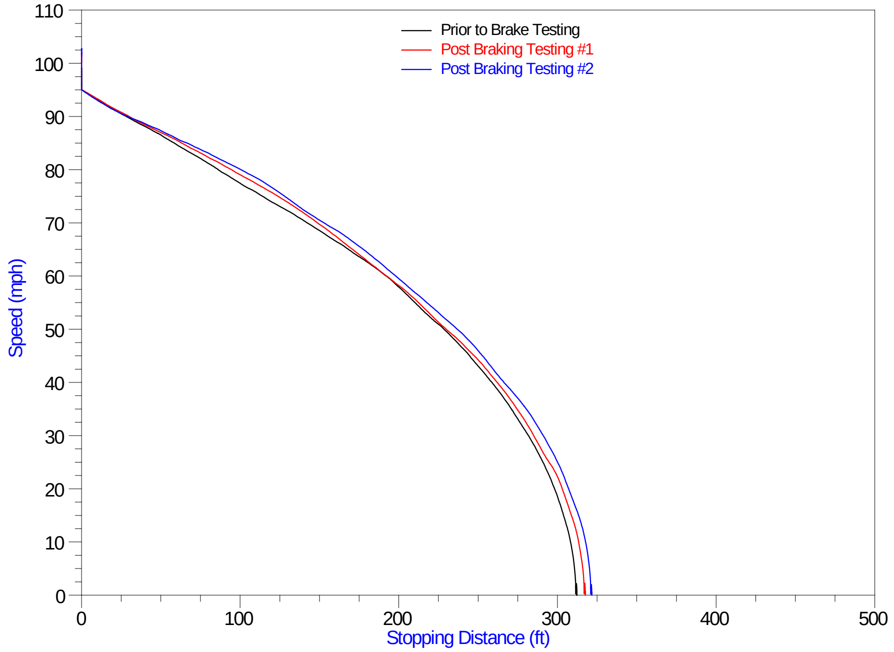
2003 Toyota Camry 15C
Full Vacuum Best Effort Brake Tests



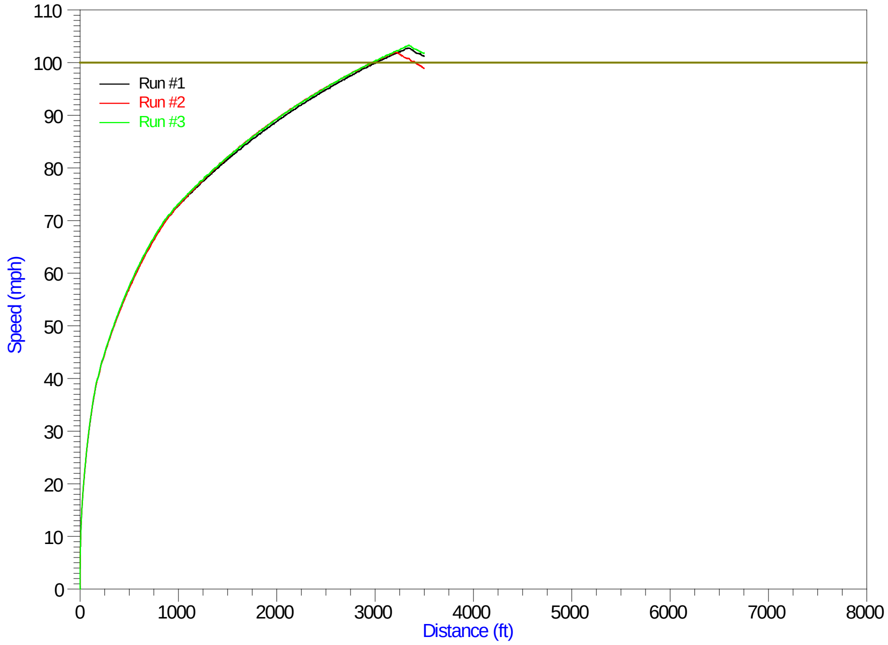
2009 Toyota Camry 16C
0 - 100 mph



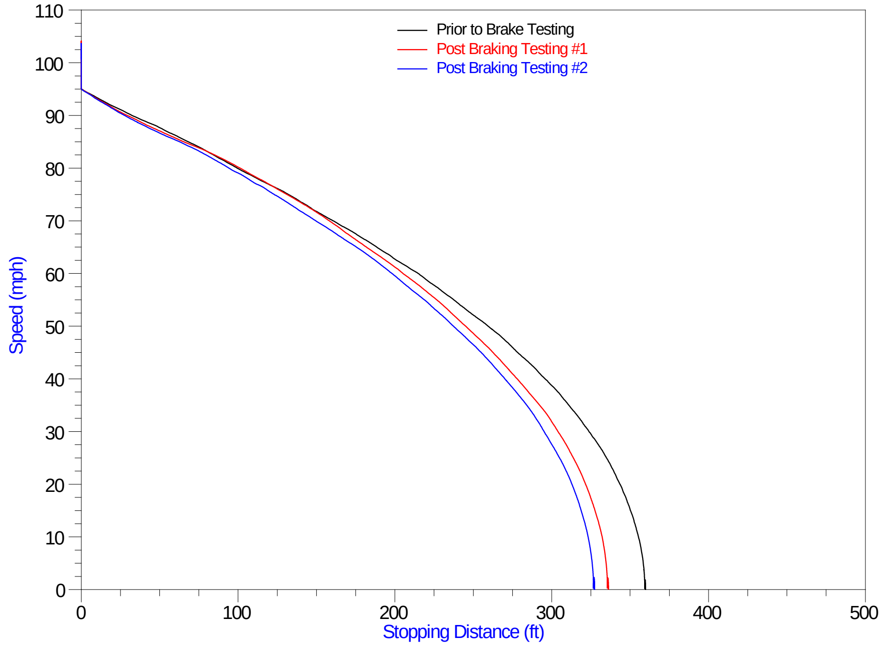
2009 Toyota Camry 16C
Full Vacuum Best Effort Brake Tests

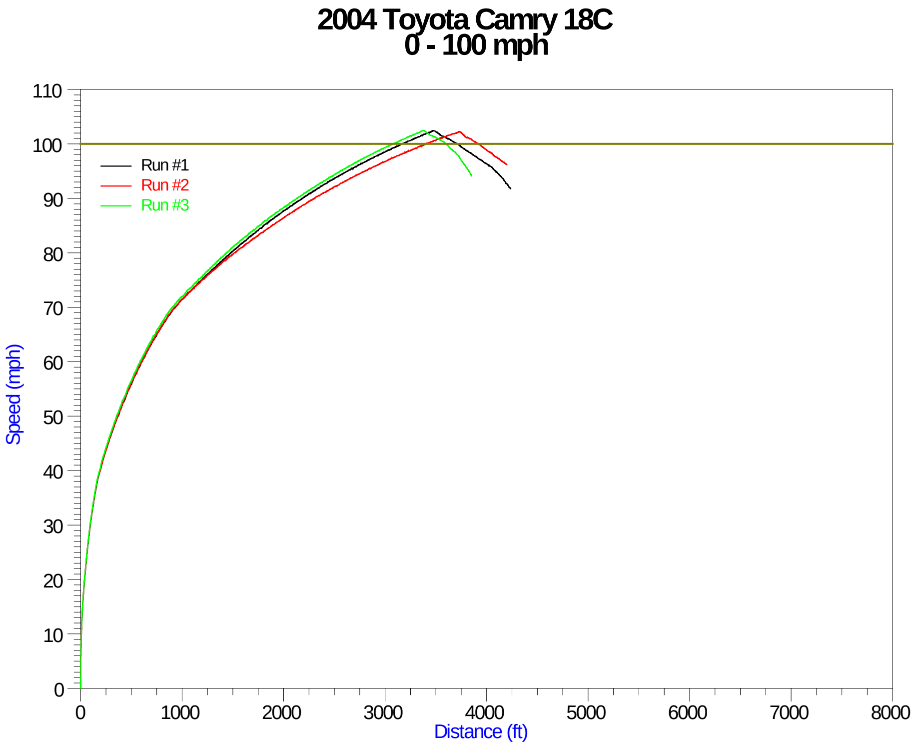


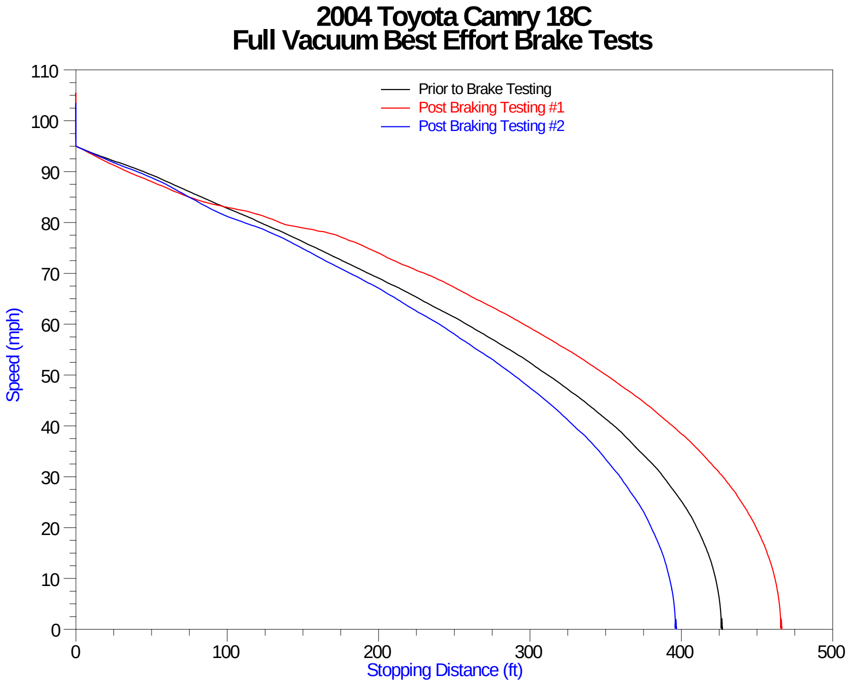
2004 Toyota Camry 17C
0 - 100 mph

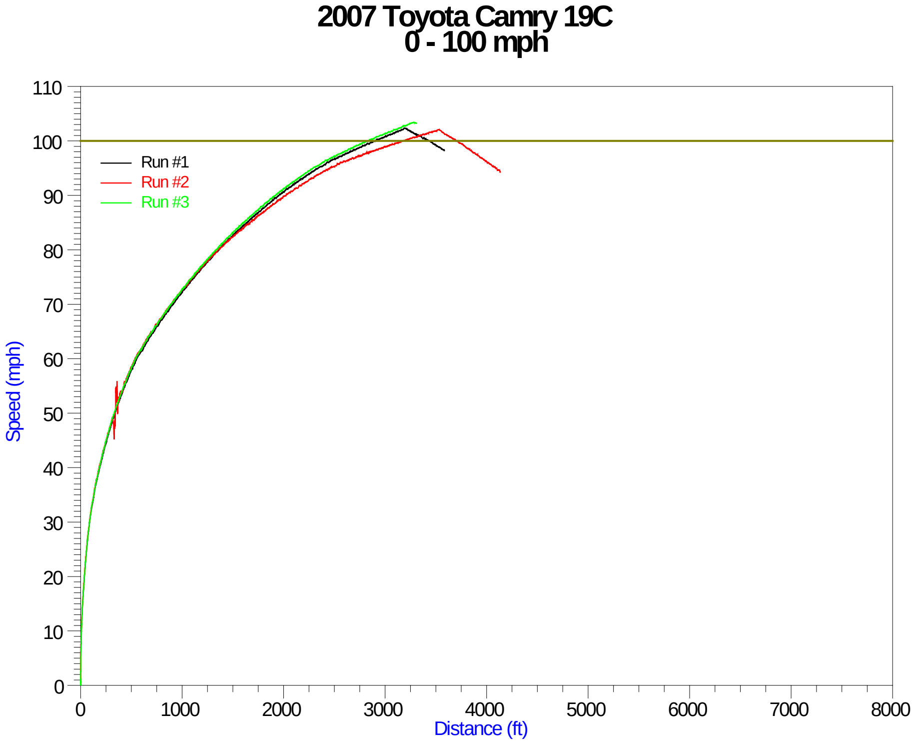


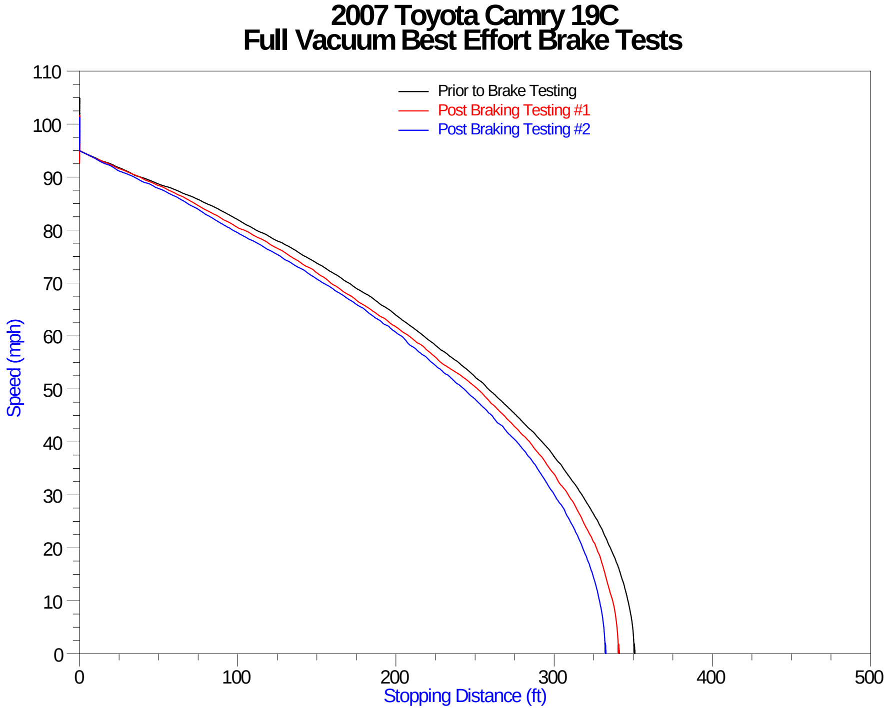
2004 Toyota Camry 17C
Full Vacuum Best Effort Brake Tests



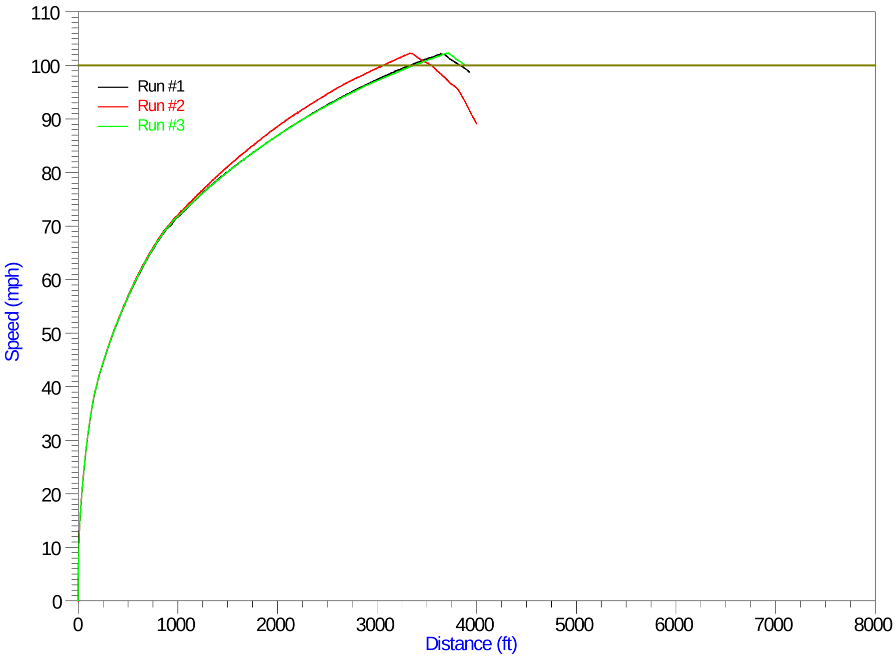

2004 Toyota Camry 18C
0 - 100 mph
Run #1
Run #2
Run #3
Speed (mph)
0
10
20
30
40
50
60
70
80
90
100
110
Distance (ft)
0
1000
2000
3000
4000
5000
6000
7000
8000


2004 Toyota Camry 18C
Full Vacuum Best Effort Brake Tests
Prior to Brake Testing
Post Braking Testing #1
Post Braking Testing #2
Speed (mph)
0
10
20
30
40
50
60
70
80
90
100
110
Stopping Distance (ft)
0
100
200
300
400
500

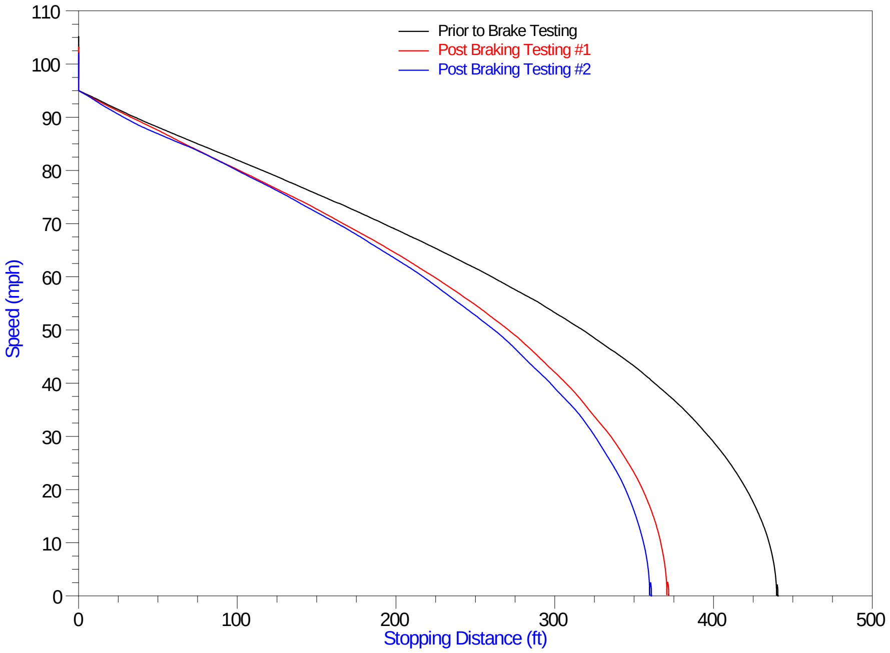

2007 Toyota Camry 19C
0 - 100 mph
Speed (mph)
Distance (ft)
Run #1
Run #2
Run #3
0
10
20
30
40
50
60
70
80
90
100
110
0
1000
2000
3000
4000
5000
6000
7000
8000


2007 Toyota Camry 19C
Full Vacuum Best Effort Brake Tests
Speed (mph)
Stopping Distance (ft)
Prior to Brake Testing
Post Braking Testing #1
Post Braking Testing #2
0
10
20
30
40
50
60
70
80
90
100
110
0
100
200
300
400
500

2004 Toyota Camry 20C
0 - 100 mph



2004 Toyota Camry 20C
Full Vacuum Best Effort Brake Tests



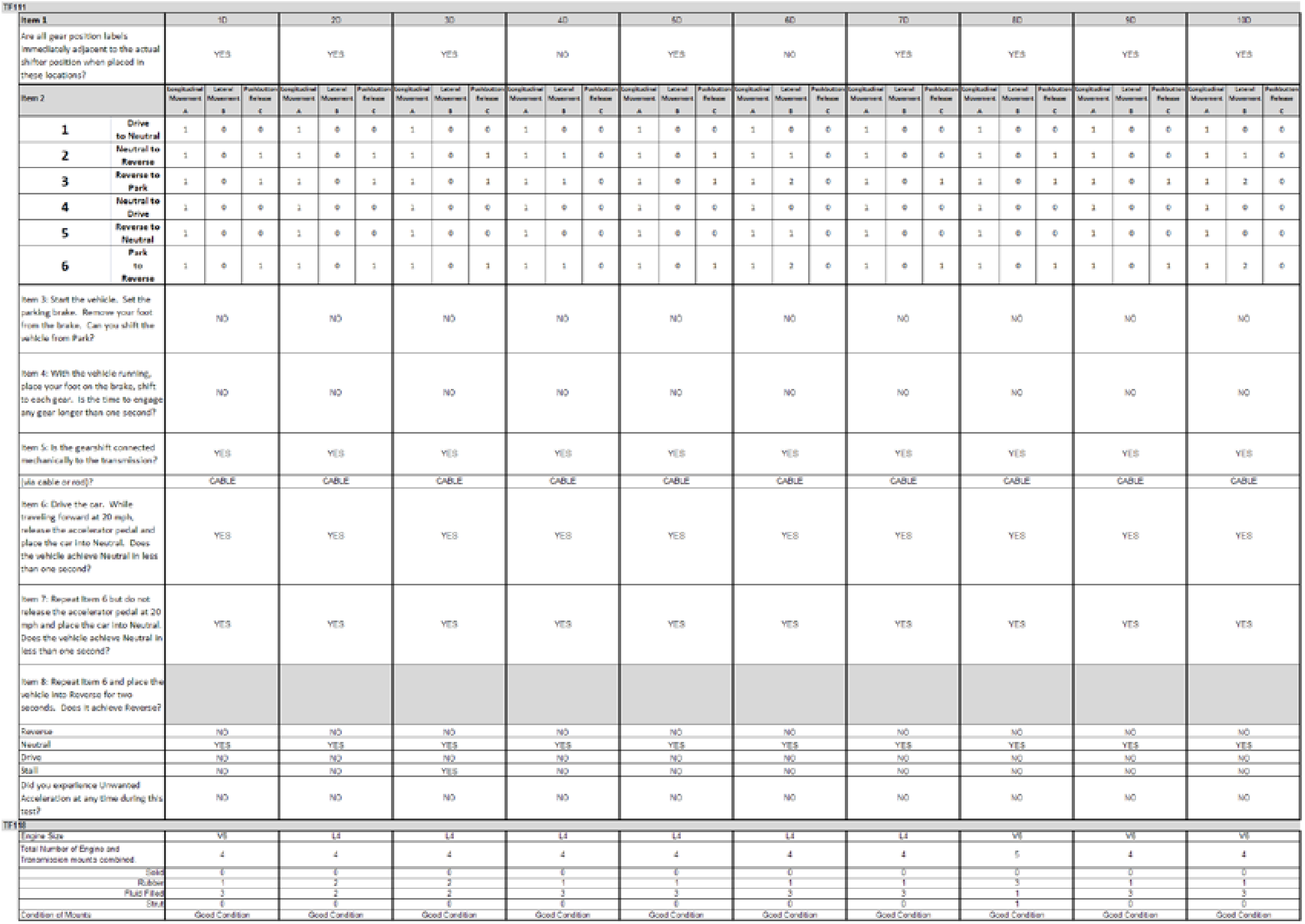
APPENDIX E5D – Cruise Control Testing – Vehicles 1-10

		1D	2D	3D	4D	5D	6D	7D	8D	9D	10D
Static											
1)	Does the brake lamp illuminate when the brake pedal is depressed?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2)	Does the control button at the end of the stalk move freely?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
3)	Does the control stalk move in all indicated directions and return normally?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
4)	Does the master cruise switch properly illuminate and extinguish the cruise light on the dash?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
5)	With the ignition on, enable the master cruise switch. Turn the ignition off and then on again. Does the cruise light remain off?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Dynamic											
1)	With the master cruise switch off (no green cruise lamp), drive at 40 mph. Do any of the functions RES, SET, and Cancel have any effect on the vehicle's operation?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2)	Enable the master cruise switch. Drive at 40 mph, use the SET function of the cruise stalk to set cruise speed. Does the vehicle hold 40 mph for at least 3/10's of a mile?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
3)	Apply the brake. Does the cruise immediately disengage?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
4)	Set the cruise at 60 MPH on straight and level road. Depress brake to release cruise. While driving steady state straight and level at 35 mph, select resume from cruise stalk. Does the cruise resume to 60 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
5)	Set the cruise at 60 on straight and level road. Use cruise stalk to cancel the cruise operation. Does the cruise immediately disengage?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
6)	When the speed is decreases to 50 mph, select the resume feature. Does the cruise resume to 60 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
7)	Select and hold the ACCEL from 60 mph to 90 mph. Does the vehicle downshift to accelerate?	NO	YES	YES	YES	YES	YES	YES	NO	YES	YES
8)	Set the cruise at 40 mph. Depress and hold ACCEL for at least five seconds. Without releasing the ACCEL button, rapidly depress the accelerator to the floor. Does pressing the accelerator cause a greater increased engine power or further downshifting?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
9)	When ACCEL is released at 90 mph, does the vehicle maintain 90 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
10)	Hold ACCEL at 90 mph. Does the cruise accelerate the vehicle to at least 120 mph?	YES	YES	NO*	YES	YES	YES	YES	YES	YES	YES
11)	Hold the DECEL button to 50 mph. Does the cruise maintain 50 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
12)	With the cruise maintaining a speed of 50 mph, shift to Neutral. Does the cruise disengage?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
13)	With the cruise maintaining a speed of 50 mph, downshift. Does the cruise disengage?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
14)	With the cruise maintaining a speed of 50 mph, push the accelerator to increase speed to 60 mph. Release the accelerator pedal and let the car coast. Does cruise automatically resume speed at 50 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
15)	With the cruise maintaining a speed of 60 mph, turn off the master cruise switch. Turn it back on and press resume. Does the cruise control resume speed?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
16)	Drive at 40 and set cruise, apply brake, coast to 10 mph. Verify cruise will not resume at this speed. Slowly increase speed in 2 mph increments to establish minimum speed for resume function. What is the minimum speed that cruise will begin to resume?	DNR	DNR	DNR	30mph	28 mph	27 mph	25 mph	DNR	26 mph	26 mph
17)	Did you experience any unwanted acceleration incidents durng testing?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

APPENDIX E5D – Cruise Control Testing – Vehicles 11-20

		11D	12C	13C	14C	15C	16C	17C	18C	19C	20C
Static											
1)	Does the brake lamp illuminate when the brake pedal is depressed?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
2)	Does the control button at the end of the stalk move freely?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
3)	Does the control stalk move in all indicated directions and return normally?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
4)	Does the master cruise switch properly illuminate and extinguish the cruise light on the dash?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
5)	With the ignition on, enable the master cruise switch. Turn the ignition off and then on again. Does the cruise light remain off?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Dynamic											
1)	With the master cruise switch off (no green cruise lamp), drive at 40 mph. Do any of the functions RES, SET, and Cancel have any effect on the vehicle's operation?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2)	Enable the master cruise switch. Drive at 40 mph, use the SET function of the cruise stalk to set cruise speed. Does the vehicle hold 40 mph for at least 3/10's of a mile?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
3)	Apply the brake. Does the cruise immediately disengage?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
4)	Set the cruise at 60 MPH on straight and level road. Depress brake to release cruise. While driving steady state straight and level at 35 mph, select resume from cruise stalk. Does the cruise resume to 60 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
5)	Set the cruise at 60 on straight and level road. Use cruise stalk to cancel the cruise operation. Does the cruise immediately disengage?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
6)	When the speed is decreases to 50 mph, select the resume feature. Does the cruise resume to 60 mph?	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES
7)	Select and hold the ACCEL from 60 mph to 90 mph. Does the vehicle downshift to accelerate?	YES	YES	NO	YES	YES	NO	YES	NO	YES	YES
8)	Set the cruise at 40 mph. Depress and hold ACCEL for at least five seconds. Without releasing the ACCEL button, rapidly depress the accelerator to the floor. Does pressing the accelerator cause a greater increased engine power or further downshifting?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
9)	When ACCEL is released at 90 mph, does the vehicle maintain 90 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
10)	Hold ACCEL at 90 mph. Does the cruise accelerate the vehicle to at least 120 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
11)	Hold the DECEL button to 50 mph. Does the cruise maintain 50 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
12)	With the cruise maintaining a speed of 50 mph, shift to Neutral. Does the cruise disengage?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
13)	With the cruise maintaining a speed of 50 mph, downshift. Does the cruise disengage?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
14)	With the cruise maintaining a speed of 50 mph, push the accelerator to increase speed to 60 mph. Release the accelerator pedal and let the car coast. Does cruise automatically resume speed at 50 mph?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
15)	With the cruise maintaining a speed of 60 mph, turn off the master cruise switch. Turn it back on and press resume. Does the cruise control resume speed?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
16)	Drive at 40 and set cruise, apply brake, coast to 10 mph. Verify cruise will not resume at this speed. Slowly increase speed in 2 mph increments to establish minimum speed for resume function. What is the minimum speed that cruise will begin to resume?	25 mph	25 mph	DNR	DNR	25 mph	25 mph	DNR	26 mph	25 mph	DNR
17)	Did you experience any unwanted acceleration incidents durng testing?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

APPENDIX E6 - Module 6 – Gearshift Lever and Transmission (Page 1 of 2)



