Police Vehicle Evaluation
Model Year 2010

STATE OF MICHIGAN
Department of State Police
and
Department of Management and Budget

2010 Model Year
Police Vehicle
Evaluation Program

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PREFACE

The Michigan State Police Vehicle Test Team is pleased to announce the results of the 2010 model year Police Vehicle Evaluation. This year we tested eight vehicles in total, and five motorcycles. We appreciate your continued support and encouragement. The vehicles evaluated this year included the following:

POLICE CATEGORY

Ford Police Interceptor (3.27:1)	4.6L
Ford Police Interceptor (3.55:1)	4.6L
Chevrolet Impala 9C1	3.9L
Chevrolet Impala 9C1 E85	3.9L
Chevrolet Tahoe PPV 2WD	5.3L
Chevrolet Tahoe PPV 2WD E85	5.3L
Dodge Charger	3.5L
Dodge Charger	5.7L

MOTORCYCLES

Harley-Davidson Electra Glide FLHTP

Harley-Davidson Road King FLHP

BMW Motorrad USA R1200RTP

Buell Ulysses

BMW G650 GS-P

GENERAL INFORMATION

All of the cars were tested with a clean roof (no overhead light or lightbar) and without “A” pillar mount spotlights. We believe this is the best way to ensure all of the vehicles are tested on an equal basis. Remember that once overhead lights, spotlights, radio antennas, sirens, and other emergency equipment are installed, overall performance may be somewhat lower than we report.

Each vehicle was tested with the tires that are available as original equipment on the production model. Specific tire information for each vehicle is available in the Vehicle Description portion of this report. All vehicles listed in this report were equipped with electronic speed limiters.

Motorcycles were tested with equipment installed as provided by their respective manufacturer. Harley-Davidson chose to test their bikes with minimal equipment. BMW chose to test their bike with the majority of the equipment installed. We will continue to refine the testing procedures with the motorcycle manufacturers and their participation.

Chrysler Proving Grounds - Acceleration, Top Speed, & Braking Tests
Saturday, September 19, 2009, we had a full line up of test vehicles and we would like to thank Mr. Craig Hageman for the assistance we got from him at the Chrysler Chrysler Proving Grounds. We appreciate the support we received from General Motors, Ford, Chrysler, Harley-Davidson and BMW during testing. This also was the fourth year of motorcycle testing and we continue to get great feedback on this important component to the testing lineup. We expect other manufacturers that produce law enforcement motorcycles to participate in the future.

Michigan State Police Precision Driving Unit- Motorcycle Dynamics
Sunday, September 20, 2009, we completed the motorcycle dynamics testing with moderate temperatures. This portion of the testing continues to grow. We had a large audience of observers who seemed to enjoy their interaction with the motorcycle manufacturers and the Vehicle Test Team.

Grattan Raceway - Vehicle Dynamics (High Speed Handling) Test
Monday, September 21, 2009, rain delayed the start of testing. However, the Vehicle Test Team was able to complete this portion of the test by days end. The Chevrolet Impala 9 C1, E 85, experienced an ABS fault code during one of the test runs. The code was cleared by a General Motors technician and the car was sent back out on the track with no further problems. The vehicles were loaded up and returned to the Precision Driving Unit where they were made ready for the Ergonomics portion of the test.

We recommend you review the information contained in this report and then apply it to the needs of your agency. This report is not an endorsement of products, but a means of learning what’s available for your officers so they can do their job effectively and safely. If anything in this report requires further explanation or clarification, please call or write.

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ACKNOWLEGEMENTS

We would like to thank the following contributors. We are grateful for their support and encouragement toward our ultimate goal: a safe, successful testing program that benefits the law enforcement community nationwide and beyond.

Colonel Peter C. Munoz, Director, Michigan Department of State Police
Lt. Colonel Eddie Washington, Deputy Director, Field Services Bureau
Lt. Colonel Kriste K. Etue, Deputy Director, Administrative Services Bureau
Personnel from the Michigan Department of Management & Budget, Vehicle and Travel Services

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Al & Betty Burnett, Clayton Babcock, Jim Mayo, Loren Lee and Robert Johnson

The Michigan State Police Rockford Post for their assistance at Grattan Raceway.

Special thanks to General Motors, Ford Motor Company, Chrysler Motors, Harley-Davidson Motorcycle and BMW Motorrad USA for their hard work in building and preparing the test cars and motorcycles. We are grateful for your dedication to law enforcement. Everyday law enforcement looks to these vehicles to do a list of duties varied and enduring.

Finally, thanks to all in the United States and Canada who represent law enforcement and purchasing agencies for your constant encouragement and support. We are proud to make a contribution to the law enforcement community.

Michigan State Police Vehicle Test Team:

TEST EQUIPMENT

The following test equipment is utilized during the acceleration, top speed, braking, and vehicle dynamics portions of the evaluation program.

CORRSYS DATRON SENSOR SYSTEMS, INC., 40000 Grand River, Suite 503, Novi, MI 48375

DLS Smart Sensor – Optical non-contact speed and distance sensor

Correvit L-350 1 Axis Optical Sensor

Shoei Helmets, 3002 Dow Ave., Suite 128, Tustin, CA 92780

Law Enforcement Helmet – Model RJ-Air LE
Motorcycle Helmet – Multi Tech

AMB i.t. US INC., 1631 Phoenix Blvd., Suite 11, College Park, GA 30349

AMB TranX extended loop decoder

Mains adapter 230 V AC/12 V DC

AMB TranX260 transponders

AMMCO TOOLS, Inc., 2100 Commonwealth Ave., North Chicago, IL 60064

Decelerometer, Model 7350

TEST VEHICLE DESCRIPTIONS AND PHOTOGRAPHS


Ford Police Interceptor
3.27 4.6L

TEST VEHICLE DESCRIPTION

MAKE Ford	**MODEL** Police Interceptor		**SALES CODE NO.** P71	
ENGINE DISPLACEMENT	**CUBIC INCHES** 281		**LITERS** 4.6	
FUEL SYSTEM	Sequential Multiport Fuel Injection E85 Capable		**EXHAUST** Dual	
HORSEPOWER (SAE NET)	250 @ 5000 RPM		**ALTERNATOR** 200	
TORQUE	297ft-lbs @ 4000 RPM		**BATTERY** 750 CCA	
COMPRESSION RATIO	9.4:1			
TRANSMISSION	**MODEL** 4R70W	**TYPE** 4-Speed Electronic Automatic		
	LOCKUP TORQUE CONVERTER? Yes			
	OVERDRIVE? Yes			
AXLE RATIO	3.27			
STEERING	Power Rack and Pinion, variable ratio			
TURNING CIRCLE (CURB TO CURB)	40.3 ft.			
TIRE SIZE, LOAD & SPEED RATING	P235/55R17 98W Goodyear Eagle RS-A			
SUSPENSION TYPE (FRONT)	Independent SLA with ball joint & coil spring			
SUSPENSION TYPE (REAR)	4 bar link with Watts Linkage			
GROUND CLEARANCE, MINIMUM	5.6 in.	**LOCATION** Exhaust joint		
BRAKE SYSTEM	Power, dual front piston, single rear piston, 4 circuit and ABS			
BRAKES, FRONT	**TYPE** Vented disc		**SWEPT AREA** 273 sq. in.	
BRAKES, REAR	**TYPE** Vented disc		**SWEPT AREA** 176 sq. in.	
FUEL CAPACITY	**GALLONS** 19.0		**LITERS** 71.9	
GENERAL MEASUREMENTS	**WHEELBASE** 114.6 in.		**LENGTH** 212.0 in.	
	TEST WEIGHT 4144		**HEIGHT** 58.3 in.	
HEADROOM	**FRONT** 39.5 in.		**REAR** 37.8 in.	
LEGROOM	**FRONT** 41.6 in.		**REAR** 38.0 in.	
SHOULDER ROOM	**FRONT** 60.6 in.		**REAR** 60.0 in.	
HIPROOM	**FRONT** 57.4 in.		**REAR** 56.1 in.	
INTERIOR VOLUME	**FRONT** 57.6 cu. ft.		**REAR** 49.8 cu. ft.	
	COMB 107.5 cu. ft.		**TRUNK** 20.6 cu. ft.	
EPA MILEAGE EST. (MPG) Label	**CITY** 14	**HIGHWAY** 21	**COMBINED** 17	
EPA MILEAGE EST. (MPG) Unadjusted	**CITY** 17.9	**HIGHWAY** 29.7	**COMBINED** 21.7	
EPA MILEAGE EST. (MPG) Label E85	**CITY** 11	**HIGHWAY** 15	**COMBINED** 12	

Ford Police Interceptor

3.55 4.6L

TEST VEHICLE DESCRIPTION

MAKE Ford	**MODEL** Police Interceptor		**SALES CODE NO.** P71		
ENGINE DISPLACEMENT	**CUBIC INCHES** 281		**LITERS** 4.6		
FUEL SYSTEM	Sequential Multiport Fuel Injection E85 Capable		**EXHAUST** Dual		
HORSEPOWER (SAE NET)	250 @ 5000 RPM		**ALTERNATOR** 200		
TORQUE	297 ft-lbs @ 4000 RPM		**BATTERY** 750 CCA		
COMPRESSION RATIO	9.4:1				
TRANSMISSION	**MODEL** 4R70W	**TYPE** 4-Speed Electronic Automatic			
	LOCKUP TORQUE CONVERTER? Yes				
	OVERDRIVE? Yes				
AXLE RATIO	3.55				
STEERING	Power Rack and Pinion, variable ratio				
TURNING CIRCLE (CURB TO CURB)	40.3 ft.				
TIRE SIZE, LOAD & SPEED RATING	P235/55R17 98W Goodyear Eagle RS-A				
SUSPENSION TYPE (FRONT)	Independent SLA with ball joint & coil spring				
SUSPENSION TYPE (REAR)	4 bar link with Watts Linkage				
GROUND CLEARANCE, MINIMUM	5.6 in.	**LOCATION** Exhaust joint			
BRAKE SYSTEM	Power, dual front piston, single rear piston, 4 circuit and ABS				
BRAKES, FRONT	**TYPE** Vented disc		**SWEPT AREA** 273 sq. in.		
BRAKES, REAR	**TYPE** Vented disc		**SWEPT AREA** 176 sq. in.		
FUEL CAPACITY	**GALLONS** 19.0		**LITERS** 71.9		
GENERAL MEASUREMENTS	**WHEELBASE** 114.6 in.		**LENGTH** 212.0 in.		
	TEST WEIGHT 4113		**HEIGHT** 58.3 in.		
HEADROOM	**FRONT** 39.5 in.		**REAR** 37.8 in.		
LEGROOM	**FRONT** 41.6 in.		**REAR** 38.0 in.		
SHOULDER ROOM	**FRONT** 60.6 in.		**REAR** 60.0 in.		
HIPROOM	**FRONT** 57.4 in.		**REAR** 56.1 in.		
INTERIOR VOLUME	**FRONT** 57.6 cu. ft.		**REAR** 49.8 cu. ft.		
	COMB 107.5 cu. ft.		**TRUNK** 20.6 cu. ft.		
EPA MILEAGE EST. (MPG) Label	**CITY** 14	**HIGHWAY** 21	**COMBINED** 17		
EPA MILEAGE EST. (MPG) Unadjusted	**CITY** 17.9	**HIGHWAY** 29.7	**COMBINED** 21.7		

Chevrolet Impala
9C1

TEST VEHICLE DESCRIPTION

MAKE Chevrolet	**MODEL** Impala 9C1		**SALES CODE NO.** 1WS19		
ENGINE DISPLACEMENT	**CUBIC INCHES** 237		**LITERS** 3.9		
FUEL SYSTEM	Sequential Port Fuel Injection E85 Capable		**EXHAUST** Single		
HORSEPOWER (SAE NET)	233 @ 5600 RPM		**ALTERNATOR** 150 amp.		
TORQUE	240 ft-lbs @ 4000 RPM		**BATTERY** 750 CCA		
COMPRESSION RATIO	9.4:1				
TRANSMISSION	**MODEL** 4T65E	**TYPE** 4-Speed Automatic			
	LOCKUP TORQUE CONVERTER? Yes				
	OVERDRIVE? Yes				
AXLE RATIO	3.29:1				
STEERING	Power Rack and Pinion				
TURNING CIRCLE (CURB TO CURB)	38.0 ft.				
TIRE SIZE, LOAD & SPEED RATING	P225/60R16 Pirelli P6 97V				
SUSPENSION TYPE (FRONT)	Independent McPherson strut, coil springs & stabilizer bar				
SUSPENSION TYPE (REAR)	Independent Tri-Link coil spring over strut & stabilizer bar				
GROUND CLEARANCE, MINIMUM	7.1 in.	**LOCATION** Engine cradle			
BRAKE SYSTEM	Power, dual hydraulic, anti-lock				
BRAKES, FRONT	**TYPE** Vented disc		**SWEPT AREA** 235.4 sq. in.		
BRAKES, REAR	**TYPE** Solid disc		**SWEPT AREA** 160.3 sq. in.		
FUEL CAPACITY	**GALLONS** 17.0		**LITERS** 64.3		
GENERAL MEASUREMENTS	**WHEELBASE** 110.5 in.		**LENGTH** 200.4 in.		
	TEST WEIGHT 3732		**HEIGHT** 58.7 in.		
HEADROOM	**FRONT** 39.4 in.		**REAR** 37.8 in.		
LEGROOM	**FRONT** 42.3 in.		**REAR** 37.6 in.		
SHOULDER ROOM	**FRONT** 58.7 in.		**REAR** 58.6 in.		
HIPROOM	**FRONT** 56.4 in.		**REAR** 57.2 in.		
INTERIOR VOLUME	**FRONT** 56.5 cu. ft.		**REAR** 55.7 cu. ft.		
	COMB 104.8 cu. ft.		**TRUNK** 18.6 cu. ft. w/ compact spare		
EPA MILEAGE EST. (MPG) Label	**CITY** 17	**HIGHWAY** 24	**COMBINED** 20		
EPA MILEAGE EST. (MPG) Unadjusted	**CITY** 21.2	**HIGHWAY** 33.8	**COMBINED** 25.5		
EPA Mileage EST (MPG) Label E85	**CITY** 12	**HIGHWAY** 18	**COMBINED** 15		
EPA Mileage EST (MPG) Unadjusted E85	**CITY** 15.5	**HIGHWAY** 24.7	**COMBINED** 18.6		

Chevrolet Tahoe
PPV (2WD)

VEHICLE TEST DESCRIPTION

MAKE Chevrolet	**MODEL** Tahoe PPV – 2WD		**SALES CODE NO.** CC10706		
ENGINE DISPLACEMENT	**CUBIC INCHES** 327		**LITERS** 5.3		
FUEL SYSTEM	Sequential Port Fuel Injection E85 Capable		**EXHAUST** Single		
HORSEPOWER (SAE NET)	320 @ 5200 RPM		**ALTERNATOR** 160		
TORQUE	340 ft-lbs @ 4000 RPM		**BATTERY** 730 CCA		
COMPRESSION RATIO	9.5:1				
TRANSMISSION	**MODEL** 6L80E	**TYPE** 6 – Speed Automatic			
	LOCKUP TORQUE CONVERTER? Yes				
	OVERDRIVE? Yes				
AXLE RATIO	3.08				
STEERING	Power – Rack & Pinion				
TURNING CIRCLE (CURB TO CURB)	39.0 ft.				
TIRE SIZE, LOAD & SPEED RATING	P265/60/R17 Goodyear RSA 108H				
SUSPENSION TYPE (FRONT)	Independent, single coil over shock with stabilizer bar				
SUSPENSION TYPE (REAR)	Multi-link with coil springs				
GROUND CLEARANCE, MINIMUM	8.00 in.	**LOCATION** Rear axle			
BRAKE SYSTEM	Vacuum-boost, power, anti-lock				
BRAKES, FRONT	**TYPE** Disc		**SWEPT AREA** 213 sq. in.		
BRAKES, REAR	**TYPE** Disc		**SWEPT AREA** 133 sq. in.		
FUEL CAPACITY	**GALLONS** 26.0		**LITERS** 98.4		
GENERAL MEASUREMENTS	**WHEELBASE** 116 in.		**LENGTH** 198.9 in.		
	TEST WEIGHT 5307		**HEIGHT** 73.9		
HEADROOM	**FRONT** 40.3 in.		**REAR** 39.2 in.		
LEGROOM	**FRONT** 41.3 in.		**REAR** 39.0 in.		
SHOULDER ROOM	**FRONT** 65.3 in.		**REAR** 65.2 in.		
HIPROOM	**FRONT** 64.4 in.		**REAR** 60.6 in.		
INTERIOR VOLUME ***MAX. CARGO IS W/REAR SEATS FOLDED DOWN**	**FRONT** 62.9 cu. ft.		**REAR** 57.68 cu. ft.		
	COMB 120.58 cu. ft.		***MAX. CARGO** 108.9 cu. ft.		
EPA MILEAGE EST. (MPG) Label	**CITY** 15	**HIGHWAY** 21	**COMBINED** 17		
EPA MILEAGE EST. (MPG) Unadjusted	**CITY** 18.3	**HIGHWAY** 29.4	**COMBINED** 22.05		
EPA MILEAGE EST. (MPG) E85 Label	**CITY** 11	**HIGHWAY** 16	**COMBINED** 13		
EPA MILEAGE EST. (MPG) E85 Unadjusted	**CITY** 13.4	**HIGHWAY** 22.2	**COMBINED** 16.31		

