
ACCELERATION AND TOP SPEED TESTING

ACCELERATION TEST OBJECTIVE

Determine the ability of each test vehicle to accelerate from a standing start to 60 mph, 80 mph, and 100 mph, and determine the distance to reach 110 mph and 120 mph.

ACCELERATION TEST METHODOLOGY

Using a DLS Smart Sensor – Optical non-contact Speed and Distance Sensor in conjunction with a lap top computer, each vehicle is driven through four acceleration sequences, two northbound and two southbound, to allow for wind direction. The four resulting times for each target speed are averaged and the average times used to derive scores on the competitive test for acceleration.

TOP SPEED TEST OBJECTIVE

Determine the actual top speed attainable by each test vehicle within a distance of 14 miles from a standing start.

TOP SPEED TEST METHODOLOGY

Following the fourth acceleration run, each test vehicle continues to accelerate to the top speed attainable within 14 miles from the start of the run. The highest speed attained within the 14-mile distance is the vehicle's score on the competitive test for top speed.



ACCELERATION AND TOP SPEED TESTS

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

MAKE & MODEL: Ford Police Interceptor 4.6L 3.27

BEGINNING TIME: 9:33 a.m.

WIND VELOCITY: 4.2 mph

WIND DIRECTION: 113°

TEMPERATURE: 51.8°

ACCELERATION

SPEEDS	TIME REQUIREMENTS*	RUN#1	RUN#2	RUN#3	RUN#4	AVERAGE
0 – 60	9.6 sec	8.79	8.95	8.77	8.99	8.88
0 – 80	16.4 sec.	14.08	14.37	14.06	14.36	14.22
0 – 100	27.1 sec.	23.45	24.20	23.40	23.86	23.73

DISTANCE TO REACH: 110 MPH .65 mile

120 MPH 1.02 mile

TOP SPEED ATTAINED: 129 mph

MAKE & MODEL: Ford Police Interceptor 4.6L 3.55

BEGINNING TIME: 10:37 a.m.

WIND VELOCITY: 2.0 mph

WIND DIRECTION: 44°

TEMPERATURE: 57.2°

ACCELERATION

SPEEDS	TIME REQUIREMENTS*	RUN#1	RUN#2	RUN#3	RUN#4	AVERAGE
0 – 60	9.6 sec	8.37	8.46	8.30	8.55	8.42
0 – 80	16.4 sec.	13.55	13.73	13.49	13.96	13.68
0 – 100	27.1 sec.	22.35	22.55	22.08	22.77	22.44

DISTANCE TO REACH: 110 MPH .60 mile

120 MPH 1.18

TOP SPEED ATTAINED: 120 mph

*Michigan State Police minimum requirement.

ACCELERATION AND TOP SPEED TESTS

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

MAKE & MODEL: Chevrolet Impala 9C1

BEGINNING TIME: 8:08 a.m.

WIND VELOCITY: 1.2 mph

WIND DIRECTION: 350°

TEMPERATURE: 39.4°

ACCELERATION

SPEEDS	TIME REQUIREMENTS*	RUN#1	RUN#2	RUN#3	RUN#4	AVERAGE
0 – 60	9.6 sec	8.60	8.49	8.49	8.55	8.53
0 – 80	16.4 sec.	13.80	13.79	13.58	13.73	13.72
0 – 100	27.1 sec.	23.26	23.16	22.57	22.97	22.99

DISTANCE TO REACH: 110 MPH .60 mile

120 MPH .87 mile

TOP SPEED ATTAINED: 139 mph

MAKE & MODEL: Chevrolet Impala 9C1 E85

BEGINNING TIME: 11:38 a.m.

WIND VELOCITY: 4.1 mph

WIND DIRECTION: 174°

TEMPERATURE: 61.8°

ACCELERATION

SPEEDS	TIME REQUIREMENTS*	RUN#1	RUN#2	RUN#3	RUN#4	AVERAGE
0 – 60	9.6 sec	8.78	8.83	8.57	8.71	8.72
0 – 80	16.4 sec.	14.37	14.22	13.86	13.88	14.08
0 – 100	27.1 sec.	23.64	23.64	22.91	22.84	23.26

DISTANCE TO REACH: 110 MPH .60 mile

120 MPH .85 mile

TOP SPEED ATTAINED: 139 mph

*Michigan State Police minimum requirement.