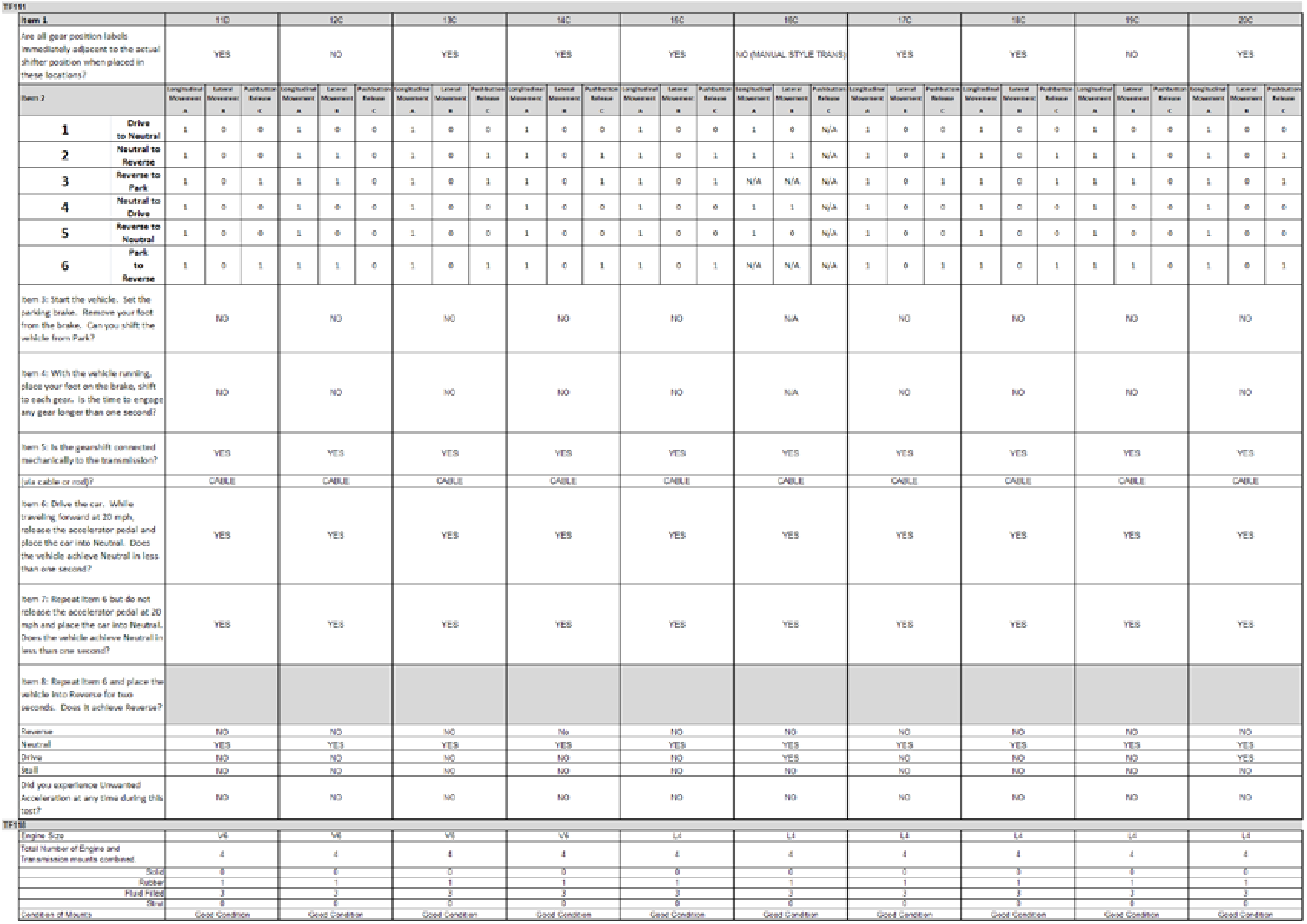
TF111

Item 1	1D			2D			3D			4D			5D			6D			7D			8D			9D			10D		
Are all gear position labels immediately adjacent to the actual shifter position when placed in these locations?	YES			YES			YES			NO			YES			NO			YES			YES			YES			YES		
Item 2	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C
1 Drive to Neutral	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
2 Neutral to Reverse	1	0	1	1	0	1	1	0	1	1	1	0	1	0	1	1	1	0	1	0	0	1	0	1	1	0	0	1	1	0
3 Reverse to Park	1	0	1	1	0	1	1	0	1	1	1	0	1	0	1	1	2	0	1	0	1	1	0	1	1	0	1	1	2	0
4 Neutral to Drive	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
5 Reverse to Neutral	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0
6 Park to Reverse	1	0	1	1	0	1	1	0	1	1	1	0	1	0	1	1	2	0	1	0	1	1	0	1	1	0	1	1	2	0
Item 3: Start the vehicle. Set the parking brake. Remove your foot from the brake. Can you shift the vehicle from Park?	NO			NO			NO			NO			NO			NO			NO			NO			NO			NO		
Item 4: With the vehicle running, place your foot on the brake, shift to each gear. Is the time to engage any gear longer than one second?	NO			NO			NO			NO			NO			NO			NO			NO			NO			NO		
Item 5: Is the gearshift connected mechanically to the transmission?	YES			YES			YES			YES			YES			YES			YES			YES			YES			YES		
(via cable or rod)?	CABLE			CABLE			CABLE			CABLE			CABLE			CABLE			CABLE			CABLE			CABLE			CABLE		
Item 6: Drive the car. While travelling forward at 20 mph, release the accelerator pedal and place the car into Neutral. Does the vehicle achieve Neutral in less than one second?	YES			YES			YES			YES			YES			YES			YES			YES			YES			YES		
Item 7: Repeat Item 6 but do not release the accelerator pedal at 20 mph and place the car into Neutral. Does the vehicle achieve Neutral in less than one second?	YES			YES			YES			YES			YES			YES			YES			YES			YES			YES		
Item 8: Repeat Item 6 and place the vehicle into Reverse for two seconds. Does it achieve Reverse?																														
Reverse	NO			NO			NO			NO			NO			NO			NO			NO			NO			NO		
Neutral	YES			YES			YES			YES			YES			YES			YES			YES			YES			YES		
Drive	NO			NO			NO			NO			NO			NO			NO			NO			NO			NO		
Stall	NO			NO			YES			NO			NO			NO			NO			NO			NO			NO		
Did you experience Unwanted Acceleration at any time during this test?	NO			NO			NO			NO			NO			NO			NO			NO			NO			NO		

TF1[illegible]

	1D	2D	3D	4D	5D	6D	7D	8D	9D	10D
Engine Size	V6	L4	L4	L4	L4	L4	L4	V6	V6	V6
Total Number of Engine and Transmission mounts combined	4	4	4	4	4	4	4	5	4	4
Solid	0	0	0	0	0	0	0	0	0	0
Rubber	1	2	2	1	1	1	1	3	1	1
Fluid Filled	3	2	2	3	3	3	3	1	3	3
Strut	0	0	0	0	0	0	0	1	0	0
Condition of Mounts	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition

APPENDIX E6 - Module 6 – Gearshift Lever and Transmission (Page 2 of 2)



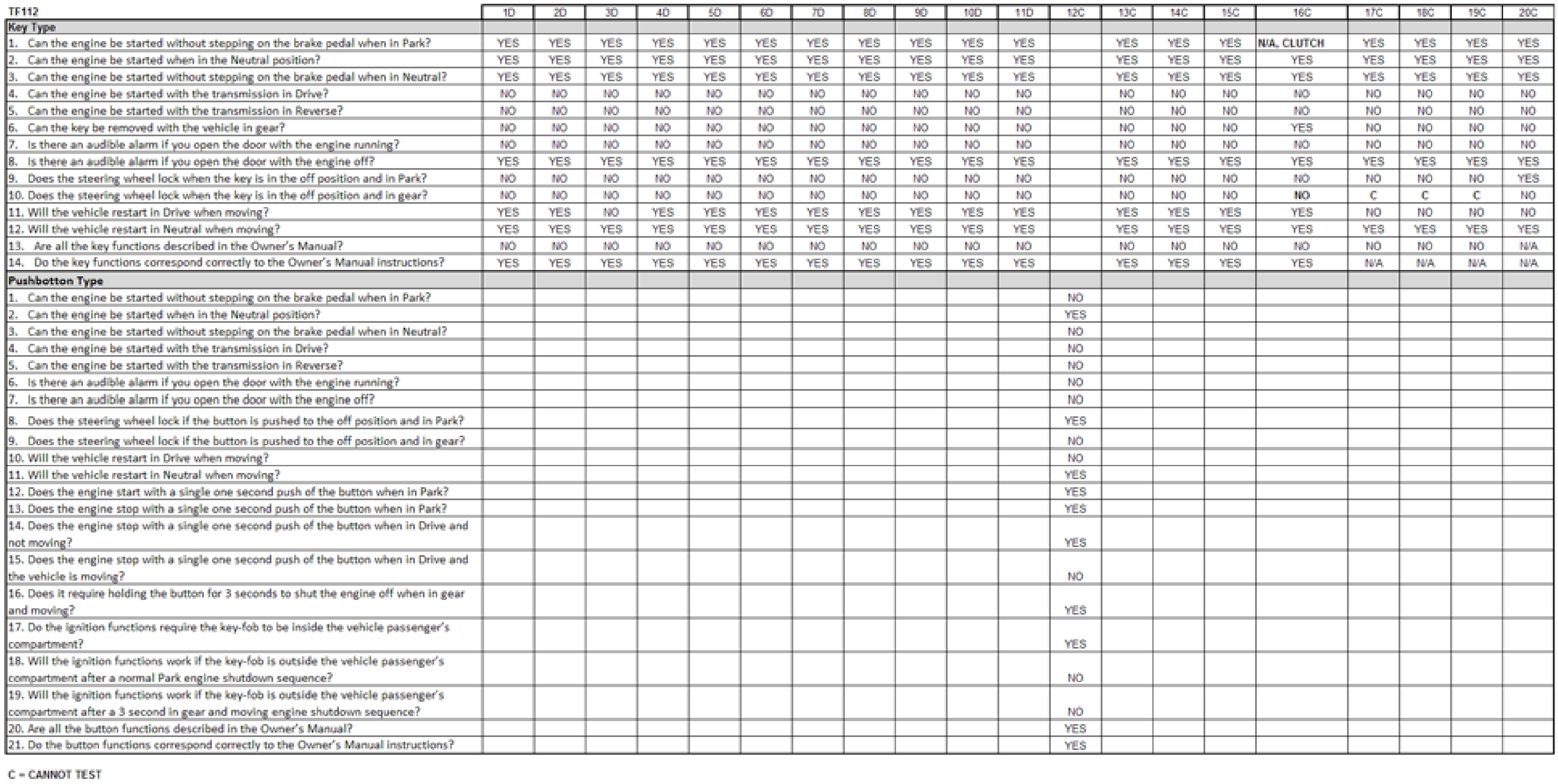
TF111

Item 1	11D			12C			13C			14C			15C			16C			17C			18C			19C			20C		
Are all gear position labels immediately adjacent to the actual shifter position when placed in these locations?	YES			NO			YES			YES			YES			NO (MANUAL STYLE TRANS)			YES			YES			NO			YES		
Item 2	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C	Longitudinal Movement A	Lateral Movement B	Pushbutton Release C
1 Drive to Neutral	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	N/A	1	0	0	1	0	0	1	0	0	1	0	0
2 Neutral to Reverse	1	0	0	1	1	0	1	0	1	1	0	1	1	0	1	1	1	N/A	1	0	1	1	0	1	1	1	0	1	0	1
3 Reverse to Park	1	0	1	1	1	0	1	0	1	1	0	1	1	0	1	N/A	N/A	N/A	1	0	1	1	0	1	1	1	0	1	0	1
4 Neutral to Drive	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	1	N/A	1	0	0	1	0	0	1	0	0	1	0	0
5 Reverse to Neutral	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	N/A	1	0	0	1	0	0	1	0	0	1	0	0
6 Park to Reverse	1	0	1	1	1	0	1	0	1	1	0	1	1	0	1	N/A	N/A	N/A	1	0	1	1	0	1	1	1	0	1	0	1
Item 3: Start the vehicle. Set the parking brake. Remove your foot from the brake. Can you shift the vehicle from Park?	NO			NO			NO			NO			NO			N/A			NO			NO			NO			NO		
Item 4: With the vehicle running, place your foot on the brake, shift to each gear. Is the time to engage any gear longer than one second?	NO			NO			NO			NO			NO			N/A			NO			NO			NO			NO		
Item 5: Is the gearshift connected mechanically to the transmission?	YES			YES			YES			YES			YES			YES			YES			YES			YES			YES		
(via cable or rod)?	CABLE			CABLE			CABLE			CABLE			CABLE			CABLE			CABLE			CABLE			CABLE			CABLE		
Item 6: Drive the car. While traveling forward at 20 mph, release the accelerator pedal and place the car into Neutral. Does the vehicle achieve Neutral in less than one second?	YES			YES			YES			YES			YES			YES			YES			YES			YES			YES		
Item 7: Repeat Item 6 but do not release the accelerator pedal at 20 mph and place the car into Neutral. Does the vehicle achieve Neutral in less than one second?	YES			YES			YES			YES			YES			YES			YES			YES			YES			YES		
Item 8: Repeat Item 6 and place the vehicle into Reverse for two seconds. Does it achieve Reverse?																														
Reverse	NO			NO			NO			No			NO			NO			NO			NO			NO			NO		
Neutral	YES			YES			YES			YES			YES			YES			YES			YES			YES			YES		
Drive	NO			NO			NO			NO			NO			YES			NO			NO			NO			YES		
Stall	NO			NO			NO			NO			NO			NO			NO			NO			NO			NO		
Did you experience Unwanted Acceleration at any time during this test?	NO			NO			NO			NO			NO			NO			NO			NO			NO			NO		

TF118

Engine Size	V6	V6	V6	V6	L4	L4	L4	L4	L4	L4
Total Number of Engine and Transmission mounts combined	4	4	4	4	4	4	4	4	4	4
Solid	0	0	0	0	0	0	0	0	0	0
Rubber	1	1	1	1	1	1	1	1	1	1
Fluid Filled	3	3	3	3	3	3	3	3	3	3
Strut	0	0	0	0	0	0	0	0	0	0
Condition of Mounts	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition	Good Condition

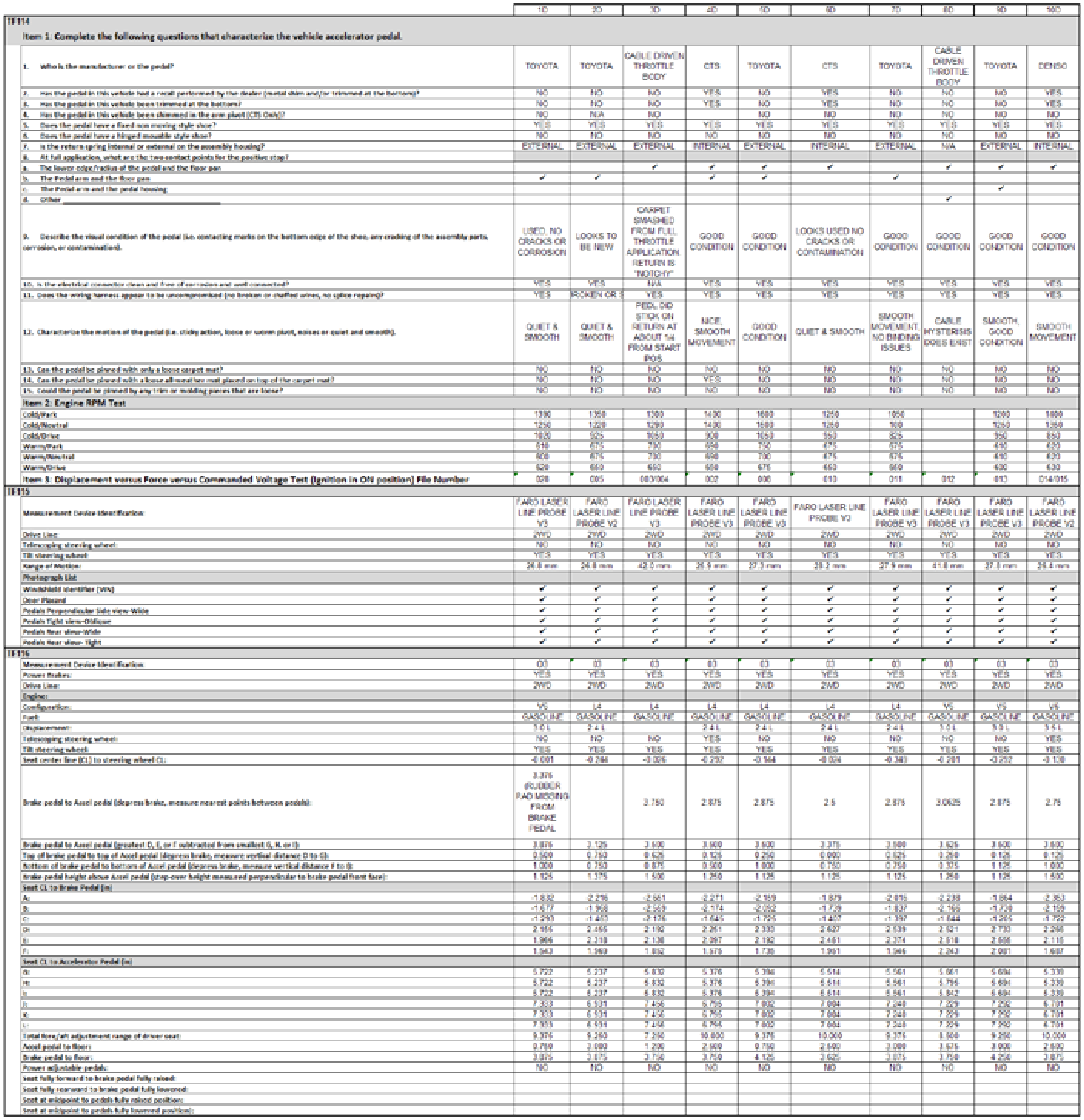
APPENDIX E7 - Module 7 – Ignition Switch Control Functionality



TF112	1D	2D	3D	4D	5D	6D	7D	8D	9D	10D	11D	12C	13C	14C	15C	16C	17C	18C	19C	20C
Key Type																				
1. Can the engine be started without stepping on the brake pedal when in Park?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	N/A, CLUTCH	YES	YES	YES	YES
2. Can the engine be started when in the Neutral position?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	YES	YES	YES	YES	YES
3. Can the engine be started without stepping on the brake pedal when in Neutral?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	YES	YES	YES	YES	YES
4. Can the engine be started with the transmission in Drive?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO
5. Can the engine be started with the transmission in Reverse?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO
6. Can the key be removed with the vehicle in gear?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	YES	NO	NO	NO	NO
7. Is there an audible alarm if you open the door with the engine running?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO
8. Is there an audible alarm if you open the door with the engine off?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	YES	YES	YES	YES	YES
9. Does the steering wheel lock when the key is in the off position and in Park?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	YES
10. Does the steering wheel lock when the key is in the off position and in gear?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	C	C	C	NO
11. Will the vehicle restart in Drive when moving?	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	YES	NO	NO	NO	NO
12. Will the vehicle restart in Neutral when moving?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	YES	YES	YES	YES	YES
13. Are all the key functions described in the Owner's Manual?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	N/A
14. Do the key functions correspond correctly to the Owner's Manual instructions?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	YES	N/A	N/A	N/A	N/A
Pushbotton Type																				
1. Can the engine be started without stepping on the brake pedal when in Park?												NO								
2. Can the engine be started when in the Neutral position?												YES								
3. Can the engine be started without stepping on the brake pedal when in Neutral?												NO								
4. Can the engine be started with the transmission in Drive?												NO								
5. Can the engine be started with the transmission in Reverse?												NO								
6. Is there an audible alarm if you open the door with the engine running?												NO								
7. Is there an audible alarm if you open the door with the engine off?												NO								
8. Does the steering wheel lock if the button is pushed to the off position and in Park?												YES								
9. Does the steering wheel lock if the button is pushed to the off position and in gear?												NO								
10. Will the vehicle restart in Drive when moving?												NO								
11. Will the vehicle restart in Neutral when moving?												YES								
12. Does the engine start with a single one second push of the button when in Park?												YES								
13. Does the engine stop with a single one second push of the button when in Park?												YES								
14. Does the engine stop with a single one second push of the button when in Drive and not moving?												YES								
15. Does the engine stop with a single one second push of the button when in Drive and the vehicle is moving?												NO								
16. Does it require holding the button for 3 seconds to shut the engine off when in gear and moving?												YES								
17. Do the ignition functions require the key-fob to be inside the vehicle passenger's compartment?												YES								
18. Will the ignition functions work if the key-fob is outside the vehicle passenger's compartment after a normal Park engine shutdown sequence?												NO								
19. Will the ignition functions work if the key-fob is outside the vehicle passenger's compartment after a 3 second in gear and moving engine shutdown sequence?												NO								
20. Are all the button functions described in the Owner's Manual?												YES								
21. Do the button functions correspond correctly to the Owner's Manual instructions?												YES								

C = CANNOT TEST

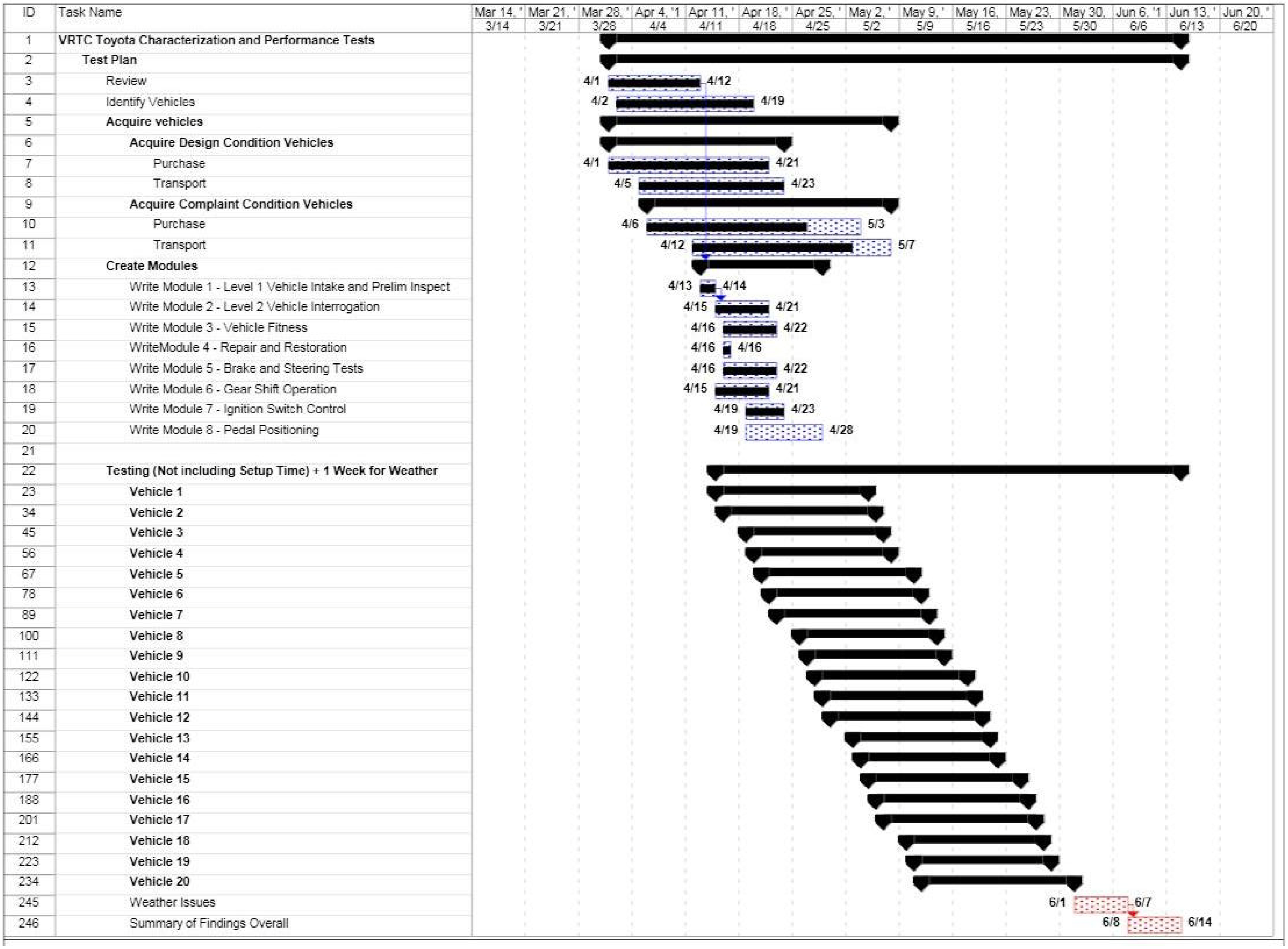
APPENDIX E8 - Module 8 – Pedal Positioning



	1D	2D	3D	4D	5D	6D	7D	8D	9D	10D
TF114										
Item 1: Complete the following questions that characterize the vehicle accelerator pedal.										
1. Who is the manufacturer or the pedal?	TOYOTA	TOYOTA	CABLE DRIVEN THROTTLE BODY	CTS	TOYOTA	CTS	TOYOTA	CABLE DRIVEN THROTTLE BODY	TOYOTA	DENSO
2. Has the pedal in this vehicle had a recall performed by the dealer (metal shim and/or trimmed at the bottom)?	NO	NO	NO	YES	NO	YES	NO	NO	NO	YES
3. Has the pedal in this vehicle been trimmed at the bottom?	NO	NO	NO	YES	NO	YES	NO	NO	NO	YES
4. Has the pedal in this vehicle been shimmed in the arm pivot (CTS Only)?	NO	N/A	NO		NO	NO	NO	NO	NO	NO
5. Does the pedal have a fixed non moving style shoe?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
6. Does the pedal have a hinged movable style shoe?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Is the return spring internal or external on the assembly housing?	EXTERNAL	EXTERNAL	EXTERNAL	INTERNAL	EXTERNAL	INTERNAL	EXTERNAL	N/A	EXTERNAL	INTERNAL
8. At full application, what are the two contact points for the positive stop?										
a. The lower edge/radius of the pedal and the floor pan			✓	✓	✓	✓		✓	✓	✓
b. The Pedal arm and the floor pan	✓	✓		✓	✓		✓			
c. The Pedal arm and the pedal housing									✓	
d. Other ____								✓		
9. Describe the visual condition of the pedal (i.e. contacting marks on the bottom edge of the shoe, any cracking of the assembly parts, corrosion, or contamination).	USED, NO CRACKS OR CORROSION	LOOKS TO BE NEW	CARPET SMASHED FROM FULL THROTTLE APPLICATION RETURN IS "NOTCHY"	GOOD CONDITION	GOOD CONDITION	LOOKS USED NO CRACKS OR CONTAMINATION	GOOD CONDITION	GOOD CONDITION	GOOD CONDITION	GOOD CONDITION
10. Is the electrical connector clean and free of corrosion and well connected?	YES	YES	N/A	YES	YES	YES	YES	YES	YES	YES
11. Does the wiring harness appear to be uncompromised (no broken or chaffed wires, no splice repairs)?	YES	ROKEN OR S	YES	YES	YES	YES	YES	YES	YES	YES
12. Characterize the motion of the pedal (i.e. sticky action, loose or worn pivot, noises or quiet and smooth).	QUIET & SMOOTH	QUIET & SMOOTH	PEDL DID STICK ON RETURN AT ABOUT 1/4 FROM START POS	NICE, SMOOTH MOVEMENT	GOOD CONDITION	QUIET & SMOOTH	SMOOTH MOVEMENT, NO BINDING ISSUES	CABLE HYSTERSIS DOES EXIST	SMOOTH, GOOD CONDITION	SMOOTH MOVEMENT
13. Can the pedal be pinned with only a loose carpet mat?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
14. Can the pedal be pinned with a loose all-weather mat placed on top of the carpet mat?	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
15. Could the pedal be pinned by any trim or molding pieces that are loose?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Item 2: Engine RPM Test										
Cold/Park	1300	1350	1300	1400	1600	1250	1650		1200	1800
Cold/Neutral	1250	1220	1290	1400	1600	1250	700		1250	1350
Cold/Drive	1020	925	1050	900	1050	550	925		950	850
Warm/Park	610	675	730	690	750	675	675		610	620
Warm/Neutral	600	675	730	690	700	675	675		610	630
Warm/Drive	620	650	650	650	675	650	650		600	630
Item 3: Displacement versus Force versus Commanded Voltage Test (Ignition in ON position) File Number	008	005	003/004	002	006	010	011	012	013	014/015
TF115										
Measurement Device Identification:	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V2	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V2
Drive Line:	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD
Telescoping steering wheel:	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Tilt steering wheel:	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Range of Motion:	26.8 mm	26.8 mm	42.0 mm	26.9 mm	27.3 mm	28.2 mm	27.9 mm	41.8 mm	27.8 mm	26.4 mm
Photograph List										
Windshield Identifier (VIN)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Door Placard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedals Perpendicular Side view-Wide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedals Tight view-Oblique	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedals Rear view-Wide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedals Rear view- Tight	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TF116										
Measurement Device Identification:	03	03	03	03	03	03	03	03	03	03
Power Brakes:	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Drive Line:	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD
Engine:										
Configuration:	V6	L4	L4	L4	L4	L4	L4	V6	V6	V6
Fuel:	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE
Displacement:	3.0 L	2.4 L		2.4 L	2.4 L	2.4 L	2.4 L	3.0 L	3.5 L	3.5 L
Telescoping steering wheel:	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES
Tilt steering wheel:	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Seat center line (CL) to steering wheel CL:	-0.001	-0.288	-3.026	-0.292	-0.144	-0.004	-0.340	-0.281	-0.252	-0.130
Brake pedal to Accel pedal (depress brake, measure nearest points between pedals):	3.375 (RUBBER PAD MISSING FROM BRAKE PEDAL		3.750	2.875	2.875	2.5	2.875	3.0625	2.875	2.75
Brake pedal to Accel pedal (greatest D, E, or F subtracted from smallest G, H, or I):	3.875	3.125	3.600	3.500	3.600	3.375	3.500	3.625	3.600	3.600
Top of brake pedal to top of Accel pedal (depress brake, measure vertical distance D to G):	0.500	0.750	0.625	0.125	0.250	0.000	0.625	0.250	0.125	0.125
Bottom of brake pedal to bottom of Accel pedal (depress brake, measure vertical distance F to I):	1.000	0.750	0.875	0.500	1.000	0.750	0.750	0.375	1.125	1.000
Brake pedal height above Accel pedal (step-over height measured perpendicular to brake pedal front face):	1.125	1.375	1.500	1.250	1.125	1.125	1.125	1.250	1.125	1.500
Seat CL to Brake Pedal (in)										
A:	-1.832	-2.276	-2.561	-2.271	-2.159	-1.879	-2.035	-2.238	-1.864	-2.353
B:	-1.677	-1.968	-2.559	-2.174	-2.052	-1.728	-1.837	-2.165	-1.728	-2.159
C:	-1.293	-1.403	-2.126	-1.645	-1.725	-1.407	-1.397	-1.844	-1.265	-1.722
D:	2.155	2.455	2.192	2.261	2.333	2.627	2.139	2.521	2.730	2.266
E:	1.966	2.318	2.138	2.397	2.192	2.461	2.374	2.518	2.656	2.115
F:	1.543	1.969	1.862	1.575	1.738	1.951	1.946	2.243	2.001	1.687
Seat CL to Accelerator Pedal (in)										
G:	5.722	5.237	5.832	5.376	5.394	5.514	5.561	5.661	5.694	5.339
H:	5.722	5.237	5.832	5.376	5.394	5.514	5.561	5.755	5.694	5.339
I:	5.722	5.237	5.832	5.376	5.394	5.514	5.561	5.842	5.694	5.339
J:	7.333	6.531	7.456	6.795	7.002	7.004	7.240	7.229	7.292	6.701
K:	7.333	6.531	7.456	6.795	7.002	7.004	7.228	7.229	7.292	6.701
L:	7.333	6.531	7.456	6.795	7.002	7.004	7.228	7.229	7.292	6.701
Total fore/aft adjustment range of driver seat:	9.375	9.250	7.250	10.000	9.375	10.000	9.375	8.500	9.250	10.000
Accel pedal to floor:	0.750	3.000	1.200	2.500	0.750	2.500	3.000	3.625	3.000	2.500
Brake pedal to floor:	3.375	3.875	3.750	3.750	4.125	3.625	3.375	3.750	4.250	3.875
Power adjustable pedals:	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Seat fully forward to brake pedal fully raised:										
Seat fully rearward to brake pedal fully lowered:										
Seat at midpoint to pedals fully raised position:										
Seat at midpoint to pedals fully lowered position:										

