

# LOS ANGELES COUNTY SHERIFF'S DEPARTMENT



## LAW ENFORCEMENT MOTORCYCLE TEST AND EVALUATION PROGRAM

**SUMMER 2006**

**LEROY D. BACA, SHERIFF**

# INTRODUCTION

The Los Angeles County Sheriff's Department first implemented its police vehicle testing program in 1974. Since that time, our Department has become nationally recognized as a major source of information relative to police vehicles and their use.

This year, we are proud to announce that vehicle testing has carried over to motorcycles. On June 13, 2006 and August 30, 2006, the Los Angeles County Sheriff's Department, together with the Los Angeles Police Department, conducted formalized motorcycle testing for the first time.

All major manufacturers of police motorcycles were invited to participate. BMW, Harley-Davidson, and Honda each submitted motorcycles for evaluation. The motorcycles submitted were:

The 2006 BMW - R 1200 RT-P

The 2007 Harley-Davidson Electra Glide

The 2007 Harley-Davidson Road King

The 2005 Honda - ST1300 PA

**All of the motorcycles that were submitted completed the test satisfactorily.**

The testing process is designed to address the law enforcement officer's operational requirements in terms of motorcycle performance, safety, and comfort. The fleet maintenance interest is addressed by performing an extensive mechanical evaluation on each motorcycle submitted.

Each test is designed and executed to simulate actual field use conditions as closely as possible. Law enforcement motorcycle personnel conduct the evaluations on city streets, freeways, and the performance track.

This booklet is not intended as a recommendation for any specific motorcycle contained within, nor is it designed to rank the motorcycles in any order. Our motorcycle testing program is conducted in order to accomplish two primary goals. To provide law enforcement agencies with the data necessary to assist them in the motorcycle selection process, and to provide the various motorcycle manufacturers with the input necessary to better meet the needs of law enforcement.

We recognize the fact that individual agency needs can be influenced by cost, operational considerations and other factors. As such, interpretation of test results is the responsibility of each agency, and should be made based upon that agency's needs.

It is our goal to provide law enforcement agencies with the information they require to successfully evaluate and select the right motorcycle for their needs. We believe that we have accomplished that goal.

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# **MOTORCYCLE EVALUATION PROTOCOL**

## **32 LAP HIGH - SPEED COURSE**

### **TEST RIDER'S SUBJECTIVE EVALUATION**

This evaluation is conducted on a high speed riding course. It is designed to evaluate, identify and eliminate the obvious unacceptable motorcycles (i.e., those motorcycles that are demonstrably unstable or otherwise exhibit unsafe characteristics).

For this evaluation, four riders are utilized for each motorcycle. Each rider completes eight laps around our 1.57 mile test track at the Los Angeles County Fairplex in Pomona, for a total of 32 timed laps. Lap timing is via a "HOT LAP," digital-infrared timing device, mounted on the motorcycle. The fastest and the slowest lap times are eliminated, the remaining 6 lap times are averaged. The average time and speed are recorded next to the riders' name.

Four Emergency Vehicle Operations Center motorcycle training instructors, two each from the Los Angeles County Sheriff's Department and Los Angeles Police Department share the riding and evaluation of these motorcycles.

At the conclusion of the preliminary handling portion of the evaluation, each rider completes a "Rider's Subjective Evaluation" form. If the motorcycle is judged unacceptable in this preliminary review, it is rejected and not subjected to further evaluation.

## **PURSUIT COURSE**

This evaluation is for motorcycles identified by the manufacturer as police, or law enforcement motorcycles. This evaluation is conducted on a closed 2.45 mile city street course which closely represents the environment most urban law enforcement agencies must contend with. The course has virtually no straight-a-ways and consists of right and left hand turns and obstacles in the roadway.

This is the final track evaluation, and the manufacturers, if they so choose, are allowed to rebuild the motorcycle's brake system prior to this portion of the evaluation process.

For this evaluation, two riders are utilized for each motorcycle. Each rider completes two laps around the city or "pursuit" course. Lap timing is via a "HOT LAP," digital-infrared timing device, mounted on the motorcycle. The combined times of the two laps are recorded next to the rider's name.

## **BASIC MOTORCYCLE PATTERNS**

Four circle patterns will be used to determine each motorcycle's minimum turning radius. The diameters of the circles will be 20, 19, 18, and 17 feet. The circle pattern will be entered at a speed of 2-3 MPH. Once inside the circle, the rider will make three revolutions in one direction, exit the circle and make three more revolutions in the opposite direction. The Circle pattern will be ridden in first gear without the use of brakes.

Each motorcycle will be ridden in five different 180 degree U-Turn patterns. The diameters of the U-Turns will be 20, 19, 18, 17, and 16 feet. The U-Turn will be entered at a speed of 2-3 MPH in first gear without the use of brakes. The rider will fully turn the handlebars and lean the motorcycle as necessary to complete the turn.

The 30 MPH cone weave consists of seven sets of three cones each, alternately offset from a center line at 36 foot intervals. The rider will approach the pattern from a sufficient distance to establish and maintain a speed of 30 MPH. Using counter steering, the rider will weave the motorcycle around the seven sets of cones maintaining 30 MPH, plus or minus 2 MPH. The 30 MPH cone weave represents steering or negotiating around debris or other hazards on the roadway.

The Short Cone Weave pattern utilizes eight single cones placed in a straight line at various distances. The cones will be placed at 11, 10 ½, 10 and 9 ½ foot intervals measured from cone center to cone center. The rider will negotiate the cone weave at about 1-2 MPH in first gear, utilizing the rear brake as needed. Lock-to-lock turns will be used to successfully ride the course. This exercise represents typical motorcycle maneuverability used in slow-speed enforcement riding.

All of the Basic Motorcycle Pattern Evaluation protocols will be conducted by all four riders.

## **ACCELERATION PERFORMANCE EVALUATION**

This evaluation is designed to measure motorcycle performance and control in terms of acceleration, including speed and time elapsed at the quarter mile. Although the top speed is not recorded, a minimum speed of 100 MPH is generally obtained to satisfy the requirements for high speed law enforcement patrol. Special attention will be paid to overall acceleration, stability, loss of rear wheel traction, and whether or not the front wheel lifts off the ground uncontrollably. Three runs will be made with each motorcycle. The results will be averaged.

All of the information gathered during the acceleration and subsequent brake evaluation is gathered using a "Vericom VC 2000" performance computer. This electronic device measures distance, time and speed.

## **BRAKE EVALUATION**

This evaluation procedure measures the braking response and efficiency of the motorcycle. There are three different brake evaluations. A “cold” transitional brake evaluation, wherein the brakes are tested when the motorcycle has not been ridden, a debris field braking evaluation, (also done “cold), and a “hot” brake evaluation. The hot brake evaluation is conducted after the motorcycle has been ridden for a significant time under hard braking conditions, thus allowing the brake components to reach higher temperatures.

The cold transitional brake evaluation incorporates transitioning from a dry to wet surface during braking. The motorcycle will be accelerated to 40 MPH, and at a predetermined location, the brakes will be applied. The braking application will begin on dry pavement for approximately 25 feet, and will transition to and conclude on wet pavement. Controllability of the motorcycle and its ABS operation will be evaluated. This evaluation will be conducted by all four riders.