Dodge Charger
3.5L

TEST VEHICLE DESCRIPTION

MAKE Dodge	**MODEL** Charger		**SALES CODE NO.** 27A		
ENGINE DISPLACEMENT	**CUBIC INCHES** 214		**LITERS** 3.5		
FUEL SYSTEM	Sequential Port Fuel Injection		**EXHAUST** Single		
HORSEPOWER (SAE NET)	250 @ 6400		**ALTERNATOR** 160 Amp		
TORQUE	250 ft-lbs @ 3800		**BATTERY** 800 CCA		
COMPRESSION RATIO	10.0:1				
TRANSMISSION	**MODEL** A580	**TYPE** 5 Speed Electronic Automatic			
	LOCKUP TORQUE CONVERTER? Yes				
	OVERDRIVE? Yes				
AXLE RATIO	2.87:1				
STEERING	Power Rack & Pinion				
TURNING CIRCLE (CURB TO CURB)	38.9 ft.				
TIRE SIZE, LOAD & SPEED RATING	P225/60 R 18 99V Continental ProContact				
SUSPENSION TYPE (FRONT)	Independent High Arm SLA with Dual Ball Joint Lower, Coil Spring, Sway Bar				
SUSPENSION TYPE (REAR)	Independent Multi-Link, Coil Spring, Sway Bar				
GROUND CLEARANCE, MINIMUM	5.2 in.	**LOCATION** Fascia Belly Pan			
BRAKE SYSTEM	Power, Dual Piston Front/Single Piston Rear, Anti-Lock				
BRAKES, FRONT	**TYPE** Vented Disc		**SWEPT AREA** 282 sq. in.		
BRAKES, REAR	**TYPE** Vented Disc		**SWEPT AREA** 242 sq. in.		
FUEL CAPACITY	**GALLONS** 19		**LITERS** 72		
GENERAL MEASUREMENTS	**WHEELBASE** 120 in.		**LENGTH** 200.1 in.		
	TEST WEIGHT 3856		**HEIGHT** 58.2 in.		
HEADROOM	**FRONT** 38.7 in.		**REAR** 36.2 in.		
LEGROOM	**FRONT** 41.8 in.		**REAR** 40.2 in.		
SHOULDER ROOM	**FRONT** 59.3 in.		**REAR** 57.6 in.		
HIPROOM	**FRONT** 56.2 in.		**REAR** 55.5 in.		
INTERIOR VOLUME	**FRONT** 55.5 cu. ft.		**REAR** 48.5 cu. ft.		
	COMB 104 cu. ft.		**TRUNK** 16.2 cu. ft.		
EPA MILEAGE EST. (MPG) Label	**CITY** 17.25	**HIGHWAY** 25	**COMBINED** 19		
EPA MILEAGE EST. (MPG) Unadjusted	**CITY** 21.2	**HIGHWAY** 35.1	**COMBINED** 25.8		

Dodge Charger
5.7L

TEST VEHICLE DESCRIPTION

MAKE Dodge	**MODEL** Charger		**SALES CODE NO.** 29A		
ENGINE DISPLACEMENT	**CUBIC INCHES** 345		**LITERS** 5.7		
FUEL SYSTEM	Sequential Port Fuel Injection		**EXHAUST** Dual		
HORSEPOWER (SAE NET)	368 @ 5200		**ALTERNATOR** 160 Amp		
TORQUE	395 ft-lbs @ 4350		**BATTERY** 800 CCA		
COMPRESSION RATIO	10.5:1				
TRANSMISSION	**MODEL** A580	**TYPE** 5 Speed Electronic Automatic			
	LOCKUP TORQUE CONVERTER? Yes				
	OVERDRIVE? Yes				
AXLE RATIO	2.65:1				
STEERING	Power Rack & Pinion				
TURNING CIRCLE (CURB TO CURB)	38.9 ft.				
TIRE SIZE, LOAD & SPEED RATING	P225/60 R 18 99V Continental ProContact				
SUSPENSION TYPE (FRONT)	Independent High Arm SLA with Dual Ball Joint Lower, Coil Spring, Sway Bar				
SUSPENSION TYPE (REAR)	Independent Multi-Link, Coil Spring, Sway Bar				
GROUND CLEARANCE, MINIMUM	5.2 in.	**LOCATION** Fascia Belly Pan			
BRAKE SYSTEM	Power, Dual Piston Front/Single Piston Rear, Anti-Lock				
BRAKES, FRONT	**TYPE** Vented Disc		**SWEPT AREA** 282 sq. in.		
BRAKES, REAR	**TYPE** Vented Disc		**SWEPT AREA** 242 sq. in.		
FUEL CAPACITY	**GALLONS** 19		**LITERS** 72		
GENERAL MEASUREMENTS	**WHEELBASE** 120 in.		**LENGTH** 200.1 in.		
	TEST WEIGHT 4118		**HEIGHT** 58.2 in.		
HEADROOM	**FRONT** 38.7 in.		**REAR** 36.2 in.		
LEGROOM	**FRONT** 41.8 in.		**REAR** 40.2 in.		
SHOULDER ROOM	**FRONT** 59.3 in.		**REAR** 57.6 in.		
HIPROOM	**FRONT** 56.2 in.		**REAR** 55.5 in.		
INTERIOR VOLUME	**FRONT** 55.5 cu. ft.		**REAR** 48.5 cu. ft.		
	COMB 104 cu. ft.		**TRUNK** 16.2 cu. ft.		
EPA MILEAGE EST. (MPG) Label	**CITY** 16	**HIGHWAY** 25	**COMBINED** 19		
EPA MILEAGE EST. (MPG) Unadjusted	**CITY** 19.3	**HIGHWAY** 34.6	**COMBINED** 24.1		

TEST VEHICLE DESCRIPTION SUMMARY

	Ford Police Interceptor 3.27		Chevrolet Impala 9C1		Dodge Charger 3.5L
ENGINE DISPLACEMENT – CU. IN.	281		237		214
ENGINE DISPLACEMENT – LITERS	4.6		3.9		3.5
ENGINE FUEL SYSTEM	SMFI		SPFI		SPFI
HORSEPOWER (SAE NET)	250		233		250
TORQUE (FT. LBS.)	297		240		250
COMPRESSION RATIO	9.4:1		9.4:1		10.0:1
AXLE RATIO	3.27		3.29:1		2.87:1
TURNING CIRCLE – FT. CURB TO CURB	40.3		38.0		38.9
TRANSMISSION	4 Speed elec. auto		4 Speed auto		5 Speed elec. auto
TRANSMISSION MODEL NUMBER	4R70W		4T65E		A580
LOCKUP TORQUE CONVERTER	Yes		Yes		Yes
TRANSMISSION OVERDRIVE	Yes		Yes		Yes
TIRE SIZE	P235/55R		P225/60R		P225/60R
WHEEL RIM SIZE – INCHES	17		16		18
GROUND CLEARANCE – INCHES	5.6		7.1		5.2
BRAKE SYSTEM	Power, ABS		Power, ABS		Power, ABS
BRAKES – FRONT TYPE	Vented Disc		Vented Disc		Vented Disc
BRAKES – REAR TYPE	Vented Disc		Solid Disc		Vented Disc
FUEL CAPACITY – GALLONS	19		17		19
FUEL CAPACITY – LITERS	71.9		64.3		72
OVERALL LENGTH – INCHES	212.0		200.4		200.1
OVERALL HEIGHT – INCHES	58.3		58.7		58.2
TEST WEIGHT – LBS.	4144		3732		3856
WHEELBASE – INCHES	114.6		110.5		120
HEADROOM FRONT – INCHES	39.5		39.4		38.7
HEADROOM REAR – INCHES	37.8		37.8		36.2
LEGROOM FRONT – INCHES	41.6		42.3		41.8
LEGROOM REAR – INCHES	38.0		37.6		40.2
SHOULDER ROOM FRONT – INCHES	60.6		58.7		59.3
SHOULDER ROOM REAR – INCHES	60.0		58.6		57.6
HIPROOM FRONT – INCHES	57.4		56.4		56.2
HIPROOM REAR – INCHES	56.1		57.2		55.5
INTERIOR VOLUME FRONT – CU. FT.	57.6		56.5		55.5
INTERIOR VOLUME REAR – CU. FT.	49.8		55.7		48.5
INTERIOR VOLUME COMB. – CU. FT.	107.5		104.8		104
TRUNK VOLUME – CU. FT.	20.6		18.6		16.2
	Gas	**E85**	**Gas**	**E-85**	**Gas**
EPA MILEAGE – CITY – MPG Label	14	11	17	12	17.25
EPA MILEAGE – CITY – MPG Unadjusted	17.9		21.2	15.5	21.2
EPA MILEAGE – HIGHWAY – MPG Label	21	15	24	18	25
EPA MILEAGE – HIGHWAY – MPG Unadjusted	29.7		33.8	24.7	35.1
EPA MILEAGE – COMBINED – MPG Label	17	12	20	15	19
EPA MILEAGE – COMBINED – MPG Unadjusted	21.7		25.5	18.6	25.8

TEST VEHICLE DESCRIPTION SUMMARY

	Dodge Charger 5.7L	Ford Police Interceptor 3.55	Chevrolet Tahoe PPV	
ENGINE DISPLACEMENT – CU. IN.	345	281	327	
ENGINE DISPLACEMENT – LITERS	5.7	4.6	5.3	
ENGINE FUEL SYSTEM	SPFI	SMFI	SPFI	
HORSEPOWER (SAE NET)	368	250	320	
TORQUE (FT. LBS.)	395	297	340	
COMPRESSION RATIO	10.5:1	9.4:1	9.5:1	
AXLE RATIO	2.65:1	3.55	3.08	
TURNING CIRCLE – FT. CURB TO CURB	38.9	40.3	39.0	
TRANSMISSION	5 Speed elec. auto	4 Speed elec. auto	6-Speed Automatic Overdrive	
TRANSMISSION MODEL NUMBER	A580	4R70W	6L80E	
LOCKUP TORQUE CONVERTER	Yes	Yes	Yes	
TRANSMISSION OVERDRIVE	Yes	Yes	Yes	
TIRE SIZE	P225/60R	P235/55R	P265/60R	
WHEEL RIM SIZE – INCHES	18	17	17	
GROUND CLEARANCE – INCHES	5.2	5.6	8.00	
BRAKE SYSTEM	Power, ABS	Power, ABS	Power, ABS	
BRAKES – FRONT TYPE	Vented Disc	Vented Disc	Disc	
BRAKES – REAR TYPE	Vented Disc	Vented Disc	Disc	
FUEL CAPACITY – GALLONS	19	19	26	
FUEL CAPACITY – LITERS	72	71.9	98.4	
OVERALL LENGTH – INCHES	200.1	212.0	198.9	
OVERALL HEIGHT – INCHES	58.2	58.3	73.9	
TEST WEIGHT – LBS.	4118	4113	5307	
WHEELBASE – INCHES	120	114.6	116	
HEADROOM FRONT – INCHES	38.7	39.5	40.3	
HEADROOM REAR – INCHES	36.2	37.8	39.2	
LEGROOM FRONT – INCHES	41.8	41.6	41.3	
LEGROOM REAR – INCHES	40.2	38.0	39.0	
SHOULDER ROOM FRONT – INCHES	59.3	60.6	65.3	
SHOULDER ROOM REAR – INCHES	57.6	60.0	65.2	
HIPROOM FRONT – INCHES	56.2	57.4	64.4	
HIPROOM REAR – INCHES	55.5	56.1	60.6	
INTERIOR VOLUME FRONT – CU. FT.	55.5	57.6	62.9	
INTERIOR VOLUME REAR – CU. FT.	48.5	49.8	57.68	
INTERIOR VOLUME COMB. – CU. FT.	104	107.5	120.58	
TRUNK VOLUME – CU. FT.	16.2	20.6	108.9	
	Gas	**Gas**	**Gas**	**E85**
EPA MILEAGE – CITY – MPG- Label	16	14	15	11
EPA MILEAGE CITY – MPG - Unadjusted	19.3	17.9	18.3	13.4
EPA MILEAGE – HIGHWAY – MPG - Label	25	21	21	16
.EPA MILEAGE – HIGHWAY – MPG - Unadjusted	34.6	29.7	29.4	22.2
EPA MILEAGE – COMBINED – MPG - Label	19	17	17	13
EPA MILEAGE – COMBINED – MPG Unadjusted	24.1	21.7	22.05	16.31

VEHICLE DYNAMICS TESTING

TEST OBJECTIVE

Determine each vehicle's high-speed pursuit or emergency handling characteristics and performance in comparison to the other vehicles in the test group. The course used is a 2-mile road-racing type configuration, containing hills, curves, and corners. The course simulates actual conditions encountered in pursuit or emergency driving situations in the field, with the exception of other traffic. The evaluation is a true test of the success or failure of the vehicle manufacturers to offer vehicles that provide the optimum balance between handling (suspension components), acceleration (usable horsepower), and braking characteristics.

TEST METHODOLOGY

Each vehicle is driven over the course a total of 32 timed laps, using four separate drivers, each driving an 8 lap series. The final score for the vehicle is the combined average (from the 4 drivers) of the 5 fastest laps for each driver during the 8 lap series.

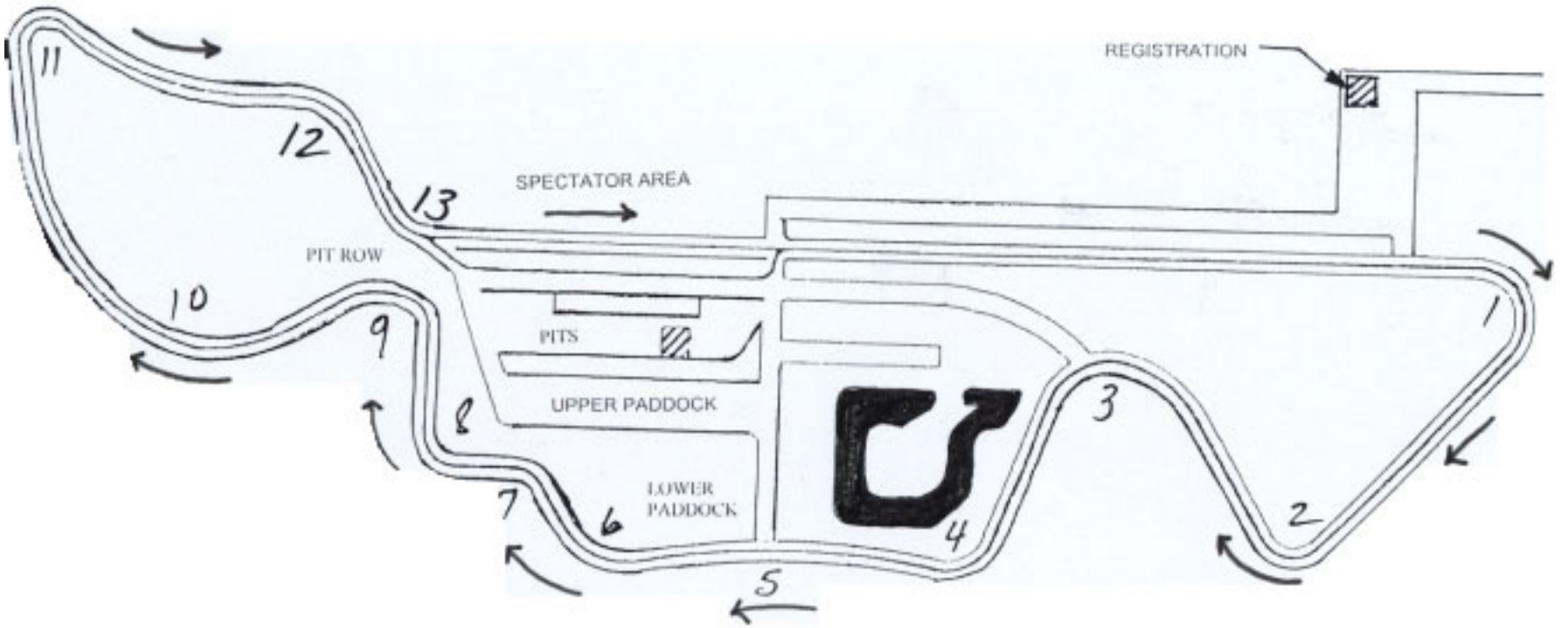
TEST DAY WEATHER

The weather during Vehicle Dynamics Testing is shown in the table below:

DATE	TIME	TEMP F	HUMIDITY	WIND SPEED	WIND DIRECTION
9/21/2009	2:00 PM	70	88	8	SW
9/21/2009	2:30 PM	69.8	88	6	SW
9/21/2009	3:00 PM	69.8	86	9	SW
9/21/2009	3:30 PM	71.5	82	8	SW
9/21/2009	4:00 PM	70.6	82	8	SW
9/21/2009	4:30 PM	69.7	83	7	WSW
9/21/2009	5:00 PM	69.5	80	9	SW
9/21/2009	5:30 PM	69	82	6	WSW

Grattan Raceway Park

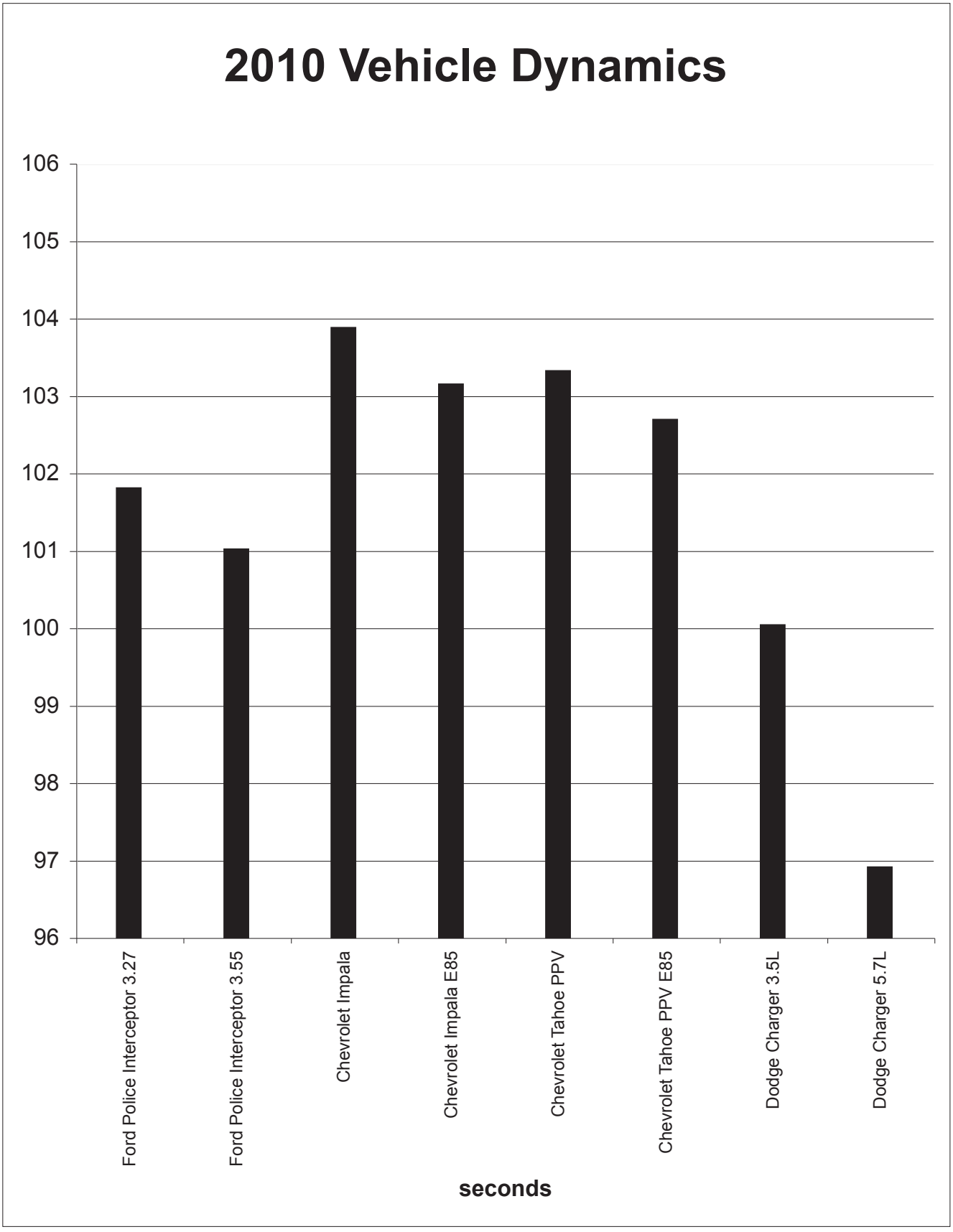
7201 Lessiter
Belding, Michigan 48809



Arrows indicate Michigan State Police Road Test Course and Direction of Travel.