	11C	12C	13C	14C	15C	16C	17C	18C	19C	20C
TF114										
Item 1: Complete the following questions that characterize the vehicle accelerator pedal.										
1. Who is the manufacturer or the pedal?	TOYOTA	DENSO	TOYOTA	TOYOTA	TOYOTA	CTS	TOYOTA	TOYOTA	CTS	DENSO
2. Has the pedal in this vehicle had a recall performed by the dealer (metal shim and/or trimmed at the bottom)?	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO
3. Has the pedal in this vehicle been trimmed at the bottom?	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO
4. Has the pedal in this vehicle been shimmed in the arm pivot (CTS Only)?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Does the pedal have a fixed non moving style shoe?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
6. Does the pedal have a hinged movable style shoe?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7. Is the return spring internal or external on the assembly housing?	EXTERNAL	INTERNAL	EXTERNAL	EXTERNAL	EXTERNAL	INTERNAL	EXTERNAL	EXTERNAL	INTERNAL	EXTERNAL
8. At full application, what are the two contact points for the positive stop?										
a. The inner edge/radius of the pedal and the floor pan		✓				✓				
b. The Pedal arm and the floor pan	✓		✓	✓	✓	✓	✓	✓		✓
c. The Pedal arm and the pedal housing										✓
d. Other ______________________									✓	
9. Describe the visual condition of the pedal (i.e. contacting marks on the bottom edge of the shoe, any cracking of the assembly parts, corrosion, or contamination).	VERY CLEAN	CLEAN, NO CRACKS OR CORROSION	CLEAN, NO CRACKS	CLEAN, NO MODS, NO CRACKS	NO CRACKS OR MARKS & IS CLEAN	LOOKS USED BUT NO CORROSION OR RUST	USED, NO CRACKS OR CORROSION	CLEAN, NO CRAKS OR CORROSION	USED BUT CLEAN	GOOD CONDITION, FREE MOVEMENT
10. Is the electrical connector clean and free of corrosion and well connected?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
11. Does the wiring harness appear to be uncompromised (no broken or chaffed wires, no splice repairs)?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
12. Characterize the motion of the pedal (i.e. sticky action, loose or worn pivot, noises or quiet and smooth).	QUIET & SMOOTH	QUIET & SMOOTH	QUIET & SMOOTH	QUIET & SMOOTH	QUIET & SMOOTH	QUIET & SMOOTH	QUIET & SMOOTH	QUIET & SMOOTH	QUIET & SMOOTH	SMOOTH MOVEMENT, NO BINDING
13. Can the pedal be pinned with only a loose carpet mat?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
14. Can the pedal be pinned with a loose all weather mat placed on top of the carpet mat?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
15. Could the pedal be pinned by any trim or molding pieces that are loose?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Item 2: Engine RPM Test										
Cold/Park	1450	500	1430	1150	1200	N/A	1450	1350	1150	1450
Cold/Neutral	1450	500	1430	1220	1200	1500	1400	1350	1150	1450
Cold/Drive	1050	670	1050	950	910	N/A	1000	990	870	950
Warm/Park	610	580	610	580	800	N/A	660	660	670	660
Warm/Neutral	610	580	600	580	800	730	60	660	670	660
Warm/Drive	620	600	600	580	700	N/A	660	680	650	680
Item 3: Displacement versus Force versus Commanded Voltage Test (Ignition in ON position) File Number	017	022	019	020	023	006	025	027	029	
TF115										
Measurement Device Identification:	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3	FARO LASER LINE PROBE V3
Drive Line:	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD
Telescoping steering wheel:	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO
Tilt steering wheel:	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Range of Motion:	28.1 mm	25.1 mm	26.9 mm	27.3 mm	25.9 mm	28.7 mm	23.6 mm	28.2 mm	26.7 mm	27.5 mm
Photograph List										
Windshield Identifier (VIN)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Door Placard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedals Perpendicular Side view-Wide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedals Tight view-Oblique	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedals Rear view-Wide	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedals Rear view- Tight	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TF116										
Measurement Device Identification:	03	03	03	03	03	03	03	03	03	03
Power Brakes:	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Drive Line:	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD	2WD
Engine:										
Configuration:	V6	V6	V6	V6	L4	L4	L4	L4	L4	L4
Fuel:	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE	GASOLINE
Displacement:	3.0 L	3.5 L	3.0 L	3.0 L	2.4 L	2.4 L	2.4 L	2.4 L	2.4 L	2.4 L
Telescoping steering wheel:	NO	YES	NO	NO	NO	YES	NO	NO	YES	NO
Tilt steering wheel:	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Seat center line (CL) to steering wheel CL:	-0.228	0.164	0.000	-2.600	-0.089	-0.049	-0.150	-0.200	-0.179	-0.123
Brake pedal to Accel pedal (depress brake, measure nearest points between pedals):	2.875	2.75	3	2.5	2.625	2.5	2.875	2.75	2.625	2.5
Brake pedal to Accel pedal (greatest D, E, or F subtracted from smallest G, H, or I):	3.250	3.750	3.500	3.250	3.250	3.000	3.500	3.500	3.375	3.125
Top of brake pedal to top of Accel pedal (depress brake, measure vertical distance D to G):	0.125	0.000	0.000	0.500	0.500	1.250	0.500	0.000	0.500	0.000
Bottom of brake pedal to bottom of Accel pedal (depress brake, measure vertical distance F to I):	1.250	2.000	1.000	1.000	0.750	0.750	1.375	1.125	0.250	1.125
Brake pedal height above Accel pedal (step-over height measured perpendicular to brake pedal front face):	1.250	1.500	1.250	1.375	1.250	1.750	1.125	0.125	0.500	1.250
Seat CL to Brake Pedal (in):										
A:	-2.305	-2.205		-2.142	-2.012	0.277	-2.121	-2.204	2.305	-1.797
B:	-2.176	-2.214		-1.988	-1.724	0.406	-2.011	-1.982	-2.053	-1.661
C:	-1.863	-1.740		-1.606	-1.304	0.671	-1.587	-1.680	-1.584	-1.208
D:	2.203	2.210		2.410	2.868	2.646	2.432	2.266	2.329	2.647
E:	2.051	2.218		2.264	2.440	2.468	2.269	2.105	2.127	2.634
F:	1.619	1.764		1.763	1.926	2.189	1.886	1.746	1.727	2.169
Seat CL to Accelerator Pedal (in):										
G:	5.161	5.265		5.236	5.351	5.101	5.283	5.182	5.290	5.165
H:	5.161	5.349		5.236	5.351	5.101	5.363	5.219	5.290	5.225
I:	5.161	5.658		5.236	5.351	5.101	5.473	5.342	5.290	5.310
J:	6.644	6.695		6.844	6.916	6.627	6.997	6.872	6.610	6.974
K:	6.644	6.695		6.844	6.916	6.627	6.997	6.872	6.610	6.989
L:	6.644	6.695		6.844	6.916	6.627	6.997	6.872	6.610	6.943
Total fore/aft adjustment range of driver seat:	9.250	10.000	9.375	9.375	9.500	7.500	9.250	9.250	9.825	9.125
Accel pedal to floor:	3.125	3.000	3.000	3.000	3.000	2.500	3.125	0.750	2.500	3.000
Brake pedal to floor:	4.125	1.500	4.125	4.125	4.000	4.125	3.750	4.000	3.750	4.000
Power adjustable pedals:	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Seat fully forward to brake pedal fully raised:										
Seat fully rearward to brake pedal fully lowered:										
Seat at midpoint to pedals fully raised position:										
Seat at midpoint to pedals fully lowered position:										

APPENDIX F - Project Schedule



ID	Task Name
1	**VRTC Toyota Characterization and Performance Tests**
2	**Test Plan**
3	Review
4	Identify Vehicles
5	**Acquire vehicles**
6	**Acquire Design Condition Vehicles**
7	Purchase
8	Transport
9	**Acquire Complaint Condition Vehicles**
10	Purchase
11	Transport
12	**Create Modules**
13	Write Module 1 - Level 1 Vehicle Intake and Prelim Inspect
14	Write Module 2 - Level 2 Vehicle Interrogation
15	Write Module 3 - Vehicle Fitness
16	WriteModule 4 - Repair and Restoration
17	Write Module 5 - Brake and Steering Tests
18	Write Module 6 - Gear Shift Operation
19	Write Module 7 - Ignition Switch Control
20	Write Module 8 - Pedal Positioning
21	
22	**Testing (Not including Setup Time) + 1 Week for Weather**
23	**Vehicle 1**
34	**Vehicle 2**
45	**Vehicle 3**
56	**Vehicle 4**
67	**Vehicle 5**
78	**Vehicle 6**
89	**Vehicle 7**
100	**Vehicle 8**
111	**Vehicle 9**
122	**Vehicle 10**
133	**Vehicle 11**
144	**Vehicle 12**
155	**Vehicle 13**
166	**Vehicle 14**
177	**Vehicle 15**
188	**Vehicle 16**
201	**Vehicle 17**
212	**Vehicle 18**
223	**Vehicle 19**
234	**Vehicle 20**
245	Weather Issues
246	Summary of Findings Overall

APPENDIX G - Blank Technician Worksheet Forms

PROJ.	9157	**PROJ.TITLE:**	9157 Toyota	**Page/s**	1 of 1
TEST	VEHICLE RECEIVING INSPECTION REPORT			**Form**	**TF-100**
Date:					
Technician:		Signature When Complete:			

Vehicle Lot Identifier and Color: ______________________________

Vehicle Information:

VIN: ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Mfr. Date: ___________ Model Year (EPA label): ___________ Make: __________ Model: _________

Trim line: _________ Odometer in: _________

Drive Train Information:

Engine type: ( ) L4 ( ) V6 ( ) V8 Displacement:_______L/CID

( ) Automatic ( )Manual Speeds Fwd: ____________ Drive Type: ( ) 2WD ( ) 4WD ( ) AWD

Brake Information:

Power Brakes? ( ) Yes ( ) No If Yes, ( )Vacuum Assist ( )Hydroboost ( ) Other ABS? ( )Yes ( ) No

If yes, ABS ECU (cap) No.: _________________________ No. of Wheel Speed Sensors: ____________

Front: ( ) Rotor ( ) Drum Rear: ( )Rotor ( ) Drum Parking: ( ) Rotor ( ) Drum and ( ) Hand ( ) Foot

Chassis Information:

Wheelbase: _____________ Roof height: _____________ Estimated CG height (40% RH): ___________

Front Track width _________[inches] Rear track width ____________[inches] (Measured center to center)

Gallons of fuel added to tank(s): ______________________

Weight Information:

Curb weight (full tank, no occupants or instrumentation):

LF: ________[lb], RF: ________[lb], LR: ________[lb], RR: ________[lb] Total: _________[lb]

GVWR_____________[lb] Front GAWR _____________[lb] Rear GAWR _____________[lb]

Tire Information:

Vehicle Mfr.'s recommended inflation: Front: _____[psi] Rear: _____[psi] (**see vehicle manufacturer placard/manual)**

Vehicle Mfr.'s recommended tire size: _________________________

Tires as Received:

Wheel	Tire Brand and Model	Size	Tread Wear Rating	Max. Inflation Press.	Press. As Found	Press. As Left	Tread Depth (32^{nd}'s)	Durometer A
LF								
RF								
LR								
RR								

Other Observations:

NHTSA www.nhtsa.gov	**PROJ.**	9157	**PROJ.TITLE:**	9157 Toyota	**Page/s**	1 of 1
	TEST	Vehicle Detailed Listed Options and Accessories			**Form No.**	TF101
	Date:		Vehicle Lot Identifier			
	Technician:		Signature When Complete			

Traction Control	**YES** ____	**NO** ____
ABS Braking	**YES** ____	**NO** ____
ESC Stability Control System	**YES** ____	**NO** ____
TPM Tire Pressure Monitor	**YES** ____	**NO** ____
Air Conditioning	**YES** ____	**NO** ____
Cruise Control	**YES** ____	**NO** ____
Backing Assist Video	**YES** ____	**NO** ____
Dual Airbags	**YES** ____	**NO** ____
Rear Defrost	**YES** ____	**NO** ____
Cell Phone	**YES** ____	**NO** ____
TV/VCR/DVD	**YES** ____	**NO** ____
Stereo System	**YES** ____	**NO** ____
Power Antenna	**YES** ____	**NO** ____
Speed Proportional Power Steering	**YES** ____	**NO** ____
Power Tilt Steering Wheel	**YES** ____	**NO** ____
Power Adjustable Pedals	**YES** ____	**NO** ____
Power Door Locks	**YES** ____	**NO** ____
Keyless Entry	**YES** ____	**NO** ____
Power Windows	**YES** ____	**NO** ____
Power Driver Seat	**YES** ____	**NO** ____
Power Passenger Seat	**YES** ____	**NO** ____
Seat Heater	**YES** ____	**NO** ____
Interval Wipers	**YES** ____	**NO** ____
Power Mirrors	**YES** ____	**NO** ____
Power Sun Roof	**YES** ____	**NO** ____

Additional Options Listed Below

PROJ.	9157	**PROJ.TITLE:**	Toyota 9157		**Page/s**	1 of 1
TEST	Owner's Manual Information				**Form**	TF102
Date:		Vehicle Lot Identifier:			Mileage:	
Technician:		Signature When Complete:				

Locate the Owner's Manual.

1) **Print a copy of the information requested below and place into the vehicle folder (in the Technicians' office area).**
2) **Write the page numbers on the line provided.**
3) **Save a digital copy in the specific vehicle folder on the O: Drive.**
4) **Also copy all related warnings and advisements related to the function. Indicate whether the task was completed OK or NOK (Not OK). If a task could not be completed, please explain why in the space provided at the bottom.**

Task 1: Locate the vehicle Owner's Manual. OK ____ NOK ____

Task 2: Within the manual, find and copy the engine starting procedure. OK ____ NOK ____
Pages Copied:

Task 3: Within the manual, find and copy the engine stop procedure. OK ____ NOK ____
Pages Copied:

Task 4: Within the manual, find and copy information for cruise control operation. OK ____ NOK ____
Pages Copied:

Task 5: Within the manual, find and copy information for transmission gearshift operation. OK ____ NOK ____
Pages Copied:

If any of the above were answered NOK, please indicate why:

____

____

NHTSA www.nhtsa.gov	PROJ.		PROJ.TITLE:		Page/s	1 of 3
	TEST	Level 2 Vehicle Interrogation			Form	TF103
	Date:		Mileage:			Signature When Complete
	Tech:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

QUALIFICATION STANDARDS	Response	If Repair Necessary Mark "X"	Description or Comments Copy all items to TF 106 Repair and Restoration
QUALIFICATION STANDARDS			
1. Frame/Unibody Overall			
2. Body Overall			
3. Glass condition			
4. Aftermarket accessories			
5. A/M Affects emission			
6. A/M affects safety			
OWNERSHIP MATERIALS			
7. Owner's manual			
8. Spare key			
9. Key fobs			
10.Other maintenance documents			
MECHANICAL STANDARDS			
Under Hood			
11. Hood release			
12. Brake fluid			
13. Power steering fluid filled			
14. Wiper washer fluid filled			
15. Battery condition/load test			
16. Charging system operation			
17. Throttle linkage operation			
18. Power cable routing Normal			
19. Seating of cables			
20. Seating of modules			
21. Overall engine cleanliness			
OPERATIONAL CHECKS			
22. Remote key fob			
23. Type of Ignition switch			
24. Ignition on dash/column			
25. Door/liftgate/trunk			
26. Seat adjuster			
27. Steering column adjuster			
28. Air bag system			
29. Overhead console			
30. Heated seat			
31. Heating, ventilation, AC			

NHTSA www.nhtsa.gov	**PROJ.**	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 1
	TEST	Level 2 Vehicle Stored Information Download			**Form**	**TF104**
	Date:		Mileage:			Signature When Complete
	Tech:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

DATE/TIME	DATA ITEM REQUIREMENT	RESULT/COMMENTS
	Carfax - Obtained and on Paper and Digital Record?	
	Technical Service Bulletins and Recall Notices - Obtained and on Paper and Digital Record? Is there evidence that these bulletins/recalls have been performed on this vehicle?	
	All diagnostic trouble codes should be recorded. If a Techstream screen print is available with DTC's, capture this information. If this is a complaint vehicle, do not reset DTC's. Otherwise, reset DTC. If the cause or action that led to the DTC is known, record the cause.	
	Event Data Recorder – Download. If an event exists, create a PDF image and save to the digital vehicle folder. Also print a paper copy for the vehicle folder.	
Other?		

PROJ.	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 2
TEST	Drivability Fitness			**Form**	**TF105**
Date:		Start Time/Mileage:	___:___/ _________	Signature When Complete _________	
Driver:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

QUALIFICATION STANDARDS	**Response**	**If Repair Necessary Mark "X"**	**Description or Comments** **Copy all Items to TF 106 Repair and Restoration**
QUALIFICATION STANDARDS			
Verify that each item meets expectation.			
Road Test			
1. Ease of starting			
2. Cold-idle quality			
3. Gear selector operation			
Steering performance			
4. Power steering performance			
5. Power steering noise			
6. Steering wheel alignment			
7. Vehicle tracking			
8. Vehicle alignment			
Equipment operation			
9. Cruise control – See TF108	See TF108		
10. Overdrive button			
11. Gauges/instrument panel			
12. MIL lamps on			
13. Sound system			
Powertrain performance			
14. Acceleration performance			
15. Clutch operation (manual)			
16. Upshifting performance			
17. Downshifting performance			
18. Steady throttle perform			
19. Transfer case performance			
20. Hot-idle performance			
Braking performance			
21. Brake booster performance			
22. Vehicle tracking during Braking			
23. Antilock brake system			
24. ESC System			
25. Traction Control System			
26. AWD Driver Selection			
27. Overdrive Driver Selection			
28. Overall stopping perform			
29. Brake Override equipped?			

NHTSA www.nhtsa.gov	**PROJ.**	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 2
	TEST	Repair and Readiness			**Form**	**TF106**
	Date:		Mileage:			Signature When Completed
	Tech:		Vehicle Lot Identifier			

Item 1: Check TF102, 103, 104, and 105 for any non-functioning items already listed.

Item 2: List by category all components and systems in disrepair.

Item 3: Repair or restore all non-conforming systems. If un-repairable, indicate the reason why it cannot be repaired.

Repair Item	Repair Status	
	Repaired	**Unrepairable**
Engine:		
Drivetran:		
Chassis:		
Electrical:		

NHTSA www.nhtsa.gov	**PROJ.**	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 5
	TEST	Braking Performance			**Form**	**TF107**
	Date:		Start Time/Mileage:	___:___/ _________		Signature When Complete _________
	Driver:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

Vehicle weight with occupants and instrumentation:
LF________ RF________ LR________ RR________ Total____________

Note: Prior to the start of this module, all brake friction material (pads/shoes) and rotors should be replaced with new components, not including the parking brake. Vehicles must have completed the appropriate burnish procedure.

Brakes pads, shoes, and rotors have been replaced immediately prior to the start of this module? ____YES ___NO

Burnish has been completed and is on file? ____YES ___NO

Collect a data acquisition file for each maneuver. Record the file number next to the corresponding test.

Prior to each test run, measure each of the two front rotors temperatures with two individual touch pyrometers to verify the rotors are below 300 degrees. Record the temperatures.

If vehicle is not equipped with ABS, wheel lock up during brake applies should be kept to a minimum.

Maneuver 1 – 100-0 MPH ABS panic stop, maximum effort, vacuum connected, brakes applied manually.

Maneuver 2 – Acceleration and Braking Tests with varying levels of braking pedal force, with and without vacuum. For "No Vacuum" tests, disconnect vacuum line from the booster and plug intake. Pump brake pedal four times to deplete accumulated vacuum.

***When forward acceleration of the vehicle ceases, conclude test run to prevent torque converter damage.**

Maneuver 3 – Brake Pedal Force required to keep vehicle stationary. With and without vacuum apply the brake ram at a threshold only sufficient to allow the vehicle to creep forward when the accelerator is depressed fully. Release the brakes and begin recording the test file. Apply brakes, place vehicle in drive, fully depress accelerator. If vehicle moves, shift to neutral, release the brakes, increase the brake force and repeat until the vehicle becomes stationary.

Comments____

____

Maneuver 4 – Measure stopping distances from 70 mph using different levels of brake pedal force with and without vacuum assist; also with and without full acceleration.

***If the given level of effort stops producing deceleration, stop the test run to prevent brake damage.**

Did you experience any unwanted acceleration incidents during this testing? ___YES ___NO. If YES, Please explain:

____

____

____

____

____

NHTSA www.nhtsa.gov	PROJ.	9157	PROJ.TITLE:	Toyota 9157	Page/s	1 of 1
	TEST	Cruise Control Performance			Form	TF108
	Date:		Start Time/Mileage:	___:___/ _________	Signature When Complete	_________
	Driver:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

Note: Prior to the start of this module, the brake ram cylinder should be removed. Verify that brake system functions normally.

Static Tests:

1) Does the brake lamp illuminate when the brake pedal is depressed?......___YES ___NO
2) Does the control button at the end of the stalk move freely?......___YES ___NO
3) Does the control stalk move in all indicated directions and return normally?......___YES ___NO
4) Does the master cruise switch properly illuminate and extinguish the cruise light on the dash?...... ___YES ___NO
5) With the ignition on, enable the master cruise switch. Turn the ignition off and then on again. Does the cruise light remain off?......___YES ___NO

Driving Tests on the High Speed Test Track (Abort any test if there are any safety concerns):

1) With the master cruise switch off (no green cruise lamp), drive at 40 mph. Do any of the functions RES, SET, and Cancel have any effect on the vehicle's operation?......___YES ___NO
2) Enable the master cruise switch. Drive at 40 mph, use the SET function of the cruise stalk to set cruise speed. Does the vehicle hold 40 mph for at least 3/10's of a mile?...... ___YES ___NO
3) Apply the brake. Does the cruise immediately disengage?...... ___YES ___NO
4) Set the cruise at 60 MPH on straight and level road. Depress brake to release cruise. While driving steady state straight and level at 35 mph, select resume from cruise stalk. Does the cruise resume to 60 mph?...... ___YES ___NO
5) Set the cruise at 60 on straight and level road. Use cruise stalk to cancel the cruise operation. Does the cruise immediately disengage?...... ___YES ___NO
6) When the speed is decreases to 50 mph, select the resume feature. Does the cruise resume to 60 mph?...... ___YES ___NO
7) Select and hold the ACCEL from 60 mph to 90 mph. Does the vehicle downshift to accelerate?...... ___YES ___NO
8) Set the cruise at 40 mph. Depress and hold ACCEL for at least five seconds. Without releasing the ACCEL button, rapidly depress the accelerator to the floor. Does pressing the accelerator cause a greater increased engine power or further downshifting?......___YES ___NO
9) When ACCEL is released at 90 mph, does the vehicle maintain 90 mph? ...... ___YES ___NO

10) Hold ACCEL at 90 mph. Does the cruise accelerate the vehicle to at least 120 mph?...... ___YES ___NO
11) Hold the DECEL button to 50 mph. Does the cruise maintain 50 mph? ...... ___YES ___NO
12) With the cruise maintaining a speed of 50 mph, shift to Neutral. Does the cruise disengage?......___YES ___NO

13) With the cruise maintaining a speed of 50 mph, downshift. Does the cruise disengage?......___YES ___NO
14) With the cruise maintaining a speed of 50 mph, push the accelerator to increase speed to 60 mph. Release the accelerator pedal and let the car coast. Does cruise automatically resume speed at 50 mph?......___YES ___NO
15) With the cruise maintaining a speed of 60 mph, turn off the master cruise switch. Turn it back on and press resume. Does the cruise control resume speed?......___YES ___NO
16) Drive at 40 and set cruise, apply brake, coast to 10 mph. Verify cruise will not resume at this speed. Slowly increase speed in 2 mph increments to establish minimum speed for resume function. What is the minimum speed that cruise will begin to resume? _________mph

Comments/Concerns?:____Did you experience any unwanted acceleration incidents during this testing? ___YES ___ NO. If YES, Please explain:

____

NHTSA www.nhtsa.gov	**PROJ.**	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 1
	TEST	Brake Burnish			**Form**	**TF109**
	Date:		Start Time/Mileage:	___:___/ _________	Signature When Complete _________	
	Driver:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

200-Stop Burnish Procedure

Make 200 burnish stops from 40 mph at 12 ft/sec/sec. Begin the burnish set with a one-mile interval between burnish stops. After the 25th burnish stop, continue making stops as before to app 1 mile before the pit lane. Proceed to the pit lane and use the parking (emergency) brake to stop, and check each front rotor. The target temperature for this burnish is 250°F +/-20°F IBT (Initial Brake Temperature). If IBT is less than 240°F shorten the one-mile burnish interval by ~0.1 mile. If the IBT is above 260°F, lengthen the burnish interval by ~0.1 mile. If the cooling interval becomes increased to 1.5 mile or more, then decrease the vehicle speed by 5 mph and reset the cooling interval to 1 mile. Likewise, if the cooling interval decreases to 0.5 mile or less, then increase the vehicle speed by 5 mph and reset the cooling interval to one mile. At app. every 25 burnish sets, stop in the pit lane and check the IBT before making the next burnish stop. Record time and ambient temperature of each IBT stop and each time burnish is stopped (breaks, lunch, etc). Use the "Comments" section for length of cooling interval, weather conditions, and other notes.

Start: Odometer:____________________
Ambient Temp:____________(°F) Wind Velocity:_____________(mph) Wind Direction:_______________
Weather conditions:____

Prior to Stop Number	**Time**	**Odometer Reading**	**Rotor Temperature(°F)**		**Burnish Comments (weather, length of cooling interval, etc)**
			Left	**Right**	
1					
26					
51					
76					
101					
126					
151					
176					
201					

End: Odometer:________________________ Date:_____________________ Time:_________________
Ambient Temp:____________(°F) Wind Velocity:_______________(mph) Wind Direction:_____________
Weather conditions:____

PROJ.	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 1
TEST	Steering Performance			**Form**	**TF110**
Date:		Start Time/Mileage:	___:____ / __________	Signature When Complete	__________
Driver:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

Collect a data acquisition file for each run. Record the file number next to the corresponding test.

Maneuver 1 – Steering Into a Parking Space – This maneuver will measure the effect of power steering and air conditioning on engine speed. Collect a file:

a. Using the parking course, make a right turn into the first parking space and stop.
b. Make a left turn into the second space and stop.
c. Make a right turn into the third space and stop.
d. Make a left turn into the fourth space and stop.

Steering Into a Parking Space	File #
Steer Test 1 – No A/C, Non-Aggressive Parking	(1)
Steer Test 2 – No A/C, Non-Aggressive Parking	(2)
Steer Test 3 - A/C ON, Aggressive Parking	(3)
Steer Test 4 – A/C ON, Aggressive Parking	(4)

Other Observations or Concerns?:____

Did you experience any unwanted acceleration incidents during this testing? ___YES ___ NO. If YES, Please explain:

____

NHTSA www.nhtsa.gov	**PROJ.**	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 3
	TEST	Transmission Shift Lever Operation			**Form**	**TF111**
	Date:		Start Time/Mileage:	___:___/ ________		Signature When Complete
	Driver:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

Item 1: Are all gear position labels immediately adjacent to the actual shifter position when placed in these locations? If no, list these discrepancies in the comment area below. ___Yes___No

Comments:

Item 2: Record in the following table the number of and types of movements required to place the shift lever in the six different listed conditions.