During the cold debris field braking evaluation, the motorcycle will be accelerated to 40 mph, and at a predetermined position, the brakes will be applied. The entire brake application will take place on a roadway strewn with sand and gravel. Controllability of the motorcycle and its ABS operation will be evaluated. This evaluation will be conducted by all four riders.

The hot brake evaluation is conducted immediately following the preliminary handling evaluation (32 laps). This ensures that the brakes are evaluated after being driven at high speeds, with severe braking, thus simulating the actual operating conditions experienced by an officer in the field. This evaluation will only be conducted once, by one rider.

The hot brake evaluation is conducted by first accelerating the motorcycle to 80 MPH, then decelerating to a stop, maintaining an average deceleration rate of 22 feet per second. This procedure is repeated three additional times. The motorcycle is then immediately accelerated to 60 MPH and then stopped as quickly as possible, simulating a panic stop. That stopping distance is measured and recorded. If a brake malfunction is experienced (i.e., severe brake fading), an effort is made to detect the cause of the brake failure. If it is decided that the failure is inherent in the engineering of the brake system of the motorcycle, the evaluation is discontinued and the motorcycle is disqualified from further evaluation. If the failure is associated with a correctable situation, it is corrected and the evaluation is run again. The defect and any remedial action taken are noted in the evaluation results.

# **ERGONOMICS & RIDEABILITY EVALUATION**

## **157 MILE RIDE**

This portion evaluates the fuel efficiency and ergonomics of the motorcycle during extended field operations. It is designed to simulate the types of situations that an officer may encounter during an eight hour shift. Each motorcycle is driven four times through a 158 mile loop, once by each of the four EVOC riders. The loop covers 33.4 miles of city streets, 75.5 miles of California Freeways, 20.9 miles of Coastal Highway, and 28.3 miles of mountain canyons. No attempt is made to "baby" the motorcycle through the loop, but hard acceleration starts are avoided.

During the rideability evaluation, a minimum of fifteen simulated traffic stops will be performed while on city streets. The rider will be required to properly position the motorcycle in a safe traffic enforcement position, dismount the motorcycle, pause for a minimum of two minutes per stop, remount the motorcycle, and accelerate into traffic.

The numerical results of the evaluation are recorded and then averaged between the four riders. This average is then recorded as the final result of this portion of the evaluation. Each rider will also submit a subjective evaluation of each motorcycle at the end of the ride.

The fuel efficiency evaluation is an attempt to estimate MPG (miles per gallon) based on actual riding conditions. It is the average gas usage of all four riders, for all four loops.

This subjective evaluation is a rating of human factors done individually and independently by all four riders. The ratings are averaged to minimize personal prejudices that individuals may have for or against any given motorcycle. This evaluation rates each motorcycle comparatively for its general suitability and efficiency for patrol operations.

## **TIRE EVALUATION**

Each of our structured high speed evaluation procedures are performed with factory equipped tires. During our tire evaluation phase we examine the construction, design, road handling abilities, wear patterns and durability of tires submitted for evaluation by the motorcycle manufacturers.

For a tire to be acceptable for high speed law enforcement use it must successfully perform through 32 laps of high speed riding on our 1.57 mile road course and two laps through our high speed pursuit course.

## **HEAT EVALUATION**

Our heat evaluation is a "PASS-FAIL" scenario and is based on manufacturer's allowable operating temperatures.

Heat from each engine component is measured by means of a digital thermometer with a bi-metallic probe and infrared heat gun at the conclusion of the 32 high speed laps. This process is accomplished in the following manner:

1. Transmission Fluid            The probe is inserted into the transmission via the oil fill hole.
2. Engine Oil                    The probe is inserted into the engine case via the oil fill hole.
3. Radiator Coolant            Temperature is measured via the infrared heat gun aimed below the top radiator tank.
4. Cockpit Heat                 Temperature is measured utilizing the digital thermometer with the bi-metallic probe placed approximately 6 inches from the engine/transmission case, exhaust header and pipes, and body panels.
5. Outside Air                  Temperature is measured away from the motorcycle and in direct sunlight.

## **MECHANICAL EVALUATION**

The mechanical evaluation evaluates the day to day serviceability and maintenance of the motorcycle. It is performed by mechanics employed by the Los Angeles Sheriff's Department and also by mechanics employed by the Los Angeles Police Department. The results are then averaged.

Major consideration is given toward the accessibility and ease of repair of component parts for the purpose of obtaining a predictive evaluation of the time, and ease of major repairs. The specific factors considered in evaluating each component are enumerated on the Mechanical Evaluation form.

## **SOUND LEVEL EVALUATION**

The sound level evaluation measures the sound levels emitted by the motorcycle at different speeds. This evaluation is conducted at 40 MPH, 60 MPH, 80 MPH, and while accelerating from 0 to 80 MPH. The db ratings are recorded with an EXTECH digital sound level meter. The sound level meter's microphone is mounted at the riders shoulder level, approximately 6 inches from his ear. During the fixed speed portion of the evaluation, the rider will accelerate to the identified speed, and after attaining that speed, will turn on the EXTECH meter and record the result. During the acceleration portion of the evaluation, the meter will be turned on, and the motorcycle will be accelerated to 80 MPH. The meter will record the highest db rating achieved during the entire acceleration of the motorcycle.

# **MOTORCYCLE SPECIFICATIONS**

# MOTORCYCLE SPECIFICATIONS

## 2006 BMW POLICE MOTORCYCLE – R 1200 RT-P

<b>Vehicle Description:</b>	Full size, Sport Touring, Police Package motorcycle
<b>Engine Type:</b>	1170cc air/oil cooled 2 cylinders
<b>Bore and Stroke:</b>	101mm x 73mm
<b>Compression Ratio:</b>	12.0:1
<b>Valve Train:</b>	4 valves per cylinder
<b>Carburetor / Fuel Injection:</b>	Electronic intake pipe injection
<b>Ignition:</b>	Digital engine management BMS-K w/ dual ignition
<b>Horsepower:</b>	110 bhp @ 7,500 rpm
<b>Torque:</b>	115 Nm. @ 6000 rpm
<b>Final Drive (shaft, chain, belt):</b>	Shaft 1:2.75 ratio
<b>Dry Weight:</b>	650 lbs
<b>Alternator Output:</b>	720 watt, 27 amps at idle
<b>Battery:</b>	19AH linked gel (2)
<b>Transmission:</b>	6 speed
<b>Clutch:</b>	Single disc, dry clutch
<b>Suspension,</b>	
<b>Front:</b>	Special front shock strut police application, 4.7 inches of travel
<b>Rear:</b>	Special travel-dependent damping system, 5.3 inches of travel
<b>Brakes,</b>	
<b>Front:</b>	Dual front disc IABS partial integral system
<b>Rear:</b>	Single rear disc, independent rear brake control
<b>Tires:</b>	Fr - 120/70ZR-17    Rr - 180/55ZR-17
<b>Wheels:</b>	Die cast aluminum
<b>Wheelbase:</b>	58.4 inches
<b>Rake:</b>	63.4 degree
<b>Trail:</b>	4.3 inches castor
<b>Fuel Tank Capacity:</b>	7.1 gallons w/ 1 gallon reserve
<b>EPA Fuel Mileage:</b>	
<b>Seat Height:</b>	760-780 mm
<b>Adjustments:</b>	yes
<b>Windscreen:</b>	
<b>Adjustable / Fixed</b>	Adjustable, electric
<b>Foot peg / Floorboard Position:</b>	Foot Peg
<b>Saddlebag Storage Capacity:</b>	23 liters each, top opening