ACCELERATION AND TOP SPEED TESTS

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

MAKE & MODEL: Dodge Charger 5.7L

BEGINNING TIME: 9:57 a.m.

WIND VELOCITY: 1.8 mph

WIND DIRECTION: 86°

TEMPERATURE: 54.1°

ACCELERATION

SPEEDS	TIME REQUIREMENTS*	RUN#1	RUN#2	RUN#3	RUN#4	AVERAGE
0 – 60	9.6 sec	6.06	6.27	5.86	5.83	6.00
0 – 80	16.4 sec.	9.42	9.58	9.22	9.06	9.32
0 – 100	27.1 sec.	14.37	14.58	14.10	13.80	14.21

DISTANCE TO REACH: 110 MPH .32 mile

120 MPH .42 mile

TOP SPEED ATTAINED: 146 mph

MAKE & MODEL: Dodge Charger 3.5L

BEGINNING TIME: 10:58 a.m.

WIND VELOCITY: 4.8 mph

WIND DIRECTION: 111°

TEMPERATURE: 59.4°

ACCELERATION

SPEEDS	TIME REQUIREMENTS*	RUN#1	RUN#2	RUN#3	RUN#4	AVERAGE
0 – 60	9.6 sec	8.77	8.64	8.60	8.56	8.64
0 – 80	16.4 sec.	14.33	14.06	14.02	13.69	14.03
0 – 100	27.1 sec.	23.32	22.66	22.63	22.37	22.74

DISTANCE TO REACH: 110 MPH .57 mile

120 MPH .82 mile

TOP SPEED ATTAINED: 137 mph

*Michigan State Police minimum requirement.

ACCELERATION AND TOP SPEED TESTS

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

MAKE & MODEL: Chevrolet Tahoe PPV

BEGINNING TIME: 10:17 a.m.

WIND VELOCITY: 4.9 mph

WIND DIRECTION: 14°

TEMPERATURE: 55.5°

ACCELERATION

SPEEDS	TIME REQUIREMENTS*	RUN#1	RUN#2	RUN#3	RUN#4	AVERAGE
0 – 60	10.0 sec	8.48	8.31	8.27	8.27	8.33
0 – 80	16.0 sec.	14.11	13.83	13.84	13.94	13.93
0 – 100	27.0 sec.	21.86	21.73	21.48	22.12	21.80

DISTANCE TO REACH: 110 MPH .58 mile

120 MPH .86 mile

TOP SPEED ATTAINED: 133 mph

MAKE & MODEL: Chevrolet Tahoe PPV E85

BEGINNING TIME: 11:17 p.m.

WIND VELOCITY: 6.3 mph

WIND DIRECTION: 124°

TEMPERATURE: 60.7°

ACCELERATION

SPEEDS	TIME REQUIREMENTS*	RUN#1	RUN#2	RUN#3	RUN#4	AVERAGE
0 – 60	10.0 sec	8.01	8.19	8.13	8.18	8.13
0 – 80	16.0 sec.	13.50	13.68	13.69	13.57	13.61
0 – 100	27.0 sec.	21.25	21.22	21.45	21.25	21.29

DISTANCE TO REACH: 110 MPH .55 mile

120 MPH .81 mile

TOP SPEED ATTAINED: 132 mph

*Michigan State Police minimum requirement.

SUMMARY OF ACCELERATION AND TOP SPEED

ACCELERATION*		Ford Police Interceptor 4.6 L 3.27	Ford Police Interceptor 4.6 L 3.55	Dodge Charger 3.5 L	Dodge Charger 5.7 L
0 – 20 mph	(sec.)	2.02	1.85	2.10	1.70
0 – 30 mph	(sec.)	3.30	3.05	3.44	2.61
0 – 40 mph	(sec.)	4.69	4.39	4.81	3.58
0 – 50 mph	(sec.)	6.63	6.40	6.46	4.63
0 – 60 mph	(sec.)	8.88	8.42	8.64	6.00
0 – 70 mph	(sec.)	11.29	10.73	11.21	7.44
0 – 80 mph	(sec.)	14.22	13.68	14.03	9.32
0 – 90 mph	(sec.)	18.42	17.72	17.84	11.68
0 – 100 mph	(sec.)	23.73	22.44	22.74	14.21
TOP SPEED	(mph)	129	120	137	146
DISTANCE TO REACH					
110 mph (miles)		.65	.60	.57	.32
120 mph (miles)		1.02	1.18	.82	.42
QUARTER MILE					
Time	(sec.)	16.74	16.42	16.68	14.30
Speed (miles)		86.67	86.98	87.27	101.47