- Column A is longitudinal (forward or backwards) motion. Fill in the box with the number of times this motion was used.
- Column B is lateral (side to side) motion. Fill in the box with the number of times this motion was used.
- Column C - Does the pushbutton lock have to be used to move the lever to the position? If Yes, fill in the box with a 1.

"Note" Enter a 0 in any entry that was not required to move the shift lever to the specified position.

NHTSA www.nhtsa.gov	PROJ.	9157	PROJ.TITLE:	Toyota 9157	Page/s	1 of 3
	TEST	Ignition Control Switch Operation			Form	TF112
	Date:		Start Time/Mileage:	___:____/ _________	Signature When Complete __________	
	Driver:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

Identify the style of ignition switch the vehicle has as either a key type or pushbutton type.

Complete the questionnaire below that represents the chosen style of ignition switch.

Key Type_______

1. Can the engine be started without stepping on the brake pedal when in Park?
   Yes___ No___
2. Can the engine be started when in the Neutral position?
   Yes___ No___
3. Can the engine be started without stepping on the brake pedal when in Neutral?
   Yes___ No___
4. Can the engine be started with the transmission in Drive?
   Yes___ No___
5. Can the engine be started with the transmission in Reverse?
   Yes___ No___
6. Can the key be removed with the vehicle in gear?
   Yes___ No___
7. Is there an audible alarm if you open the door with the engine running?
   Yes___ No___
8. Is there an audible alarm if you open the door with the engine off?
   Yes___ No___
9. Does the steering wheel lock when the key is in the off position and in Park?
   Yes___ No___
10. Does the steering wheel lock when the key is in the off position and in gear?
    Yes___ No___
11. Will the vehicle restart in Drive when moving?
    Yes___ No___
12. Will the vehicle restart in Neutral when moving?
    Yes___ No___

Form TF112`: Ignition Control Switch Operation

PROJ.	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 1
TEST	Critical Vertical Offset			**Form**	**TF113**
Date:		Mileage:			Signature When Completed
Tech:		Vehicle Lot Identifier			

Test Conditions:____________________ Transmission Gear:_______ Drive or Reverse

CVO Offset	**Applied Brake Force 20 lb.**	**Applied Brake Force 40 lb.**	**Applied Brake Force 60 lb.**
0.50 inches			
0.75			
1.00			
1.25			
1.50			
1.75			
2.00			
2.25			
2.50			

How is the accelerator pedal mounted to the lever? (Mark one)
One piece pedal - pedal attached to the lever arm. ☐
Two piece pedal - separate pivoting pedal mounted to the lever arm at the pedal:
☐ Top ☐ Middle ☐ Bottom

-For Two-piece pedal assemblies, position the CVO device pedestal over the pivot point.

-Note whether vehicle remains stationary, accelerates, or decelerates in each box of the table.

-Determine range from 0.50 inch offset value and repeat with increasing offset until the vehicle remains in motion for all three levels of pedal force.

*Ratio: 3.25 screw rotations = 0.25 inch longitudinal displacement.

NHTSA www.nhtsa.gov	PROJ.	9157	PROJ.TITLE:	Toyota 9157	Page/s	1 of 3
	TEST	Accelerator Pedal Inspection/Functional Test			Form	TF114
	Date:		Mileage:			Signature When Completed
	Tech:		Vehicle Lot Identifier			

Item 1: Complete the following questions that characterize the vehicle accelerator pedal.

1. **Who is the manufacturer or the pedal?**
    a. **Denso** b. **CTS** c. **Other** ______________________
2. **Has the pedal in this vehicle had a recall performed by the dealer (metal shim and/or trimmed at the bottom)?**
    Yes____ **No**____
3. **Has the pedal in this vehicle been trimmed at the bottom?**
    Yes____ **No**____
4. **Has the pedal in this vehicle been shimmed in the arm pivot (CTS Only)?**
    Yes____ **No**____
5. **Does the pedal have a fixed non moving style shoe?**
    Yes____ **No**____
6. **Does the pedal have a hinged movable style shoe?**
    Yes____ **No**____
7. **Is the return spring internal or external on the assembly housing?**
    Internal____ **External**____
8. **At full application, what are the two contact points for the positive stop?**
    a. **The lower edge/radius of the pedal and the floor pan**
    b. **The Pedal arm and the floor pan**
    c. **The Pedal arm and the pedal housing**
    d. **Other** ____
9. **Describe the visual condition of the pedal (i.e. contacting marks on the bottom edge of the shoe, any cracking of the assembly parts, corrosion, or contamination).**
    Comments____
    ____
10. **Is the electrical connector clean and free of corrosion and well connected?**
    Yes____ **No**____

NHTSA www.nhtsa.gov	**PROJ.**	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 2
	TEST	Driver Floor Area 3D Measurement & Rendering			**Form**	**TF115**
	Date:		Mileage:			Signature When Completed
	Tech:		Vehicle Lot Identifier			

Measurement Device Identification:____

Drive Line: ( ) 2WD ( ) 4WD ( ) AWD

Telescoping steering wheel: ( ) Yes ( ) No **Tilt steering wheel:** ( ) Yes ( ) No

Range of Motion: __________ (chord measured from steering wheel center bolt, front face)

3D Scan Procedure – (For later dimensional comparison):

1) **Place driver seat in the rearward most position.**
2) **Place Tilt/Telescoping Steering Wheel in downward most and rearward most position.**
3) **Remove floor mats.**
4) **Record Y-Axis Datum Reference from the center of the front face of the steering wheel retention bolt (Airbag must be removed).**
5) **Record Z-Axis Datum Reference from Floor Pan horizontal surface on factory carpet.**
6) **Scan:**
    a. **Steering Wheel**
    b. **Floor Pan, including exhaust tunnel and transition to vertical portion of firewall**
    c. **Brake Pedal (Face and Arm) in the Idle position (Repeat for Clutch Pedal if Equipped)**
    d. **Accelerator Pedal (Face and Arm) in the Idle position**
    e. **Accelerator Pedal (Face and Arm) in the Depressed Condition**
    f. **Seat bottom Cushion, Top Face (Bottom Cushion), edge to edge**
    g. **Seatback, Front Face, edge to edge**

NHTSA
www.nhtsa.gov

PROJ.	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 2
TEST	Pedal Placement Profile			**Form**	**TF116**
Date:		Mileage:		Signature When Completed	
Tech:		Vehicle Lot Identifier			

Measurement Device Identification:_____

Power Brakes: ( ) Yes ( ) No ( ) Vacuum **Drive Line:** ( ) 2WD ( ) 4WD ( ) AWD

Engine: L4 L6 V6 V8 ( ) Gasoline ( ) Diesel **Displacement:**______________ L or CID

Telescoping steering wheel: ( ) Yes ( ) No

Tilt steering wheel: ( ) Yes ( ) No **Seat center line (CL) to steering wheel CL:** ______________________

Seat CL to Brake Pedal (in)		Seat CL to Accel Pedal (in)	
A		G	
B		H	
C		I	
D		J	
E		K	
F		L	

Brake pedal to Accel pedal: __________________________
(depress brake, measure nearest points between pedals)

Brake pedal to Accel pedal: __________________________
(greatest D, E, or F subtracted from smallest G, H. or I)

Top of brake pedal to top of Accel pedal: ______________
(depress brake, measure vertical distance D to G)

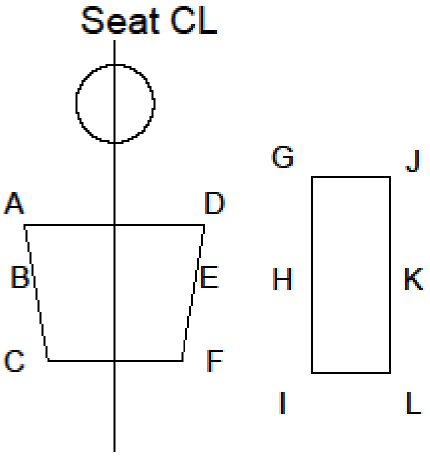
Bottom of brake pedal to bottom of Accel pedal: _______
(depress brake, measure vertical distance F to I)

Brake pedal height above Accel pedal: ________________
(step-over height measured perpendicular to brake pedal front face)

Total fore/aft adjustment range of driver seat: __________

Accel pedal to floor: _______**Brake pedal to floor:** ________

Power adjustable pedals: ( ) Yes ( ) No



NHTSA www.nhtsa.gov	PROJ.	9157	PROJ.TITLE:	Toyota 9157	Page/s	1 of 1
	TEST	As Received Photography			Form	TF117
	Date:		Mileage:			Signature When Completed
	Tech:		Vehicle Lot Identifier			

Photograph the listed item views below. Place images in the photo folder under the corresponding test unit.

1 ___ Windshield Identifier

2 ___ Door placard

3 ___ Driver floor mats installed

4 ___ Driver floor mats out

5 ___ Rear View Wide- driver compartment

6 ___ Tight View -shift gate

7 ___ Tight View- ignition

8 ___ Tight View -steering wheel controls

9 ___ Tight Rear View- pedals

10 ___ Tight View -ABS module

11 ___ Tight View -throttle body

12 ___ Tight View- brake booster

13 ___ Overall View-engine compartment

14 ___ Side View #1 -vehicle overall

15 ___ Front View #2 -vehicle overall

16 ___ Side View #3 -vehicle overall

17 ___ Rear view #4 -vehicle overall

18 ___ Oblique View #1 -vehicle overall

19 ___ Oblique View #2 -vehicle overall

20 ___ Oblique View #3 -vehicle overall

21 ___ Oblique View #4 -vehicle overall

NHTSA www.nhtsa.gov	**PROJ.**	9157	**PROJ.TITLE:**	Toyota 9157	**Page/s**	1 of 2
	TEST	Transmission Documentation/Photography			**Form**	**TF118**
	Date:		Start Time/Mileage:	___:___ / _________	Signature When Complete _________	
	Driver:		Vehicle Lot Identifier			

VEHICLE MAKE:	COMPLAINT VEHICLE [YES/NO]	
VEHICLE MODEL:		
VEHICLE MODEL YEAR:		

1. Engine Size L4 ____ V6 ____

2. Total number of engine and transmission mounts combined. ______

   Comments: ____

3. Type of mount. (check all that apply and the number of each type)

   __ Solid ____

   __ Rubber ____

   __ Fluid Filled ____

   __ Strut ____

   Comments: ____

4. Condition of mounts. (explain location and number of mounts for the condition)

   Good condition ____

   Cracking condition ____

   Torn condition ____

   Broken condition ____

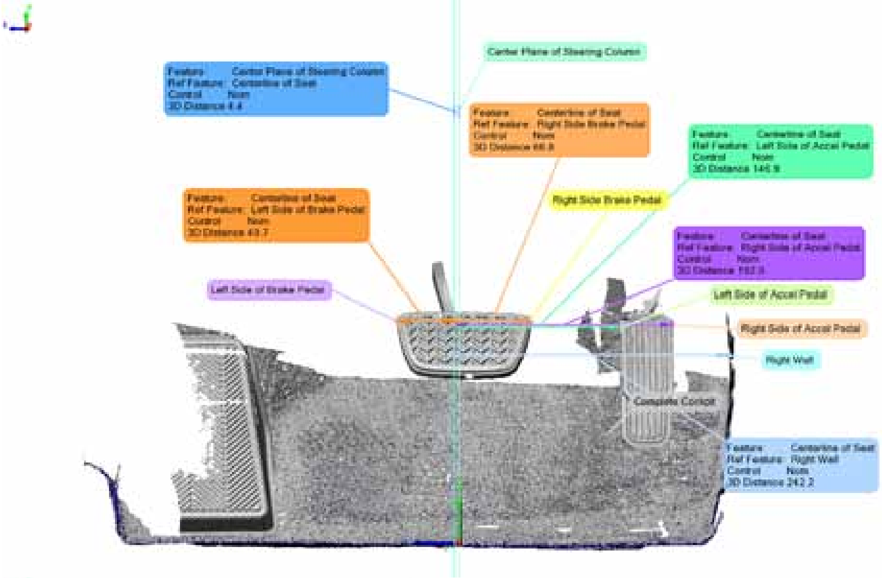
   Leaking (fluid filled, source of leak) ______________________________

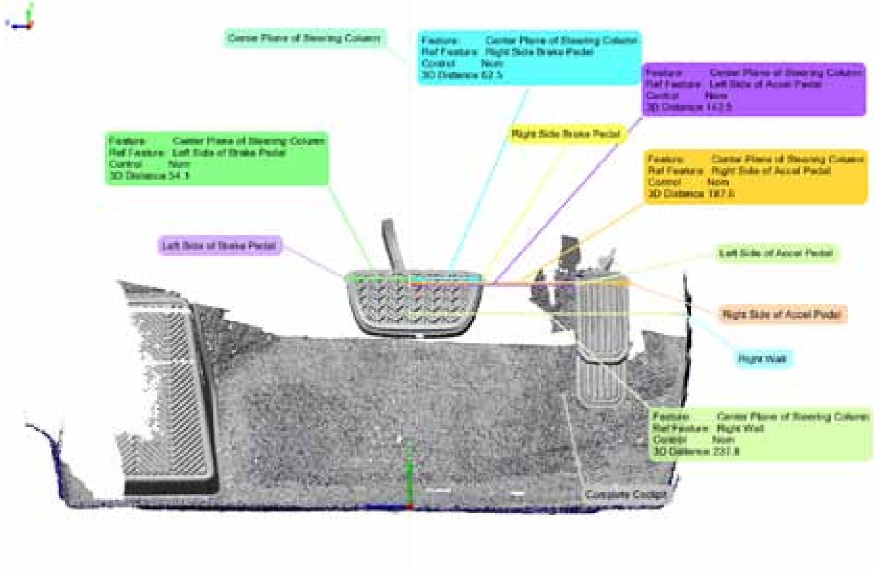
   Other damage ____

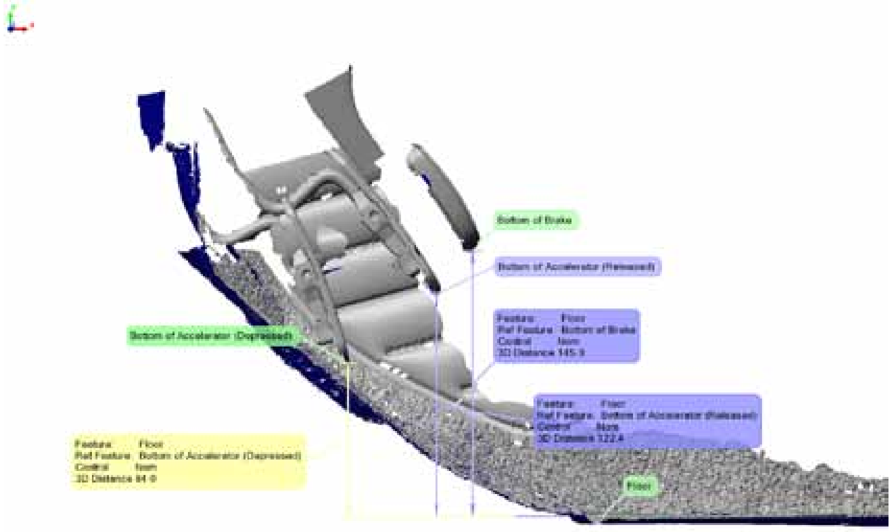
   Comments: ____

APPENDIX H - Three Dimensional Renderings of Floor Pan and Pedals by Vehicle

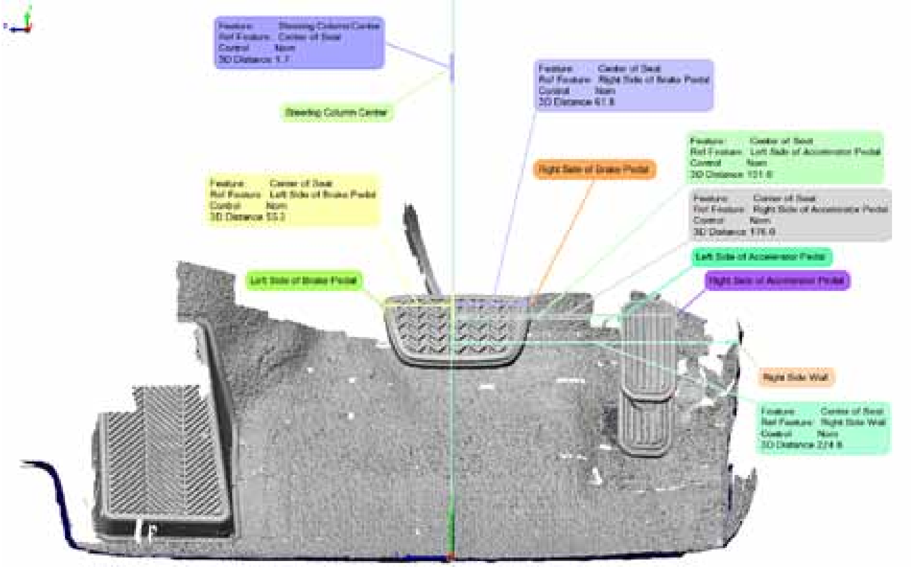
Toyota Camry 1D

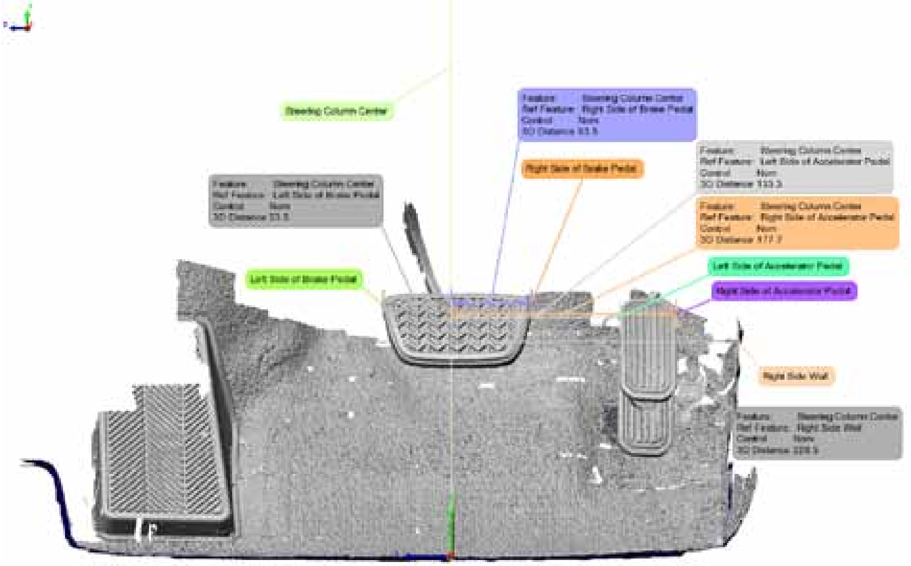


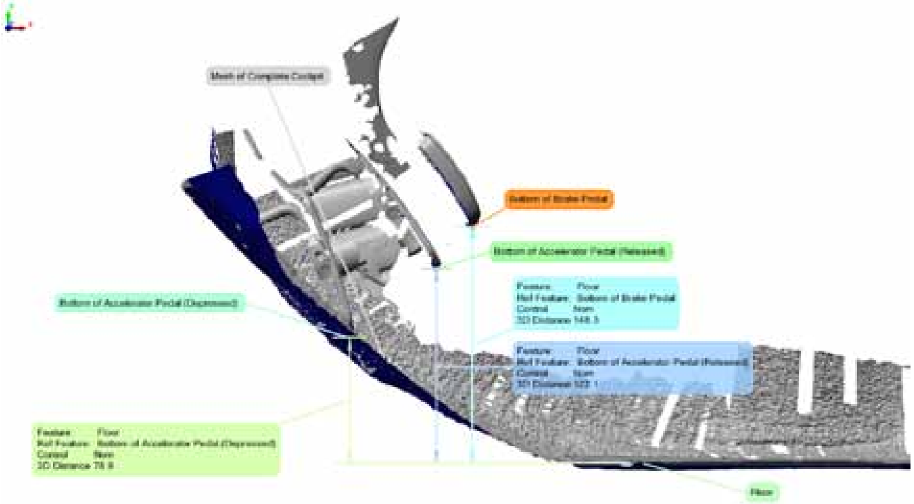




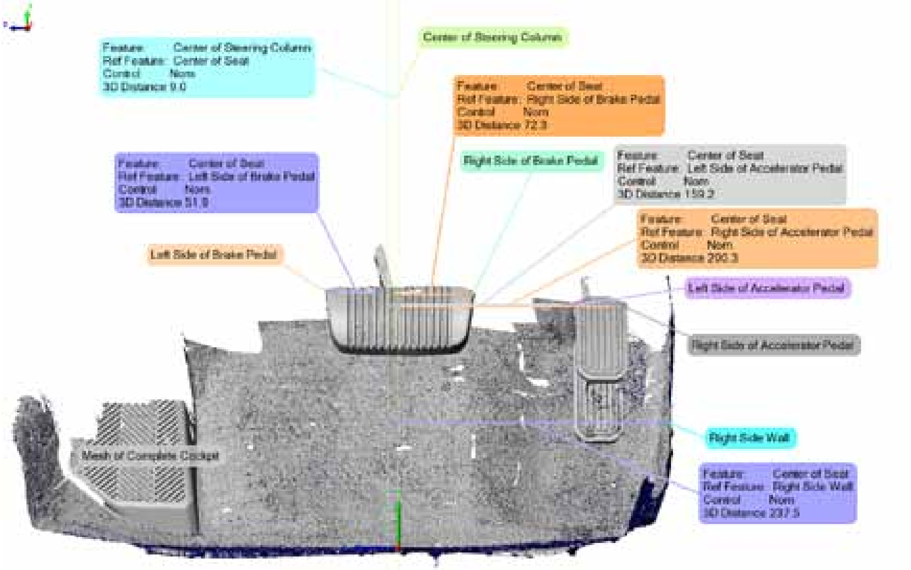
Toyota Camry 2D

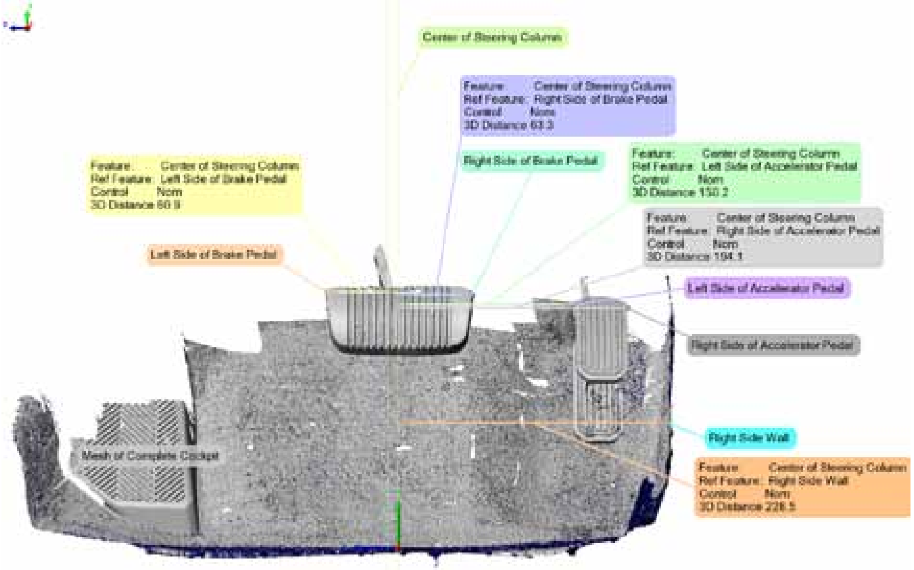


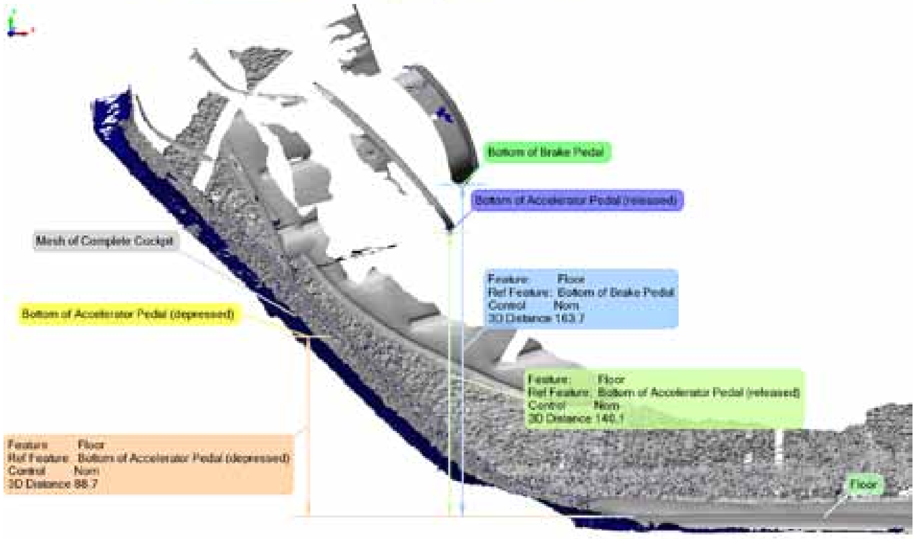




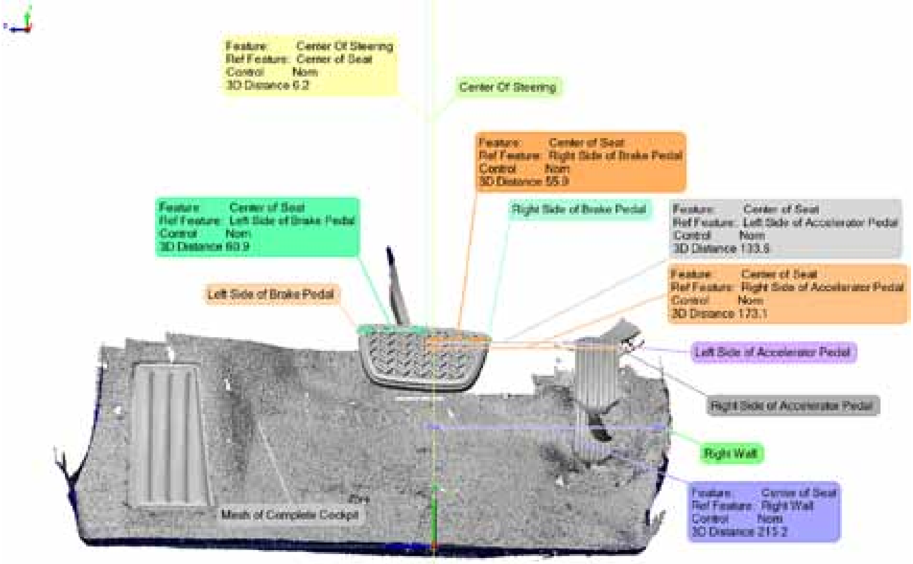
Toyota Camry 3D







Toyota Camry 4D



Feature: Center Of Steering
Ref Feature: Center of Seat
Control Nom
3D Distance 6.2

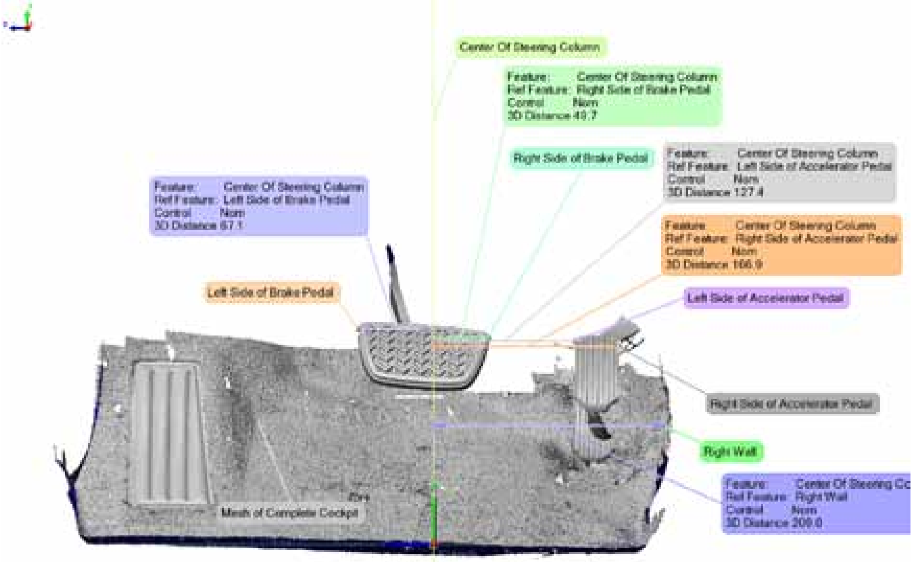
Feature: Center of Seat
Ref Feature: Right Side of Brake Pedal
Control Nom
3D Distance 55.9

Feature: Center of Seat
Ref Feature: Left Side of Brake Pedal
Control Nom
3D Distance 60.9

Feature: Center of Seat
Ref Feature: Left Side of Accelerator Pedal
Control Nom
3D Distance 133.8

Feature: Center of Seat
Ref Feature: Right Side of Accelerator Pedal
Control Nom
3D Distance 173.1