VEHICLE DYNAMICS TESTING

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Average
Ford Police Interceptor 3:27 SPFI	GROMAK	01:41.40	01:41.70	01:41.80	01:41.80	01:41.90	01:41.72
	ROGERS	01:41.50	01:41.70	01:41.70	01:41.90	01:41.90	01:41.74
	MCCARTHY	01:42.20	01:42.30	01:42.40	01:42.50	01:42.60	01:42.40
	FLEGEL	01:40.80	01:41.30	01:41.40	01:41.50	01:41.70	01:41.34
Overall Average							**01:41.80**
Ford Police Interceptor 3:55 SPFI	GROMAK	01:40.40	01:40.40	01:40.50	01:40.60	01:40.80	01:40.54
	ROGERS	01:40.70	01:41.00	01:41.00	01:41.10	01:41.20	01:41.00
	MCCARTHY	01:41.80	01:41.80	01:41.90	01:42.00	01:42.10	01:41.92
	FLEGEL	01:40.40	01:40.50	01:40.60	01:40.60	01:40.90	01:40.60
Overall Average							**01:41.01**
Chevrolet Impala 9C1 3.9L SPFI	GROMAK	01:42.80	01:43.10	01:43.30	01:43.40	01:43.50	01:43.22
	ROGERS	01:43.30	01:43.60	01:43.70	01:44.00	01:44.10	01:43.74
	MCCARTHY	01:44.10	01:44.30	01:44.30	01:44.80	01:44.90	01:44.48
	FLEGEL	01:43.90	01:44.00	01:44.00	01:44.10	01:44.20	01:44.04
Overall Average							**01:43.87**
Chevrolet Impala E85 3.9L SPFI	GROMAK	01:42.50	01:42.60	01:43.00	01:43.00	01:43.00	01:42.82
	ROGERS	01:42.40	01:42.50	01:42.60	01:42.70	01:42.80	01:42.60
	MCCARTHY	01:43.40	01:43.50	01:43.70	01:43.70	01:43.90	01:43.64
	FLEGEL	01:43.20	01:43.30	01:43.60	01:43.70	01:43.80	01:43.52
Overall Average							**01:43.14**
Chevrolet Tahoe PPV 2WD 5.3L SPFI	GROMAK	01:43.00	01:43.20	01:43.30	01:43.40	01:43.50	01:43.28
	ROGERS	01:42.60	01:42.70	01:42.90	01:43.20	01:43.30	01:42.94
	MCCARTHY	01:43.60	01:43.70	01:43.80	01:43.90	01:43.90	01:43.78
	FLEGEL	01:43.00	01:43.00	01:43.20	01:43.50	01:43.50	01:43.24
Overall Average							**01:43.31**
Chevrolet Tahoe PPV 2WD E85 5.3L SPFI	GROMAK	01:42.10	01:42.30	01:42.40	01:42.80	01:42.80	01:42.48
	ROGERS	01:42.10	01:42.30	01:42.80	01:43.30	01:43.40	01:42.78
	MCCARTHY	01:42.90	01:42.90	01:43.00	01:43.00	01:43.10	01:42.98
	FLEGEL	01:42.00	01:42.40	01:42.40	01:42.80	01:42.80	01:42.48
Overall Average							**01:42.68**
Dodge Charger 3.5L SPFI	GROMAK	01:39.20	01:39.30	01:39.40	01:39.50	01:39.60	01:39.40
	ROGERS	01:39.80	01:39.80	01:39.90	01:39.90	01:39.90	01:39.86
	MCCARTHY	01:40.70	01:40.80	01:40.90	01:41.00	01:41.00	01:40.88
	FLEGEL	01:39.60	01:39.90	01:40.00	01:40.20	01:40.20	01:39.98
							01:40.03
Dodge Charger 5.7L SPFI	GROMAK	01:36.50	01:36.60	01:36.60	01:36.90	01:37.10	01:36.74
	ROGERS	01:36.60	01:37.00	01:37.20	01:37.30	01:37.30	01:37.08
	MCCARTHY	01:37.20	01:37.30	01:37.40	01:37.40	01:37.50	01:37.36
	FLEGEL	01:35.80	01:36.40	01:36.40	01:36.70	01:36.80	01:36.42
Overall Average							**01:36.90**


2010 Vehicle Dynamics
106
105
104
103
102
101
100
99
98
97
96
Ford Police Interceptor 3.27
Ford Police Interceptor 3.55
Chevrolet Impala
Chevrolet Impala E85
Chevrolet Tahoe PPV
Chevrolet Tahoe PPV E85
Dodge Charger 3.5L
Dodge Charger 5.7L
seconds

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

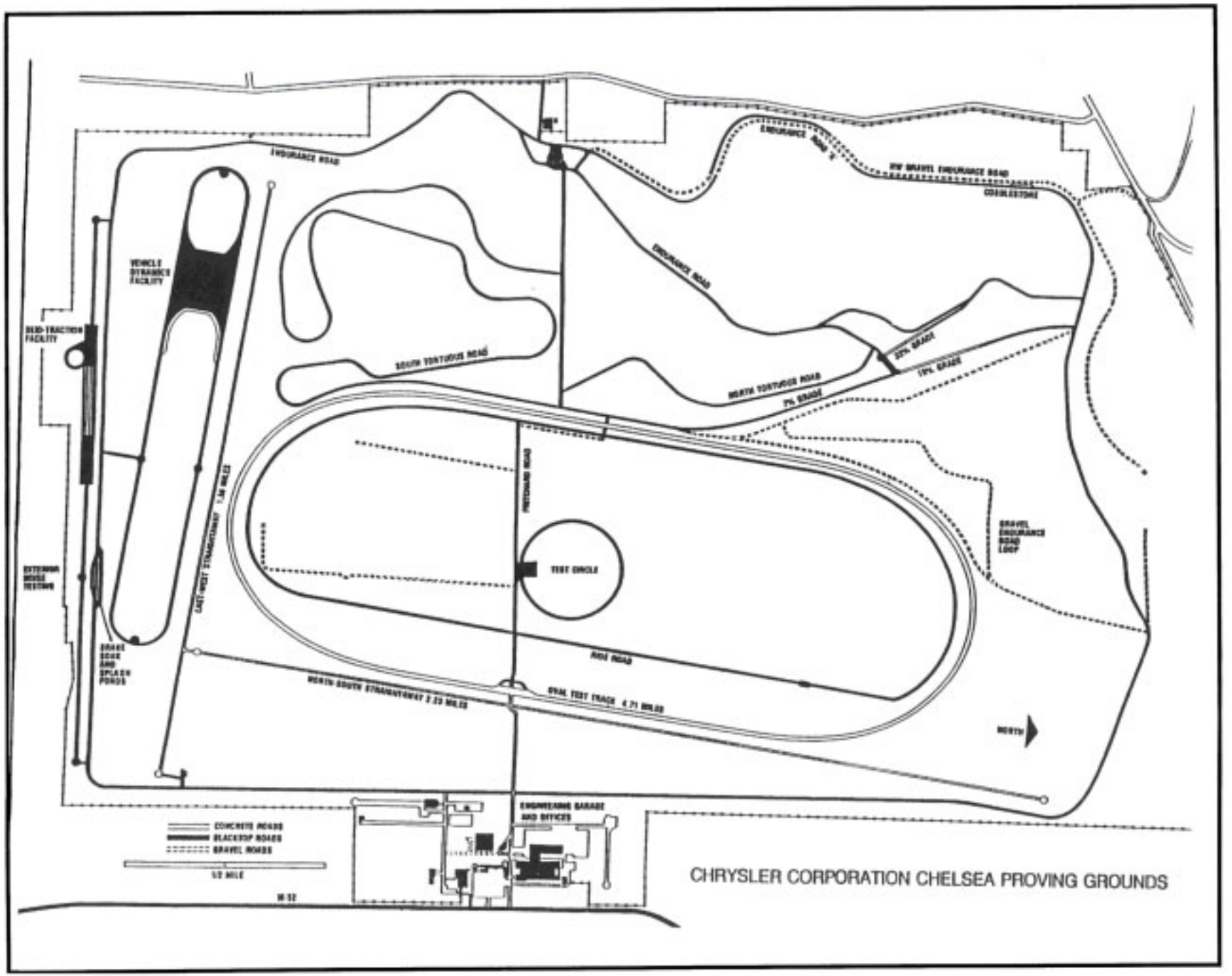
Using a DLS Smart Sensor – Optical non-contact Speed and Distance Sensor in conjunction with a lap top computer, each vehicle is driven through four acceleration sequences, two northbound and two southbound, to allow for wind direction. The four resulting times for each target speed are averaged and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


ENDURANCE ROAD
VEHICLE DYNAMICS FACILITY
SKID-TRACTION FACILITY
SOUTH TORTUOSE ROAD
NORTH TORTUOSE ROAD
7% GRADE
10% GRADE
EAST-WEST STRAIGHTAWAY 1.34 MILES
PERIMETER ROAD
TEST CIRCLE
RIDE ROAD
OVAL TEST TRACK 4.71 MILES
NORTH SOUTH STRAIGHTAWAY 2.23 MILES
BRAKE RIDE AND SPLASH PONDS
EXTERIOR NOISE TESTING
GRAVEL ENDURANCE ROAD LOOP
ENGINEERING GARAGE AND OFFICES
CONCRETE ROADS
BLACKTOP ROADS
GRAVEL ROADS
1/2 MILE
M-52
NORTH
CHRYSLER CORPORATION CHELSEA PROVING GROUNDS

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.

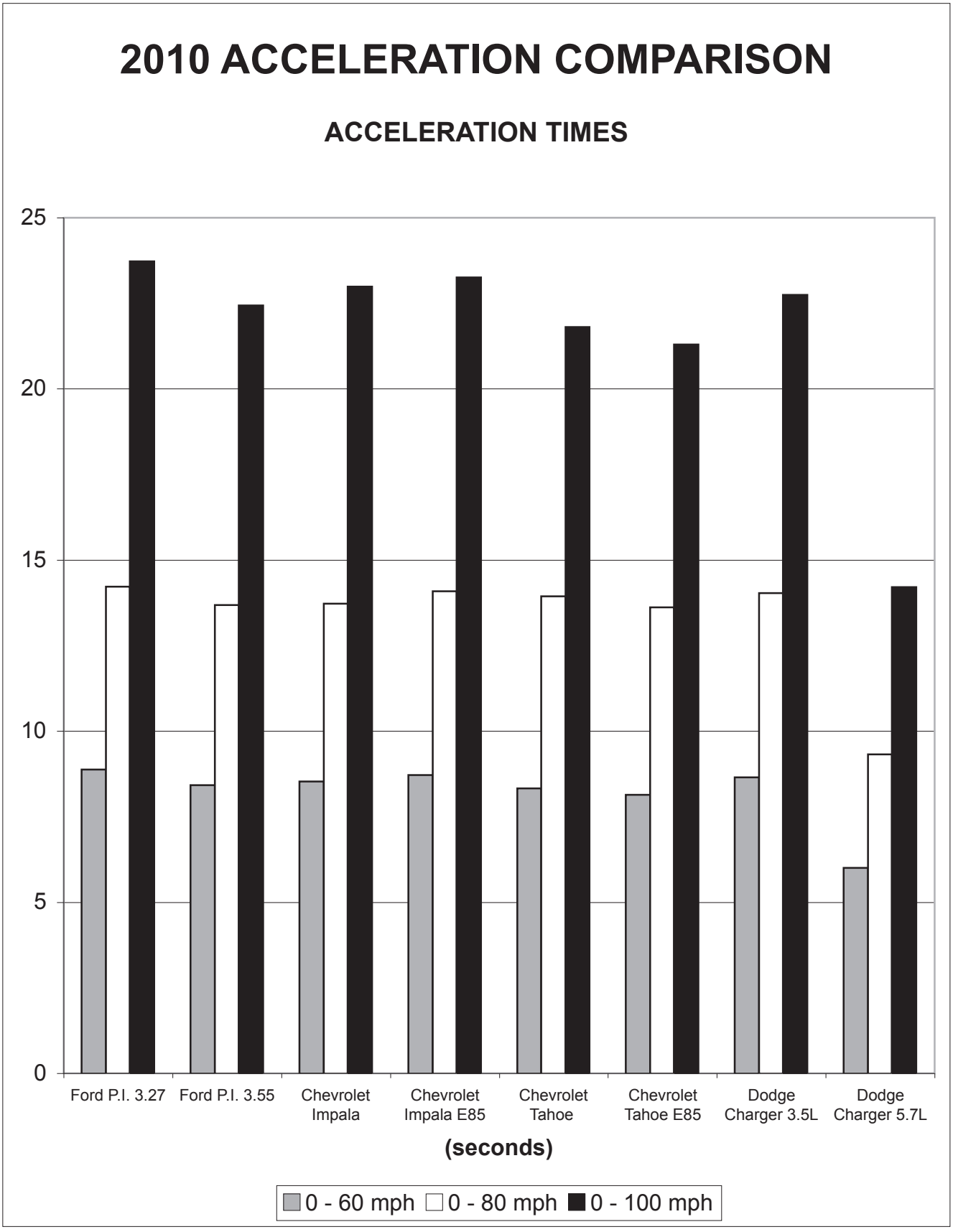
SUMMARY OF ACCELERATION AND TOP SPEED

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

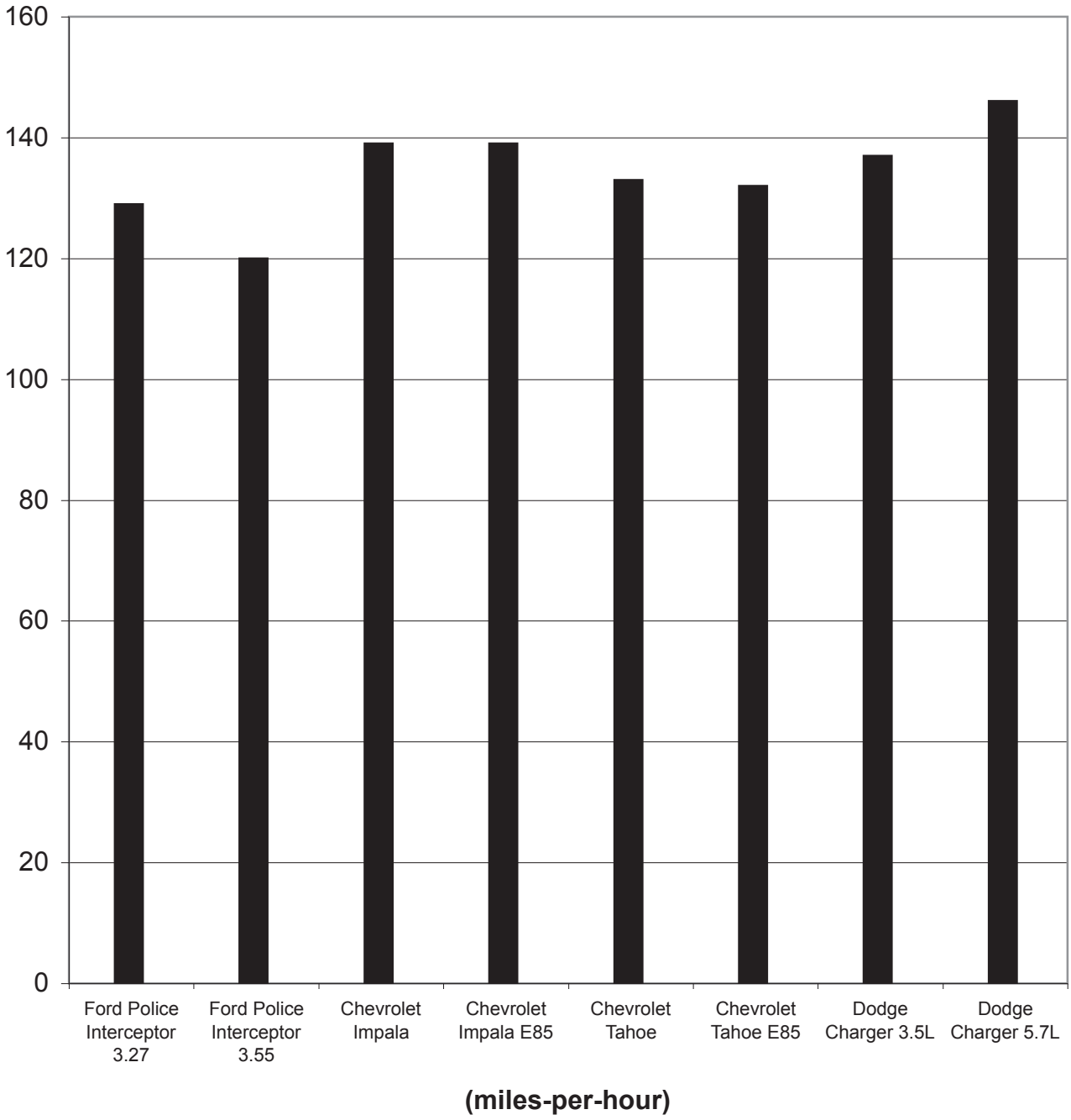
SUMMARY OF ACCELERATION AND TOP SPEED

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



2010 TOP SPEED COMPARISON



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/s^2, 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

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

EXAMPLE:

Initial Velocity = 89.175 ft/s (60.8 mph x 1.4667*)
Stopping Distance = 171.4 ft.