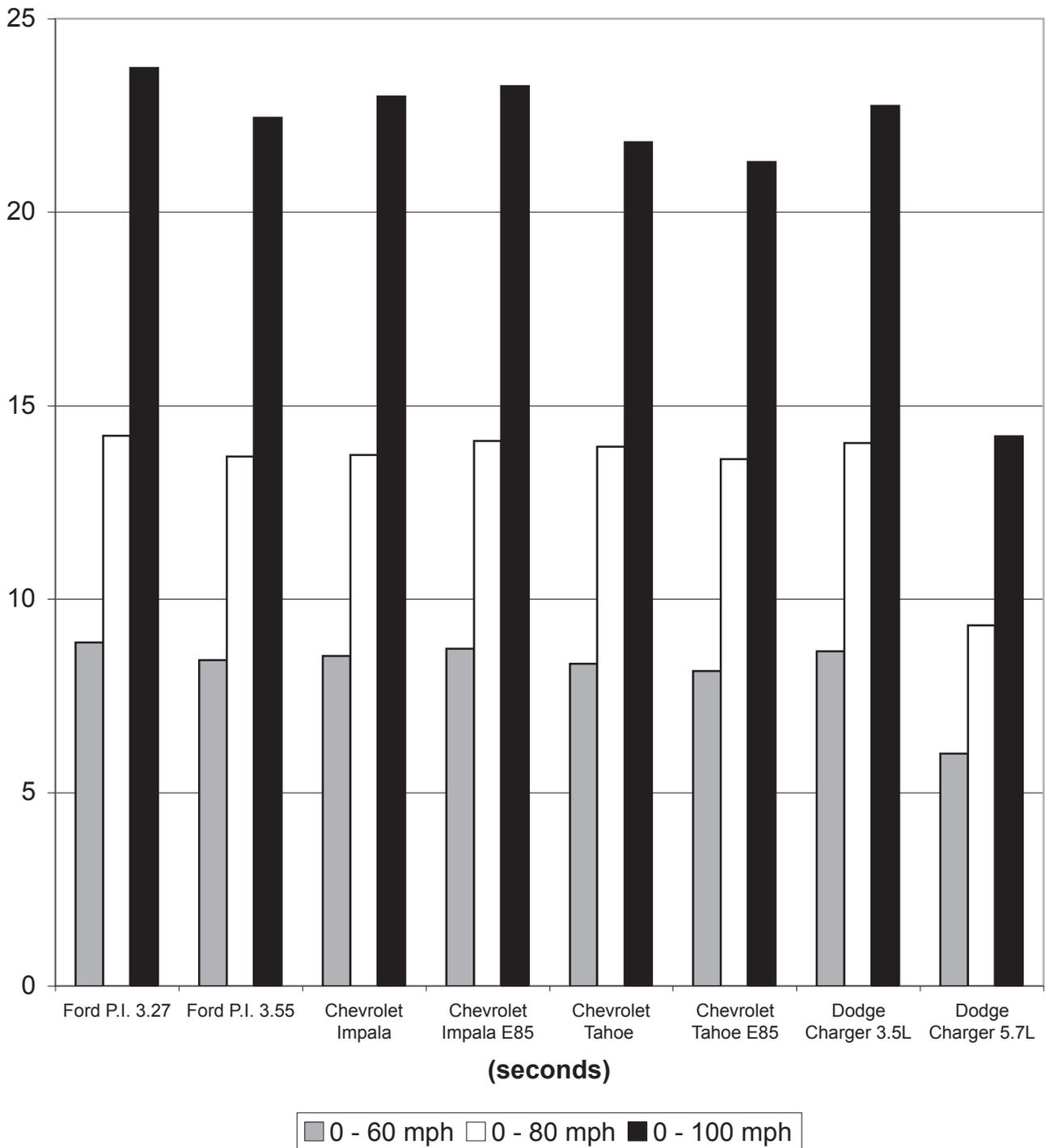
SUMMARY OF ACCELERATION AND TOP SPEED

ACCELERATION*		Chevrolet Impala 9C1 3.9 L	Chevrolet Impala 9C1 3.9L E85	Chevrolet Tahoe PPV	Chevrolet Tahoe PPV E85
0 – 20 mph	(sec.)	1.94	2.00	2.09	1.96
0 – 30 mph	(sec.)	3.18	3.26	3.24	3.12
0 – 40 mph	(sec.)	4.47	4.57	4.68	4.53
0 – 50 mph	(sec.)	6.19	6.32	6.41	6.27
0 – 60 mph	(sec.)	8.53	8.72	8.33	8.13
0 – 70 mph	(sec.)	11.01	11.30	10.90	10.67
0 – 80 mph	(sec.)	13.72	14.08	13.93	13.61
0 – 90 mph	(sec.)	17.38	17.80	17.37	16.98
0 – 100 mph	(sec.)	22.99	23.26	21.80	21.29
TOP SPEED	(mph)	139	139	133	132
DISTANCE TO REACH					
110 mph	(miles)	.60	.60	.58	.55
120 mph	(miles)	.87	.85	.86	.81
QUARTER MILE					
Time	(sec.)	16.47	16.64	16.55	16.36
Speed	(miles)	88.08	87.42	87.70	88.27