Feature: Center of Seat
Ref Feature: Right Wall
Control Nom
3D Distance 215.2



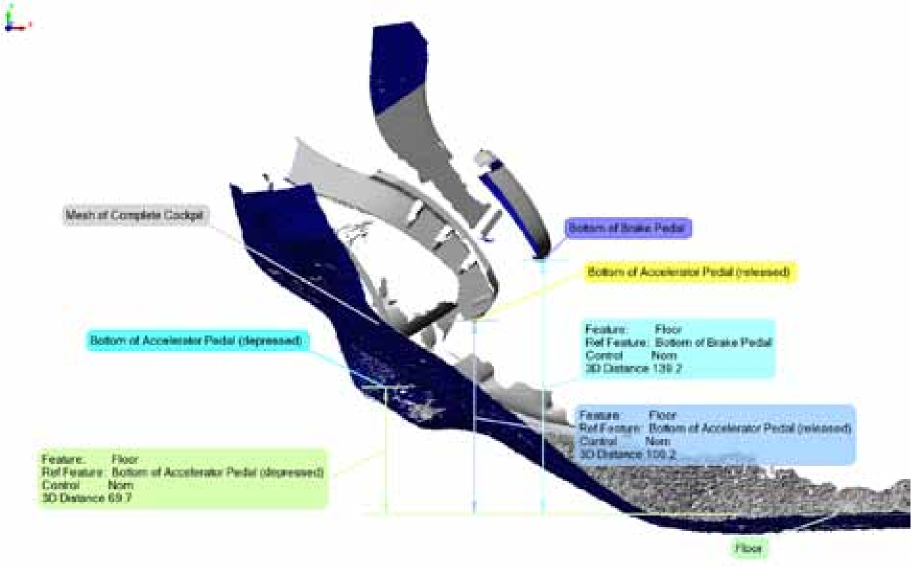
Feature: Center Of Steering Column
Ref Feature: Right Side of Brake Pedal
Control Nom
3D Distance 49.7

Feature: Center Of Steering Column
Ref Feature: Left Side of Accelerator Pedal
Control Nom
3D Distance 127.4

Feature: Center Of Steering Column
Ref Feature: Left Side of Brake Pedal
Control Nom
3D Distance 67.1

Feature: Center Of Steering Column
Ref Feature: Right Side of Accelerator Pedal
Control Nom
3D Distance 166.9

Feature: Center Of Steering Co
Ref Feature: Right Wall
Control Nom
3D Distance 209.0

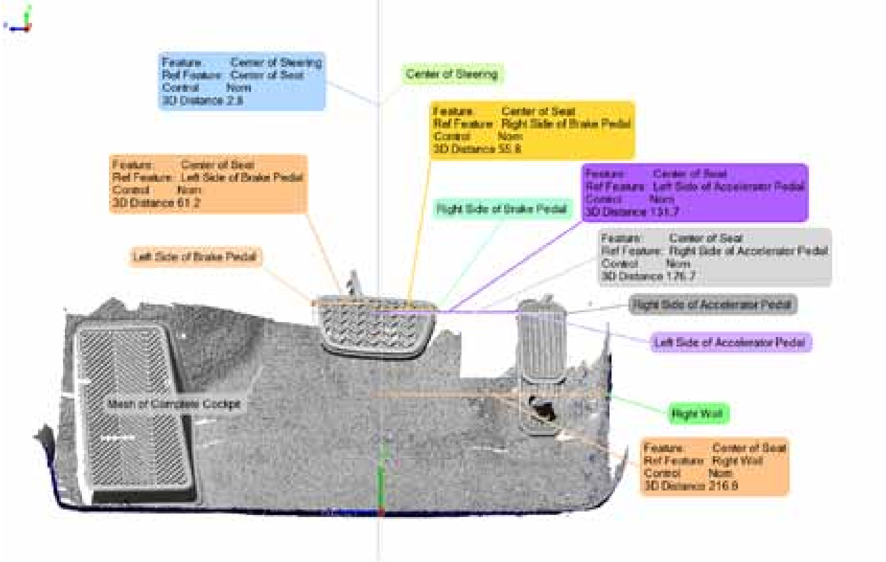


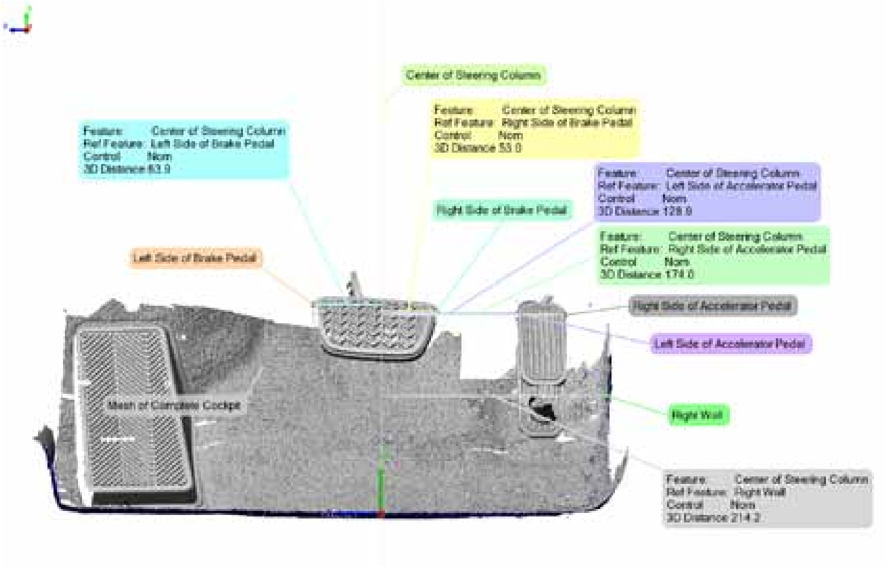
Feature: Floor
Ref Feature: Bottom of Brake Pedal
Control Nom
3D Distance 139.2

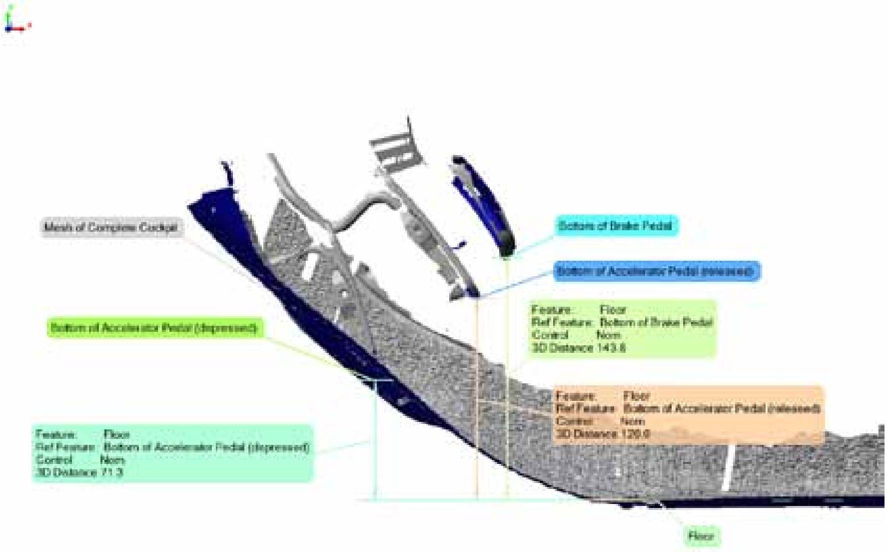
Feature: Floor
Ref Feature: Bottom of Accelerator Pedal (released)
Control Nom
3D Distance 100.2

Feature: Floor
Ref Feature: Bottom of Accelerator Pedal (depressed)
Control Nom
3D Distance 69.7

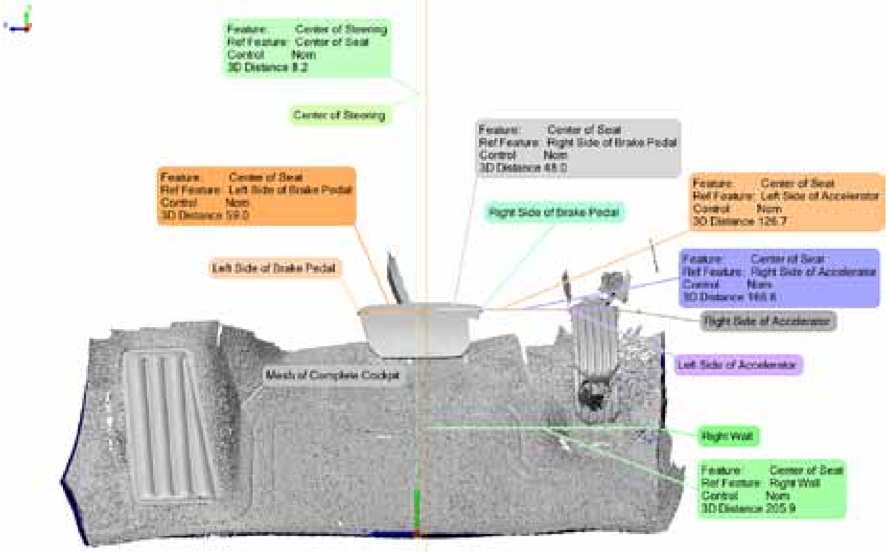
Toyota Camry 5D

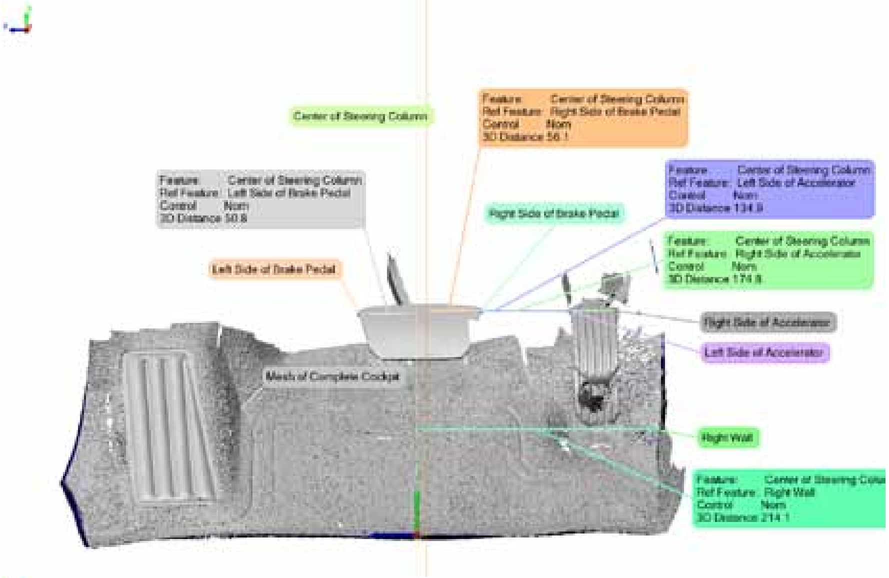


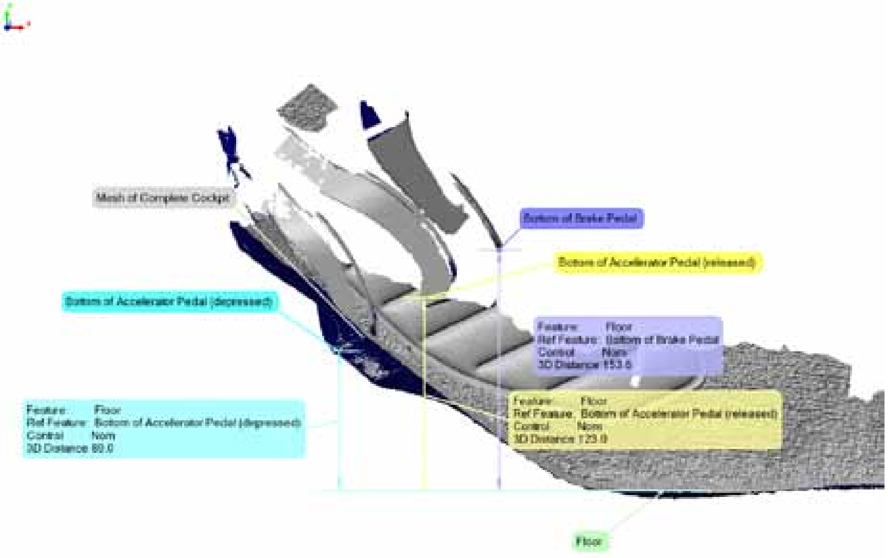




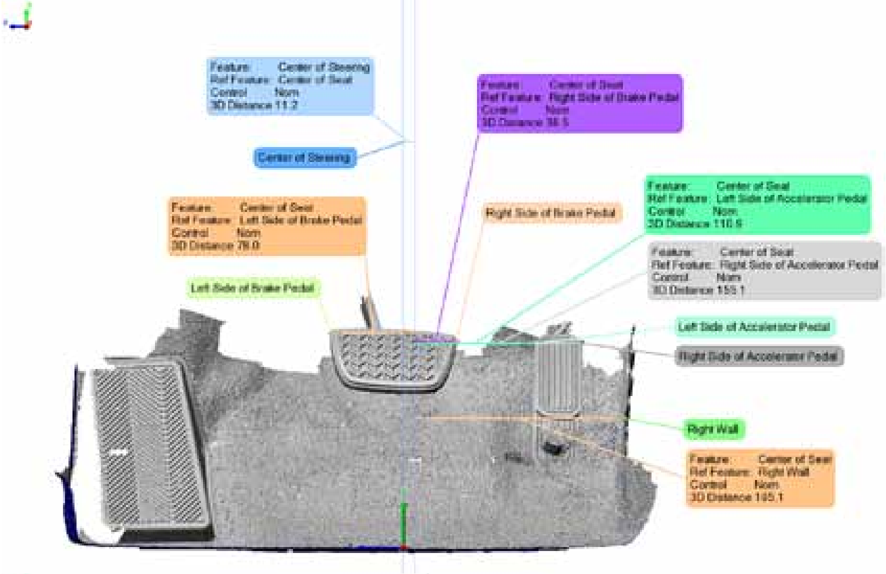
Toyota Camry 6D

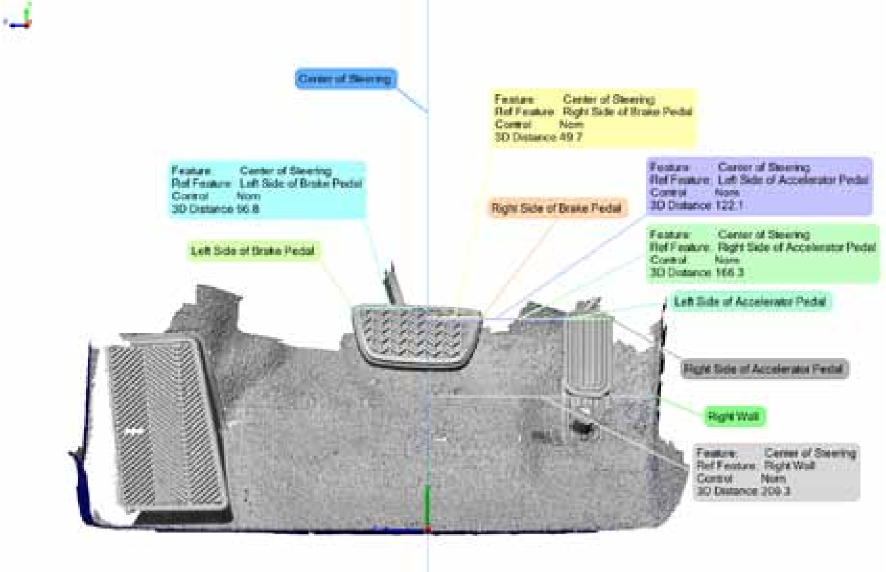


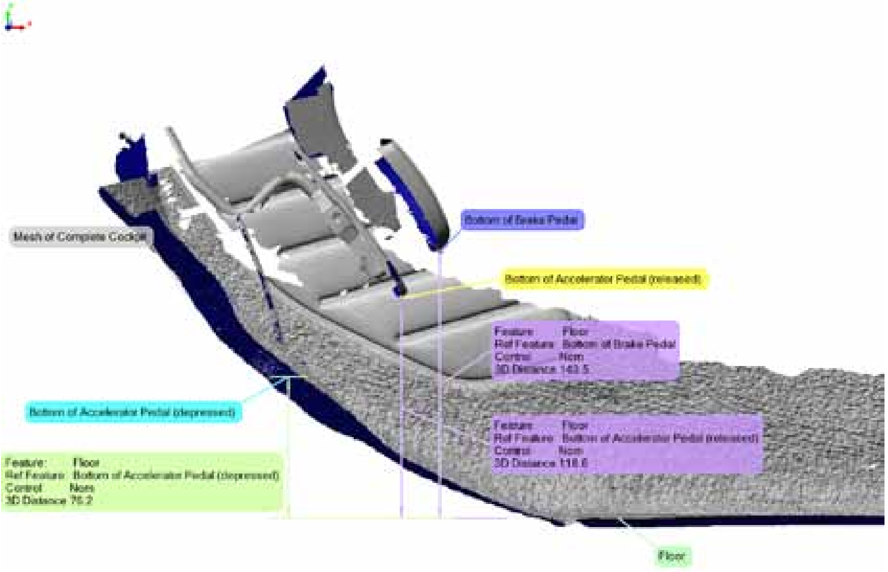




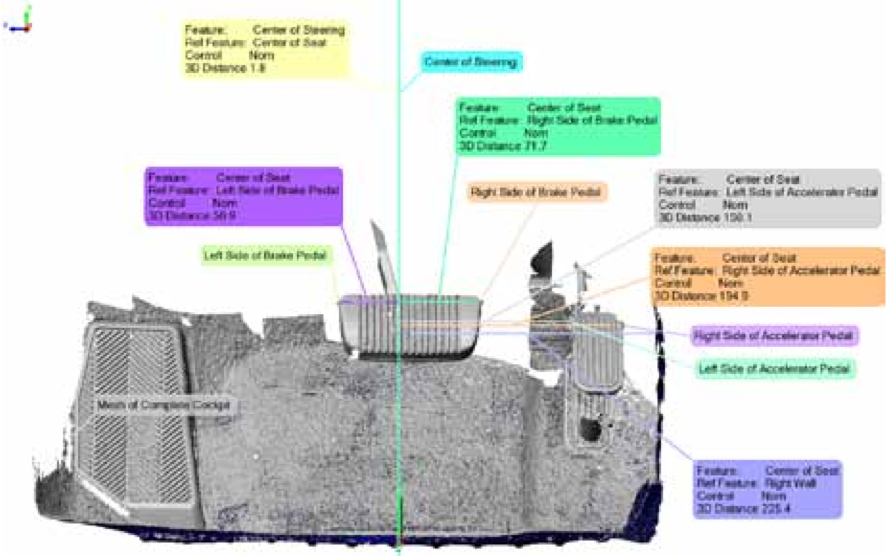
Toyota Camry 7D

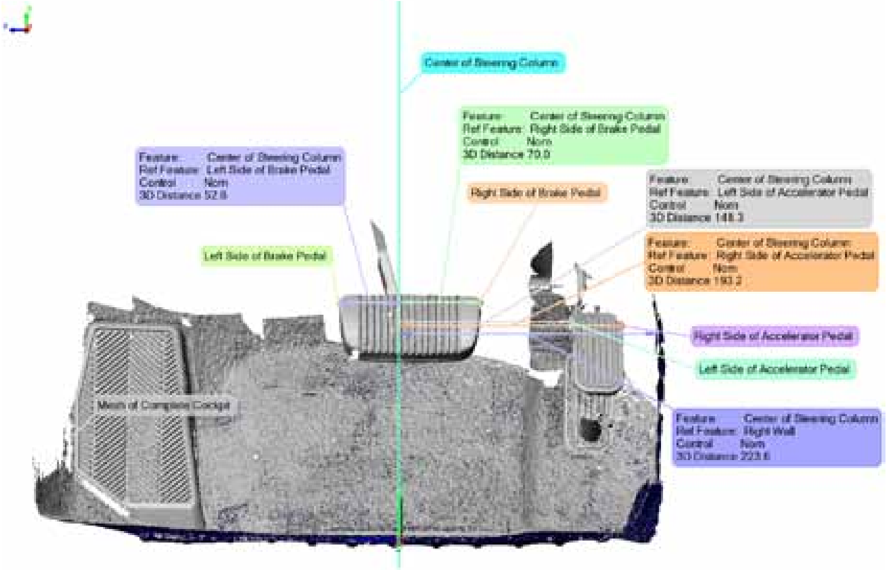


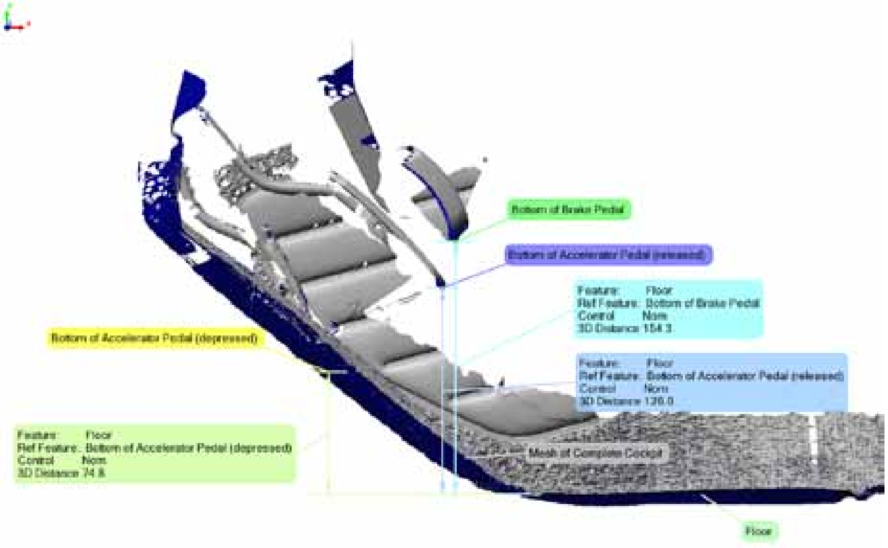




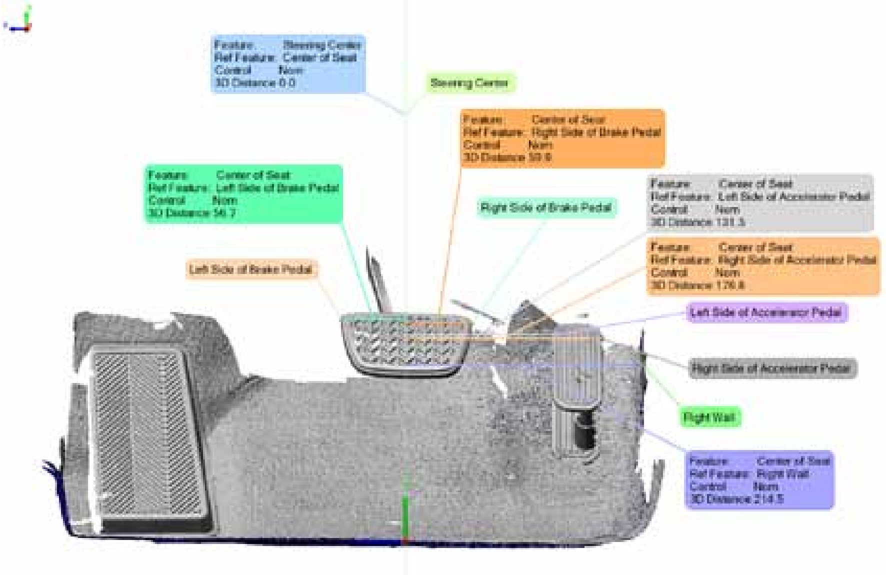
Toyota Camry 8D

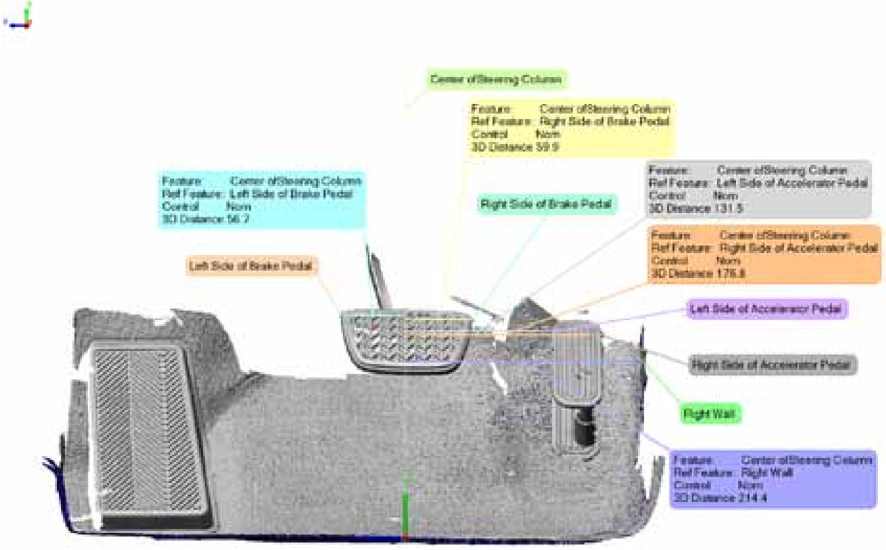


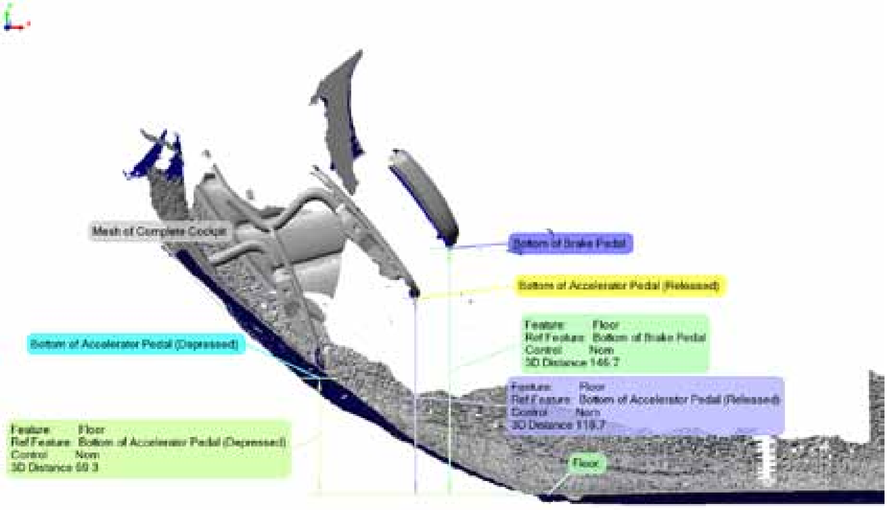




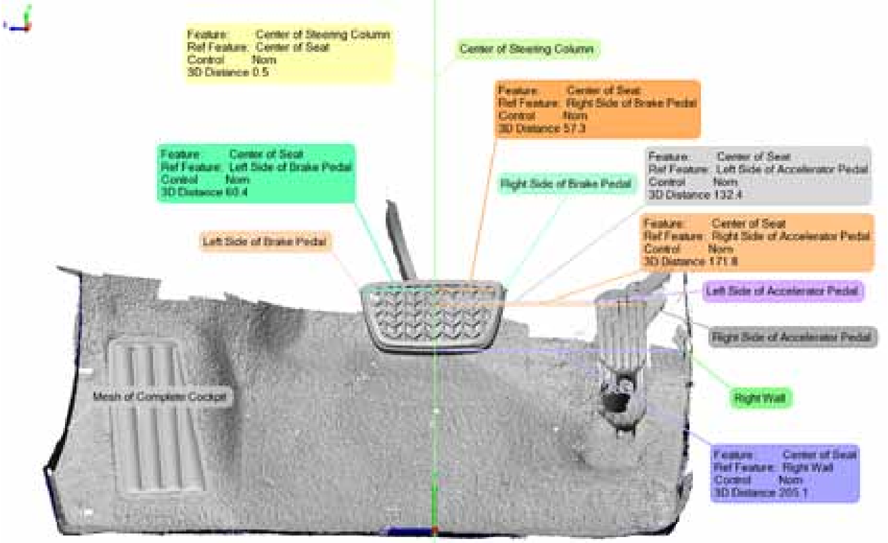
Toyota Camry 9D







Toyota Camry 10D



Feature: Center of Steering Column
Ref Feature: Center of Seat
Control Nom
3D Distance 0.5

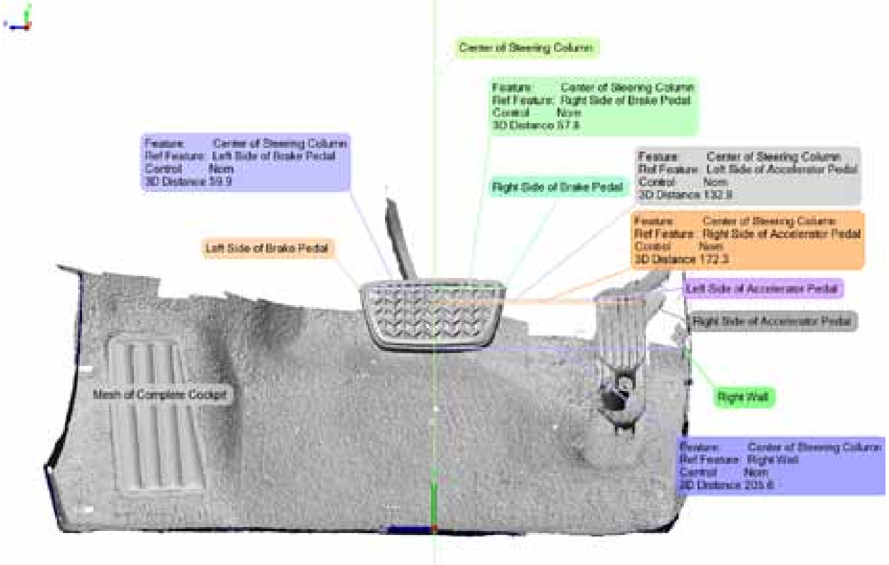
Feature: Center of Seat
Ref Feature: Right Side of Brake Pedal
Control Nom
3D Distance 57.3