# MOTORCYCLE SPECIFICATIONS

## 2007 HARLEY-DAVIDSON – ELECTRA GLIDE

<b>Vehicle Description:</b>	Full size, Touring, Police Package motorcycle
<b>Engine Type:</b>	1690cc air/oil cooled 2 cylinders Twin Cam
<b>Bore and Stroke:</b>	98.55mm x 111.13mm
<b>Compression Ratio:</b>	9.6: 1
<b>Valve Train:</b>	2 valves per cylinder
<b>Carburetor / Fuel Injection:</b>	Electronic Sequential Port Fuel Injection (ESPFI)
<b>Ignition:</b>	Electronic
<b>Horsepower:</b>	84 bhp @ 5000 rpm
<b>Torque :</b>	102 ft. /lbs @ 2500 rpm
<b>Final Drive (shaft, chain, belt):</b>	Drive belt, 32/66 ratio
<b>Dry Weight:</b>	758 lbs
<b>Alternator Output:</b>	Three-phase 50-Amp system, 585w @ 13V, 2000 rpm, 650 watt max @ 13V
<b>Battery:</b>	Sealed, maintenance –free; 12 volt, 28 amp/hour.
<b>Transmission:</b>	6 speed
<b>Clutch:</b>	9 plate, wet
<b>Suspension,</b>	
<b>Front:</b>	41.3mm telescopic cartridge, 4.6 inches of travel
<b>Rear:</b>	Air adjustable shocks, 3.0 inches of travel
<b>Brakes,</b>	
<b>Front:</b>	Dual front disc 11.5 in. x .20 in.
<b>Rear:</b>	Single disc w/ABS 11.5 in. x .23 in
<b>Tires:</b>	Fr – MT90B/16 72H Rr – MT90B/16 72H
<b>Wheels:</b>	Black, 9 – spoke cast aluminum
<b>Wheelbase:</b>	63.5 inches
<b>Rake:</b>	26 degrees
<b>Trail:</b>	6.2 inches
<b>Fuel Tank Capacity:</b>	5.0 gallons
<b>EPA Fuel Mileage:</b>	46 hwy / 39 city
<b>Seat Height:</b>	27.3 in. (laden) 30.7 in. (unladen)
<b>Adjustments:</b>	Air adjustable
<b>Windscreen:</b>	Fixed
<b>Foot peg / Floorboard Position:</b>	Floorboard
<b>Saddlebag Storage Capacity:</b>	1690 cubic inches each, (without ABS) top opening

## MOTORCYCLE SPECIFICATIONS

### 2007 HARLEY-DAVIDSON – ROAD KING

<b>Vehicle Description:</b>	Full size, Touring, Police Package motorcycle
<b>Engine Type:</b>	1690cc air/oil cooled 2 cylinders Twin Cam
<b>Bore and Stroke:</b>	98.55mm x 111.13mm
<b>Compression Ratio:</b>	9.6: 1
<b>Valve Train:</b>	2 valves per cylinder
<b>Carburetor / Fuel Injection:</b>	Electronic Sequential Port Fuel Injection (ESPFI)
<b>Ignition:</b>	Electronic
<b>Horsepower:</b>	84 bhp @ 5000 rpm
<b>Torque :</b>	102 ft. /lbs. @ 2500 rpm
<b>Drive (shaft, chain, belt):</b>	Drive belt, 32/66 ratio
<b>Dry Weight:</b>	723 lbs.
<b>Alternator Output:</b>	Three-phase 50-Amp system, 585w @ 13V, 2000 rpm, 650 watt max @ 13V
<b>Battery:</b>	Sealed, maintenance –free; 12 volt, 28 amp/hour.
<b>Transmission:</b>	6 speed
<b>Clutch:</b>	9 plate, wet
<b>Suspension,</b>	
<b>Front:</b>	41.3mm telescopic cartridge, 4.6 inches of travel
<b>Rear:</b>	Air adjustable shocks, 3.0 inches of travel
<b>Brakes,</b>	
<b>Front:</b>	Dual front disc 11.5 in. x .20 in.
<b>Rear:</b>	Single disc w/ABS 11.5 in. x .23 in
<b>Tires:</b>	Fr – MT90B16 72H, Rr – MT90B16 72H
<b>Wheels:</b>	Black, 9 – spoke cast aluminum
<b>Wheelbase:</b>	63.5 inches
<b>Rake:</b>	26 degrees
<b>Trail:</b>	6.2 inches
<b>Fuel Tank Capacity:</b>	5.0 gallons
<b>EPA Fuel Mileage:</b>	46 hwy / 39 city
<b>Seat Height:</b>	27.3 inches (laden) 30.7 inches (unladen)
<b>Adjustments:</b>	Air adjustable
<b>Windscreen:</b>	Fixed
<b>Foot peg / Floorboard Position:</b>	Floorboard
<b>Saddlebag Storage Capacity:</b>	1690 inches each, (without ABS) top opening

# MOTORCYCLE SPECIFICATIONS

## **2005 HONDA POLICE MOTORCYCLE - ST 1300 PA**

<b>Vehicle Description:</b>	Full size, Sport Touring, Police Package motorcycle
<b>Engine Type:</b>	1261cc liquid cooled 90 degree V-4
<b>Bore and Stroke:</b>	78mm x 66mm
<b>Compression Ratio:</b>	10.8:1
<b>Valve Train:</b>	DOHC, 4 valves per cylinder
<b>Carburetor / Fuel Injection:</b>	PGM-FI with automatic enricher circuit
<b>Ignition:</b>	Computer Controlled digital w/ 3 dimensional mapping
<b>Horsepower:</b>	125 bhp @ 8000 rpm
<b>Torque:</b>	85 lb. /ft. @ 6000 rpm
<b>Final Drive (shaft, chain, belt):</b>	Shaft
<b>Dry Weight:</b>	679 lbs
<b>Alternator Output:</b>	660 watt, high output
<b>Battery:</b>	
<b>Transmission:</b>	Five speed
<b>Clutch:</b>	8 plate wet, hydraulic
<b>Suspension,</b>	
<b>Front:</b>	45mm HMAS cartridge fork, 4.6 inches of travel
<b>Rear:</b>	HMAS gas-charged single shock, 4.8 inches of travel
<b>Brakes,</b>	
<b>Front:</b>	Dual full floating 310mm floating front discs
<b>Rear:</b>	Single 3/16mm rear disc with ABS
<b>Tires:</b>	Fr - 120/70ZR-18   Rr - 170/60ZR-17
<b>Wheels:</b>	3 spoke U-section cast aluminum
<b>Wheelbase:</b>	58.7 inches
<b>Rake:</b>	26.0 degree
<b>Trail:</b>	98mm / 3.9 inches
<b>Fuel Tank Capacity:</b>	7.7 gallons
<b>EPA Fuel Mileage:</b>	
<b>Seat Height:</b>	31.1 inches (+/- 0.6 inches)
<b>Adjustments:</b>	3 positions
<b>Windscreen:</b>	
<b>Adjustable / Fixed</b>	Adjustable, electric, 7.4 inches & 13 degrees adjustability
<b>Foot peg / Floorboard Position:</b>	Foot Peg
<b>Saddlebag Storage Capacity:</b>	35 liters each, side opening, detachable