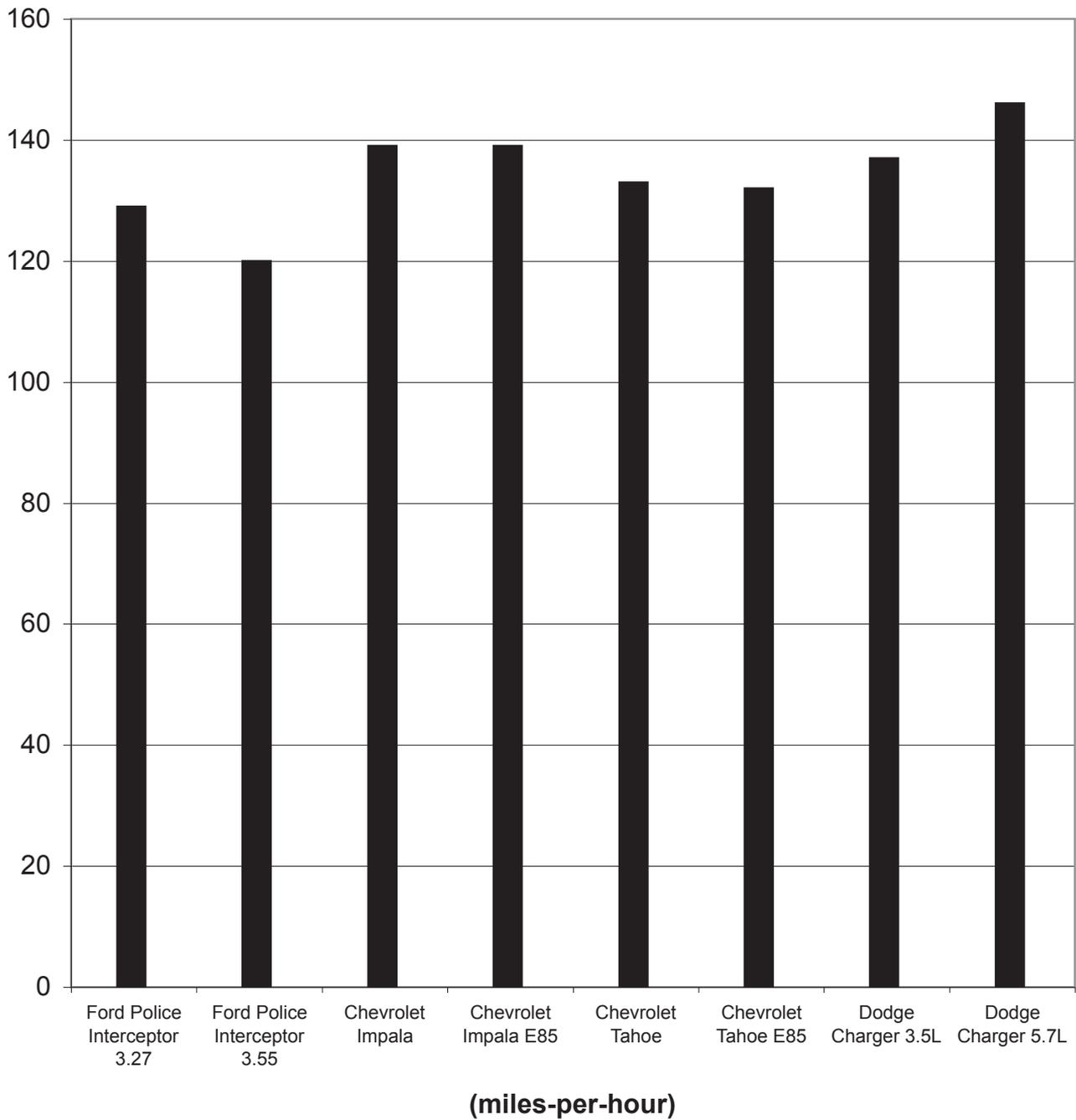
2010 ACCELERATION COMPARISON

ACCELERATION TIMES



2010 TOP SPEED COMPARISON

TOP SPEED ATTAINED



BRAKE TESTING

BRAKE TEST OBJECTIVE

Determine the deceleration rate attained by each test vehicle on twelve 60 – 0 mph impending skid (threshold) stops, with ABS in operation if the vehicle is so equipped. Each vehicle is scored on the average deceleration rate it attains.

BRAKE TEST METHODOLOGY

Each vehicle makes two decelerations at specific predetermined points on the test road from 90 – 0 mph at 22 ft/s², with the driver using a decelerometer to maintain the deceleration rate. Immediately after these “heat-up” stops are completed, the vehicle is turned around and makes six measured 60 – 0 mph impending skid (threshold) stops with ABS in operation, if so equipped, at specific predetermined points. Following a four (4) minute heat soak, the entire sequence is repeated. The exact initial velocity at the beginning of each of the 60 – 0 mph decelerations, and the exact distance required to make each stop is recorded by means of a non contact optical sensor in conjunction with electronic speed and distance meters. The data resulting from the twelve total stops is used to calculate the average deceleration rate which is the vehicle’s score for this test.