Feature: Center of Seat
Ref Feature: Left Side of Brake Pedal
Control Nom
3D Distance 60.4

Feature: Center of Seat
Ref Feature: Left Side of Accelerator Pedal
Control Nom
3D Distance 132.4

Feature: Center of Seat
Ref Feature: Right Side of Accelerator Pedal
Control Nom
3D Distance 171.8

Feature: Center of Seat
Ref Feature: Right Wall
Control Nom
3D Distance 205.1



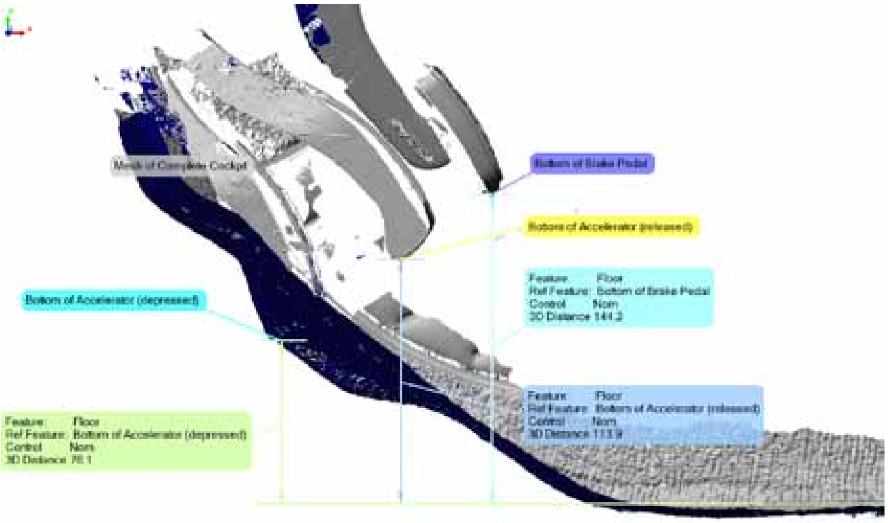
Feature: Center of Steering Column
Ref Feature: Right Side of Brake Pedal
Control Nom
3D Distance 57.8

Feature: Center of Steering Column
Ref Feature: Left Side of Brake Pedal
Control Nom
3D Distance 59.9

Feature: Center of Steering Column
Ref Feature: Left Side of Accelerator Pedal
Control Nom
3D Distance 132.9

Feature: Center of Steering Column
Ref Feature: Right Side of Accelerator Pedal
Control Nom
3D Distance 172.3

Feature: Center of Steering Column
Ref Feature: Right Wall
Control Nom
3D Distance 205.6

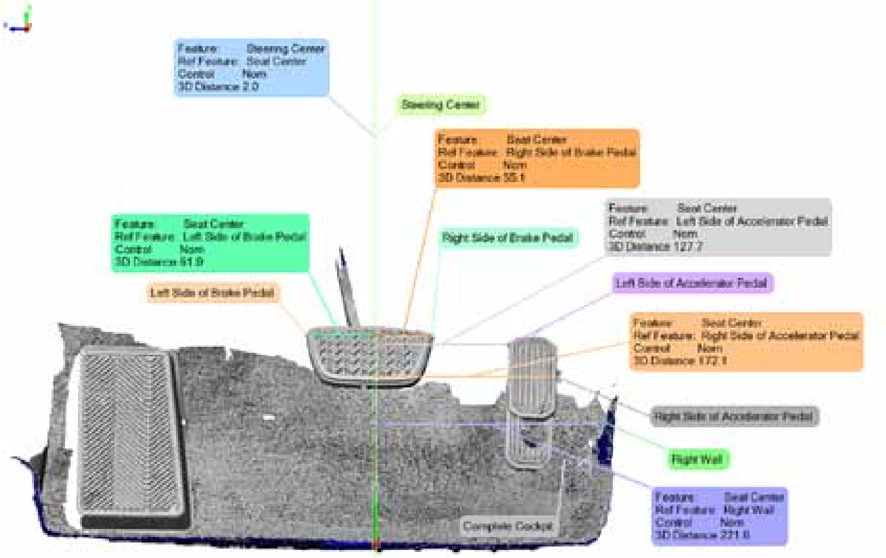


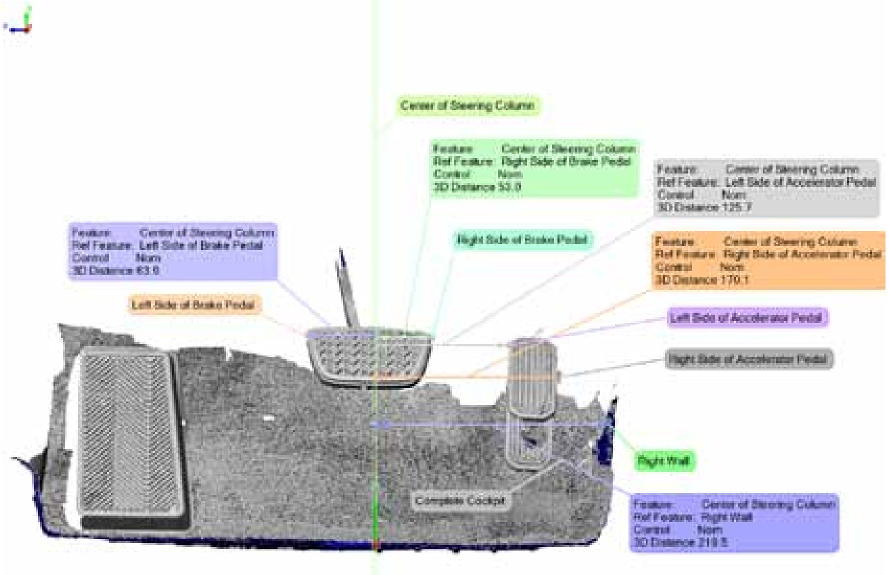
Feature: Floor
Ref Feature: Bottom of Brake Pedal
Control Nom
3D Distance 144.2

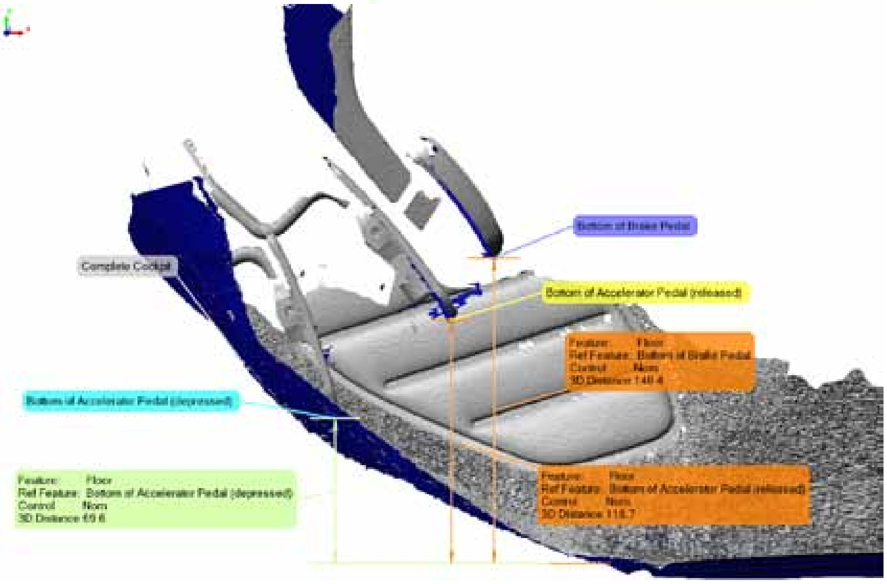
Feature: Floor
Ref Feature: Bottom of Accelerator (released)
Control Nom
3D Distance 113.9

Feature: Floor
Ref Feature: Bottom of Accelerator (depressed)
Control Nom
3D Distance 78.1

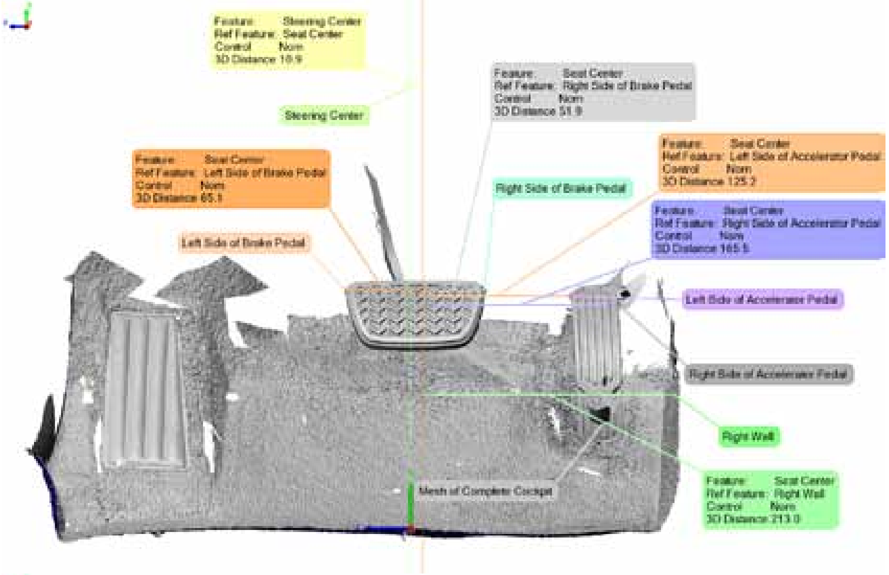
Toyota Camry 11D







Toyota Camry 12C



Feature: Steering Center
Ref Feature: Seat Center
Control: Nom
3D Distance 18.9

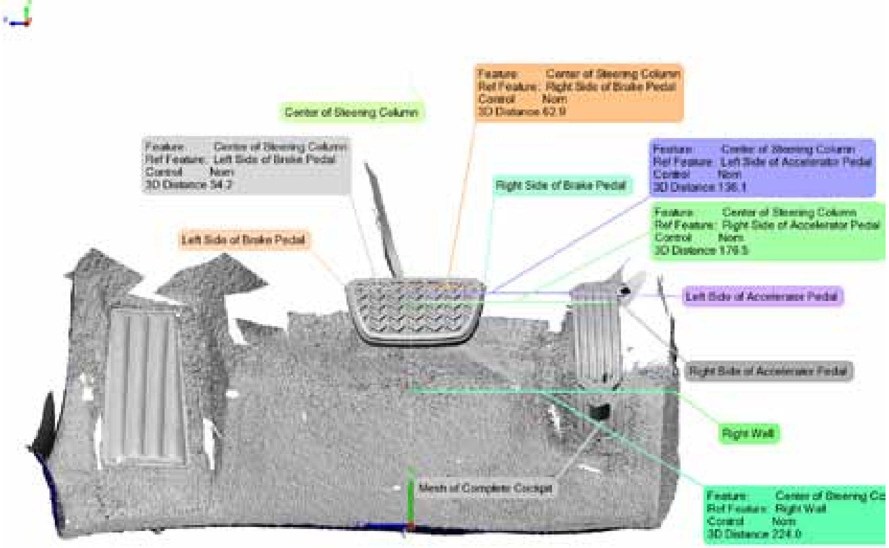
Feature: Seat Center
Ref Feature: Right Side of Brake Pedal
Control: Nom
3D Distance 51.9

Feature: Seat Center
Ref Feature: Left Side of Brake Pedal
Control: Nom
3D Distance 65.1

Feature: Seat Center
Ref Feature: Left Side of Accelerator Pedal
Control: Nom
3D Distance 125.2

Feature: Seat Center
Ref Feature: Right Side of Accelerator Pedal
Control: Nom
3D Distance 165.5

Feature: Seat Center
Ref Feature: Right Wall
Control: Nom
3D Distance 213.0



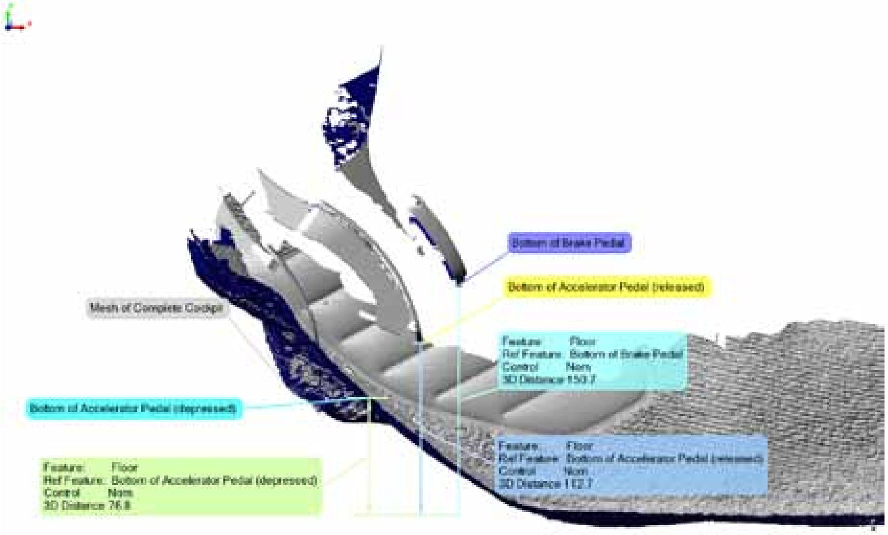
Feature: Center of Steering Column
Ref Feature: Right Side of Brake Pedal
Control: Nom
3D Distance 62.9

Feature: Center of Steering Column
Ref Feature: Left Side of Brake Pedal
Control: Nom
3D Distance 54.7

Feature: Center of Steering Column
Ref Feature: Left Side of Accelerator Pedal
Control: Nom
3D Distance 136.1

Feature: Center of Steering Column
Ref Feature: Right Side of Accelerator Pedal
Control: Nom
3D Distance 176.5

Feature: Center of Steering Co
Ref Feature: Right Wall
Control: Nom
3D Distance 224.0

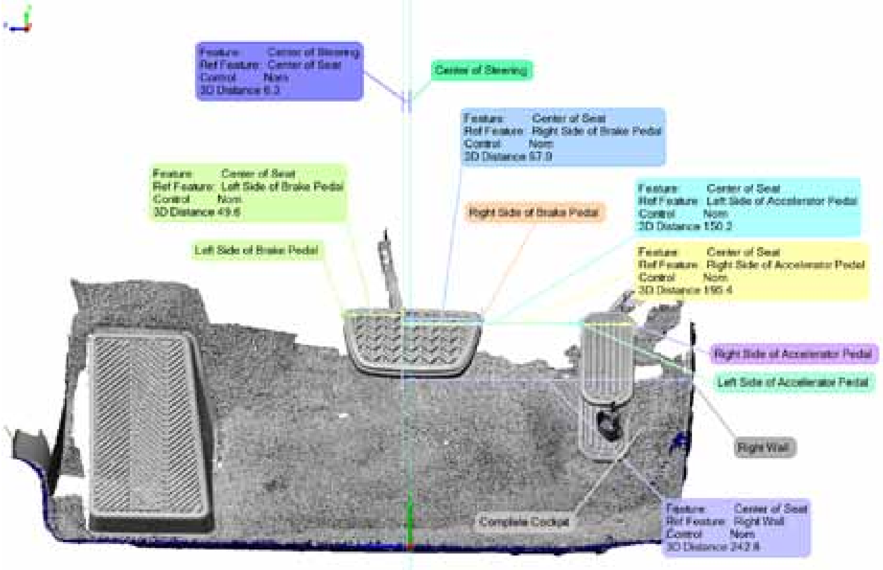


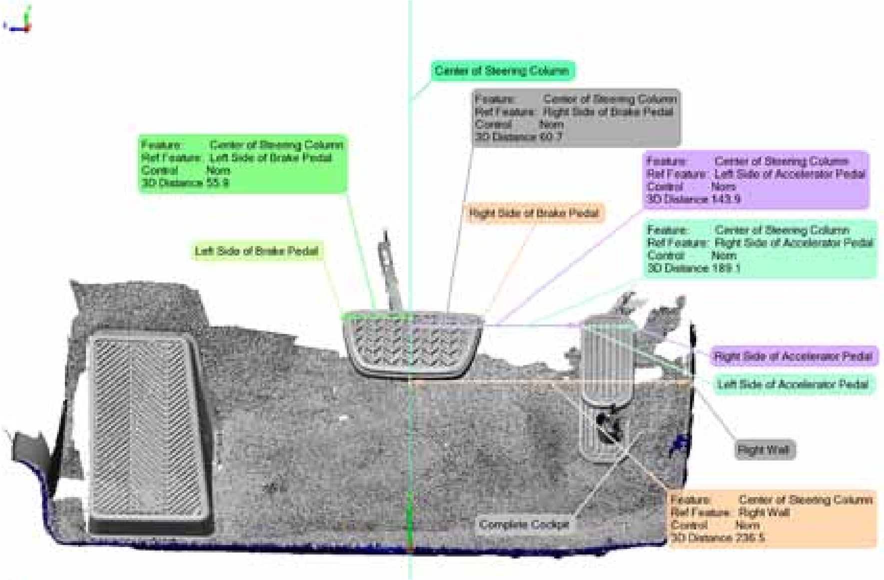
Feature: Floor
Ref Feature: Bottom of Brake Pedal
Control: Nom
3D Distance 150.7

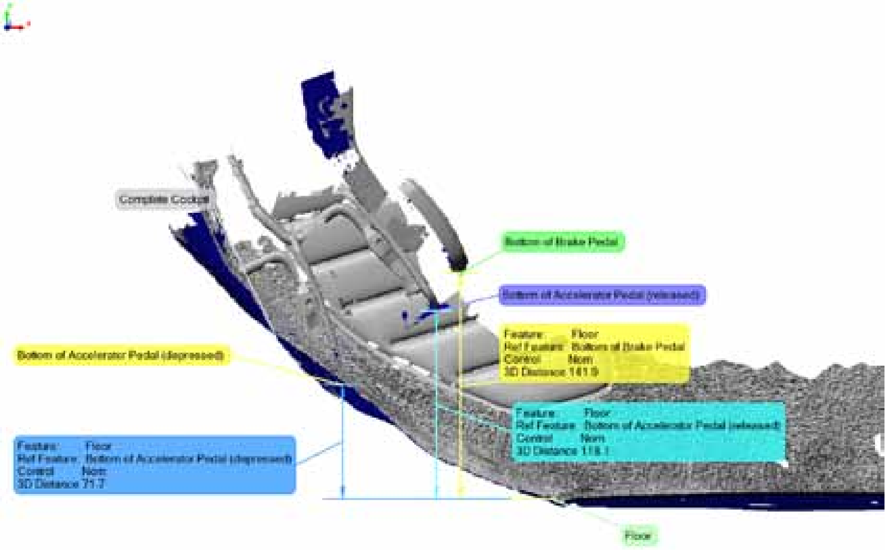
Feature: Floor
Ref Feature: Bottom of Accelerator Pedal (depressed)
Control: Nom
3D Distance 76.8

Feature: Floor
Ref Feature: Bottom of Accelerator Pedal (released)
Control: Nom
3D Distance 112.7

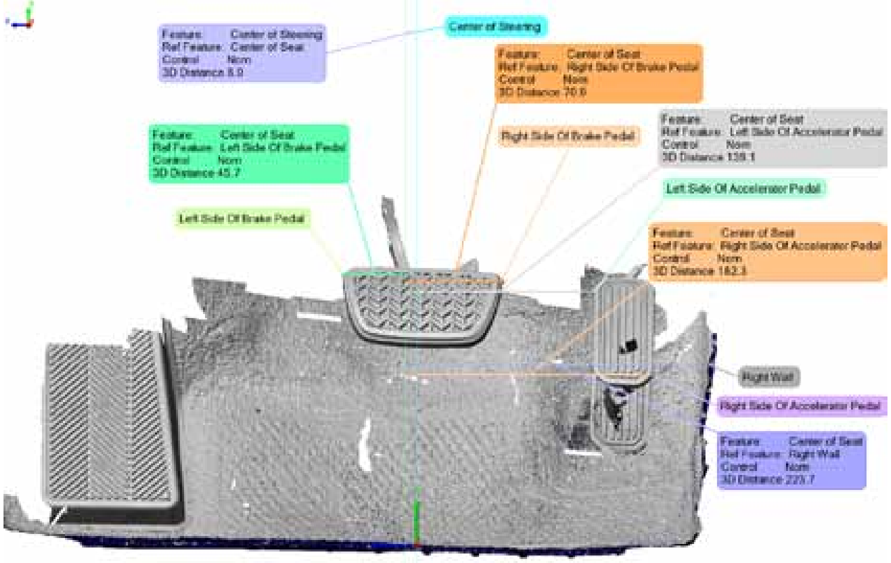
Toyota Camry 13C







Toyota Camry 14C



Feature: Center of Steering
Ref Feature: Center of Seat
Control Nom
3D Distance 8.9

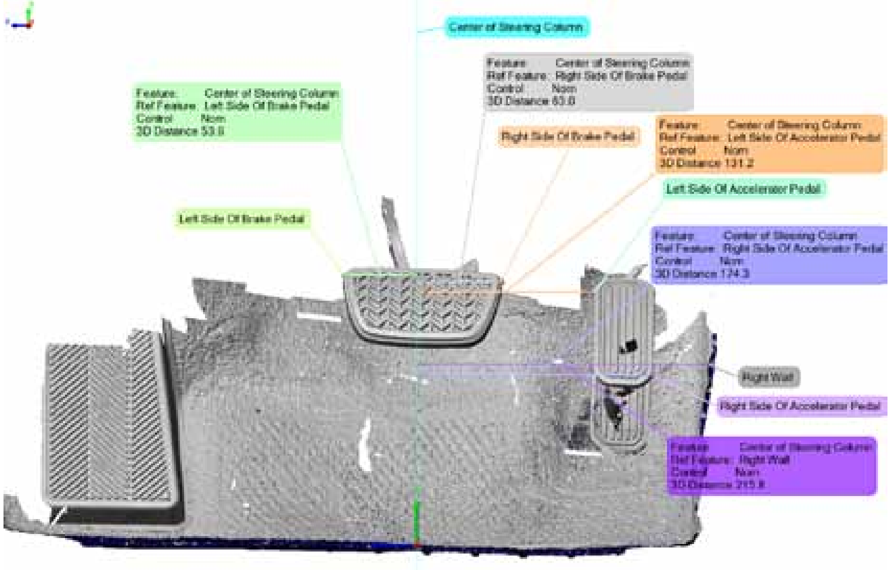
Feature: Center of Seat
Ref Feature: Right Side Of Brake Pedal
Control Nom
3D Distance 70.6

Feature: Center of Seat
Ref Feature: Left Side Of Accelerator Pedal
Control Nom
3D Distance 139.1

Feature: Center of Seat
Ref Feature: Left Side Of Brake Pedal
Control Nom
3D Distance 45.7

Feature: Center of Seat
Ref Feature: Right Side Of Accelerator Pedal
Control Nom
3D Distance 182.3

Feature: Center of Seat
Ref Feature: Right Wall
Control Nom
3D Distance 223.7



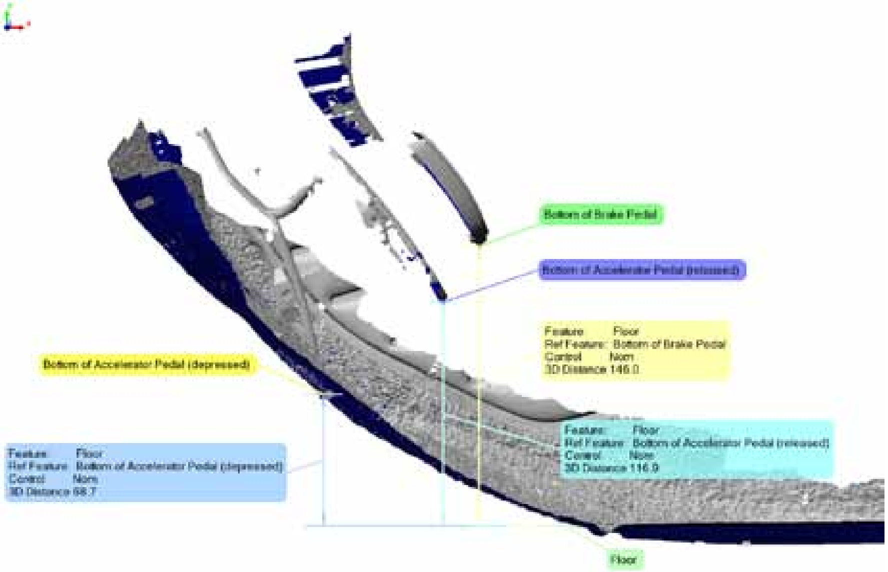
Feature: Center of Steering Column
Ref Feature: Right Side Of Brake Pedal
Control Nom
3D Distance 63.0

Feature: Center of Steering Column
Ref Feature: Left Side Of Brake Pedal
Control Nom
3D Distance 53.8

Feature: Center of Steering Column
Ref Feature: Left Side Of Accelerator Pedal
Control Nom
3D Distance 131.2

Feature: Center of Steering Column
Ref Feature: Right Side Of Accelerator Pedal
Control Nom
3D Distance 174.3

Feature: Center of Steering Column
Ref Feature: Right Wall
Control Nom
3D Distance 215.8

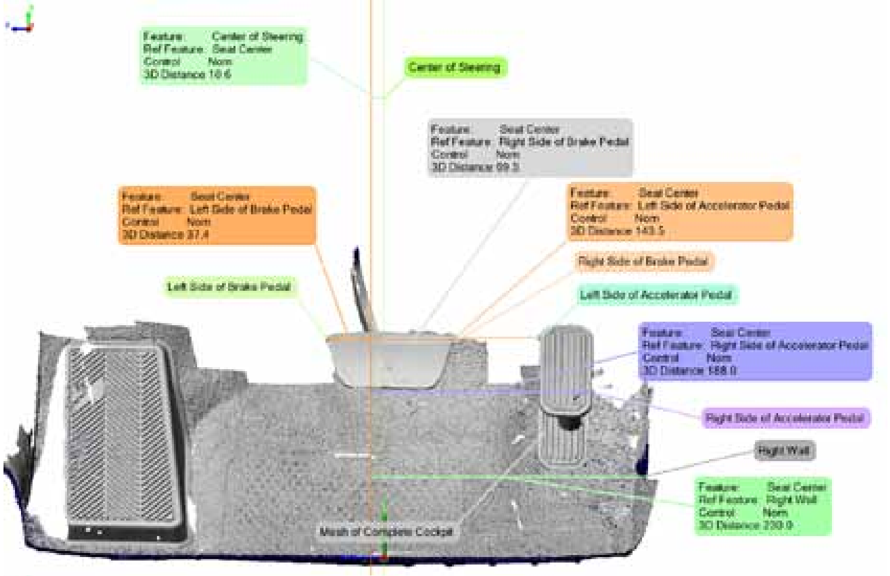


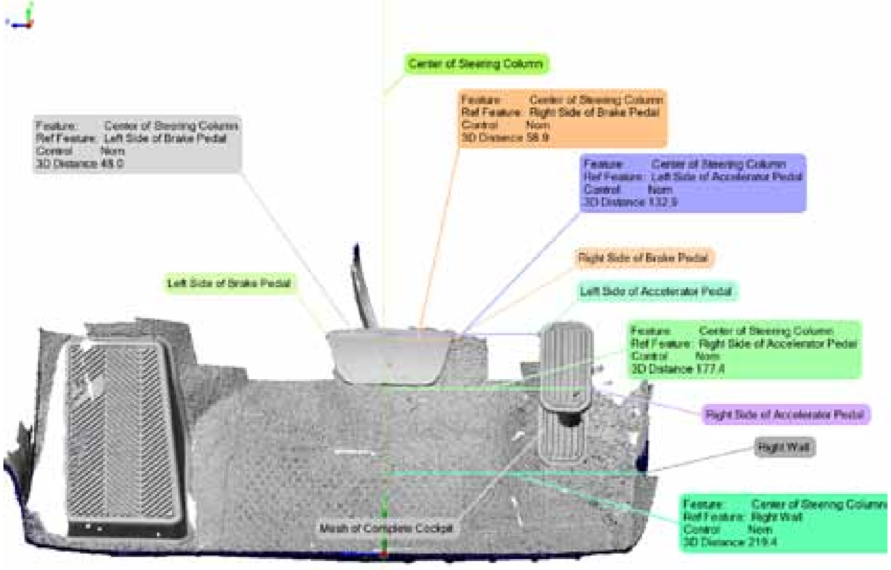
Feature: Floor
Ref Feature: Bottom of Brake Pedal
Control Nom
3D Distance 146.0

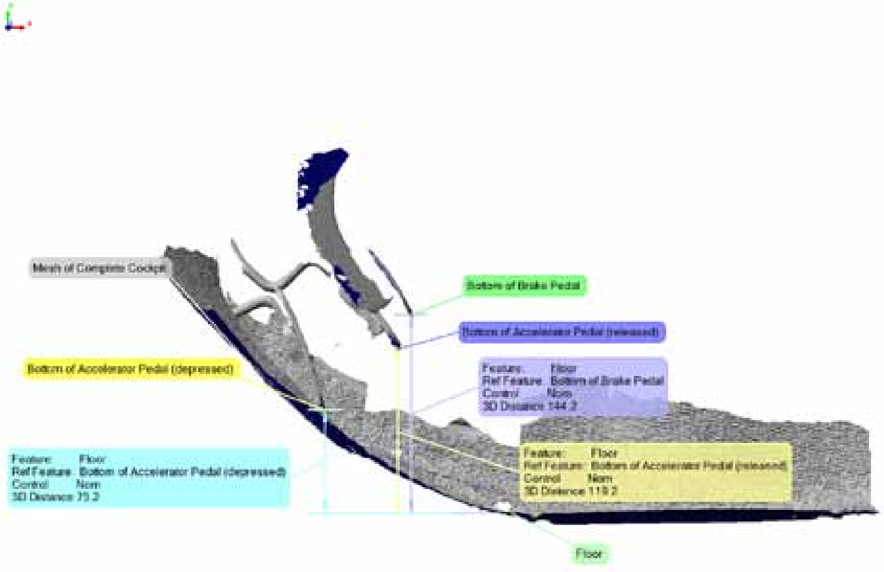
Feature: Floor
Ref Feature: Bottom of Accelerator Pedal (depressed)
Control Nom
3D Distance 68.7