# **BASIC MOTORCYCLE PATTERNS**

## **BASIC MOTORCYCLE PATTERNS**

<b>2006 BMW POLICE MOTORCYCLE – R 1200 RT-P</b>					
<b>PATTERN</b>	<b>20 FT.</b>	<b>19 FT.</b>	<b>18 FT.</b>	<b>17 FT.</b>	<b>16 FT.</b>
Circle	Yes	Yes	Yes	No	N/A
U-Turn	Yes	Yes	Yes	Yes	Yes
<b>PATTERN</b>	<b>11 FT.</b>	<b>10 ½ FT.</b>	<b>10 FT.</b>	<b>9 ½ FT.</b>	
Short Cone Weave	Yes	Yes	Yes	Yes	
<b>PATTERN</b>	<b>CONSIDERATION</b>			<b>RATING**</b>	
30 MPH Cone Weave	Counter steering effort / Bike Drag			8	
<b>RIDER COMMENTS</b>					
<p><u>DEPUTY S. BRYANT:</u>            30 MPH cone weave – The suspension can really be felt as it compresses and rebounds while counter-steering through the cone patterns.</p> <p>Circle – Extreme lean angle must be applied at these measurements when using clutch/throttle control and no braking. Uncertain if the average rider would apply such lean angle.</p>					
<p><u>OFFICER M. NOWLEN:</u>            High center of gravity; leans over quickly at slow speeds, good turning radius, clutch heats up quickly and is hard to maintain friction point for prolonged periods. Good clearance on cone weave. Rear top-box is high and is hard to dismount and mount from high side. Windshield adjusts downward to provide good visibility for cone weaves.</p>					
<p><u>DEPUTY M. BROWN:</u>            30 MPH cone weave – The rear suspension travel and rebound was a little soft. A minor adjustment to lessen travel would improve the handling in this exercise.</p> <p>Circle &amp; U-turn – Steering and handling were predictable and light. Good clutch and throttle operation.</p>					
<p><u>OFFICER P. WALTERS:</u>            The BMW felt solid during the short cone weave, however, the clutch overheated and I felt a loss of friction point control. Handlebar transition during the cone weave was very smooth. I rated the 30 MPH cone weave at a 7, due to the fact that the weight transfer required more input between cones.</p>					

\*\* Rating Scale – 1 thru 10; 1 - Poor; 5 - Average; 10 – Outstanding

## **BASIC MOTORCYCLE PATTERNS**

<b>2007 HARLEY-DAVIDSON – ELECTRA GLIDE</b>					
<b>PATTERN</b>	<b>20 FT.</b>	<b>19 FT.</b>	<b>18 FT.</b>	<b>17 FT.</b>	<b>16 FT.</b>
Circle	Yes	Yes	Yes	No	N/A
U-Turn	Yes	Yes	Yes	Yes	Yes
<b>PATTERN</b>	<b>11 FT.</b>	<b>10 ½ FT.</b>	<b>10 FT.</b>	<b>9 ½ FT.</b>	
Short Cone Weave	Yes	Yes	Yes	Yes	Yes
<b>PATTERN</b>	<b>CONSIDERATION</b>			<b>RATING**</b>	
30 MPH Cone Weave	Counter steering effort / Bike Drag			8	
<b>RIDER COMMENTS</b>					
<p><u>DEPUTY S. BRYANT:</u>            U-turn – Turns nicely in wide turns. Does not turn as well in the 16-foot turns because the wire loom is in the way. Clutch and throttle smooth.</p> <p>Circle – Feel as if you are bending forward at the waist while turning. The reach seems far. Tighter turns are easier to the left than to the right because of the wiring loom on the right side. The Road King seems to turn easier than the Electra Glide.</p> <p>Short cone weave – Good clutch and throttle response, smooth operation. I am 5’9 and if I sit in the saddle it’s a long reach for lock-to-lock turns. I found myself really bent forward at the waist. If I slid all the way forward in the seat the turns were much easier I was sitting almost upright and found it easier to maintain my balance.</p> <p>30 mph cone weave – Handles well in the 30 mph cone weave, smooth operation with no major suspension action. Doesn’t feel as nimble as the Road King.</p>					
<p><u>OFFICER M. NOWLEN:</u>            U-turn/Circles – Good control on entry and exit. Leans over good, but at times it hits the lower frame when turning to the right. Clutch operation is very good. Side stand scrapes in the 17 and 18 foot circles. In the left circles there is no room for error once contact is made with floorboards; will quickly pivot out and rear tire breaks contact with the ground.</p> <p>Cone weave – Good performance while slow riding. Clutch responds well while friction-point riding, holds up even during prolonged slow riding. The rider feels a lot of heat. Has good throttle input at low RPM. The motorcycle is much easier to ride during slow cone patterns when the rider sits forward in the seat.</p> <p>30 mph cone weave – The motorcycle response is good, but is a little slow on the handlebar input. The transition from side to side is slow.</p>					

## **ELECTRA GLIDE – Continued**

### DEPUTY M. BROWN:

U-turn – Good clutch and throttle control during the exercise. There is a loom of wires on the right side of the gooseneck that restricts right turns. Turned better to the left than to the right due to the location of the wiring.

Circle – Twenty and 19 foot circles were fairly easy. The 18 foot circle was more easily negotiated to the left than to the right due to the wire loom restriction

Short cone weave – The motorcycle has good slow-speed control. There was very little room for turn corrections in the 9 ½ foot pattern. The right turn restriction, due to the placement of the wire loom along the right side of the steering stem, did not interfere with turning as much as it did in the circle patterns.

30 mph cone weave – The bike handled very smoothly through the cone weave. There was very little counter-steering effort needed to accomplish the pattern. Even with the bike's low ground clearance, no dragging issues were experienced.

### OFFICER P. WALTERS:

U-turn – Very smooth turning in both directions. At 16', the right turn felt tighter than to the left. The wire loom limits the turning to the right.

Circle patterns – Both left and right directions were very smooth. The 17 foot left turn required dragging the footboard and the frame. Unable to complete the right due to the wire loom limits.

Short cone weave – Required upper body control to maintain constant forward motion to smoothly complete the exercises. Clutch action was good and the throttle was smooth. The fork mounted fairing made the front end feel a little heavy compared to the Road King.