DECELERATION RATE FORMULA

$$\text{Deceleration Rate (DR)} = \frac{\text{Initial Velocity}^*(\text{IV}) \text{ squared}}{2 \text{ times Stopping Distance (SD)}} = \frac{(\text{IV})^2}{2 (\text{SD})}$$

EXAMPLE:

$$\begin{aligned} \text{Initial Velocity} &= 89.175 \text{ ft/s (60.8 mph x 1.4667*)} \\ \text{Stopping Distance} &= 171.4 \text{ ft.} \end{aligned}$$

$$\text{DR} = \frac{(\text{IV})^2}{2(\text{SD})} = \frac{(89.175)^2}{2(171.4)} = \frac{7952.24}{342.8} = 23.198 \text{ ft/s}^2$$

Once a vehicle’s average deceleration rate has been determined, it is possible to calculate the stopping distance from any given speed by utilizing the following formula:

Select a speed; translate that speed into feet per second; square the feet per second figure by multiplying it by itself; divide the resultant figure by 2; divide the remaining figure by the average deceleration rate of the vehicle in question.

EXAMPLE:

$$60 \text{ mph} = 88.002 \text{ ft/s} \times 88.002 = 7744.352 / 2 = 3872.176 / 23.198 \text{ ft/s}^2 = 166.9 \text{ ft.}$$

*Initial velocity must be expressed in terms of feet per second, with 1 mile per hour being equal to 1.4667 feet per second.

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

BEGINNING Time: 10:54 a.m.