Feature: Floor
Ref Feature: Bottom of Accelerator Pedal (released)
Control Nom
3D Distance 116.9

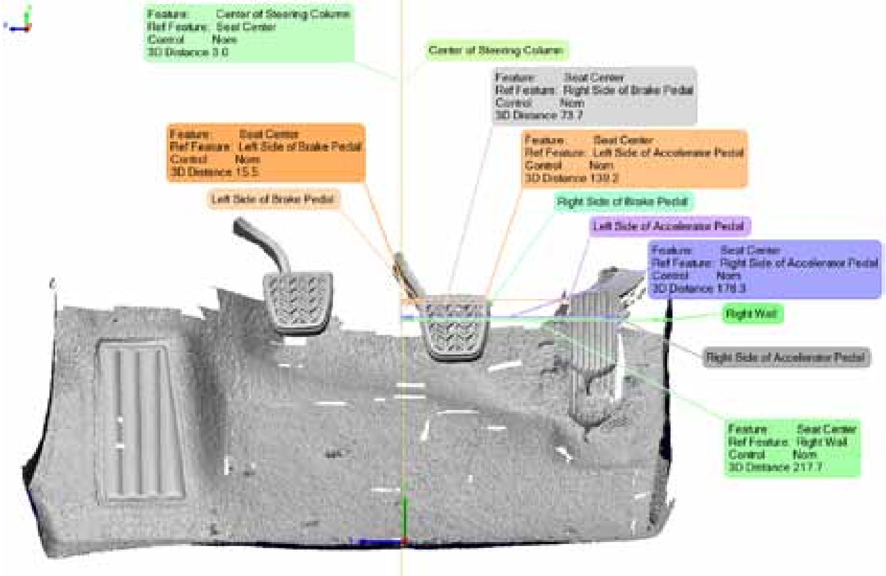
Toyota Camry 15C

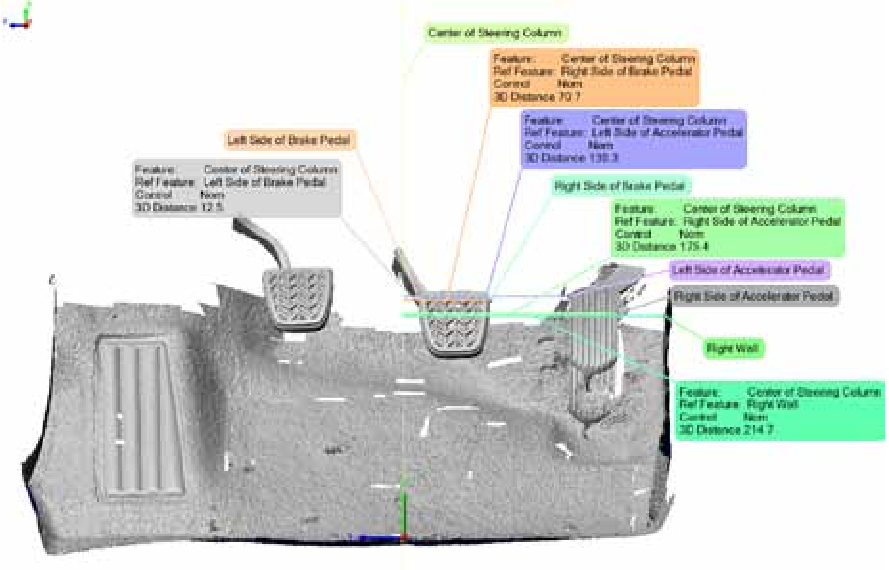


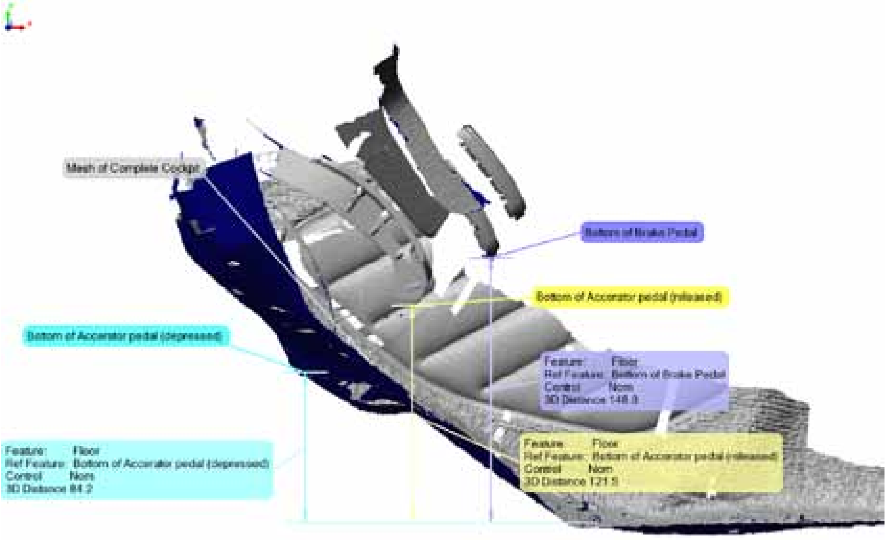




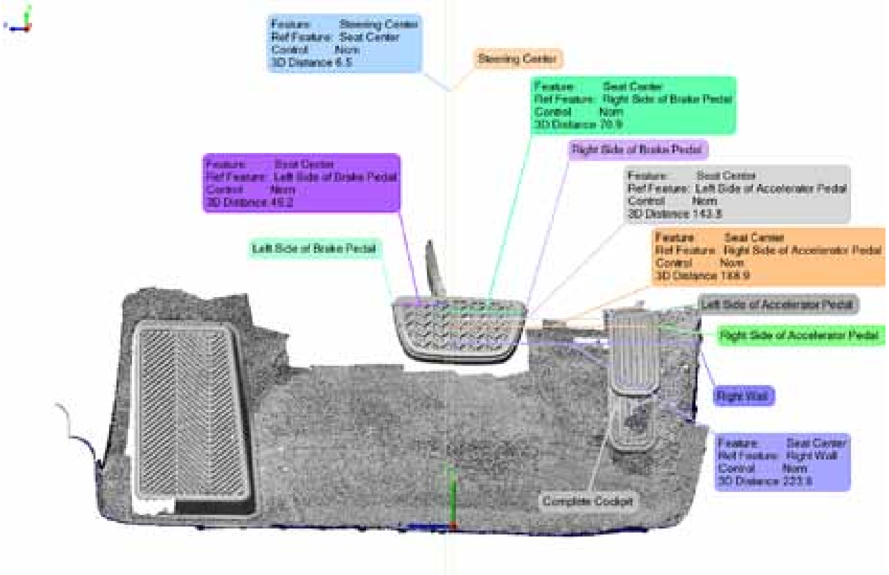
Toyota Camry 16C

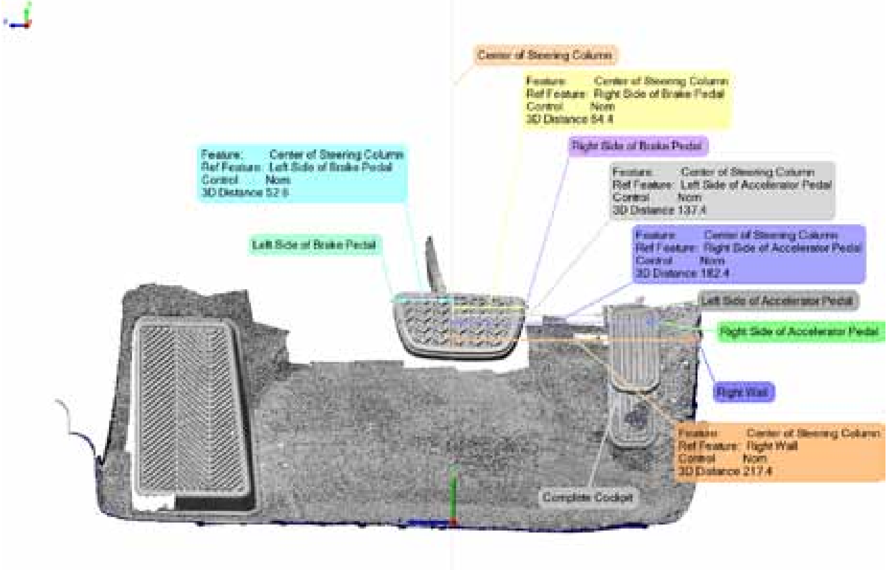


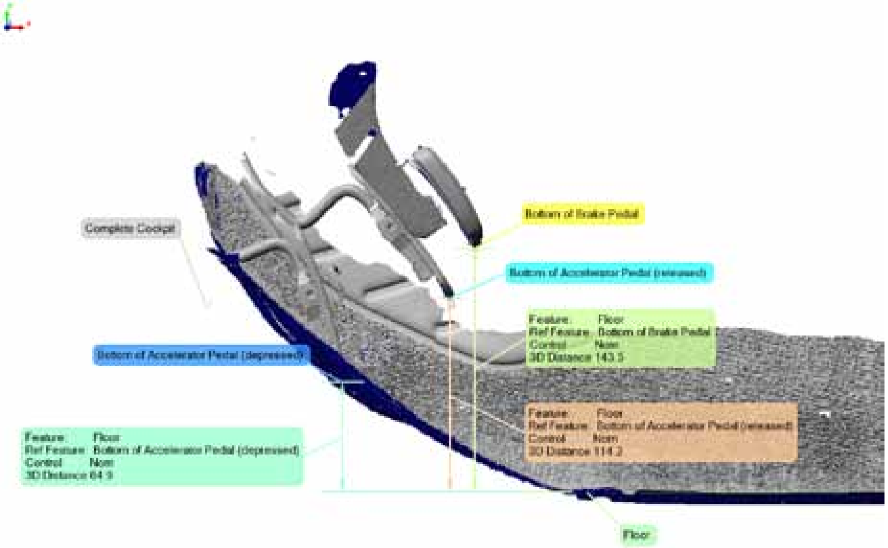




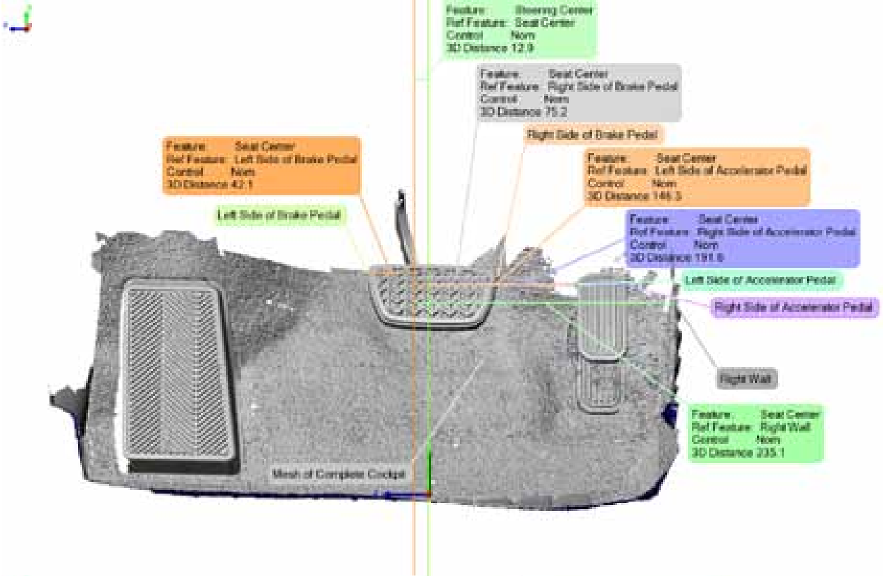
Toyota Camry 17C

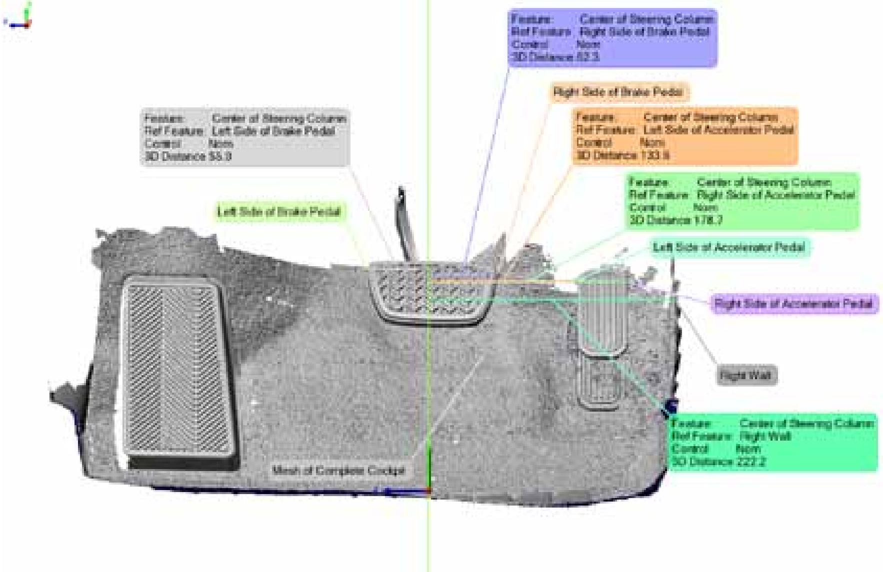


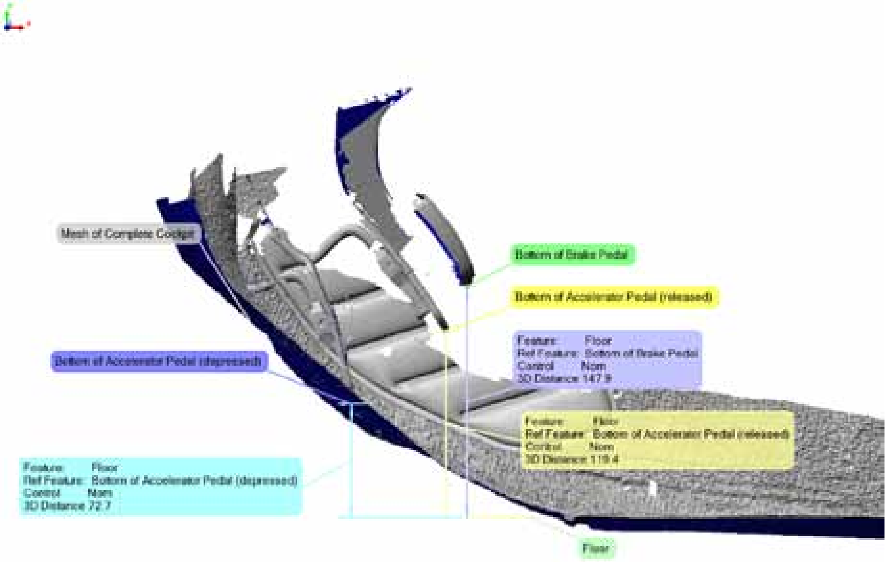




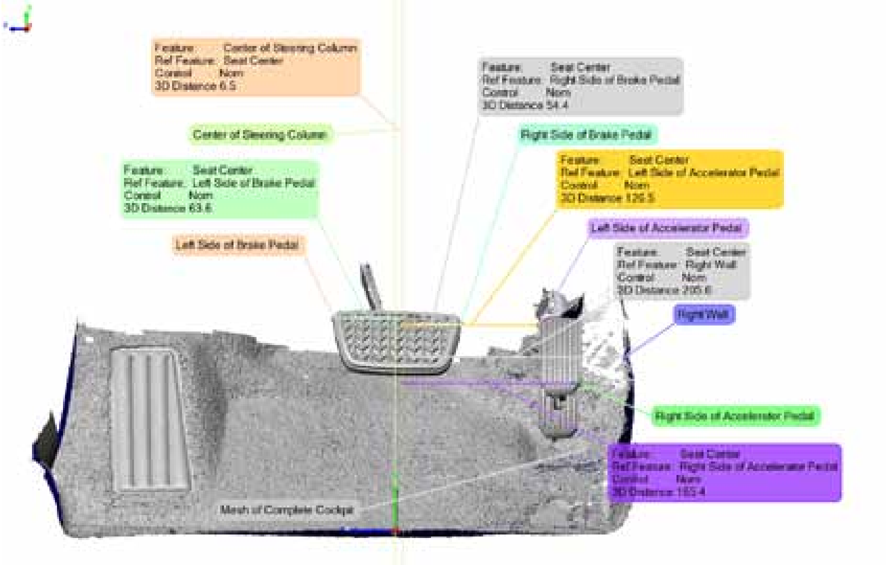
Toyota Camry 18C

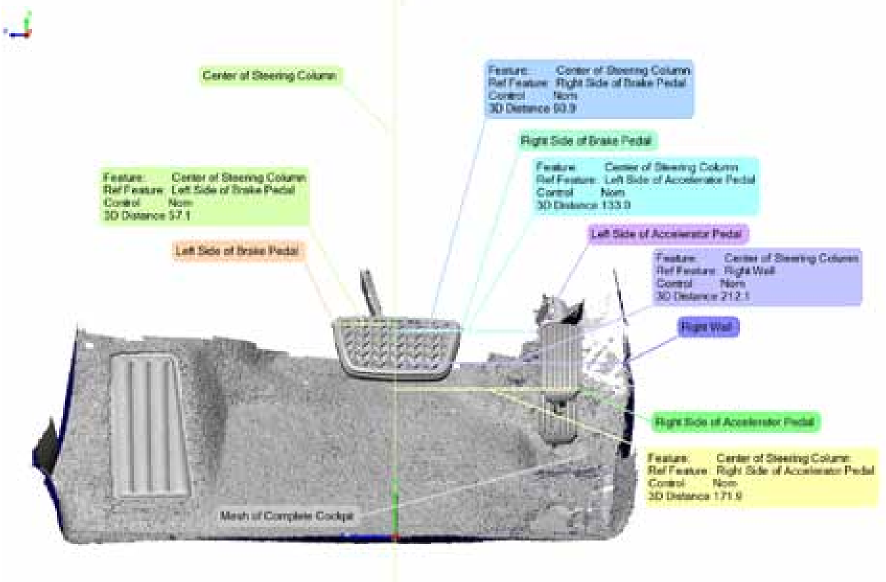


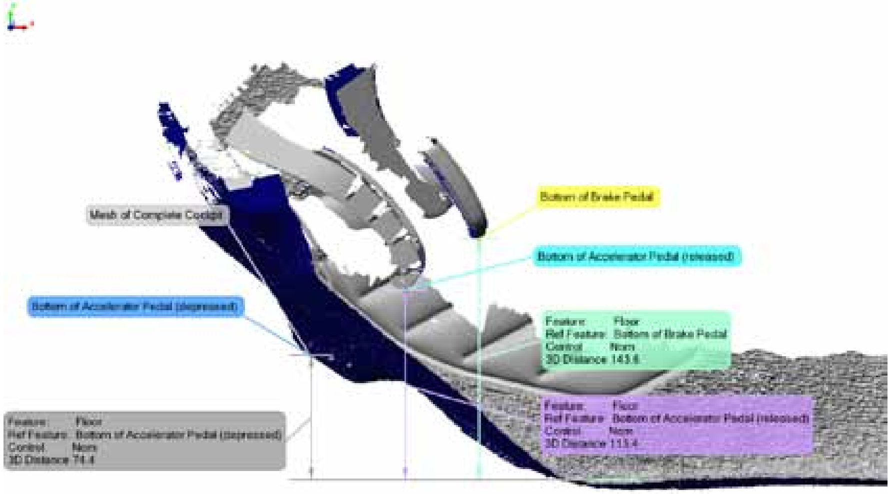




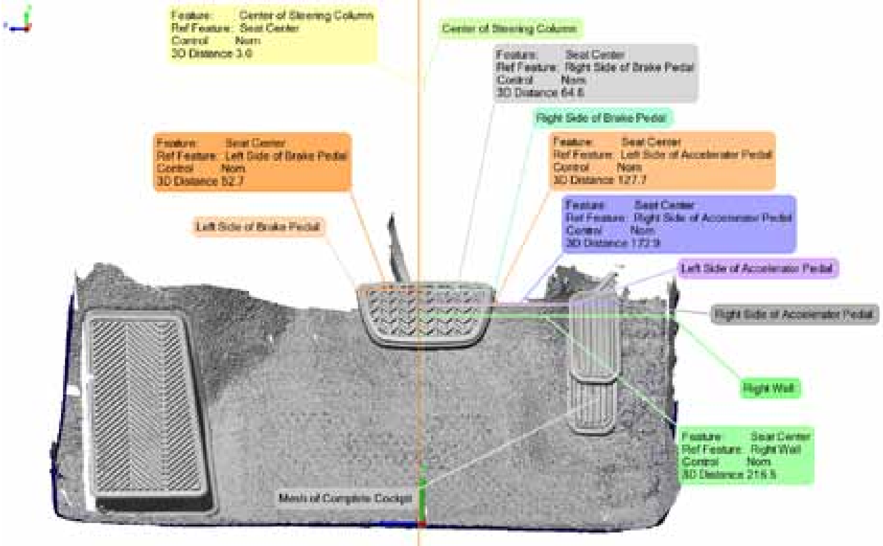
Toyota Camry 19C

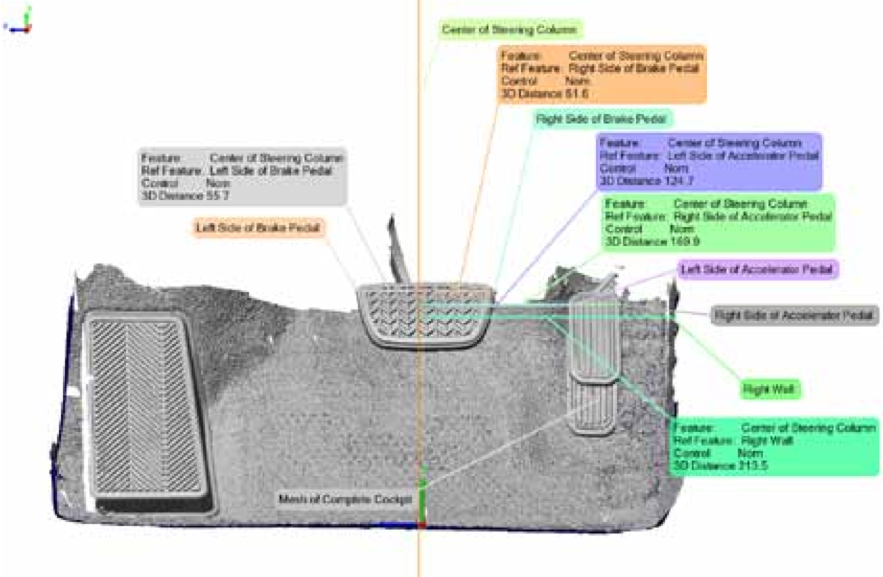


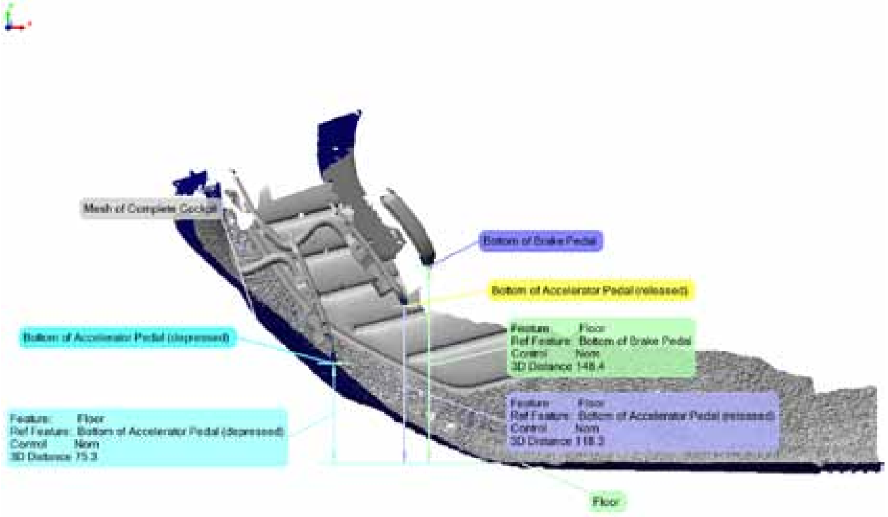




Toyota Camry 20C

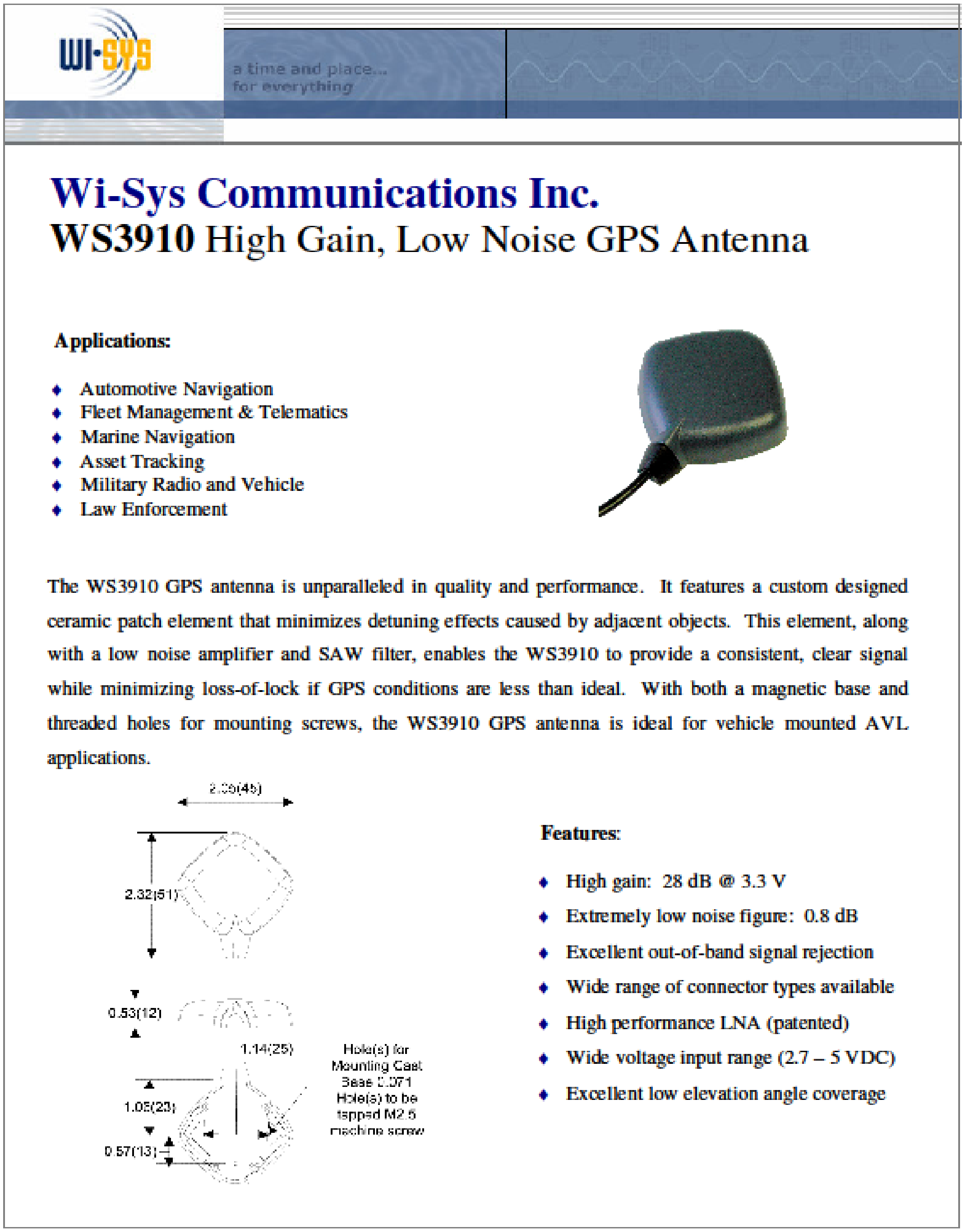






APPENDIX I - Test Equipment Specifications And Calibrations

Test Equipment



a time and place...
for everything

Wi-Sys Communications Inc.
WS3910 High Gain, Low Noise GPS Antenna

Applications:

- Automotive Navigation
- Fleet Management & Telematics
- Marine Navigation
- Asset Tracking
- Military Radio and Vehicle
- Law Enforcement

The WS3910 GPS antenna is unparalleled in quality and performance. It features a custom designed ceramic patch element that minimizes detuning effects caused by adjacent objects. This element, along with a low noise amplifier and SAW filter, enables the WS3910 to provide a consistent, clear signal while minimizing loss-of-lock if GPS conditions are less than ideal. With both a magnetic base and threaded holes for mounting screws, the WS3910 GPS antenna is ideal for vehicle mounted AVL applications.