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

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 mph = 88.002 ft/s x 88.002 = 7744.352 / 2 = 3872.176 / 23.198 ft/s^2 = 166.9 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/s^2

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/s^2

Phase III

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

OVERALL AVERAGE DECEL. RATE: 26.66 ft/s^2

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/s^2

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/s^2

Phase III

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

OVERALL AVERAGE DECEL. RATE: 26.91 ft/s^2

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/s^2

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/s^2

Phase III

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

OVERALL AVERAGE DECEL. RATE: 28.09 ft/s^2

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/s^2

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/s^2

Phase III

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

OVERALL AVERAGE DECEL. RATE: 27.01 ft/s^2

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/s^2

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

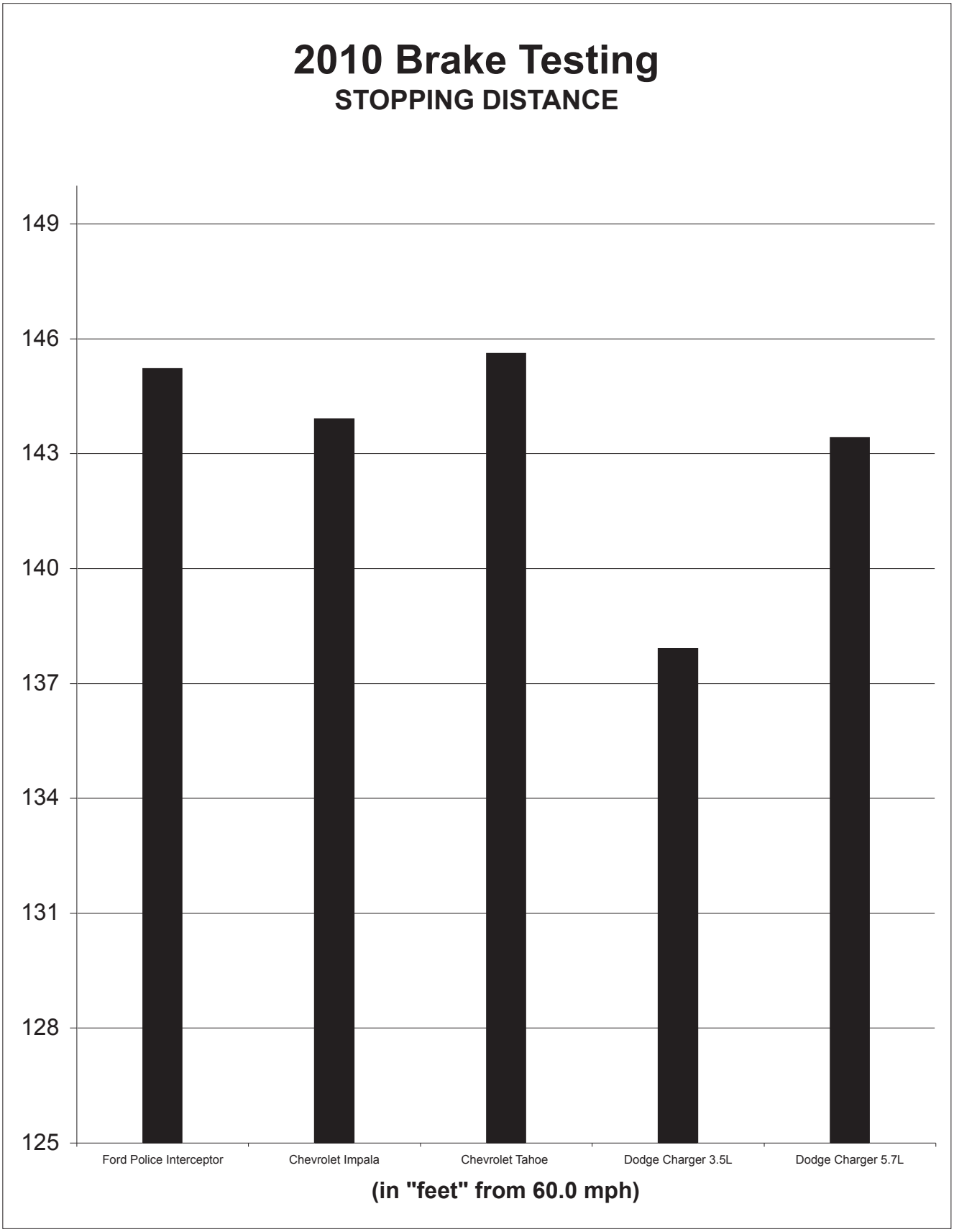
AVERAGE DECELERATION RATE 26.48 ft/s^2

Phase III

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

OVERALL AVERAGE DECEL. RATE: 26.59 ft/s^2

Projected Stopping Distance from 60.0 mph 145.6 feet


2010 Brake Testing
STOPPING DISTANCE
149
146
143
140
137
134
131
128
125
Ford Police Interceptor
Chevrolet Impala
Chevrolet Tahoe
Dodge Charger 3.5L
Dodge Charger 5.7L
(in "feet" from 60.0 mph)

ERGONOMICS AND COMMUNICATIONS

TEST OBJECTIVE

Rate each test vehicle's ability to:

1. Provide a suitable environment for the patrol officer in the performance of his/her assigned tasks.

2. Accommodate the required communications and emergency warning equipment and assess the relative difficulty of such installations.

TEST METHODOLOGY

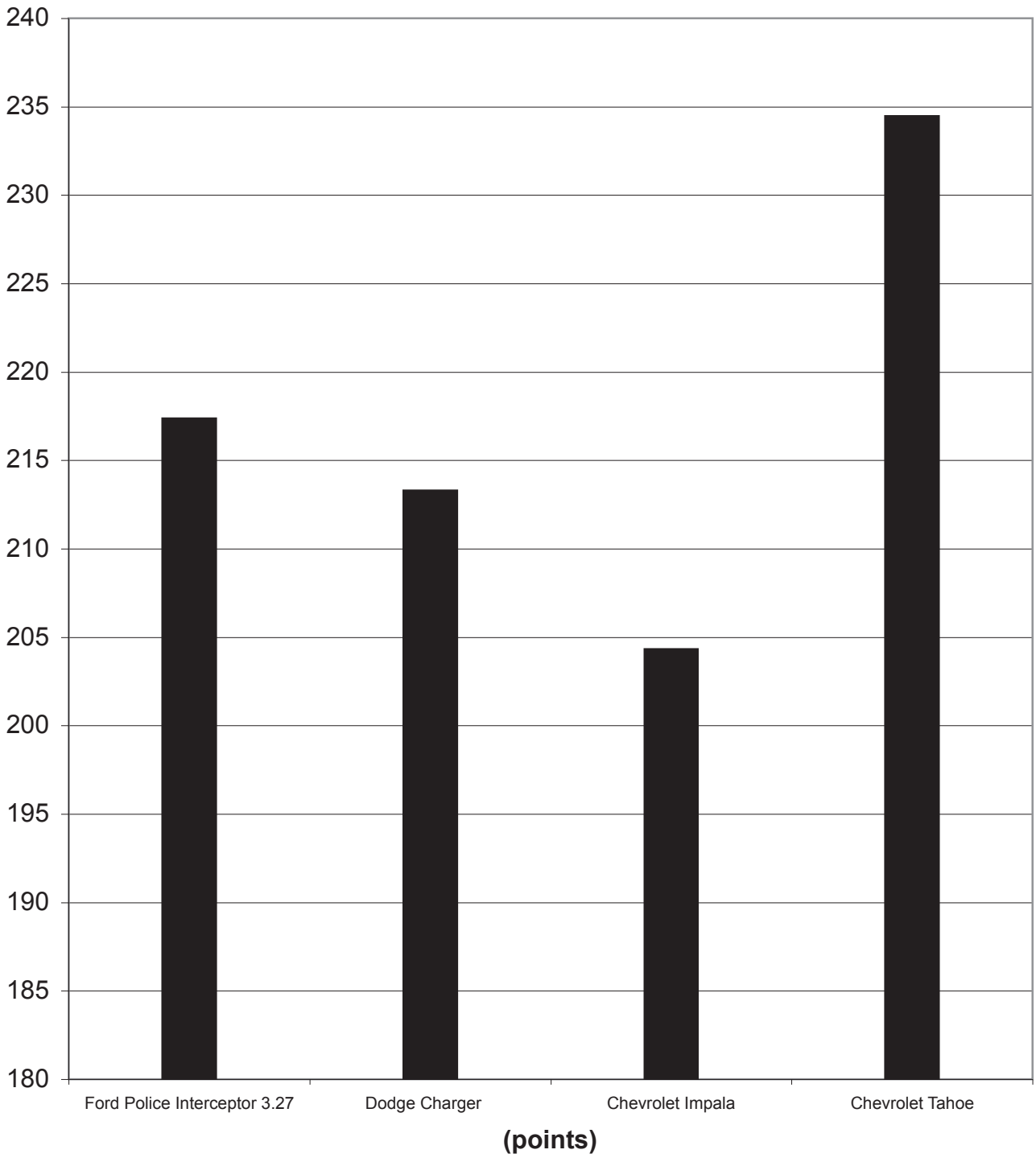
Utilizing the ergonomics portion of the form, a minimum of four officers (in this case 6) individually and independently compare and score each test vehicle on the various comfort, instrumentation, and visibility items. The installation and communications portion of the evaluation is conducted by personnel from DIT Communications, based upon the relative difficulty of the necessary installations. Each factor is graded on a 1 to 10 scale, with 1 representing "totally unacceptable," 5 representing "average," and 10 representing "superior." The scores are averaged to minimize personal prejudice for or against any given vehicle.

ERGONOMICS AND COMMUNICATIONS

ERGONOMICS	Ford Police Interceptor	Dodge Charger	Chevrolet Impala 9C1	Chevrolet Tahoe PPV
FRONT SEAT				
Padding	7.83	7.83	7.50	8.67
Depth of Bucket Seat	7.33	7.50	7.67	8.50
Adjustability – Front to Rear	9.00	8.67	8.00	8.67
Upholstery	8.00	7.83	7.00	8.17
Bucket Seat Design	7.50	8.00	7.33	8.50
Headroom	8.33	8.33	7.33	9.83
Seatbelts	6.83	8.50	8.33	8.33
Ease of Entry and Exit	7.50	8.00	5.83	9.17
Overall Comfort Rating	7.67	8.00	7.17	9.00
REAR SEAT				
Leg room – Front seat back	6.33	7.00	4.83	8.67
Ease of Entry and Exit	6.17	6.33	4.50	8.67
INSTRUMENTATION				
Clarity	7.33	8.67	8.67	9.00
Placement	8.17	8.33	8.50	9.00
VEHICLE CONTROLS				
Pedals, Size and Position	8.67	8.33	7.83	8.83
Power Window Switch	8.17	8.33	8.33	8.83
Inside Door Lock Switch	8.33	7.33	6.83	8.83
Automatic Door Lock Switch	8.50	7.33	6.67	8.50
Outside Mirror Controls	8.00	8.00	7.67	9.17
Steering Wheel, Size, Tilt Release, and Surface	8.17	7.17	8.50	9.00
Heat/AC Vent Placement and Adjustability	8.17	8.33	8.50	8.50
VISIBILITY				
Front (Windshield)	8.50	8.67	8.83	8.83
Rear (Back Window)	8.33	7.00	7.00	7.17
Left Rear Quarter	8.17	7.00	7.33	6.83
Right Rear Quarter	8.17	6.83	7.33	6.83
Outside Rear View Mirrors	8.17	8.00	7.17	8.83
COMMUNICATIONS				
Dashboard Accessibility	6.44	6.17	5.83	6.28
Trunk Accessibility	6.80	6.13	7.27	7.20
Engine Compartment	6.78	5.67	6.56	6.67
TOTAL SCORES	**217.36**	**213.28**	**204.31**	**234.48**

2010 ERGONOMICS/COMMUNICATIONS

VEHICLE SCORES



FUEL ECONOMY

TEST OBJECTIVE

Determine the fuel economy potential of all vehicles being evaluated. The data used for scoring are both valid and reliable in a comparison sense, while not necessarily being an accurate predictor of actual fuel economy in police patrol service.

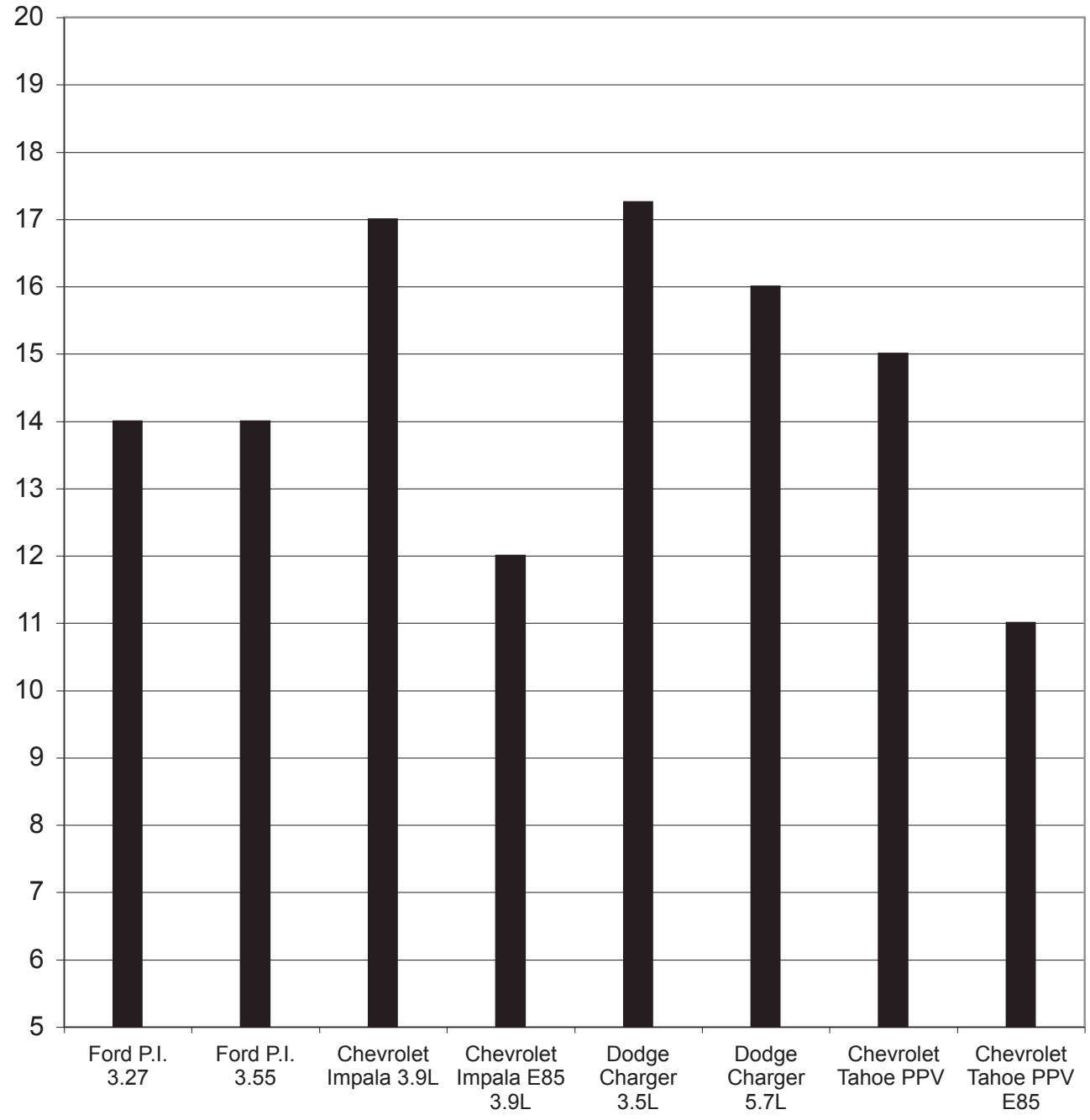
TEST METHODOLOGY

The vehicles will be scored based on estimates for city fuel economy to the nearest 1/10th mile per gallon (mpg) developed from data supplied by the vehicle manufacturer and certified by the Environmental Protection Agency.

Vehicles Make/Model/Engine		E.P.A. Miles Per Gallon					
		City		Highway		Combined	
		Label	Unadjusted	Label	Unadjusted	Label	Unadjusted
Ford Police Interceptor 3.27	4.6L SPFI	14	17.9	21	29.7	17	21.7
Ford Police Interceptor 3.55	4.6L SPFI	14	17.9	21	29.7	17	21.7
Chevrolet Impala	3.9L SPFI	17	21.2	24	33.8	20	25.5
Chevrolet Impala E85	3.9L SPFI	12	15.5	18	24.7	15	18.6
Dodge Charger	3.5L SPFI	17.25	21.2	25	35.1	19	25.8
Dodge Charger	5.7L SPFI	16	19.3	25	34.6	19	24.1
Chevrolet Tahoe PPV	5.3L SPFI	15	18.3	21	29.4	17	22.05
Chevrolet Tahoe E85 PPV	5.3L SPFI	11	13.4	16	22.2	13	16.31

2010 FUEL ECONOMY COMPARISON

"CITY" EPA ESTIMATES



MICHIGAN STATE POLICE
SCORING AND BID ADJUSTMENT METHODOLOGY*

STEP I: RAW SCORES

Raw scores are developed, through testing, for each vehicle in each of six evaluation categories. The raw scores are expressed in terms of seconds, feet per second^2, miles-per-hour, points, and miles-per-gallon.