TEMPERATURE: 59.4°F

MAKE & MODEL: Ford Police Interceptor 4.6L

BRAKE SYSTEM: Anti-lock

Phase I

BRAKE HEAT-UP: (Two 90 –0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 – mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	60.91 mph	147.57 feet	27.04 ft/s ²
Stop #2	60.78 mph	147.54 feet	26.93 ft/s ²
Stop #3	60.76 mph	148.07 feet	26.82 ft/s ²
Stop #4	60.52 mph	148.63 feet	26.51 ft/s ²
Stop #5	60.42 mph	148.28 feet	26.48 ft/s ²
Stop #6	60.54 mph	145.69 feet	27.06 ft/s ²

AVERAGE DECELERATION RATE

26.81 ft/s²

HEAT SOAK (4 minutes)

Phase II

BRAKE HEAT-UP: (Two 90 –0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 – mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	60.37 mph	149.43 feet	26.23 ft/s ²
Stop #2	59.79 mph	143.48 feet	26.80 ft/s ²
Stop #3	60.37 mph	147.95 feet	26.50 ft/s ²
Stop #4	60.20 mph	148.00 feet	26.34 ft/s ²
Stop #5	60.43 mph	148.41 feet	26.47 ft/s ²
Stop #6	60.48 mph	146.90 feet	26.78 ft/s ²

AVERAGE DECELERATION RATE

26.52 ft/s²

Phase III

Evidence of severe fading?

Yes/No

No

Vehicle stopped in straight line?

Yes

Vehicle stopped within correct lane?

Yes

OVERALL AVERAGE DECEL. RATE:

26.66 ft/s²

Projected Stopping Distance from 60.0 mph

145.2 feet

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

BEGINNING Time: 7:32 a.m.

TEMPERATURE: 38.6°F

MAKE & MODEL: Chevrolet Impala 9C1 3.9L

BRAKE SYSTEM: Anti-lock

Phase I

BRAKE HEAT-UP: (Two 90 → 0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 → mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	59.98 mph	140.05 feet	27.63 ft/s ²
Stop #2	59.22 mph	138.90 feet	27.16 ft/s ²
Stop #3	59.88 mph	141.68 feet	27.22 ft/s ²
Stop #4	59.66 mph	141.24 feet	27.11 ft/s ²
Stop #5	61.30 mph	149.78 feet	26.98 ft/s ²
Stop #6	61.06 mph	145.32 feet	27.60 ft/s ²

AVERAGE DECELERATION RATE **27.28 ft/s²**

HEAT SOAK (4 minutes)

Phase II

BRAKE HEAT-UP: (Two 90 → 0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 → mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	60.24 mph	142.99 feet	27.30 ft/s ²
Stop #2	60.49 mph	150.85 feet	26.09 ft/s ²
Stop #3	60.34 mph	151.93 feet	25.78 ft/s ²
Stop #4	60.33 mph	147.51 feet	26.54 ft/s ²
Stop #5	60.49 mph	147.70 feet	26.65 ft/s ²
Stop #6	60.52 mph	146.60 feet	26.87 ft/s ²

AVERAGE DECELERATION RATE **26.54 ft/s²**

Phase III

	Yes/No
Evidence of severe fading?	<u>No</u>
Vehicle stopped in straight line?	<u>Yes</u>
Vehicle stopped within correct lane?	<u>Yes</u>

OVERALL AVERAGE DECEL. RATE: **26.91 ft/s²**

Projected Stopping Distance from 60.0 mph 143.9 feet

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

BEGINNING Time: 9:39 a.m.

TEMPERATURE: 52.5°F

MAKE & MODEL: Dodge Charger 3.5L

BRAKE SYSTEM: Anti-lock

Phase I

BRAKE HEAT-UP: (Two 90 → 0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 → mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	60.59 mph	140.26 feet	28.15 ft/s ²
Stop #2	59.86 mph	139.24 feet	27.68 ft/s ²
Stop #3	60.35 mph	137.94 feet	28.40 ft/s ²
Stop #4	60.23 mph	141.57 feet	27.56 ft/s ²
Stop #5	60.64 mph	141.64 feet	27.92 ft/s ²
Stop #6	60.68 mph	140.96 feet	28.10 ft/s ²

AVERAGE DECELERATION RATE

27.97 ft/s²

HEAT SOAK (4 minutes)

Phase II

BRAKE HEAT-UP: (Two 90 → 0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 → mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	60.90 mph	142.90 feet	27.92 ft/s ²
Stop #2	60.57 mph	138.93 feet	28.40 ft/s ²
Stop #3	60.54 mph	139.70 feet	28.22 ft/s ²
Stop #4	59.66 mph	135.41 feet	28.27 ft/s ²
Stop #5	60.99 mph	142.37 feet	28.10 ft/s ²
Stop #6	59.74 mph	135.51 feet	28.33 ft/s ²

AVERAGE DECELERATION RATE

28.21 ft/s²

Phase III

Evidence of severe fading?