\*\* Rating Scale – 1 thru 10; 1 - Poor; 5 - Average; 10 – Outstanding

## **BASIC MOTORCYCLE PATTERNS**

<b>2007 HARLEY-DAVIDSON - ROAD KING</b>					
PATTERN	20 FT.	19 FT.	18 FT.	17 FT.	16 FT.
Circle	Yes	Yes	Yes	Yes	N/A
U-Turn	Yes	Yes	Yes	Yes	Yes
PATTERN	11 FT.	10 ½ FT.	10 FT.	9 ½ FT.	
Short Cone Weave	Yes	Yes	Yes	Yes	Yes
PATTERN	CONSIDERATION			RATING**	
30 MPH Cone Weave	Counter steering effort / Bike Drag			8.6	
<b>RIDER COMMENTS</b>					
<p><u>DEPUTY S. BRYANT:</u>            U-turn – Smooth clutch and throttle operation. Turns smoothly but I had difficulty making tight right turns (16 foot circle) due to the wire loom.</p> <p>Circle – Feels as if you are bending forward at the waist while turning. The reach seems far. Tighter turns are easier to the left than to the right because of the wiring loom on the right side. The Road King seems to turn easier than the Electra Glide.</p> <p>Short cone weave – Good clutch and throttle response, smooth operation. I am 5’9 and if I sit in the saddle it’s a long reach for lock-to-lock turns. I found myself really bent forward at the waist. If I slid all the way forward in the seat the turns were much easier. I was sitting almost upright and found it easier to maintain my balance. Turns a little easier than the Electra Glide.</p> <p>30 mph cone weave - Handles well in the 30 mph cone weave, smooth operation with no major suspension action. Seems to handle a little better than the Electra Glide, feels more nimble.</p>					
<p><u>OFFICER M. NOWLEN:</u>            U turn/circles – Clutch operates well at low RPM. Great visibility, turning radius to the right is diminished due to wiring harness run next to frame. Plenty of room to turn to the left. When turning to the right, the handle-bar hits the wiring harness (or bump stop) and the rider has to compensate with greater lean angle.</p> <p>Cone weave – Good clearance front and back; the rider has good view of side bags, making it easier to negotiate thru cones, handle-bars are at a good position for slow riding. Easy to operate hand controls, again clutch works well for slow riding.</p> <p>30 mph cone weave – Good handle bar position, handlebars are easy to turn side-to-side (no weight on the bars) a little difficult to level speed off, due to the location of the speedometer.</p>					

## ROAD KING - Continued

### DEPUTY M. BROWN:

U-turn – Good clutch and throttle feel. There is a wire loom mounted along the right side of the steering stem. The bike turned better left than it does right due to the location of the wires. This bike, however, turned better in both directions than the Electra Glide did.

Circle – Turned well in both directions in the 20' and 19' circles. I was able to complete the left turn in both the 18' and 17' circles. I was not able to turn right in either the 18' or 17' circles due to the turning restriction created by the mounting location of the wire loom next to the right side of the steering stem.

Short cone weave – Good slow-speed control. Able to negotiate all 4-pattern distances. There was very little room for turn corrections in the 9 1/2' pattern. The right turn restriction, due to the placement of the wire loom along the right side of the steering stem, did not interfere with turning as much as it did in the circle patterns.

30 mph cone weave – Handled very smoothly through the cone weave. There was very little counter-steering effort needed to accomplish the pattern. Even with the low ground clearance, no bike dragging issues were noted. Additionally, the handling of the Road King was slightly more nimble than that of the Electra Glide.

### OFFICER P. WALTERS:

The Road King feels lighter during handlebar transition. Turning to the left was better than to the right. Once again, the wires appear to limit the turning radius.

Circle – Both left and right were very smooth until the 17' left turn. It required dragging the footboard and the frame. Unable to complete the right due to the wire loom limits.

Short cone weave – Smooth and precise. The front end has a lighter feel than the Electra Glide. Good balance, clutch, throttle control and overall the Road King completed the exercise with ease.

30 mph cone weave – In order to maintain 30 MPH through the pattern, I had to look down at the speedometer, taking my vision away from the next set of cones. The Road King was easy to maneuver both left and right while counter steering.

\*\* Rating Scale – 1 thru 10; 1 - Poor; 5 - Average; 10 – Outstanding

## **BASIC MOTORCYCLE PATTERNS**

<b>2005 HONDA – ST 1300 PA</b>					
PATTERN	20 FT.	19 FT.	18 FT.	17 FT.	16 FT.
Circle	Yes	Yes	Yes	Yes	N/A
U-Turn	Yes	Yes	Yes	Yes	Yes
PATTERN	11 FT.	10 ½ FT.	10 FT.	9 ½ FT.	
Short Cone Weave	Yes	Yes	Yes	Yes	Yes
PATTERN	CONSIDERATION			RATING**	
30 MPH Cone Weave	Counter steering effort / Bike Drag			8.5	
<b>RIDER COMMENTS</b>					
<p><u>DEPUTY S. BRYANT:</u> 30 mph cone weave – Handles and responds very well for this exercise. The suspension was firm and counter-steering was easy.</p> <p>Circle 18’/17’ - Must apply extreme lean angle at these measurements when using clutch/throttle control with no brake. I don’t know if the average motor would apply such lean angle.</p>					
<p><u>OFFICER M. NOWLEN:</u> Very good acceleration (smooth and quiet), good low center of gravity, clutch is good when slow riding for long periods, shift easy, does not feel heavy when leaned over, easy to recover from the leaned position. Smooth and quick handlebar transitions at both high and low speeds. Riding position is too far forward; this results in a lot of hand and arm pressure. Small, hard seat.</p>					
<p><u>DEPUTY M. BROWN:</u> 30 mph cone weave – had light, predictable counter-steering, very nice transition from right to left and back again, no ill effects, no dragging.</p> <p>17’ circle – Had to establish a steep lean angle in order to complete the circle. Clutch had a very predictable friction point for a smooth application of power.</p>					
<p><u>OFFICER P. WALTERS:</u> The wet clutch remained consistent during all circle and U-turn patterns (no fade). Handlebar transition for the short cone weave was smooth and required little input.</p> <p>30 mph cone weave – Very smooth and controllable. Weight transfer was minimum.</p>					

\*\* Rating Scale – 1 thru 10; 1 - Poor; 5 - Average; 10 – Outstanding

**32 LAP HIGH SPEED COURSE**  
**MOTORCYCLE DYNAMICS**  
**EVALUATION**

## 32 LAP HIGH SPEED COURSE MOTORCYCLE DYNAMICS EVALUATION

### 2006 BMW POLICE MOTORCYCLE – R 1200 RT-P

RIDER	LAPS	AVG. TIME	AVG. SPEED
DEPUTY S. BRYANT, LASD	1 thru 8	1.23.59	67.6
OFFICER M. NOWLEN, LAPD	9 thru 16	1.23.75	67.5
DEPUTY M. BROWN, LASD	17 thru 23	1.24.86	66.0
OFFICER P. WALTERS, LAPD	24 thru 32	1.29.05	63.5

ITEM	RATING**
STEERING	9.0
LEAN ANGLE	8.3
SUSPENSION	7.3
BRAKE FADE	9.3
ABS OPERATION	9.6

\*\*Rating Scale 1 – 10 / 1 -Poor / 5 – Average / 10 - Outstanding

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u> Acceleration and handling is very good. Has a good feel of the roadway and turns in the corners very well. Under very hard braking at the end of the straight-a-way, it feels like there is a lot of weight transfer compressing the front and rebounding to the rear. This feels so extreme that it causes the rear end to “fish tail”. Generally the “wobble” is controllable, but during one heavy braking application it felt extreme. When leaning the bike aggressively in a turn, you will begin to drag the front engine guards (crash bars) this can become a pivot point for the motorcycle causing it to wash out. When accelerating hard out of a turn you can feel a slight “walking out” or “scuff out”, but it is controllable. Foot pegs allow drag.</p>
<p><u>OFFICER M. NOWLEN:</u> The first thing you notice on this bike is the high seat position and top box (radio box). Hard to throw your leg over, even for a six foot tall person. Upon starting the engine and shifting into gear, the transmission “clinked” and was reluctant to go into gear. Once moving, the bike felt nimble, with easy handlebar transition. Comes up through the gears smoothly with consistent power. Great leg positioning with plenty of room to move in the riding position. Great rear seat bracing. Suspension rides smooth at high speeds. Under hard braking the rear tightens up. But is predictable. Handles great through turns, even when encountering bumps (forgiving). Very consistent acceleration out of the turns. Easy to ride motorcycle.</p>

## **BMW - Continued**

DEPUTY M. BROWN:

Braking hard to the point of entering ABS mode lightened the rear of the motorcycle and allowed it to fish-tail at the end of high-speed straights. Treating the brakes as if they were non-ABS eliminated the fish-tailing from high speeds. I.e. applying medium and then maximum braking as opposed to immediately going to maximum ABS braking all at once. Acceleration was strong and predictable. I did not experience rear wheel slip when accelerating out of turns. The lean angle was good. Early peg scraping was not an issue short of making extreme lean angles. The suspension was a little soft for a track application. The rear tended to hop up and down during heavy, ABS application.