VEHICLE DYNAM. (seconds)	BRAKING RATE (ft/sec^2)	ACCEL. (seconds)	TOP SPEED (mph)	ERGONOMICS & COMMUN. (points)	FUEL ECONOMY (mpg)
92.210	26.380	45.790	115.000	173.900	14.300

STEP II: DEVIATION FACTOR

In each evaluation category, the best scoring vehicle's score is used as the benchmark against which each of the other vehicles' scores are compared. (In the Vehicle Dynamics and Acceleration categories the lowest score is best, while in the remainder of the categories the highest score is best.) The best scoring vehicle in a given category received a deviation factor of "0." The "deviation factor" is then calculated by determining the absolute difference between each vehicle's raw score and the best score in that category. The absolute difference is then divided by the best score, with the result being the "deviation factor."

CAR MAKE MODEL	TOP SPEED
CAR "A"	115.000 **.042**
CAR "B"	118.800 **.010**
CAR "C"	117.900 **.018**
CAR "D"	120.000 **0**

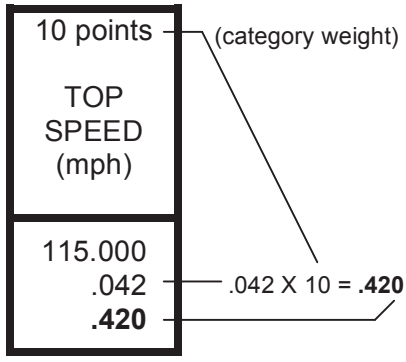
EXAMPLE:

Best Score (Car "D")		Other Vehicle Score (Car "A")		Absolute Difference		Best Score		Deviation Factor (Car "A")
120.000	-	115.000	=	5	/	120.000	=	**.042**

STEP III: WEIGHTED CATEGORY SCORE

Each vehicle's weighted category score is determined by multiplying the deviation factor (as determined in Step II) by the category weight.

RAW SCORE
DEVIATION FACTOR
WEIGHTED CATEGORY SCORE



*All mathematical computations are to be rounded to the third decimal place.

STEP IV: TOTAL WEIGHTED SCORE

Adding together the six (6) weighted category scores for that vehicle derives the total weighted score for each vehicle.

EXAMPLE:

CAR	30 pts. VEH. DYN. (seconds)	25 pts. BRAKE DECEL. (ft/sec^2)	20 pts. ACCEL. (seconds)	10 pts. TOP SPEED (mph)	10 pts. ERGO/ COMM. (points)	5 pts. FULE ECON. (mpg)	TOTAL WEIGHTED SCORE
Car "A"	92.210 .018 .540	45.790 .163 4.075	26.380 0 0	115.000 .042 .420	173.900 .184 1.840	14.300 0 0	**6.875**

STEP V: BID ADJUSTMENT FIGURE

The bid adjustment figure that we have chosen to use is one percent (1%) of the lowest bid price received. As an example, in this and the following two steps, the lowest bid price received was $15,238.00, which results in a bid adjustment figure of **$152.38**.

STEP VI: ACTUAL DOLLAR ADJUSTMENT

The actual dollar adjustment for a vehicle is determined by multiplying that vehicle's total weighted score by the bid adjustment figure as shown at right.

TOTAL WTD. SCORE	BID ADJ. FIGURE	ACTUAL DOLLAR ADJ.
	X	**=**
6.875	$152.38	**$1,047.61**

STEP VII: ADJUSTED BID PRICE

The actual dollar adjustment amount arrived at for each vehicle is added to that vehicle's bid price. Provided other necessary approvals are received, the vehicle with the lowest adjusted bid price will be the vehicle purchased. (The amount paid for the purchased vehicles will be the actual bid price.)

ACTUAL DOLLAR ADJ.	ACTUAL BID PRICE	ADJ. BID PRICE
	+	**=**
$955.42	$15,473.00	**$16,520.61**

PERFORMANCE COMPARISONS OF 2009 AND 2010 TEST VEHICLES

The following charts illustrate the scores achieved by each make and model of vehicle tested for model years 2009 and 2010. The charts presented are for the following performance categories:

Vehicle Dynamics
Acceleration 0 – 60 mph
Acceleration 0 – 80 mph
Acceleration 0 – 100 mph
Top Speed
Braking (Calculated 60 – 0 mph Stopping Distance)

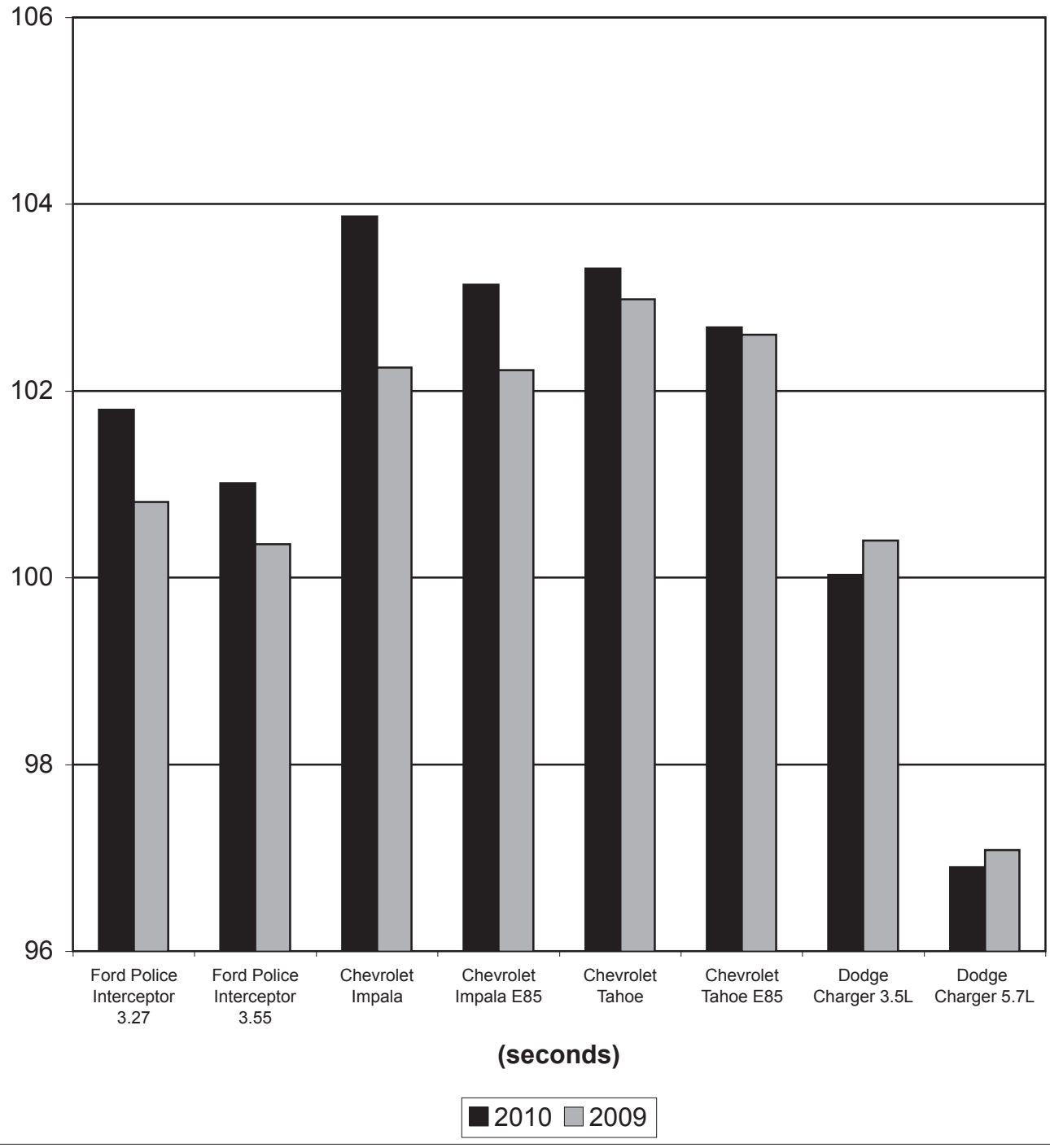
The reader should bear in mind the following information regarding variables when reviewing the 2009-2010 performance comparison charts. While as many variables as possible are eliminated from a given year's testing, those that occur over the span of a full year are sometimes impossible to eliminate.

The acceleration, top speed, and brake testing of both the 2009 and 2010 model year vehicles were conducted in the latter half of September. Temperatures on the test day in September of 2008 ranged between 49.5° F at the start of testing to a high of approximately 80.9° F during the afternoon. Temperatures during the testing this year varied, ranging between 38.6° F when testing started, to an afternoon high of 69.8° F. Such things as temperature, humidity, and barometric pressure affect the performance of internal combustion engines and brake components, and may cause minor differences from one year's evaluation to the next.

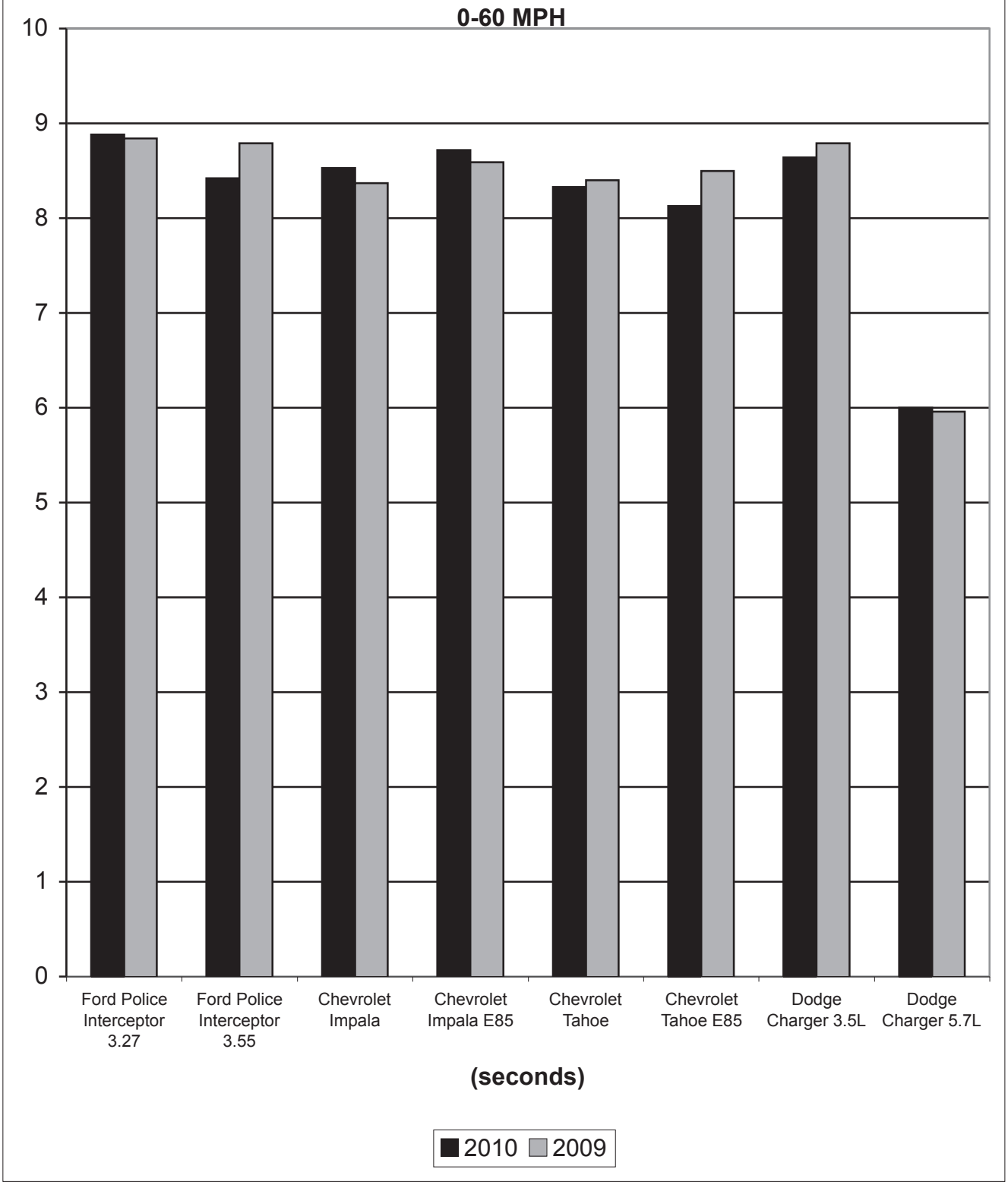
Another factor to be considered is the individual differences between two cars of the same make and model. The test cars that we evaluate are representative of their given make and model. Other cars of the same make and model will not, however, be exactly the same, particularly when it comes to performance. (It is well known that two consecutive cars off the same assembly line will perform slightly differently from each other.) Minor differences in performance from year to year within the same make and model are not only possible, but are to be expected.