Yes/No

No

Vehicle stopped in straight line?

Yes

Vehicle stopped within correct lane?

Yes

OVERALL AVERAGE DECEL. RATE:

28.09 ft/s²

Projected Stopping Distance from 60.0 mph

137.9 feet

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

BEGINNING Time: 12:35 p.m.

TEMPERATURE: 64.8°F

MAKE & MODEL: Dodge Charger 5.7L

BRAKE SYSTEM: Anti-lock

Phase I

BRAKE HEAT-UP: (Two 90 → 0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 → mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	59.98 mph	145.05 feet	26.68 ft/s ²
Stop #2	59.91 mph	142.40 feet	27.11 ft/s ²
Stop #3	60.20 mph	146.38 feet	26.63 ft/s ²
Stop #4	60.32 mph	141.85 feet	27.59 ft/s ²
Stop #5	60.86 mph	146.20 feet	27.25 ft/s ²
Stop #6	59.83 mph	143.59 feet	26.81 ft/s ²

AVERAGE DECELERATION RATE

27.01 ft/s²

HEAT SOAK (4 minutes)

Phase II

BRAKE HEAT-UP: (Two 90 → 0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 → mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	60.60 mph	147.17 feet	26.84 ft/s ²
Stop #2	60.74 mph	145.93 feet	27.19 ft/s ²
Stop #3	60.92 mph	150.33 feet	26.55 ft/s ²
Stop #4	60.40 mph	145.54 feet	26.96 ft/s ²
Stop #5	60.12 mph	141.34 feet	27.51 ft/s ²
Stop #6	60.89 mph	147.94 feet	26.96 ft/s ²

AVERAGE DECELERATION RATE

27.00 ft/s²

Phase III

Evidence of severe fading?

Yes/No

No

Vehicle stopped in straight line?

Yes

Vehicle stopped within correct lane?

Yes

OVERALL AVERAGE DECEL. RATE:

27.01 ft/s²

Projected Stopping Distance from 60.0 mph

143.4 feet

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds

DATE: September 19, 2009

BEGINNING Time: 8:56 a.m.

TEMPERATURE: 50.3F

MAKE & MODEL: Chevrolet Tahoe 5.3L 2WD

BRAKE SYSTEM: Anti-lock

Phase I

BRAKE HEAT-UP: (Two 90 -0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 - mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	60.56 mph	150.96 feet	26.13 ft/s ²
Stop #2	59.96 mph	146.77 feet	26.35 ft/s ²
Stop #3	60.20 mph	147.35 feet	26.45 ft/s ²
Stop #4	59.70 mph	144.77 feet	26.48 ft/s ²
Stop #5	60.60 mph	143.99 feet	27.43 ft/s ²
Stop #6	59.95 mph	141.60 feet	27.30 ft/s ²

AVERAGE DECELERATION RATE

26.69 ft/s²

HEAT SOAK (4 minutes)

Phase II

BRAKE HEAT-UP: (Two 90 -0 mph decelerations @ 22 ft.sec.²)

TEST: (Six 60 - mph impending skid (ABS) maximum deceleration rate stops)

	Initial Velocity	Stopping Distance	Deceleration Rate
Stop #1	61.27 mph	153.22 feet	26.35 ft/s ²
Stop #2	60.09 mph	146.48 feet	26.51 ft/s ²
Stop #3	60.48 mph	148.02 feet	26.58 ft/s ²
Stop #4	60.31 mph	149.30 feet	26.20 ft/s ²
Stop #5	60.08 mph	146.49 feet	26.50 ft/s ²
Stop #6	60.94 mph	149.31 feet	26.75 ft/s ²

AVERAGE DECELERATION RATE

26.48 ft/s²

Phase III

Evidence of severe fading?

Yes/No

No

Vehicle stopped in straight line?

Yes

Vehicle stopped within correct lane?

Yes

OVERALL AVERAGE DECEL. RATE:

26.59 ft/s²

Projected Stopping Distance from 60.0 mph

145.6 feet

2010 Brake Testing

STOPPING DISTANCE