Features:

- High gain: 28 dB @ 3.3 V
- Extremely low noise figure: 0.8 dB
- Excellent out-of-band signal rejection
- Wide range of connector types available
- High performance LNA (patented)
- Wide voltage input range (2.7 – 5 VDC)
- Excellent low elevation angle coverage

VBOX

VBOX III 100Hz

Overview

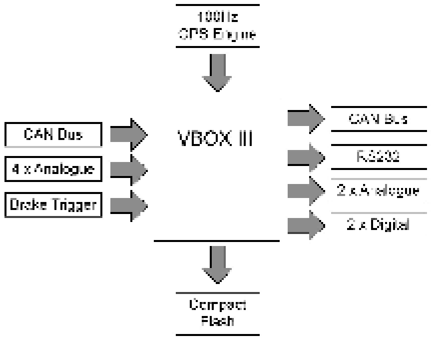
The VBOX III represents the 3rd generation of GPS data logging system from Racelogic. Using a powerful new GPS engine, the VBOX III can log GPS and other data at 100Hz. The logged data is stored directly onto a compact flash card for easy transfer to a PC. Used with a DGPS basestation, the VBOX III is capable of achieving 40cm positional accuracy.
A 2cm 95% CEP (RTK) positional accuracy VBOXIII is available as an option; also requiring an RTK enabled basestation (RLVBBS3).
The VBOX III includes 4 high-resolution analogue input channels and 8 user configurable CAN channels.

The 2 CAN bus interfaces allow connection of Racelogic input modules while simultaneously transmitting GPS data or receiving vehicle CAN data on the second bus.

In line with previous VBOX models, the VBOX III is compatible with all of the existing peripherals including the Multifunction display, ADC03, TC8, FIM02 and Yaw rate sensor.

Features

- Non-contact 100Hz speed and distance measurement using GPS
- 12.5ms Latency
- 4 x 24bit differential analogue input channels with ±50v input range and synchronous capture
- Brake/Event Trigger input, 12µS resolution
- 2 x CAN Bus interface for data input & output
- RS-232 serial interface
- Data logged to industry standard Compact Flash memory cards
- 2 x 16bit User configurable analogue outputs
- 2 x Digital outputs
- User configurable trigger options
- Logging rate selectable to 100Hz, 50Hz, 20Hz, 10Hz, 5Hz, 1Hz
- Wide 5.3V to 30V operating range
- Can be used with a differential basestation for positional accuracies of up to 40cm,
- 2cm 95% CEP positional accuracy, (requiring RTK VBOX (VBOX3R5 and RLVBBS3 Basestation)



VBOX III Input & Output

Model 141

High Output Linear Accelerometer
For Vibration, Shock, Impact

Ranges from: ±2g to ±600g
With External R_{cal} Calibration

The Model 141 is a linear accelerometer that produces a high level instantaneous DC output signal proportional to sensed accelerations (ranging from static acceleration up to 3000 Hz as indicated below).

Setra accelerometers are unique in their ability to withstand exceedingly high g overload without damage. The Model 141 incorporates the super-rugged Setra capacitance-type sensor and a miniaturized electronic circuit.

Its excellent dynamic response is maintained by air damping, which varies with temperature approximately one-tenth as much as the best fluid damping.

The electrical characteristics are compatible with conventional strain-gauge type signal conditioning, including the use of shunt R_{cal} over any selected range up to 100% full scale. The stainless steel case is O-ring sealed, has a well-defined base plane and is quite insensitive to mounting strain.

Cross axis interference is exceedingly low. The external easy-to-replace cable attachment facilitates installation and service.

Full Scale Ranges

For each of the available g ranges, the linearity is characterized by this range chart:
(Non-linearity as % full range, best straight line)

Nominal Range	Non-Linearity ±1%	Natural Frequency (Nominal)	Flat Response (± 3 db) 0 Hz to:
±2g	±2g	300Hz	200Hz
±4g	±4g	440Hz	260Hz
±8g	±8g	570Hz	300Hz
±15g	±15g	840Hz	400Hz
±30g	±30g	1200Hz	700Hz
±60g	±60g	1560Hz	1000Hz
±150g	±150g	2600Hz	1600Hz
±600g	±600g	5000Hz	3000Hz

NOTE: Setra adheres to strict quality standards including ISO 9001 and ANSI-Z540-1. The calibration of this product is NIST traceable.

159 Swanson Rd., Boxborough, MA 01719/Telephone: 978-263-1400/Fax: 978-264-0292

Features

- Excellent Static and Dynamic Response
- Temperature-Insensitive Gas Damping (0.7 Critical)
- High Output Signal
- High Overload Capability, (2000g static)
- Low Transverse Sensitivity (0.012 g/g)
- Wide-Range R_{cal} Type Calibration
- Easy-to-Replace Cable Attachment
- Compact, Lightweight
- Optional EMI Filter Upgrade
- Meets CE Conformance Standards

When it comes to a product to rely on, choose the Model 141.
When it comes to a company to trust, choose Setra .

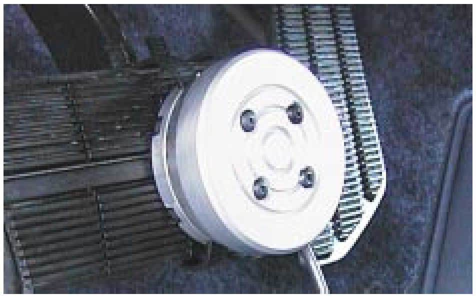
ISO 9001 Certified

Visit Setra Online:
http://www.setra.com

setra
800-257-3872

10118

BRAKE PEDAL FORCE SENSOR



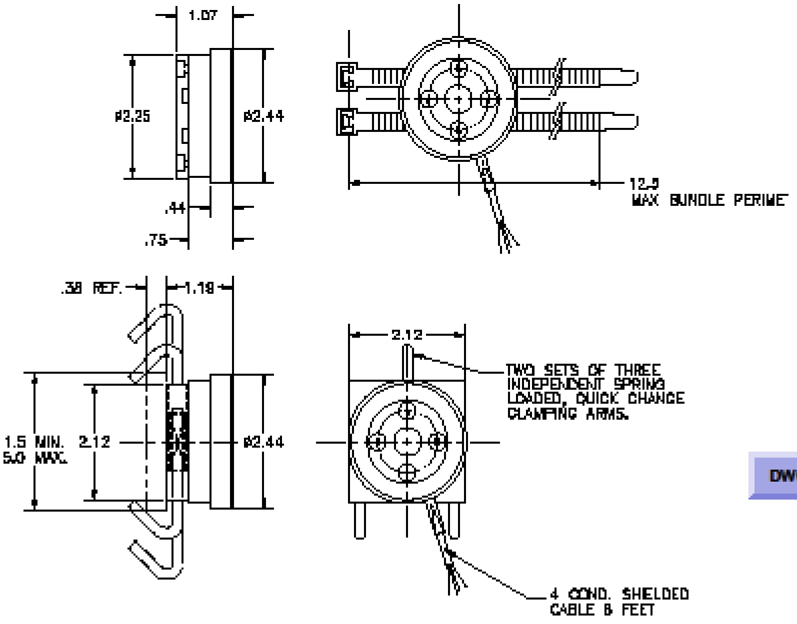
The 10118 Pedal Force sensor is used to evaluate the force requirements of new and existing brake systems. The transducer adapts to pedals in automobiles, trucks, buses, or material handling equipment. It mounts directly to the pedal with spring-loaded, quick-change clamping arms or cable ties for easy installation. The sensor is available in capacities ranging from 25 to 400 lbs. The required capacity needs to be specified at time of order.

SPECIFICATIONS

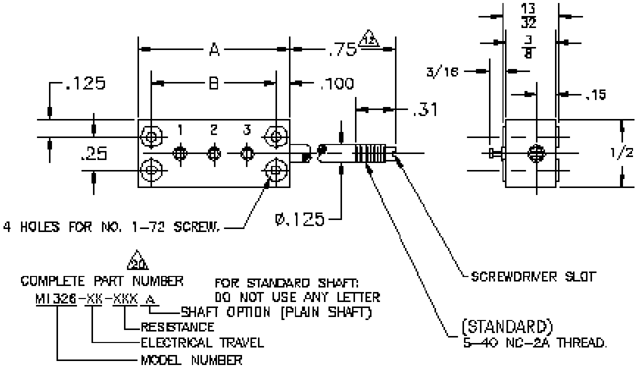
Capacities	25 to 400 lbs. (See chart)
Overload capacity	150% of F.S.
Output at full scale load	2.0 mV/V nominal
Non-linearity	0.10% of F.S.
Hysteresis	0.10% of F.S.
Zero balance	1% of F.S.
Compensated temperature	70 to 170°F
Useable temperature	-65 to +250°F
Temperature effect on zero	0.002% of F.S./°F
Temperature effect on span	0.002% of Rdg./°F
Bridge resistance	700 Ohms
Excitation voltage, maximum	20 Vdc

DIMENSIONS

MODEL	CAPACITY
	LB
10118-250	25
10118-051	50
10118-012	100
10118-022	200
10118-251	250
10118-042	400



DWG



20

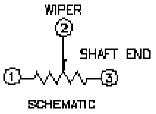
COMPLETE PART NUMBER

MI326-XX-XXX A

- A — SHAFT OPTION (PLAIN SHAFT)
- XXX — RESISTANCE
- XX — ELECTRICAL TRAVEL
- MI326 — MODEL NUMBER

FOR STANDARD SHAFT:
DO NOT USE ANY LETTER

20. WHEN ORDERING SPECIFY ELECTRICAL TRAVEL, RESISTANCE & SHAFT OPTION.
19. SHAFT MAY BE FREELY ROTATED.
18. HARDWARE INCLUDED: 4 EA.: 1-72 X 7/8 SCREWS, 1-72 HEX NUTS AND A # 5-40 HEX NUT ATTACHED ON THE SHAFT.
17. GOLD PLATED TERMINALS.
16. PRECIOUS METAL CONTACTS.
15. STAINLESS STEEL SHAFT.
14. ANODIZED ALUMINUN HOUSING.
13. SHAFT FRICTIONAL FORCE: 4 OUNCES, MAX.
12. SHAFT SHOWN IN RETRACTED POSITION.
11. EQUIVALENT NOISE RESISTANCE: 100 OHMS. MAX.
10. LIFE 500,000 CYCLES AT 60 INCHES/MIN.
9. DIELECTRIC STRENGTH: 750 VOLTS AC.
8. POWER RATING: 1 WATT/INCH AT 40 °C, DERATED TO ZERO AT 125 °C.
7. OPERATING TEMPERATURE RANGE: -55° TO +125 °C.
6. TOTAL MECHANICAL TRAVEL: SEE CHART II, ±.030" ELECTRICALLY CONTINUOUS.
5. ACTUAL ELECTRICAL TRAVEL: SEE CHART II, ±.010".
4. INDEPENDENT LINEARITY: SEE CHART III. (SEE SHEET 2)
3. THEORETICAL RESOLUTION: SEE CHART III. (SEE SHEET 2)
2. TOTAL RESISTANCE TOLERANCE: ±5%.
1. TOTAL RESISTANCE: SEE CHART I. OTHER VALUES ON REQUEST



SCHEMATIC

REVISIONS

C/L	DESCRIPTION	BY	APP'D	DATE
P	ADDED DIM. OVER EYELETS	AD	JAH	11/16/0
D	REV. NOTE 18	AD	MKG	5/10/04

CHART II

DASH NUMBER	A	B	MECHANICAL TRAVEL	ELECTRICAL TRAVEL
1	2.00	1.80	1.10	1.000
2	3.00	2.80	2.10	2.000
3	4.00	3.80	3.10	3.000
4	5.00	4.80	4.10	4.000
5	6.00	5.80	5.10	5.000
6	7.00	6.80	6.10	6.000
7	8.00	7.80	7.10	7.000
8	9.00	8.80	8.10	8.000
9	10.0	9.80	9.10	9.000
10	11.0	10.80	10.10	10.000
11	12.0	11.80	11.10	11.000
12	13.0	12.80	12.10	12.000

SHAFT OPTIONS

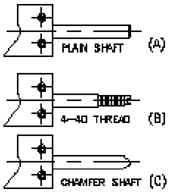


CHART I

104	100,000
503	50,000
253	25,000
203	20,000
103	10,000
502	5,000
252	2,500
202	2,000
102	1,000
501	500
251	250
101	100
50R	50
DASH NO.	RESISTANCE (±5%)

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ±1/64
DECIMALS [illegible]
ANGLES ±1/2

[illegible]

	XM1326
PART NO.	NEXT ASSY.

MAUREY INSTRUMENT CORP.
4555 W 60th ST. CHICAGO, ILL 60629

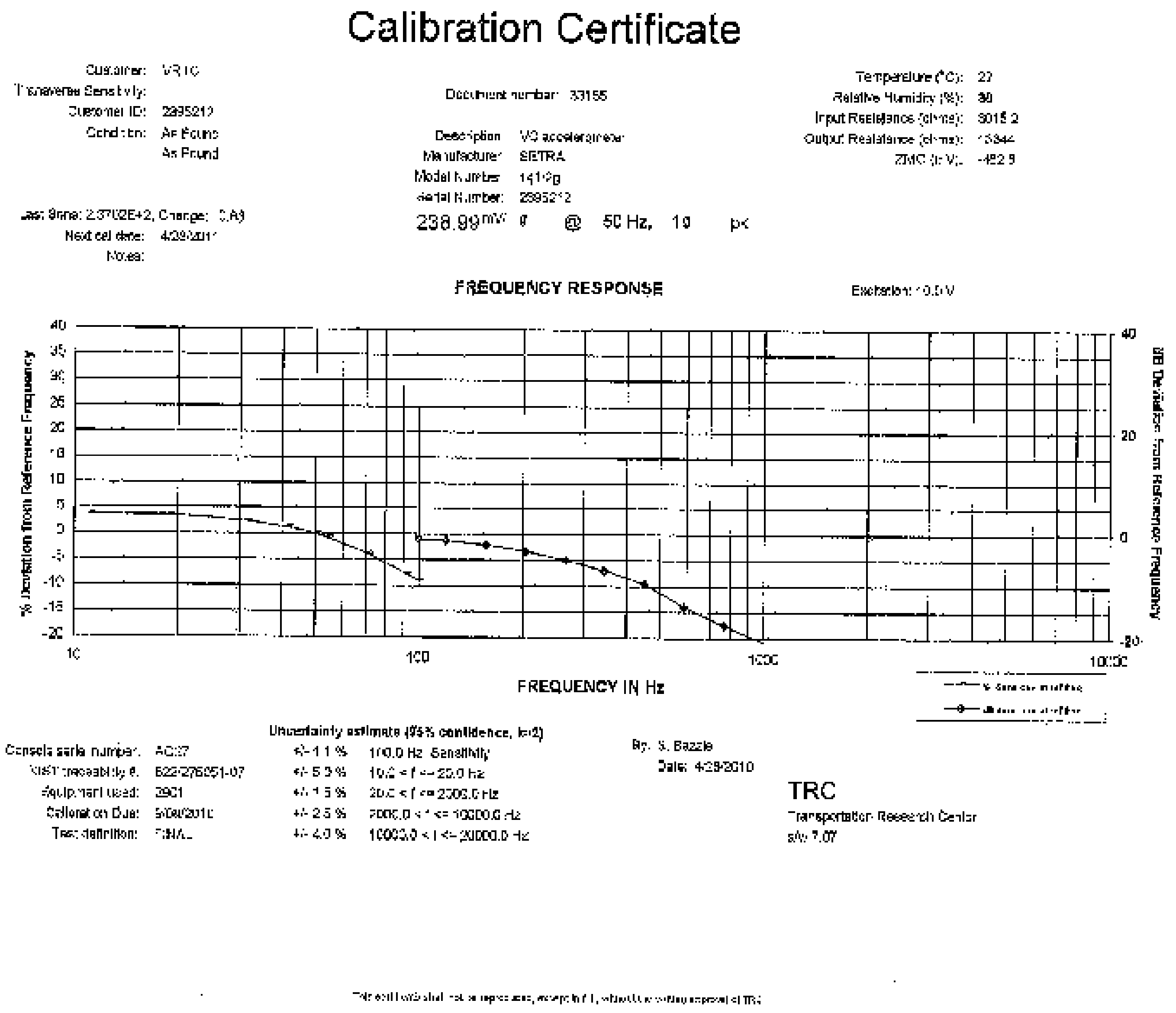
POTENTIOMETER, LINEAR MOTION

CUSTOMER

DRAWN BY J. OLSEN	SCALE 2/1	M1326	Q
APPD BM	DATE 04/01/88		

CAD No. M1326 REDRAWN SHEET 1

Calibrations



Calibration Certificate

Customer: VR10
Transverse Sensitivity:
Customer ID: 2395212
Condition: As Found
As Found

Last Sens: 2.3702E+2, Change: 0.83
Next cal date: 4/29/2011
Notes:

Document number: 33155

Description: VC accelerometer
Manufacturer: SETRA
Model Number: 141-2g
Serial Number: 2395212
238.99 mV/ g @ 50 Hz, 10 pk

Temperature (°C): 22
Relative Humidity (%): 30
Input Resistance (ohms): 3015.2
Output Resistance (ohms): 13344
ZMO (mV): -482.9

FREQUENCY RESPONSE

Excitation: 10.0 V

Uncertainty estimate (95% confidence, k=2)

Console serial number: AC37
NIST traceability #: 822/276051-07
Equipment used: 2901
Calibration Due: 5/06/2010
Test definition: FINAL

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 < f <= 20.0 Hz
+/- 1.5 %	20.0 < f <= 2000.0 Hz
+/- 2.5 %	2000.0 < f <= 10000.0 Hz
+/- 4.0 %	10000.0 < f <= 20000.0 Hz

By: S. Bazzle
Date: 4/29/2010

TRC
Transportation Research Center
s/w 7.07

KEITHLEY

A GREATER MEASURE OF CONFIDENCE

KEITHLEY INSTRUMENTS, INC. ■ 28775 AURORA RD, CLEVELAND, OHIO USA ■ 440-248-0400 ■ 1-888-KEITHLEY ■ www.keithley.com

CALIBRATION CERT #2462.01

Calibration Certificate

Manufacturer:	Keithley	Calibration Date:	27 April 2010
Model No:	2000	Temperature:	23.70 °C
Serial No:	1274715	Relative Humidity:	35.2 %
Procedure:	QA-7000E.0	Report No:	1274715:1272330720
Data Type:	**AFTER DATA**	Test Status:	**IN TOLERANCE**

Customer Information: Not Applicable

- Keithley Instruments, Inc. certifies that the above instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
- The quality system is registered to ISO 9001:2008.
- This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.
- The test results shown in this report apply to the calibrated item identified on page 1 of this certificate.
- This calibration certificate shall not be reproduced except in full without the written approval of Keithley Instruments, Inc.
- The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.
- Test status is PASS unless indicated otherwise.
- Testpoints marked with a preceding "*" are not accredited.

Standards Used

Control Number	Description	Cal Date	Due Date
7591	Keithley RHT Temperature/Humidity Sensor	05-Jun-2009	05 Jun 2010
7753	Fluke 5720A Multifunction Calibrator	15-Mar-2010	14 May 2010
8231	Fluke 5725A Amplifier	08-Apr-2010	07 Jul 2010

Technician: 0825

Approved By: Helga A. Alexander

Helga A. Alexander
Metrology Services Manager

T.R.C. Inc.
F111-1,9/02/99
St. Rt. 347 East

East Liberty,Oh 43319-0367

Certificate of Calibration

Print Date 4/27/2010 **Certificate Number: (None)**

Gage ID	LC-182421Nhsla	**Approved**	Yes
Gage S/N	182421	**As Found Condition**	In
Description	LOAD CELL	**Uncertainty:**	
Asset No.		**Coverage Factor k**	
Model No.	10118	**Deg. of Freedom (DF)**	
Unit of Meas.	LBS	**NIST No.**	
Manufacturer	SENSOR DEVELOPMENT	**Customer Info.**	
Cal. Date	4/27/2010		
Next Due	10/27/2010		
Cal. Freq.	6.00 **Months**		
Location	NHTSA		

Certification Statement

It is hereby certified that the above described instrument conforms to the original manufacturer's specifications and has been calibrated using standards whose accuracy's are traceable to the National Institute of Standards and Technology within the limitations of the Institute Calibration Services or have been derived from accepted values of natural physical constants or have been derived by the ratio type of self calibration techniques. Our calibration system satisfies ISO-9000 requirements.

Findings

Environmental Conditions

Temperature 73
Humidity 27
Pressure 28.55
Other

Standard ID	01 Pedal Force (0 Lbs)	**Uncertainty**		**Units**	Lbs	**CS Type**	V
Limited Use?	No	**Minimum**	0	**Nominal**	0	**Maximum**	0
Ref Type	OHAUS WEIGHT KIT	**Before**	0	**Accuracy**	0	**Fail Before**	No
		After	0	**Accuracy**	0	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date	3/4/2011	**Gage S/N**		**Model No.**	239410	**NIST No.**	331000441

.015V

Standard ID	02 Pedal Force (50 Lbs)	**Uncertainty**		**Units**	Lbs	**CS Type**	V
Limited Use?	No	**Minimum**	49	**Nominal**	50	**Maximum**	51
Ref Type	OHAUS WEIGHT KIT	**Before**	50.15	**Accuracy**	0.1499999995	**Fail Before**	No
		After	50.15	**Accuracy**	0.1499999999	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date	3/4/2011	**Gage S/N**		**Model No.**	239410	**NIST No.**	331000141

.175v

Standard ID	03. Pedal Force (100 Lbs)	**Uncertainty**		**Units**	Lbs	**CS Type**	V

Limited Use?	No	**Minimum**	98	**Nominal**	100	**Maximum**	102
Ref Type	OHAUS WEIGHT KIT	**Before**	100.1	**Accuracy**	9.9999999999	**Fail Before**	No
		After	100.1	**Accuracy**	9.9999999999	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date	3/4/2011	**Gage S/N**		**Model No.**	238-00	**NIST No.**	381000441

.356v

Standard ID	04. Pedal Force (150 Lbs)	**Uncertainty**		**Units**	Lbs	**CS Type**	V
Limited Use?	No	**Minimum**	147	**Nominal**	150	**Maximum**	151
Ref Type	OHAUS WEIGHT KIT	**Before**	150	**Accuracy**	0	**Fail Before**	No
		After	150	**Accuracy**	0	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date	3/4/2011	**Gage S/N**		**Model No.**	238-00	**NIST No.**	381000441

.556v

Standard ID	05. Pedal Force (200 Lbs)	**Uncertainty**		**Units**	Lbs	**CS Type**	V
Limited Use?	No	**Minimum**	196	**Nominal**	200	**Maximum**	204
Ref Type	OHAUS WEIGHT KIT	**Before**	200	**Accuracy**	0	**Fail Before**	No
		After	200	**Accuracy**	0	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date	3/4/2011	**Gage S/N**		**Model No.**	238-00	**NIST No.**	381000441

.746v

Standard ID	06. Pedal Force (250 Lbs)	**Uncertainty**		**Units**	Lbs	**CS Type**	V
Limited Use?	No	**Minimum**	245	**Nominal**	250	**Maximum**	255
Ref Type	OHAUS WEIGHT KIT	**Before**	249.8	**Accuracy**	-0.199999999	**Fail Before**	No
		After	249.8	**Accuracy**	-0.199999999	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date	3/4/2011	**Gage S/N**		**Model No.**	238-00	**NIST No.**	381000441

.938v

Standard ID	07. 0 Lbs down	**Uncertainty**		**Units**		**CS Type**	V
Limited Use?	No	**Minimum**	0	**Nominal**	0	**Maximum**	0
Ref Type	OHAUS WEIGHT KIT	**Before**	0	**Accuracy**	0	**Fail Before**	No
		After	0	**Accuracy**	0	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date		**Gage S/N**		**Model No.**	238-00	**NIST No.**	381000441

.015v

Standard ID	08. 50 Lbs down	**Uncertainty**		**Units**		**CS Type**	V
Limited Use?	No	**Minimum**	49	**Nominal**	50	**Maximum**	51
Ref Type	OHAUS WEIGHT KIT	**Before**	50.15	**Accuracy**	0.1499999999	**Fail Before**	No
		After	50.15	**Accuracy**	0.1499999999	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date		**Gage S/N**		**Model No.**	238-00	**NIST No.**	381000441

.176v

Standard ID	09. 100 Lbs Down	**Uncertainty**		**Units**		**CS Type**	V
Limited Use?	No	**Minimum**	98	**Nominal**	100	**Maximum**	102
Ref Type	OHAUS WEIGHT KIT	**Before**	100.1	**Accuracy**	9.9999999999	**Fail Before**	No
		After	100.1	**Accuracy**	9.9999999999	**Fail After**	No
Gage ID of Standard	LBS-KiloMasters						
Std Due Date		**Gage S/N**		**Model No.**	238-00	**NIST No.**	381000441

LC 162421Nhsts

4/27/2010

.067V

Standard ID	10. 150 lbs Down	**Uncertainty**		**Units**		**CS Type**	V
Limited Use?	No	**Minimum**	147	**Nominal**	150	**Maximum**	153
Ref Type	OHAUS WEIGHT KIT	**Before**	150.1	**Accuracy**	9.9999999999	**Fail Before**	No
		After	150.1	**Accuracy**	9.9999999999	**Fail After**	No

Gage ID of Standard LBS-KiloMasters

Std Due Date	**Gage S/N**	**Model No.**	238-00	**NIST No.**	391000441

.556

Standard ID	11. 200 lbs Down	**Uncertainty**		**Units**		**CS Type**	V
Limited Use?	No	**Minimum**	196	**Nominal**	200	**Maximum**	204
Ref Type	OHAUS WEIGHT KIT	**Before**	200	**Accuracy**	0	**Fail Before**	No
		After	200	**Accuracy**	0	**Fail After**	No

Gage ID of Standard LBS-KiloMasters

Std Due Date	**Gage S/N**	**Model No.**	238-00	**NIST No.**	391000441

.749

Standard ID	12. 250 Lbs Down	**Uncertainty**		**Units**		**CS Type**	V
Limited Use?	No	**Minimum**	245	**Nominal**	250	**Maximum**	255
Ref Type	OHAUS WEIGHT KIT	**Before**	249.6	**Accuracy**	-0.400000000	**Fail Before**	No
		After	249.6	**Accuracy**	0.400000000	**Fail After**	No

Gage ID of Standard LBS KiloMasters

Std Due Date	**Gage S/N**	**Model No.**	238-00	**NIST No.**	391000441

.093

Calibrated By Ron Blankenship **Date** 4-27-10

Approved By __________ **Date** __________

CERTIFICATE OF CALIBRATION

RACELOGIC

Customer	NHTSA/Vehicle Research and Test	Equipment	GPS Data logger
Location	VBOX USA	Model	VB3iS
Customer ID #	006917	Serial number	008319
In tolerance as received (Y/N)	Y	Calibration date	11/12/2009
Certificate No.	5917	Calibration due	11/12/2010
Temperature	23.6ºC	Engineer	Joe Lachowsky
Humidity	31%		

Calibration Procedure

The unit under test was subjected to the standard production test procedure. This procedure covers measured velocity by the VBOX over a simulated test course. Simulation data is provided via a calibrated LabSat GPS simulator. Analogue output voltage and digital output frequency are checked for calibration against simulated speed. Voltage output range is configured at 5 volts at 100Km/h. Frequency output is configured to 25Hz per Km/h. VBOX indicated values are taken from the serial output of the VBOX.

Equipment used

	Equipment	Serial number	CAL Cert No.	CAL due
Simulation of GPS	LabSat	009922	HC40515001	9/25/2010
Analogue Voltage	LabSat	009922	HC40515001	9/25/2010
Frequency	LabSat	009922	HC40515001	9/25/2010

Results

Accuracy of analogue and digital output signals

Applied Speed	Analogue Output 1			Analogue Output 2		
	Expected	As received	As returned	Expected	As received	As returned
30 Km/h	1.500 V ± 5.0mV	1.502 V	1.502 V	1.500 V ± 5.0mV	1.503 V	1.503 V
60 Km/h	3.000 V ± 5.0mV	3.002 V	3.002 V	3.000 V ± 5.0mV	3.003 V	3.003 V
100 Km/h	5.000 V ± 5.0mV	5.000 V	5.000 V	5.000 V ± 5.0mV	5.001 V	5.001 V

Applied Speed	Frequency Output 1		
	Expected	As received	As returned
30 Km/h	750 Hz ±2.5Hz	749.2 Hz	749.2 Hz
60 Km/h	1500 Hz ±2.5Hz	1499.7 Hz	1499.7 Hz
100 Km/h	2500 Hz ±2.5Hz	2499.7 Hz	2499.7 Hz

Simulation of constant speed by LabSat

Applied simulated value	VBOX indicated speed		
	Criteria	As received	As returned
30 Km/h	±0.1 Km/h	30.00	30.00
60 Km/h	±0.1 Km/h	59.97	59.97
100 Km/h	±0.1 Km/h	100.00	100.00
400 Km/h	±0.1 Km/h	399.98	399.98

Simulation of constant heading by LabSat

Applied simulated value	VBOX indicated heading		
	Criteria	As received	As returned
0°	±0.1°	0.00°	0.00°
90°	±0.1°	89.97°	89.97°
180°	±0.1°	179.96°	179.97°
270°	±0.1°	269.97°	269.97°

Summary

The unit VB3iS 008319 passed all standard production tests and was found to be fully compliant with the product specification. Racelogic certifies the above instrument meets or exceeds published specifications and has been calibrated using instruments and standards of known accuracies.

Calibration engineer:

Racelogic Ltd. Unit 10 Swan Business Centre, Osier Way, Buckingham MK18 1TB
Tel +44 (0)1280 823803 Fax +44 (0)1280 823595