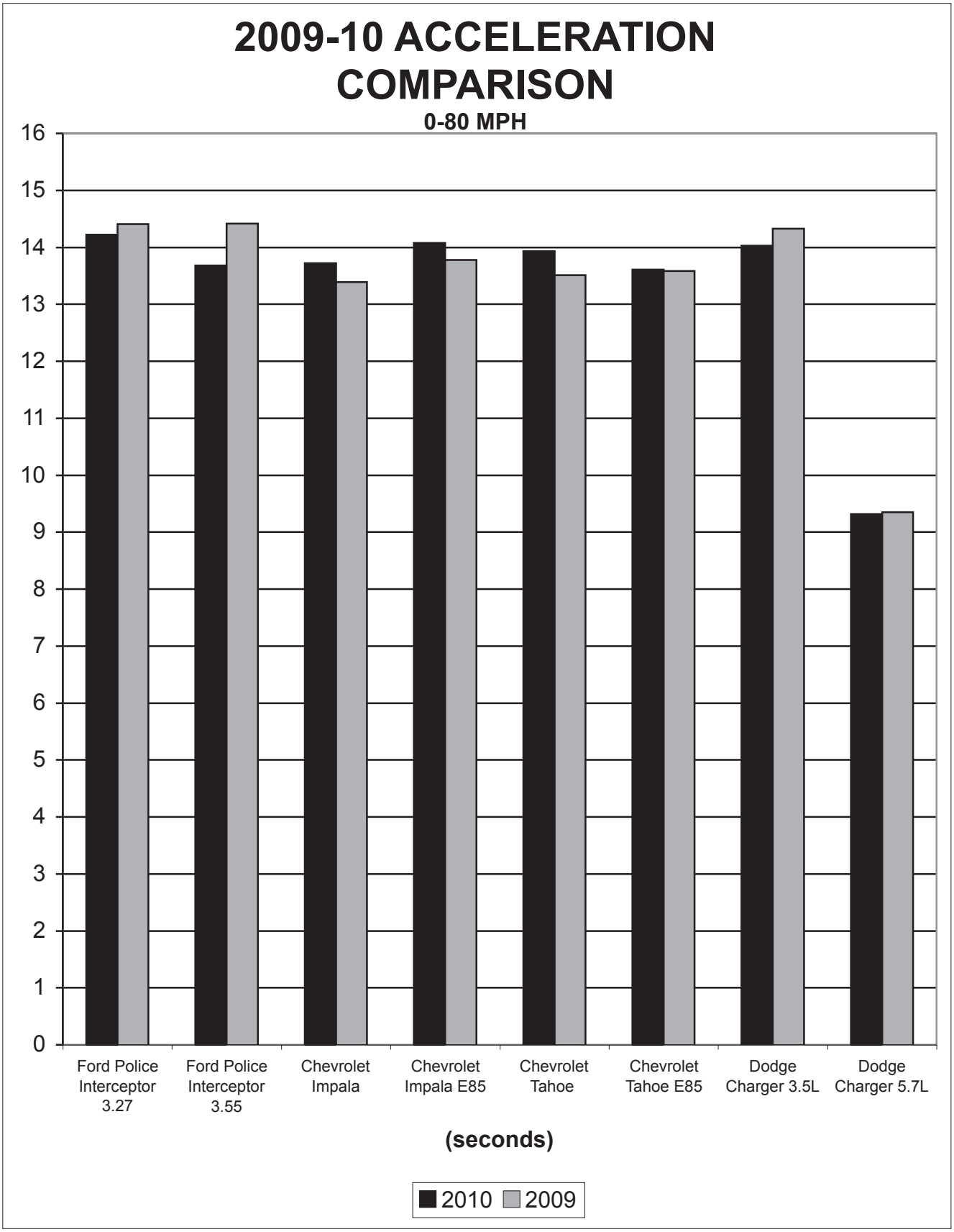
2009-10 Vehicle Dynamics Comparison

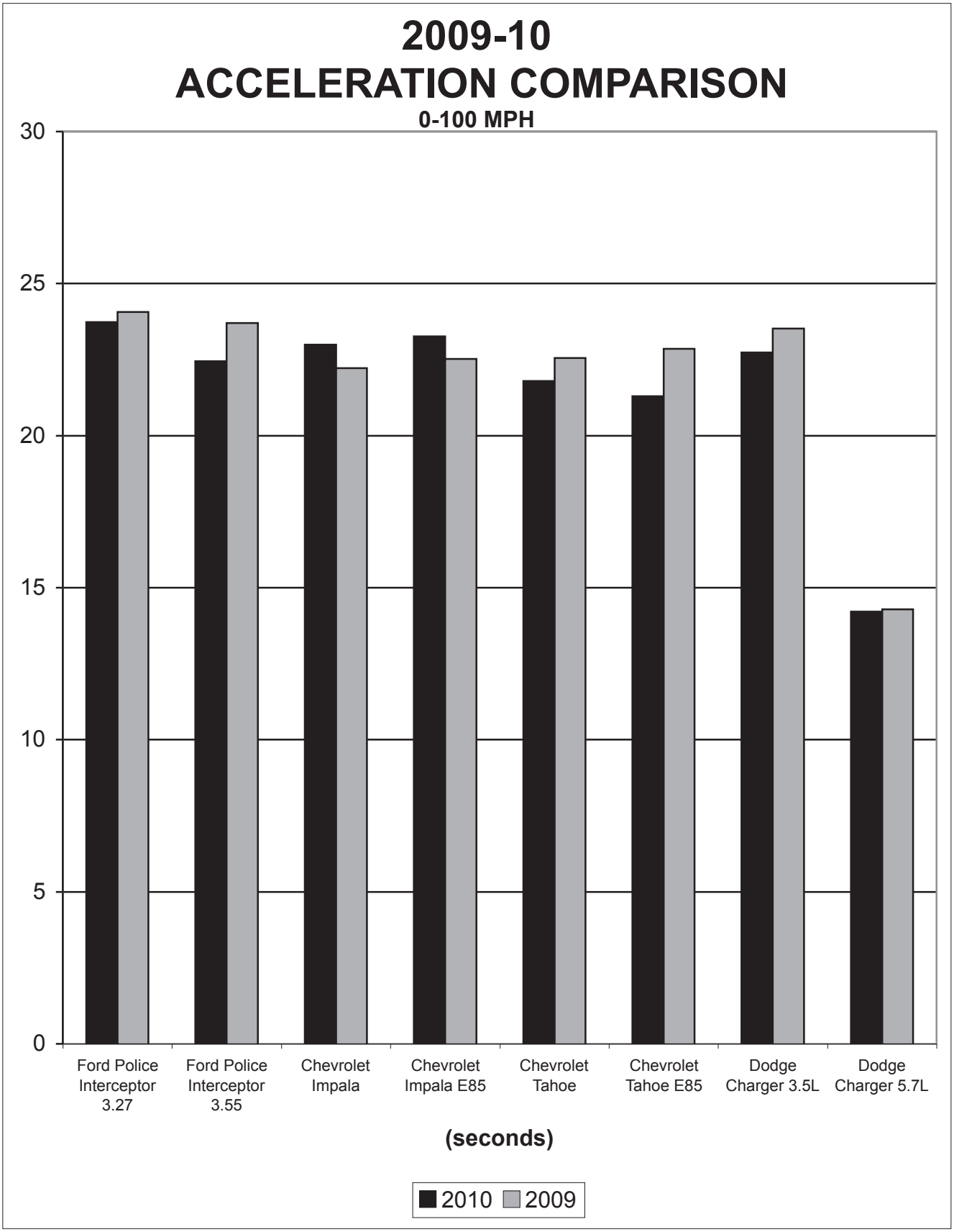
LAP TIMES



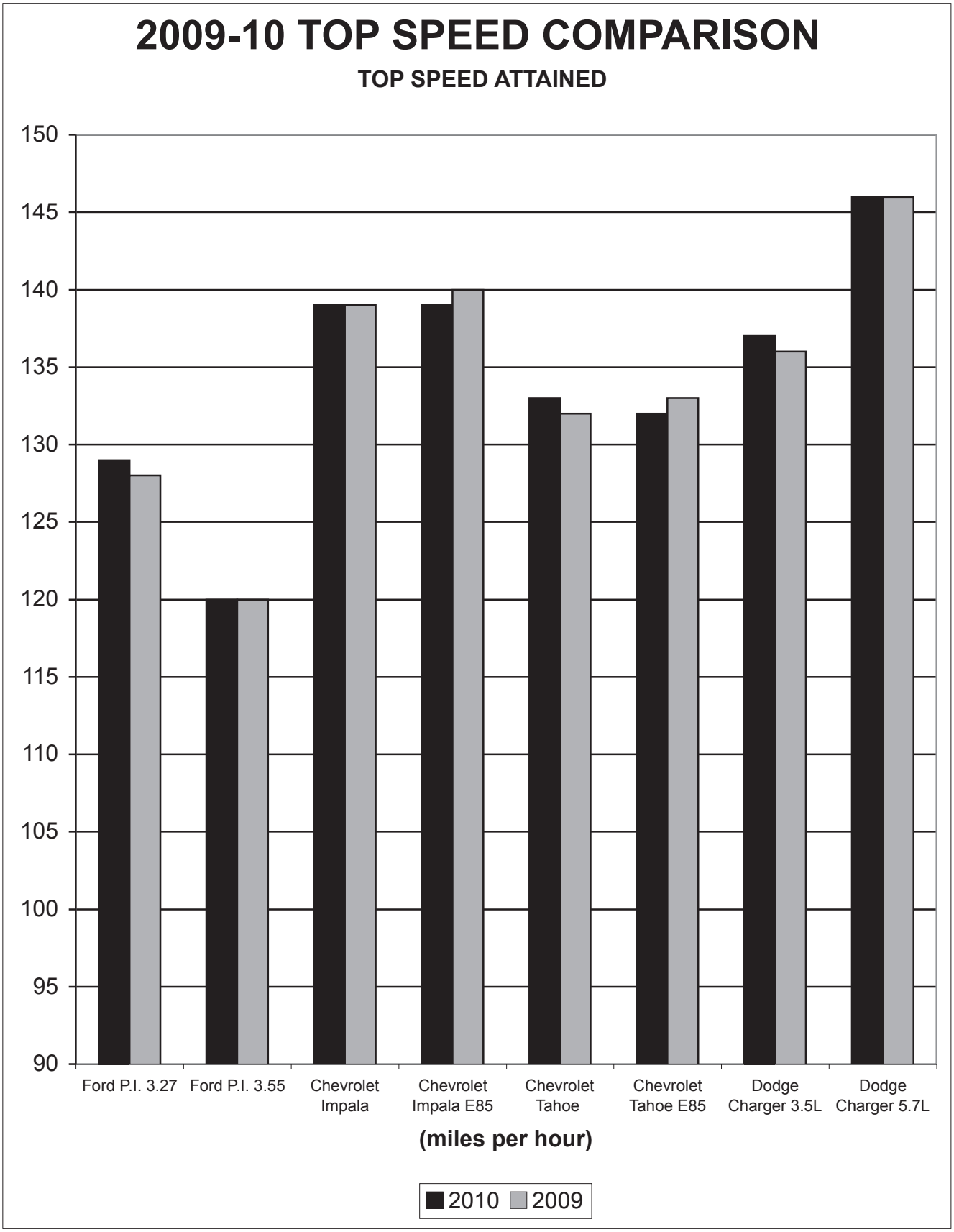
2009-10
ACCELERATION COMPARISON

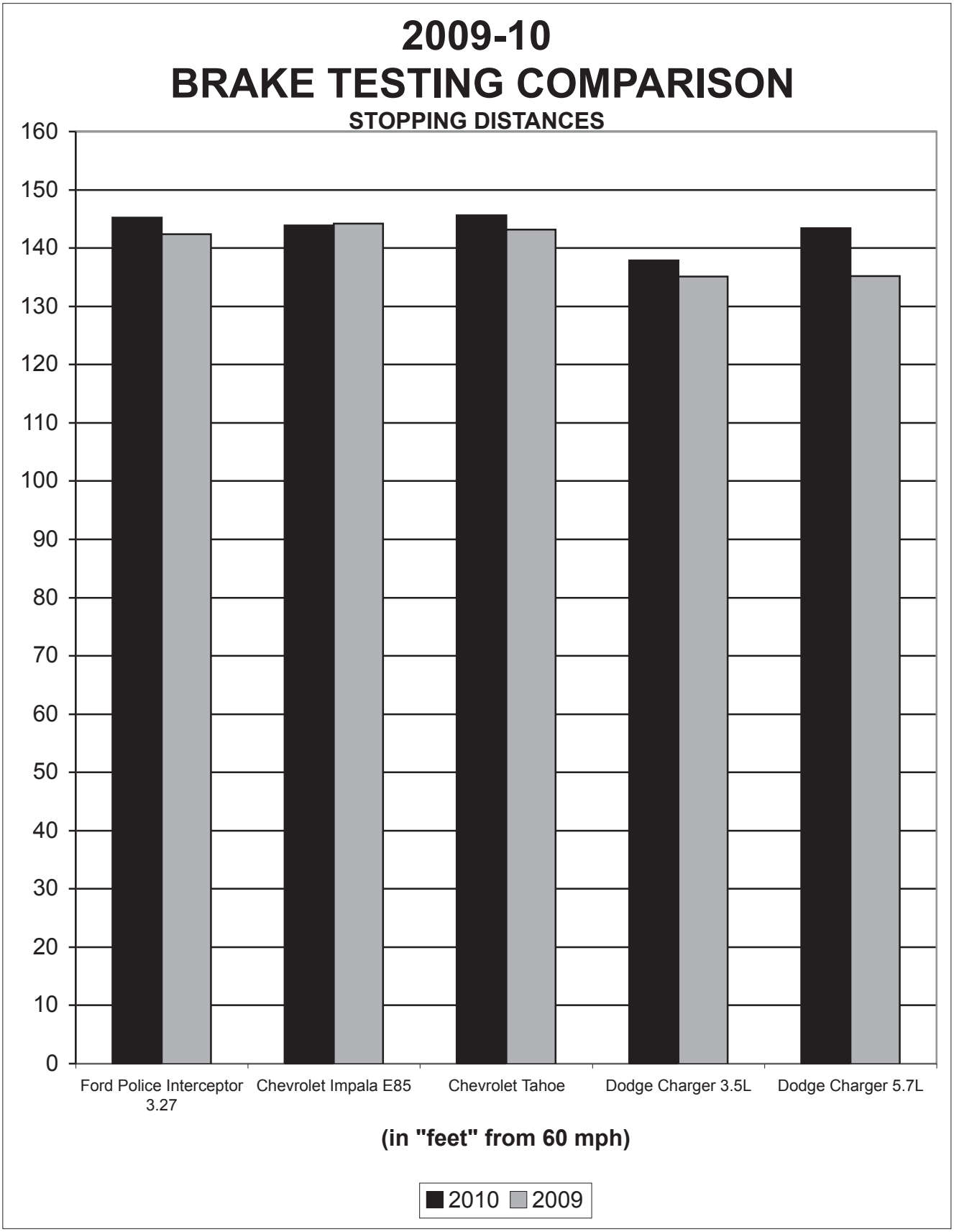



2009-10 ACCELERATION COMPARISON
0-80 MPH
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Ford Police Interceptor 3.27
Ford Police Interceptor 3.55
Chevrolet Impala
Chevrolet Impala E85
Chevrolet Tahoe
Chevrolet Tahoe E85
Dodge Charger 3.5L
Dodge Charger 5.7L
(seconds)
2010
2009


2009-10
ACCELERATION COMPARISON
0-100 MPH
30
25
20
15
10
5
0
Ford Police Interceptor 3.27
Ford Police Interceptor 3.55
Chevrolet Impala
Chevrolet Impala E85
Chevrolet Tahoe
Chevrolet Tahoe E85
Dodge Charger 3.5L
Dodge Charger 5.7L
(seconds)
2010
2009

2009-10 TOP SPEED COMPARISON




2009-10
BRAKE TESTING COMPARISON
STOPPING DISTANCES
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Ford Police Interceptor 3.27
Chevrolet Impala E85
Chevrolet Tahoe
Dodge Charger 3.5L
Dodge Charger 5.7L
(in "feet" from 60 mph)
2010
2009

MOTORCYCLES

Like many law enforcement agencies, the Michigan State Police used motorcycles up until late 1941 and then switched to automobiles. The Michigan State Police rekindled interest in motorcycles for day to day patrol operations in 1993. In 2004, Michigan State Police headquarters asked if we had additional information as a resource for our purchasing decisions regarding motorcycles. During that time, we were given direction to expand vehicle testing to include motorcycle testing. We are pleased to announce the fourth MSP police motorcycle test. We would like to thank Harley-Davidson and BMW for participating and providing their assistance in preparation for this year's successful testing program.

Please keep in mind while reading this evaluation, due to production cycles, BMW entries are model year 2009 motorcycles. BMW begins production on model year 2010 products months after this test was completed. Model year 2011 evaluation results will represent future product offerings from BMW.

When looking at the data, it is very important for the reader to apply your mission requirements to the motorcycle you are considering so you may make an appropriate decision. This report is not an endorsement of products, but a means of learning what's available for your officers so they can do their job more effectively and safely. If anything in this report requires further explanation or clarification, please call or write.

Harley Davidson Road King

TEST VEHICLE DESCRIPTION

MAKE Harley-Davidson	**MODEL** FLHP		**SALES CODE NO.**
ENGINE DISPLACEMENT	**CUBIC CENTIMETERS** 1690		**ENGINE** 2 Cyl. **CUBIC IN** 103
FUEL SYSTEM	Electronic Sequential Port FI		**EXHAUST** Two into One into Two Crossover Dual
BORE & STROKE	3.875 X 4.375		**ALTERNATOR** 50 Amp 600W
TORQUE	102 FT.LBS@3500 RPM		**BATTERY** 12V 28 amp/hour, 270CCA
COMPRESSION RATIO	9.6:1		
TRANSMISSION	**PRIMARY DRIVE** 34/46		**FINAL DRIVE** 32/68
GEAR RATIO	1st/9.593 2nd/6.650 3rd/4.938 4th/4.0 5th/3.378 6th/2.875		
LEAN ANGLE	**LEFT** 31°		**RIGHT** 33°
CLUTCH	Wet Multi-Plate		
WHEELS/TIRES	Wheels / Slotted Cast Aluminum front and rear / Front 17 X 3 / Rear 16 X 5 Tires / Front Dunlop D408F 130/80B17 Rear Dunlop D407 180/65B16		
FRONT SUSPENSION	**FORK ANGLE** 29.25°		**RAKE** 26°
REAR SUSPENSION	Swingarm w/ Air Adjustable Shocks		
SUSPENSION TRAVEL	**FRONT** 4.60 inches		**REAR** 3.0 inches
GROUND CLEARANCE, MINIMUM	5.10 inches		
BRAKE SYSTEM	Hydraulic Disc / Independent Front and Rear ABS		
BRAKES, FRONT	**TYPE** Dual Disc		**SWEPT AREA** 180 Sq.In.
BRAKES, REAR	**TYPE** Single Disc		**SWEPT AREA** 90 Sq.In.
FUEL CAPACITY	**GALLONS** 6.0		**LITERS** **22.71**
OIL CAPACITY	4.0 Quarts		
GENERAL MEASUREMENTS	**WHEELBASE** 63.54 in.		**LENGTH** 95.14 in.
	TEST WEIGHT 845 lbs		**OVERALL HEIGHT** 55.10 in.
	SEAT HEIGHT 27.30 inches / laden		
EPA MILEAGE EST. (MPG)	**CITY** 35	**HIGHWAY** 54	**COMBINED** 44.5

Harley Davidson Electra Glide

TEST VEHICLE DESCRIPTION

MAKE Harley-Davidson	**MODEL** FLHTP		**SALES CODE NO.** N/A
ENGINE DISPLACEMENT	**CUBIC CENTIMETERS** 1690		**ENGINE** 2 Cyl. **CUBIC IN** 103
FUEL SYSTEM	Electronic Sequential Port FI		**EXHAUST** Crossover Dual
BORE & STROKE	3.875 x 4.375 in		**ALTERNATOR** 50 amp 600W
TORQUE	102 FT.LBS@3500RPM		**BATTERY** 12v 28 amp hour 270CCA
COMPRESSION RATIO	9.6:1		
TRANSMISSION	**PRIMARY DRIVE** 34/46		**FINAL DRIVE** 32/68
GEAR RATIO	1st/9.593 2nd/6.650 3rd/4.938 4th/4.0 5th /3.378 6th/2.875		
LEAN ANGLE	**LEFT** 31°		**RIGHT** 33°
CLUTCH	Wet multiple plate		
WHEELS/TIRES	Wheels / Slotted Cast Aluminum front and rear / Front 17 x 3 / Rear 16 x 5 Tires / Front Dunlop D408F 130/80B17 Rear Dunlop D407 180/65B16		
FRONT SUSPENSION	**FORK ANGLE** 29.25°		**RAKE** 26°
REAR SUSPENSION	Swing Arm w/ Air Adjustable Shocks		
SUSPENSION TRAVEL	**FRONT** 4.6 in.		**REAR** 3.0 in.
GROUND CLEARANCE, MINIMUM	5.10 in.		
BRAKE SYSTEM	Hydraulic Disc / Independent Front & Rear ABS		
BRAKES, FRONT	**TYPE** Dual Disc		**SWEPT AREA** 180sq in.
BRAKES, REAR	**TYPE** Single Disc		**SWEPT AREA** 90sq in.
FUEL CAPACITY	**GALLONS** 6.0		**LITERS** 22.71
OIL CAPACITY	4.0 Qts		
GENERAL MEASUREMENTS	**WHEELBASE** 63.54 in.		**LENGTH** 95.14 in.
	TEST WEIGHT 849 lbs.		**OVERALL HEIGHT** 61 in.
	SEAT HEIGHT 27.30 in./laden		
EPA MILEAGE EST. (MPG)	**CITY** 35	**HIGHWAY** 54	**COMBINED** 44.5

BMW R1200 RTP

TEST VEHICLE DESCRIPTION

MAKE BMW 2009	**MODEL** R1200RT-P		**SALES CODE NO.** 09RB
ENGINE DISPLACEMENT	**CUBIC CENTIMETERS** 1170		**Engine** 2 Cyl. **CUBIC IN** 72
FUEL SYSTEM	BMSK-P Injection		**EXHAUST** Two into One Stainless Steel
BORE & STROKE	101 mm. x 73 mm.		**ALTERNATOR** 60 Amp 720 W
TORQUE	85 ft-lbs @ 6,000 rpm.		**BATTERY** (2) 12V 19 amp/hour Maintenance-Free
COMPRESSION RATIO	12.0:1		
TRANSMISSION	**PRIMARY DRIVE** Gear 1:1.882		**FINAL DRIVE** Shaft w/ring & pinion gear
GEAR RATIO	1:2.75 rear drive ratio		
LEAN ANGLE	**LEFT** 46°		**RIGHT** 46°
CLUTCH	Self-adjusting Hydraulic Actuating Single Plate Dry Clutch		
WHEELS/TIRES	Die-cast Aluminum MTH2 Rim / Front Dunlop Roadsmart Size 120/70ZR17 / Rear Dunlop Roadsmart Size 180/55ZR17		
FRONT SUSPENSION	**FORK ANGLE** 63.4 BMW Telelever		**RAKE** Castor in normal position 4.3 in.
REAR SUSPENSION	BMW Evo Paralever		
SUSPENSION TRAVEL	**FRONT** 4.7 in.		**REAR** 5.3 in.
GROUND CLEARANCE, MINIMUM	5.125 in.		
BRAKE SYSTEM	BMW IABS II Partially Integral Brake System		
BRAKES, FRONT	**TYPE** Dual 12.6 in. Disc		**SWEPT AREA** 186 sq. in.
BRAKES, REAR	**TYPE** Single10.4in.Disc		**SWEPT AREA** 62 sq. in.
FUEL CAPACITY	**GALLONS** 7.1		**LITERS** 27
OIL CAPACITY	4.0 Qts.		
GENERAL MEASUREMENTS	**WHEELBASE** 58.4 in.		**LENGTH** 87.8 in.
	TEST WEIGHT 679		**OVERALL HEIGHT** 56.3 in.
	SEAT HEIGHT 33.2 in. **OPTIONAL LOW SEAT** 31.2 in.		
EPA MILEAGE EST. (MPG) (Based on DIN standard test)	**CITY** 43.3*	**HIGHWAY** 48 @ 75mph 65 @ 55mph	**COMBINED** N/A

Note: *FTP (Federal Test Procedure) mileage figures indicate 43.3 mpg during exhaust emission test.