OFFICER P. WALTERS:

Handling in both high and low speed turns is smooth and predictable. Changing lines while in the turns was easy. I was able to pick different entrance and exit locations with each lap. Braking prior to entering a turn required firm application of both brakes; non-ABS. Over rough roadway surfaces prior to a turn using maximum ABS causes a sudden weight transfer. The windshield and air management design of the motorcycle is very good. At 100+ MPH you get the feeling that you are only going 60 mph.

## 32 LAP HIGH SPEED COURSE MOTORCYCLE DYNAMICS EVALUATION

### **2007 HARLEY-DAVIDSON – ELECTRA GLIDE**

RIDER	LAPS	AVG. TIME	AVG. SPEED
DEPUTY S. BRYANT, LASD	1 thru 8	1.30.55	62.4
OFFICER M. NOWLEN, LAPD	9 thru 16	1.29.72	63.0
DEPUTY M. BROWN, LASD	17 thru 23	1.31.95	61.5
OFFICER P. WALTERS, LAPD	24 thru 32	1.35.81	59.0

ITEM	RATING**
STEERING	7.5
LEAN ANGLE	3.7
SUSPENSION	7.2
BRAKE FADE	7.7
ABS OPERATION	7.0

\*\*Rating Scale 1 – 10 / 1 -Poor / 5 – Average / 10 - Outstanding

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u> The bike accelerates well and the 6-speed transmission is well spaced. Lacks sufficient lean angle. In high-speed corners you start to drag the floorboards, when you try leaning a little more than the initial floorboard contact you start to drag the frame (mounting bracket for floorboards). This becomes a pivot point for the bike; I felt that I could have ridden the bike a lot harder in the corners if the frame wasn't dragging. After you feel it begin to slide out once or twice you become very cautious. When you hit the frame it causes the bike to bump up out of your lean (turn) causing you to go wide, and it can start to slide out. The brakes are firm and responsive. While braking hard coming into the decreasing radius turn there is a bump that seems to set off the ABS system. When the ABS is engaged, the bike really seemed to lose stopping ability. The acceleration out of the corners is good, the bike pulls hard. The top end acceleration in the straight-aways is flat.</p>
<p><u>OFFICER M. NOWLEN:</u> The steering was smooth and consistent, but reaching the apex was late. Heavy handle bar input again, when the bike begins to lean, it runs out of room and drags the footboards and frame a great deal. The bike breaks away quickly, when negotiating small bumps in the turns. Power comes on good and strong with consistent shifts around 4,000 RPM. ABS is strong and stops the motorcycle well. The seat is comfortable when sitting upright, but difficult when shifting your weight. The big fairing provides good protection from the wind. Love the speedometer location.</p>

## **ELECTRA GLIDE - Continued**

### DEPUTY M. BROWN:

The steering was good using minimal effort. The bike drags in turns fairly early requiring very conservative cornering speeds. The footboard and frame contact the roadway almost simultaneously. Heavy frame drag caused the bike to slip sideways in turns. Frame contact acts as a pivot point which causes loss of rear wheel traction. Suspension was good. The ABS activated on a bumpy section of track on laps #7 and #8. The bike continued in ABS mode even when lessening brake lever pressure. ABS operation caused a significant increase in stopping distance.

### OFFICER P. WALTERS:

Acceleration is strong up to around 85 MPH then tapers off with a max speed of 110 MPH. Corner speed is limited by the lean angle. As soon as the footboards touch the roadway the frame starts to drag also. On several turns I changed the apex to see if the frame contact would change. Less footboard and frame dragging resulted in slower lap times.

## 32 LAP HIGH SPEED COURSE MOTORCYCLE DYNAMICS EVALUATION

### 2007 HARLEY-DAVIDSON – ROAD KING

RIDER	LAPS	AVG. TIME	AVG. SPEED
DEPUTY S. BRYANT, LASD	1 thru 8	1.31.08	62.0
OFFICER M. NOWLEN, LAPD	9 thru 16	1.31.10	62.0
DEPUTY M. BROWN, LASD	17 thru 23	1.32.32	61.2
OFFICER P. WALTERS, LAPD	24 thru 32	1.34.66	59.7

ITEM	RATING**
STEERING	7.5
LEAN ANGLE	3.7
SUSPENSION	7.2
BRAKE FADE	7.7
ABS OPERATION	7.2

\*\*Rating Scale 1 – 10 / 1 -Poor / 5 – Average / 10 - Outstanding

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u> The bike accelerates well and the 6 speed transmission is well spaced, the bike lacks sufficient lean angle. In high speed corners you start to drag the floorboards, when you try leaning a little more than the initial floorboard contact you start to drag the frame (mount bracket for floorboards). This becomes a pivot point for the bike; I felt that I could have ridden the bike a lot harder in the corners if the frame wasn't dragging. After you feel it begin to slide out once or twice you become very cautious. When you hit the frame it causes the bike to bump up out of your lean (turn) causing you to go wide in your turn. And it can start to slide out. The brakes are firm and responsive. While braking hard coming into the decreasing radius turn there is a bump that seems to set off the ABS system. When the ABS is engaged the bike really seemed to lose stopping ability. The acceleration out of the corners is good the bike pulls hard. The top end acceleration in the straight-aways is flat.</p>
<p><u>OFFICER M. NOWLEN:</u> The steering is slow to the apex, with a slight wobble when negotiating bumps. The bike starts its lean good, but quickly runs out of the angle, dragging the footboards then the frame. There is no give when scraping, a little too much and the bike walks out from under the rider. Good pull out of the turns at 3500-4800 rpm. When shifting, the motorcycle tends to give a lot of distance up, when braking with ABS mode. Limited side-to-side body positioning due to the seat shape. Suspension rocks back and forth under heavy braking and when carrying speed thru late apex turns. Great straight line stability at high speeds. Speedometer location is bad, the rider has to take his eyes off the road for more than just a glance.</p>

## **ROAD KING - Continued**

### DEPUTY M. BROWN:

The steering on the Road King has a lighter, more nimble feel than the Electra Glide. The bike drags footboard and frame early in turns requiring conservative cornering speeds. Heavy frame drag caused the bike to slip sideways in turns. Frame contact acts as a pivot point which causes loss of rear wheel traction, the suspension performed well. The ABS system activated on a bumpy section of track in lap #6, less brake pressure allowed the ABS to deactivate and braking was restored in time to negotiate the next turn. The amount of brake pull was moderate and had a positive feel.

### OFFICER P. WALTERS:

Dragging the footboards and frame limits the Road King's ability to smoothly negotiate turns. Proper entrance, apex and exit lines are critical to safely complete the high speed course. Once the motorcycle is leaned over and the frame makes contact with the roadway, I felt the rear tire start to lose traction. I noted no brake fade riding the last eight laps of the test.