Buell Ulysses

Test Vehicle Sheet

MAKE Buell	**MODEL** XB12XP		**SALES CODE NO.**
ENGINE DISPLACEMENT	**CUBIC CENTIMETERS** 1203		**ENGINE** 2 Cyl. **CUBIC IN** 73
FUEL SYSTEM	49mm downdraft DDFI III FI		**EXHAUST** Two into One Underslung
BORE & STROKE	3.50 X 3.812		**ALTERNATOR** 30 Amp 360W
TORQUE	84 ft-lbs. @ 6000 rpm		**BATTERY** 12V 12 amp/hour, 200CCA
COMPRESSION RATIO	10.0:1		
TRANSMISSION	**PRIMARY DRIVE** 57/38		**FINAL DRIVE** 65/27
GEAR RATIO	1st/2.648 2nd/1.892 3rd/1.407 4th/1.166 5th/1.000		
LEAN ANGLE	**LEFT** 39°		**RIGHT** 39°
CLUTCH	Wet multiple plate		
WHEELS/TIRES	Wheels / Reinforced Six Spoke Cast Aluminum front and rear Front 17 X 3.5 / Rear 17 X 5.5 Tires / Front Pirelli Scorpion Sync 120/70 ZR17 Rear Pirelli Scorpion Sync 180/55 ZR17		
FRONT SUSPENSION	**FORK ANGLE** 22°		**RAKE** 23.5°
REAR SUSPENSION	Showa Coil Over Monoshock with remote reservoir and remote spring preload adjust (fully adjustable / compression, damping, rebound damping and spring preload)		
SUSPENSION TRAVEL	**FRONT** 6.51 in.		**REAR** 6.38 in.
GROUND CLEARANCE, MINIMUM	6.97 in.		
BRAKE SYSTEM	Hydraulic / Disc front and rear (ABS not available)		
BRAKES, FRONT	**TYPE** Single Disc		**SWEPT AREA** 50.1 sq in.
BRAKES, REAR	**TYPE** Single Disc		**SWEPT AREA** 34.4 sq in.
FUEL CAPACITY	**GALLONS** 4.4		**LITERS** 16.66
OIL CAPACITY	2.5 Qts.		
GENERAL MEASUREMENTS	**WHEELBASE** 54.4 in.		**LENGTH** 86.10 in.
	TEST WEIGHT 571		**OVERALL HEIGHT** n/a
	SEAT HEIGHT 31.80 in. / laden		
EPA MILEAGE EST. (MPG)	**CITY** 51	**HIGHWAY** 64	**COMBINED** 57.5


BMW G650 GS-P
POLICE
POLICE

Test Vehicle Description

MAKE BMW	**MODEL** G 650 GS-P		**SALES CODE NO.** 09FB
ENGINE DISPLACEMENT	**CUBIC CENTIMETERS** 652 cc		**ENGINE** 1-Cyl. **CUBIC IN** 40
FUEL SYSTEM	BMS-C II Engine Management with Fuel Injection		**EXHAUST** Stainless Steel with Catalytic Converter
BORE & STROKE	100 mm x 83 mm		**ALTERNATOR** 33 Amp 400 W
TORQUE	44 ft-lbs 53 hp @ 7,000 rpm		**BATTERY** 12V 12 amp/hour
COMPRESSION RATIO	11.5:1		
TRANSMISSION	**PRIMARY DRIVE** 1.946 Primary Gear Ratio		**FINAL DRIVE** 520 O'ring Chain 2.937:1
GEAR RATIO	2.750 1st, 1.750 2nd, 1.31 3rd, 1.05 4th, 0.84 5th.		
LEAN ANGLE	**LEFT** 45°		**RIGHT** 45°
CLUTCH	Seven-disc oil-bath wet clutch		
WHEELS/TIRES	Wheels / Spoke Front and Rear / Front 2.50 x 19 / Rear 3.0 x 17 Tires / Front Metzler Tourance Size 100/90x19 / Rear Metzler Tourance Size 130/80x17		
FRONT SUSPENSION	**FORK ANGLE**		**RAKE**
REAR SUSPENSION	Central spring strut actuated by lever linkage		
SUSPENSION TRAVEL	**FRONT** 6.7 in.		**REAR** 6.5 in.
GROUND CLEARANCE, MINIMUM	5.1 in.		
BRAKE SYSTEM	Hydraulic 2-channel ABS brake system. ABS disengageable		
BRAKES, FRONT	**TYPE** Single disc self-cleaning Wave design ABS		**SWEPT AREA** n/a
BRAKES, REAR	**TYPE** Single disc self-cleaning wave design ABS		**SWEPT AREA** n/a
FUEL CAPACITY	**GALLONS** 4.0		**LITERS** 15
OIL CAPACITY	2.4 Qts.		
GENERAL MEASUREMENTS Note: GVWR 739 lbs.	**WHEELBASE** 59.3 in.		**LENGTH** 86.8 in.
	TEST WEIGHT 506		**OVERALL HEIGHT** 50" without mirrors
	SEAT HEIGHT 30.7 in. **OPTIONAL LOW SEAT** 29.7 in.		
EPA MILEAGE EST. (MPG)	**CITY** 59.6	**HIGHWAY** 69.2	**COMBINED**

TEST VEHICLE DESCRIPTION SUMMARY

	Harley-Davidson FLHP	Harley-Davidson FLHTP	BMW R1200 RT-P
CUBIC CENTIMETERS	1690	1690	1170
ENGINE DISPLACEMENT – CU. IN.	103	103	72
ENGINE FUEL SYSTEM	EFI	EFI	Injection
EXHAUST	Crossover Dual	Crossover Dual	Two into One SS
BORE & STROKE	3.875x4.375 (inches)	3.875x4.375 (inches)	101x73 (mm)
ALTERNATOR	600 watts	600 watts	720 watts
TORQUE - FT. LBS.	102	102	85
BATTERY	12V 28 amp/hour	12V 28 amp/hour	(2) 12V 19 amp/hour
COMPRESSION RATIO	9.6:1	9.6:1	12.0:1
TRANSMISSION	6-Speed	6-Speed	6-Speed
PRIMARY DRIVE	34/46	34/46	1:1.882
FINAL DRIVE	32/68	32/68	Shaft w/ring & pinion
GEAR RATIO	2.875	2.875	1:2.75
LEAN ANGLE - LEFT	31°	31°	46°
LEAN ANGLE – RIGHT	33°	33°	46°
CLUTCH	Wet multi plate	Wet multi plate	Dry single plate
WHEELS/TIRES	3x16 MT/90-16 72H	3x16 MT/90-16 72H	Alum. MTH2
FORK ANGLE	29.25°	29.25°	63.4°
RAKE	26°	26°	4.3 in.
REAR SUSPENSION	Swing Arm	Swing Arm	EVO Paralever
SUSPENSION TRAVEL – FRONT	4.6 in.	4.6 in.	4.7 in.
SUSPENSION TRAVEL – BACK	3.0 in.	3.0 in.	5.3 in.
GROUND CLEARANCE-MINIMUM	5.1 in.	5.1 in.	5.125 in.
BRAKE SYSTEM	Disc/ABS	Disc/ABS	Disc/ABS
FRONT SWEPT AREA (sq. in.)	180	180	186
REAR SWEPT AREA (sq. in.)	90	90	62
FUEL CAPACITY – GALLONS	6	6	7.1
FUEL CAPACITY – LITERS	22.71	22.71	27
OIL CAPACITY – QUARTS	4	4	4
WHEELBASE	63.54	63.54	58.4
LENGTH	95.14	95.14	87.8
WEIGHT	845	849	679
OVERALL HEIGHT	55.1	61	56.3
SEAT HEIGHT	27.3	27.3	32.2
EPA MILEAGE – CITY	35	35	43.3
EPA MILEAGE - HIGHWAY	54	54	48 @ 75mph 65 @ 55mph

	Buell Ulysses	BMX G650 GS-P
CUBIC CENTIMETERS	1203	652
ENGINE DISPLACEMENT – CU. IN.	73	40
ENGINE FUEL SYSTEM	49mm DDFI	BMS-C II FI
EXHAUST	Two into One Underslung	Stainless Steel Single
BORE & STROKE	3.5 x 3.812	100mm x 83 mm
ALTERNATOR	360 watts	400 watts
TORQUE - FT. LBS.	84	44
BATTERY	12V 12 amp/hour	12V 12 amp/hour
COMPRESSION RATIO	10.0:1	11.5:1
TRANSMISSION	5-Speed	5-Speed
PRIMARY DRIVE	57/38	1.946
FINAL DRIVE	65/27	2.937:1
GEAR RATIO	1st/2.648 2nd/1.892 3rd/1.407 4th/1.166 5th/1.000	2.750 1st, 1.750 2nd, 1.131 3rd, 1.05 4th, .84 5th
LEAN ANGLE - LEFT	39°	45°
LEAN ANGLE – RIGHT	39°	45°
CLUTCH	Wet Multi-Plate	7-Disk oil-bath wet clutch
WHEELS/TIRES	Alum Spoke F17 x 3.5 R17 x 5.5	Spoke 2.50”x19 100/90 x 19 / 3.00x17 130/80x17
FORK ANGLE	22°	60.8°
RAKE	23.5°	4.5 in.
	Coil over shock/Adjustable Monoshock	Central spring strut actuated by lever linkage
SUSPENSION TRAVEL – FRONT	6.51	6.7
SUSPENSION TRAVEL – BACK	6.38	6.5
GROUND CLEARANCE-MINIMUM	6.97	5.1
BRAKE SYSTEM	Disk/Non-ABS	Disk/ABS
FRONT SWEPT AREA (sq. in.)	50.1	n/a
REAR SWEPT AREA (sq. in.)	34.4	n/a
FUEL CAPACITY – GALLONS	4.4	4.0
FUEL CAPACITY – LITERS	16.66	15
OIL CAPACITY – QUARTS	2.5	2.4
WHEELBASE	54.4	59.3
LENGTH	86.10	86.8
WEIGHT	571	506
OVERALL HEIGHT	n/a	n/a
SEAT HEIGHT	31.8	30.7
EPA MILEAGE – CITY	51	59.6
EPA MILEAGE - HIGHWAY	64	69.2

MOTORCYCLE DYNAMICS TESTING

MOTORCYCLE DYNAMICS TEST OBJECTIVE

Determine each motorcycle's high speed handling characteristics and performance in comparison to other motorcycles. The course used contains 9 turns and curves (including a 90 degree left turn, a switch back, a sweeping turn, a high speed turn and a decreasing radius, with different braking requirements) and is 1 mile in length. The course simulates actual conditions encountered in pursuit or emergency driving situations in the field, with the exception of other traffic. The evaluation is a true test of the vehicle manufacturers in offering balanced packages of acceleration capabilities, suspension components, and braking characteristics.

MOTORCYCLE DYNAMICS TEST METHODOLOGY

Each motorcycle is driven using 4 separate riders for a 6-lap series. The best 5 out of 6 laps for each rider will be totaled for a cumulative time. The cumulative time is the score for each driver. The final score of each motorcycle is the combined average from the four riders' cumulative times.

TEST DAY WEATHER

The weather during Motorcycle Dynamics Testing is shown in the table below:

DATE	TIME	TEMP F	HUMIDITY	WIND SPEED	WIND DIRECTION
9/20/2009	1:00 PM	70.8	50	5	E
9/20/2009	1:30 PM	72.6	50	5	E
9/20/2009	2:00 PM	73.1	50	6	E
9/20/2009	2:30 PM	73.9	50	6	E
9/20/2009	3:00 PM	74.4	50	5	E
9/20/2009	3:30 PM	76.5	50	3	SSW
9/20/2009	4:00 PM	70.6	50	0	---
9/20/2009	4:30 PM	71.6	50	0	---
9/20/2009	5:00 PM	80.6	50	0	---

MOTORCYCLE DYNAMICS

VEHICLES	DRIVERS	COMBINED CUMMULATIVE*
Harley-Davidson	GROMAK	06:03.70
FLHTP	JOHNSON	06:08.50
Electra Glide	TRAMMEL	06:11.50
	FLEGEL	06:00.90
Overall Average		**06:06.15**
Harley-Davidson	GROMAK	06:05.30
FLHP	JOHNSON	06:07.10
Road King	TRAMMEL	06:12.30
	FLEGEL	06:03.10
Overall Average		**06:06.95**
BMW	GROMAK	05:30.40
R1200 RTP	JOHNSON	05:41.40
	TRAMMEL	05:42.80
	FLEGEL	05:38.10
Overall Average		**05:38.18**
Buell Ulysses	GROMAK	05:20.50
	JOHNSON	05:32.20
	TRAMMEL	05:42.80
	FLEGEL	05:19.40
Overall Average		**05:28.72**
BMW G650 GS-P	GROMAK	05:30.10
Challenge	JOHNSON	05:43.00
	TRAMMEL	05:49.60
	FLEGEL	05:30.80
Overall Average		**05:38.38**

MOTORCYCLE ACCELERATION AND TOP SPEED TESTING

ACCELERATION TEST OBJECTIVE

Determine the ability of each test motorcycle to accelerate from a standing start to 60 mph, 80 mph, and 100 mph.

ACCELERATION TEST METHODOLOGY

Using a Correvit L-350 1 Axis Optical Sensor, each motorcycle 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 motorcycle within a distance of 10 miles from a standing start.

TOP SPEED TEST METHODOLOGY

Following the fourth acceleration run, each test motorcycle will continue to accelerate to the top speed attainable within 10 miles from the start of the run. The highest speed attained within the 10-mile distance will be the vehicle's score on the competitive test for top speed.

SUMMARY OF ACCELERATION & TOP SPEED

ACCELERATION*		Harley-Davidson Electra Glide	BMW R1200 RTP	Harley-Davidson Road King	Buell Ulysses	BMW G650 GS-P
0 – 20 mph	(sec.)	1.25	1.34	1.26	1.47	1.21
0 – 30 mph	(sec.)	2.04	1.97	2.05	2.26	1.96
0 – 40 mph	(sec.)	2.91	2.64	2.93	3.03	2.99
0 – 50 mph	(sec.)	4.10	3.57	4.15	3.81	4.08
0 – 60 mph	(sec.)	5.57	4.45	5.68	4.92	5.67
0 – 70 mph	(sec.)	7.37	5.80	7.47	5.98	7.80
0 – 80 mph	(sec.)	9.95	7.10	10.06	7.62	10.65
0 – 90 mph	(sec.)	13.96	9.07	13.63	9.44	15.61
0 – 100 mph	(sec.)	25.43	11.62	21.42	12.35	27.02
TOP SPEED	**(mph)**	106	127	108	108	104
QUARTER MILE						
Time	(sec.)	14.50	13.06	14.52	13.52	14.67
Speed	(mph)	90.90	104.73	91.89	103.36	88.60

BRAKE TESTING

BRAKE TEST OBJECTIVE

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

BRAKE TEST METHODOLOGY

Each motorcycle makes two decelerations at specific predetermined points on the test road from 90 – 0 mph at 22 ft/s^2, with the rider using a decelerometer to maintain the deceleration rate. Immediately after these "heat-up" stops are completed, the motorcycle turns around and makes six measured 60 – 0 mph impending skid (threshold) stops with ABS in operation, if so equipped, at specific predetermined points. 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 motorcycle's score for this test.

DECELERATION RATE FORMULA

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

EXAMPLE:

Initial Velocity = 89.175 ft/s (60.8 mph x 1.4667*)
Stopping Distance = 171.4 ft.

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

Once a motorcycle'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 motorcycle in question.

EXAMPLE:

60 mph = 88.002 ft/s x 88.002 = 7744.352 / 2 = 3872.176 / 23.198 ft/s^2 = 166.9 ft.