## 32 LAP HIGH SPEED COURSE MOTORCYCLE DYNAMICS EVALUATION

### 2005 HONDA – ST 1300 PA

RIDER	LAPS	AVG. TIME	AVG. SPEED
DEPUTY S. BRYANT, LASD	1 thru 8	1.22.66	68.4
OFFICER M. NOWLEN, LAPD	9 thru 16	1.22.45	68.5
DEPUTY M. BROWN, LASD	17 thru 23	1.23.68	67.5
OFFICER P. WALTERS, LAPD	24 thru 32	1.28.02	64.2

ITEM	RATING**
STEERING	8.2
LEAN ANGLE	6.5
SUSPENSION	8.0
BRAKE FADE	9.0
ABS OPERATION	8.0

\*\*Rating Scale 1 – 10 / 1 -Poor / 5 – Average / 10 - Outstanding

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u> Acceleration and handling are very good. You have a very confident feeling of the roadway and good stopping power. When entering the decreasing radius turn, there are a few bumps in the roadway, under hard braking, the ABS kicks-in, noticeably increasing your stopping distance. In most corners, the outside of your foot drags on the ground with the arch of your foot placed on the pegs. You need to place your toes on the pegs to avoid having your foot drag. This is not a normal riding position for enforcement riding. At extreme lean angles the foot pegs drag. In the sweeping left turn you must be in the correct gear before entering the turn because you are not able to shift up due to the ground clearance. If accelerating too hard (full throttle) while exiting a turn you will break traction on the rear tire momentarily.</p>
<p><u>OFFICER M. NOWLEN:</u> The bike comes up to speed well; becomes comfortable after just one lap. Tires grip well even when cold. Leg pockets provide good protection from wind and allow for natural knee placement (when bracing for turns). Acceleration out of turns is responsive. The rear tire breaks loose under hard throttle (exiting turns). Recovers quickly from slides. Possibly needs a softer tire for prolonged speeds. Great bike to ride.</p>

## **HONDA - Continued**

### DEPUTY M. BROWN:

Acceleration was very good. The suspension was firm and worked well in a track application. Braking was good and the tires held well. However, the rear tire did get loose under power when accelerating out of a turn. Rolling off the power slightly allowed the rear tire to regain traction and the bike recovered from the slide remarkably well. Dragging pegs occurred very early. I had to consciously resist adding more power until the end of the turn. Balls of my feet needed to be placed on the foot pegs to avoid dragging boots on the ground.

### OFFICER P. WALTERS:

The acceleration is smooth and the gear ratios are well spaced. The only time the rev limiter kicked in was at maximum speed. Under hard braking, while entering a turn, gear selection was critical. Letting the clutch out too soon would allow the rear tire to slide. Lean angles were limited by foot placement on the pegs. Several times I found it necessary to move my boot up until only the tip was touching the peg during the turn. Under hard acceleration in turns if the rear tire made contact with painted lines it would cause a slight loss of traction. Braking into a turn was more controllable using firm combination brake applications non-ABS.

**PURSUIT COURSE  
MOTORCYCLE DYNAMICS  
EVALUATION**

**PURSUIT COURSE**  
**MOTORCYCLE DYNAMICS EVALUATION**

**2006 BMW POLICE MOTORCYCLE – R 1200 RT-P**

RIDER	AVG. TIME	AVG. SPEED
DEPUTY S. BRYANT, LASD	2.02.75	36.1
OFFICER M. NOWLEN, LAPD	2.05.29	35.3
DEPUTY M. BROWN, LASD	2.06.29	35.1
OFFICER P. WALTERS, LAPD	2.08.32	34.5

ITEM	RATING**
STEERING	8.6
LEAN ANGLE	8.3
SUSPENSION	8.0
BRAKE FADE	9.6
ABS OPERATION	8.6

\*\*Rating Scale 1 – 10 / 1 -Poor / 5 – Average / 10 - Outstanding

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            Acceleration is good and very smooth and controllable. The braking is good and firm. The bike turned (cornered) well. Only on a few turns was I leaning over far enough that I dragged the front engine guard (crash-bar). The power band was good and the gear ratio (spacing) does well in pursuit conditions. I was able to leave the bike in 2<sup>nd</sup> gear in most turns and pull hard out of it.</p>
<p><u>OFFICER M. NOWLEN:</u>            Motorcycle is comfortable right away. Good smooth acceleration. Upon heavy braking the motorcycle becomes light (consistently) in the rear. But it is easily controlled. The suspension tends to work well in the turns providing the rider with a solid base to input steering movements and lean angles. Transmission has very smooth movement in both up and down shifts. Excellent gear ratios when cornering and slowing. It's very easy to adjust your apex for the exit and acceleration. This motorcycle rides and handles so comfortably that the rider can easily focus on other tasks (talking on the radio, looking for street signs, etc.). Very consistent ride in all areas. Easy to find and deploy side stand.</p>
<p><u>DEPUTY M. BROWN:</u>            Suspension was very smooth. The compression and rebound was noticeable when transitioning from left and right turns but was not objectionable. Aggressive braking caused the rear wheel to hop as weight transferred forward. Less aggressive braking allowed for smooth powerful stops. The lean angle was very good. Foot pegs scraped the ground only during extreme lean angles. Overall the bike handled very well.</p>

## **BMW – Continued**

OFFICER P. WALTERS:

Very stable during the pursuit test. The transition from left to right turns was smooth and consistent. Good combination braking (non-ABS) prior to the entrance of a turn provided a predictable weight transfer allowing the motorcycle to negotiate the turn with control. Very few times the foot pegs touched the ground when the lean angle was extreme. I felt very confident in the motorcycles abilities to handle any and all turns of the pursuit test.

## PURSUIT COURSE MOTORCYCLE DYNAMICS EVALUATION

### 2007 HARLEY-DAVIDSON – ELECTRA GLIDE

RIDER	AVG. TIME	AVG. SPEED
DEPUTY S. BRYANT, LASD	2.15.44	32.7
OFFICER M. NOWLEN, LAPD	2.08.81	34.4
DEPUTY M. BROWN, LASD	2.17.33	32.2
OFFICER P. WALTERS, LAPD	2.18.35	32.0

ITEM	RATING**
STEERING	7.7
LEAN ANGLE	3.7
SUSPENSION	7.2
BRAKE FADE	8.5
ABS OPERATION	7.7

\*\*Rating Scale 1 – 10 / 1 -Poor / 5 – Average / 10 - Outstanding

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u> Acceleration is good out of the corners. The bike has a lot of low-end torque, letting you stay in a higher gear in the corners. The bike drags floorboards and the frame in the corners if you lean too hard. I had the bike slide out from me in one corner when I hit the frame, it felt like it slide a few inches. The brakes felt firm and responded well. I never got the bike into ABS during this exercise.</p>
<p><u>OFFICER M. NOWLEN:</u> Motorcycle has good power, which makes a good match with the gear ratios. Steering input was good, but a little slow at higher speeds. In the turns the rider runs out of lean angle quickly, making entry speed critical. Bike has no give once maximum lean angle is achieved. Good smooth braking. Comfortable riding position provides good visibility.</p>
<p><u>DEPUTY M. BROWN:</u> Steering required very little effort. Minimal input was required to turn in either direction. Lean angle clearance was very minimal for this course. The footboards and frame dragged in almost every turn. The suspension worked very well. The ABS activated at the end of one of the straights over a series of small bumps in the pavement on Lap #1. In Lap #2 I took a different line and the brakes stopped well without ABS mode. I did not notice any brake fade and brake pull was moderate with good feedback through the controls.</p>

## **ELECTRA GLIDE - Continued**

OFFICER P. WALTERS:

The pursuit course is a good mix of firm combination braking, strong acceleration and aggressive lean angles. The Electra Glide has a good power band allowing me to stay in second gear thru the entire course. The ABS worked well with no brake fade or lock-ups. The lack of sufficient lean angles to both the left and right limit this motorcycle's ability quickly complete the course. The Electra Glide front end feels a little heavy compared to the Road King. Other than the feel of the front end both bikes performed the same.