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds **DATE:** September 19, 2009

BEGINNING Time: 8:15 a.m. **TEMPERATURE:** 41.8°F

MAKE & MODEL: Harley-Davidson Electra Glide FLHTP **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	60.55 mph	149.22 feet	26.43 ft/s^2
Stop #2	60.37 mph	154.29 feet	25.41 ft/s^2
Stop #3	60.48 mph	148.22 feet	26.54 ft/s^2
Stop #4	60.31 mph	151.32 feet	25.85 ft/s^2
Stop #5	60.42 mph	148.27 feet	26.48 ft/s^2
Stop #6	59.67 mph	149.49 feet	25.62 ft/s^2

AVERAGE DECELERATION RATE 26.06 ft/s^2

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	60.04 mph	148.68 feet	26.08 ft/s^2
Stop #2	59.99 mph	152.25 feet	25.42 ft/s^2
Stop #3	60.97 mph	153.34 feet	26.08 ft/s^2
Stop #4	60.50 mph	151.46 feet	25.99 ft/s^2
Stop #5	60.44 mph	151.13 feet	26.00 ft/s^2
Stop #6	60.51 mph	152.76 feet	25.78 ft/s^2

AVERAGE DECELERATION RATE 25.89 ft/s^2

Phase III

	Yes/No
Evidence of severe fading?	No
Vehicle equipped with ABS?	Yes

OVERALL AVERAGE DECEL. RATE: 25.97 ft/s^2

Projected Stopping Distance from 60.0 mph 149.1 feet

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds **DATE:** September 19, 2009

BEGINNING Time: 7:35 p.m. **TEMPERATURE:** 61.8°F

MAKE & MODEL: BMW R1200RTP **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	60.54 mph	148.77 feet	26.50 ft/s^2
Stop #2	60.57 mph	156.52 feet	25.21 ft/s^2
Stop #3	60.24 mph	141.54 feet	27.58 ft/s^2
Stop #4	60.59 mph	151.02 feet	26.15 ft/s^2
Stop #5	60.20 mph	152.85 feet	25.50 ft/s^2
Stop #6	60.24 mph	146.37 feet	26.67 ft/s^2

AVERAGE DECELERATION RATE 26.27 ft/s^2

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	59.84 mph	139.67 feet	27.58 ft/s^2
Stop #2	60.59 mph	157.20 feet	25.12 ft/s^2
Stop #3	60.13 mph	152.83 feet	25.45 ft/s^2
Stop #4	60.76 mph	154.84 feet	25.65 ft/s^2
Stop #5	60.21 mph	152.51 feet	25.57 ft/s^2
Stop #6	60.99 mph	140.82 feet	28.41 ft/s^2

AVERAGE DECELERATION RATE 26.29 ft/s^2

Phase III

	Yes/No
Evidence of severe fading?	No
Vehicle equipped with ABS?	Yes

OVERALL AVERAGE DECEL. RATE: 26.28 ft/s^2

Projected Stopping Distance from 60.0 mph 147.3 feet

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds **DATE:** September 19, 2009

BEGINNING Time: 11:23 a.m. **TEMPERATURE:** 61.2°F

MAKE & MODEL: Harley-Davidson Road King FLHP **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	60.54 mph	157.36 feet	25.05 ft/s^2
Stop #2	59.53 mph	157.77 feet	24.16 ft/s^2
Stop #3	60.59 mph	156.54 feet	25.22 ft/s^2
Stop #4	60.04 mph	154.12 feet	25.16 ft/s^2
Stop #5	60.40 mph	159.52 feet	24.60 ft/s^2
Stop #6	59.75 mph	150.96 feet	25.44 ft/s^2

AVERAGE DECELERATION RATE 24.94 ft/s^2

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	59.92 mph	161.87 feet	23.86 ft/s^2
Stop #2	60.26 mph	156.16 feet	25.01 ft/s^2
Stop #3	60.07 mph	153.95 feet	25.21 ft/s^2
Stop #4	60.57 mph	155.91 feet	25.31 ft/s^2
Stop #5	59.95 mph	154.64 feet	25.00 ft/s^2
Stop #6	60.81 mph	162.05 feet	24.54 ft/s^2

AVERAGE DECELERATION RATE 24.82 ft/s^2

Phase III

	Yes/No
Evidence of severe fading?	No
Vehicle equipped with ABS?	Yes

OVERALL AVERAGE DECEL. RATE: 24.88 ft/s^2

Projected Stopping Distance from 60.0 mph 155.6 feet

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds **DATE:** September 19, 2009

BEGINNING Time: 5:43 p.m. **TEMPERATURE:** 68.9°F

MAKE & MODEL: Buell Ulysses **BRAKE SYSTEM:** **Hydraulic**

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	59.78 mph	171.07 feet	22.47 ft/s^2
Stop #2	59.92 mph	167.13 feet	23.11 ft/s^2
Stop #3	60.59 mph	169.82 feet	23.25 ft/s^2
Stop #4	60.55 mph	159.52 feet	24.72 ft/s^2
Stop #5	60.37 mph	158.81 feet	24.68 ft/s^2
Stop #6	60.23 mph	153.12 feet	25.48 ft/s^2

AVERAGE DECELERATION RATE 23.95 ft/s^2

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	60.26 mph	154.88 feet	25.22 ft/s^2
Stop #2	60.01 mph	155.34 feet	24.94 ft/s^2
Stop #3	60.61 mph	155.20 feet	25.46 ft/s^2
Stop #4	60.29 mph	162.21 feet	24.10 ft/s^2
Stop #5	59.96 mph	150.80 feet	25.64ft/s^2
Stop #6	60.27 mph	157.82 feet	24.76 ft/s^2

AVERAGE DECELERATION RATE 25.02 ft/s^2

Phase III

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

OVERALL AVERAGE DECEL. RATE: 24.49 ft/s^2

Projected Stopping Distance from 60.0 mph 158.1 feet

BRAKE TESTING

TEST LOCATION: Chrysler Proving Grounds **DATE:** September 19, 2009

BEGINNING Time: 3:25 p.m. **TEMPERATURE:** 69°F

MAKE & MODEL: BMW G650 GS-P **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	60.65 mph	163.59 feet	24.19 ft/s^2
Stop #2	60.56 mph	160.39 feet	24.60 ft/s^2
Stop #3	59.81 mph	149.96 feet	25.66 ft/s^2
Stop #4	60.49 mph	163.03 feet	24.14 ft/s^2
Stop #5	60.36 mph	166.41 feet	23.55 ft/s^2
Stop #6	60.20 mph	163.34 feet	23.86 ft/s^2

AVERAGE DECELERATION RATE 24.33 ft/s^2

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	60.56 mph	156.27 feet	25.24 ft/s^2
Stop #2	60.77 mph	160.73 feet	24.71 ft/s^2
Stop #3	60.91 mph	159.71 feet	24.99 ft/s^2
Stop #4	60.31 mph	165.44 feet	23.65 ft/s^2
Stop #5	60.55 mph	156.49 feet	25.20 ft/s^2
Stop #6	60.35 mph	160.68 feet	24.38 ft/s^2

AVERAGE DECELERATION RATE 24.70 ft/s^2

Phase III

	Yes/No
Evidence of severe fading?	No
Vehicle equipped with ABS?	Yes

OVERALL AVERAGE DECEL. RATE: 24.51 ft/s^2

Projected Stopping Distance from 60.0 mph 158.0 feet

COMMUNICATIONS

TEST OBJECTIVE

Rate each test motorcycle's ability to:

Accommodate the required communications and emergency warning equipment and assess the relative difficulty of such installations.

TEST METHODOLOGY

The installation and communications portion of the evaluation will be conducted by personnel from DIT Communications based upon the relative difficulty of the necessary installations. Each factor will be graded on a 1 to 10 scale, with 1 representing "totally unacceptable," 5 representing "average," and 10 representing "superior." The scores will be averaged to minimize personal prejudice for or against any given motorcycle.

	BMW R1200RTP	FLHP ROAD KING	FLHTP ELECTRA GLIDE	Buell Ulysses XB12XP	BMW G650 XP
Dash Access					
Ignition Fuse terminal block	4.00	4.33	4.33	3.00	4.00
Radio-Ease of Installation	5.67	5.67	5.33	4.67	4.33
Radio Interference	10.00	10.00	10.00	10.00	10.00
Radio Box					
Antenna Installation	7.33	7.00	7.00	4.33	5.67
Emergency Lights Installation	5.33	7.00	6.67	5.33	5.00
Engine Access					
Radio Power Conn.	5.33	5.67	5.67	4.67	5.67
Power/Cont.Cable	5.67	5.33	5.33	4.67	5.67
TOTAL	**56.22**	**58.67**	**57.72**	**47.39**	**51.78**

About the National Institute of Justice

NIJ is the research, development, and evaluation agency of the U.S. Department of Justice. The Institute's mission is to advance scientific research, development and evaluation to enhance the administration of justice and public safety. NIJ's principal authorities are derived from the Omnibus Crime Control and Safe Streets Act of 1968, as amended (see 42 USC §§ 3721–3723).

The NIJ Director is appointed by the President and confirmed by the Senate. The Director establishes the Institute's objectives, guided by the priorities of the Office of Justice Programs, the U.S. Department of Justice, and the needs of the field. The Institute actively solicits the views of criminal justice and other professionals and researchers to inform its search for the knowledge and tools to guide policy and practice.

Strategic Goals

NIJ has seven strategic goals grouped into three categories:

Creating relevant knowledge and tools

1. Partner with state and local practitioners and policymakers to identify social science research and technology needs.
2. Create scientific, relevant, and reliable knowledge—with a particular emphasis on terrorism, violent crime, drugs and crime, cost-effectiveness, and community-based efforts—to enhance the administration of justice and public safety.
3. Develop affordable and effective tools and technologies to enhance the administration of justice and public safety.

Dissemination

4. Disseminate relevant knowledge and information to practitioners and policymakers in an understandable, timely, and concise manner.
5. Act as an honest broker to identify the information, tools, and technologies that respond to the needs of stakeholders.

Agency management

6. Practice fairness and openness in the research and development process.
7. Ensure professionalism, excellence, accountability, cost-effectiveness, and integrity in the management and conduct of NIJ activities and programs.

Program Areas

In addressing these strategic challenges, the institute is involved in the following program areas: crime control and prevention, including policing; drugs and crime; justice systems and offender behavior, including corrections; violence and victimization; communications and information technologies; critical incident response; investigative and forensic sciences, including DNA; less- lethal technologies; officer protection; education and training technologies; testing and standards; technology assistance to law enforcement and corrections agencies; field testing of promising programs; and international crime control.

In addition to sponsoring research and development and technology assistance, NIJ evaluates programs, policies and technologies. NIJ communicates its research and evaluation findings through conferences and print and electronic media.

About the Law Enforcement and Corrections Standards and Testing Program

The Law Enforcement and Corrections Standards and Testing Program is sponsored by the Office of Science and Technology of the National Institute of Justice (NIJ), U.S. Department of Justice. The program responds to the mandate of the Justice System Improvement Act of 1979, which directed NIJ to encourage research and development to improve the criminal justice system and to disseminate the results to federal, state and local agencies.

The Law Enforcement and Corrections Standards and Testing Program is an applied research effort that determines the technological needs of justice system agencies, sets minimum performance standards for specific devices, tests commercially available equipment against those standards, and disseminates the standards and the test results to criminal justice agencies nationwide and internationally.

The program operates through the following:

- The **Law Enforcement and Corrections Technology Advisory Council** (LECTAC), consisting of nationally recognized criminal justice practitioners from federal, state, and local agencies, assesses technological needs and sets priorities for research programs and items to be evaluated and tested.

- The **Office of Law Enforcement Standards** (OLES) at the National Institute of Standards and Technology develops voluntary national performance standards for compliance testing to ensure that individual items of equipment are suitable for use by criminal justice agencies. The equipment standards developed by OLES are based on laboratory evaluation of commercially available products in order to devise precise test methods that can be universally applied by any qualified testing laboratory and to establish minimum performance requirements for each attribute of a piece of equipment that is essential to how it functions. OLES-developed standards can serve as design criteria for manufacturers or as the basis for equipment evaluation. The application of the standards, which are highly technical in nature, is augmented through the publication of equipment performance reports and user guides. Individual jurisdictions may use the standards in their own laboratories to test equipment, have equipment tested on their behalf using the standards, or cite the standards in procurement specifications.

- The **National Law Enforcement and Corrections Technology Center** (NLECTC), operated by a grantee, supervises a national compliance testing program conducted by independent laboratories. The standards developed by OLES serve as performance benchmarks against which commercial equipment is measured. The facilities, personnel, and testing capabilities of the independent laboratories are evaluated by OLES prior to testing each item of equipment. In addition, OLES helps NLECTC staff review and analyze data. Test results are published in consumer product reports designed to help justice system procurement officials make informed purchasing decisions.

Publications are available at no charge through NLECTC. Some documents are also available online through the Justice Technology Information Network (JUSTNET), the center's Internet/World Wide Web site. To request a document or additional information, call 800–248–2742 or 301–519–5060, or write:

National Law Enforcement and Corrections Technology Center
2277 Research Boulevard
Mail Stop 8J
Rockville, MD 20850
E-mail: *asknlectc@nlectc.org*
World Wide Web address: *http://www.justnet.org*

About the National Law Enforcement and Corrections Technology Center System

The NLECTC Center System

The National Law Enforcement and Corrections Technology Center (NLECTC) system supports the National Institute of Justice (NIJ) mission of providing objective, independent, evidence-based knowledge and tools to enhance the administration of justice and public safety. Offering free assistance to law enforcement, corrections, courts and other criminal justice agencies as well as crime laboratories—large or small, rural or urban and along U.S. borders —in the implementation of current and emerging technologies, the NLECTC system is an integrated network of criminal justice technology outreach, demonstration, testing and evaluation centers and Centers of Excellence.

The NLECTC system has been reorganized to make it more sustainable, efficient and effective in providing services to the criminal justice community.

Established in 1994 by the Office of Justice Programs' NIJ as part of its research, development, testing and evaluation initiatives, the NLECTC system serves as an "honest broker" resource for technology information and assistance and helps introduce technologies into practice within the criminal justice community. The mission of NLECTC is to support NIJ's research and development activities, support the transfer and implementation of technology into practice, assist in the development and dissemination of guidelines and technology standards, and provide technology assistance, information and support.

The NLECTC system seamlessly delivers its expertise to the nation's 19,000-plus police agencies; 50 state correctional systems; thousands of prisons, jails, and probation and parole departments; courts; and crime laboratories in a number of technology areas. These technology areas are supported by technology partners who provide the leveraging of unique science and engineering expertise. In addition, technology working groups and a national advisory council provide guidance relating to the technology needs and operational requirements of the public safety community for NIJ's various technology focus areas and help to ensure that NIJ's activities focus on the real-world needs of public safety agencies.

Contact NLECTC for:

Technology Information

NLECTC disseminates information to the criminal justice community at no cost through educational bulletins, equipment performance reports, guides, consumer product lists, product information databases, news summaries, meeting/conference reports, videotapes and CD-ROMs. Most publications are available in electronic form through the Justice Technology Information Network (JUSTNET) at www.justnet.org. Hard copies of all publications can be ordered through NLECTC's toll-free number, (800) 248-2742, or via e-mail at asknlectc@nlectc.org.

Technology Identification

The NLECTC system provides information and assistance to help agencies determine the most appropriate and cost-effective technology to solve an administrative operational problem. We deliver information relating to technology availability, performance, durability, reliability, safety, ease of use, customization capabilities and interoperability.

Technology Assistance

Our staff serves as proxy scientists and engineers. Areas of assistance include unique evidence analysis (e.g., audio, video, computer, trace and explosives), systems engineering, and communications and information systems support (e.g., interoperability, propagation studies and vulnerability assessments.)

Technology Implementation

We develop technology guides, best practices and other information resources that are frequently leveraged from hands-on assistance projects and made available to other agencies.

Property Acquisition
We help departments take advantage of surplus property programs that make federal excess and surplus property available to law enforcement and corrections personnel at little or no cost.

Equipment Standards and Testing
We oversee the development of performance standards and a standards-based testing program in which equipment such as ballistic- and stab-resistant body armor, double-locking metallic handcuffs and semiautomatic pistols is tested. NLECTC also conducts comparative evaluations (testing equipment under field conditions) on patrol vehicles; patrol vehicle tires and replacement brake pads; and cut-, puncture- and pathogen-resistant gloves.

Technology Demonstrations and Capacity Building
We introduce and demonstrate new and emerging technologies through special events, conferences and practical demonstrations such as the Mock Prison Riot™ and an annual public safety technology conference. We also provide hands-on training assistance for the latest technologies through workshops and software programs dealing with crime mapping, community corrections and critical incident management. In addition, on a limited basis, NLECTC facilitates deployment of new technologies to agencies for operational testing and evaluation.

To receive more information or to add your name to the NLECTC mailing list, call 800–248–2742 or 301–519–5060, or write:

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2277 Research Boulevard
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About the Office of Law Enforcement Standards

The Office of Law Enforcement Standards (OLES) was established as a matrix management organization in 1971 through a Memorandum of Understanding between the U.S. Departments of Justice and Commerce based on the recommendations of the President's Commission on Crime. OLES's mission is to apply science and technology to the needs of the criminal justice community, including law enforcement, corrections, forensic science, and the fire service. While its major objective is to develop minimum performance standards, which are promulgated as voluntary national standards, OLES also undertakes studies leading to the publication of technical reports and user guides.

The areas of research investigated by OLES include clothing, communication systems, emergency equipment, investigative aids, protective equipment, security systems, vehicles, weapons, and analytical techniques and standard reference materials used by the forensic science community. The composition of OLES' projects varies depending on priorities of the criminal justice community at any given time and, as necessary, draws on the resources of the National Institute of Standards and Technology.

OLES assists law enforcement and criminal justice agencies in acquiring, on a cost-effective basis, the high-quality resources they need to do their jobs. To accomplish this, OLES:

- Develops methods for testing equipment performance and examining evidentiary materials.
- Develops standards for equipment and operating procedures.
- Develops standard reference materials.
- Performs other scientific and engineering research as required.

Since the program began in 1971, OLES has coordinated the development of nearly 200 standards, user guides and advisory reports. Topics range from performance parameters of police patrol vehicles, to performance reports on various speed-measuring devices, to soft body armor testing, to analytical procedures for developing DNA profiles.

The application of technology to enhance the efficiency and effectiveness of the criminal justice community continues to increase. The proper adoption of the products resulting from emerging technologies and the assessment of equipment performance, systems, methodologies etc., used by criminal justice practitioners constitute critical issues having safety and legal ramifications. The consequences of inadequate equipment performance or inadequate test methods can range from inconvenient to catastrophic. In addition, these deficiencies can adversely affect the general population when they increase public safety costs, preclude arrest, or result in evidence found to be inadmissible in court.

The NLECTC Center System

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