**PURSUIT COURSE**  
**MOTORCYCLE DYNAMICS EVALUATION**

**2007 HARLEY-DAVIDSON - ROAD KING**

RIDER	AVG. TIME	AVG. SPEED
DEPUTY S. BRYANT, LASD	N/A	N/A
OFFICER M. NOWLEN, LAPD	2.16.50	32.4
DEPUTY M. BROWN, LASD	2.16.76	32.4
OFFICER P. WALTERS, LAPD	2.19.21	31.8

ITEM	RATING**
STEERING	8.3
LEAN ANGLE	5.0
SUSPENSION	7.0
BRAKE FADE	6.6
ABS OPERATION	7.3

\*\*Rating Scale 1 – 10 / 1 -Poor / 5 – Average / 10 - Outstanding

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>  Accelerates well out of the turns; it has a lot of torque allowing the rider to remain in 2<sup>nd</sup> gear throughout most of the pursuit course. The limited lean angle affects your speed in the tight turns. The bike sits low so you drag first the floorboards then the frame. The brakes performed well with no fade and good feedback.</p>
<p><u>OFFICER M. NOWLEN:</u>  The motorcycle pulls well on the straight-a-way, with no rear wheel brake away. Steering applies well, but you run out of lean angle. Once the frame begins to drag, the bike loses its handling quickly. Approximately halfway through the first lap, the rear brake pedal compressed all the way forward, diminishing the ability to stop. I had to pump the rear brake approximately 2-3 times at each application. This made consistent brake application difficult at best. Good gear ratio makes gear selection easy.</p>
<p><u>DEPUTY M. BROWN:</u>  The steering was very good. The Road King had lighter steering than the Electra Glide. Lean angle clearance was very minimal. The footboards and frame dragged in almost every turn. The suspension worked very well. I did not note any ABS anomalies. I did not notice any brake fade and brake pull was moderate with good feedback through the controls.</p>

## **ROAD KING - Continued**

OFFICER P. WALTERS:

The pursuit course is a good mix of firm combination braking, strong acceleration and aggressive lean angles. The Electra Glide has a good power band allowing me to stay in second gear thru the entire course. The ABS worked well with no brake fade or lock-ups. The lack of sufficient lean angles to both the left and right limit this motorcycle's ability quickly complete the course. The Electra Glide front end feels a little heavy compared to the Road King. Other than the feel of the front end, both bikes preformed the same.

**PURSUIT COURSE**  
**MOTORCYCLE DYNAMICS EVALUATION**

**2005 HONDA – ST 1300 PA**

RIDER	AVG. TIME	AVG. SPEED
DEPUTY S. BRYANT, LASD	2.06.31	35.1
OFFICER M. NOWLEN, LAPD	2.02.81	36.1
DEPUTY M. BROWN, LASD	2.07.66	34.7
OFFICER P. WALTERS, LAPD	2.07.76	34.7

ITEM	RATING**
STEERING	8.6
LEAN ANGLE	6.0
SUSPENSION	7.6
BRAKE FADE	9.6
ABS OPERATION	9.0

\*\*Rating Scale 1 – 10 / 1 -Poor / 5 – Average / 10 - Outstanding

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            Acceleration pull is very good; however, I was able to get the front tire slightly off the ground once at full throttle. The braking is good and firm. The bike turns well in the corners. I feel I could have ridden faster, however the outside of my boots were dragging in most turns, and for this exercise I did not feel comfortable moving my feet back and forth on the foot pegs. The power band and gear ratio are well spaced so I could leave the bike in 2<sup>nd</sup> gear in most turns. Bike accelerates very hard out of the corners.</p>
<p><u>OFFICER M. NOWLEN:</u>            Easy to mount the bike and raise the side stand. Accelerates smoothly with good response to throttle inputs. Weight transfer was smooth when going into hard braking. Motorcycle ride tends to be hard and unforgiving in the turns. A little twitchy in handlebar transition at low speeds (probably due to weight). Needs to have more room for lean angle. The pegs dragged heavy at times. The rider has to choose the proper gear when cornering due to the low angle clearance. It is impossible to get your toes under the shifter. Rider must position his toes back on the pegs to prevent your foot from getting caught under the peg and shifter. Great power band; easy to ride.</p>

## **HONDA - Continued**

DEPUTY M. BROWN:

Under hard acceleration, broke rear wheel traction when exiting a turn. A minor decrease in throttle allowed the rear tire to regain traction. Dragging pegs and boots occurred very easily with moderate lean angles. An effort needed to be made to shift foot positions to avoid getting my feet knocked off of the pegs. Braking was very positive without any brake fade. Suspension worked very well, especially when transitioning between left and right turns.

OFFICER P. WALTERS:

Good acceleration and stopping ability made the pursuit exercise fun. The downside to this motorcycle is the lean angle limits. I found that both left and right turns that I would have to lift my boots almost off the pegs to avoid dragging them on the ground. Good combination braking not using ABS made stopping very consistent.

# **BRAKING**

**DEBRIS FIELD BRAKING**  
**SANDY SURFACE – 40 MPH TO ZERO**

**2006 BMW POLICE MOTORCYCLE – R 1200 RT-P**

RIDER	STOPPING DISTANCE
DEPUTY S. BRYANT, LASD	44.6 MPH - 93 feet - 2.69 sec
OFFICER M. NOWLEN, LAPD	45.9 MPH - 100 feet - 2.80 sec
DEPUTY M. BROWN, LASD	41.8 MPH - 90 feet - 2.89 sec
OFFICER P. WALTERS, LAPD	41.8 MPH - 85 feet - 2.70 sec

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            The ABS system works well while transitioning from clean asphalt to debris (sand and gravel). The bike is very controllable and brakes straight. However, while the ABS was operating in the debris, the front end is compressing and rebounding. You can noticeably feel the front end bouncing up and down.</p>
<p><u>OFFICER M. NOWLEN:</u>            Up to speed quick (digital speedometer tends to indicate a speed at 4 MPH faster than analog). Suspension compresses good, but nose-dives a little at initial application of brakes. Good feel in controls. Tends to rock back to forward at times, when entering and through heavy (deep) debris field. Good stopping ability and distance overall.</p>
<p><u>DEPUTY M. BROWN:</u>            The ABS activated immediately upon entering the debris field. The motorcycle maintained a straight line and had a consistent rate of deceleration. There was no lateral movement of the tires during ABS operation while in the debris field. Once out of the debris, the motorcycle braked very hard as it came to a full stop.</p>
<p><u>OFFICER P. WALTERS:</u>            Stopping the BMW at 40 MPH into the debris field was a little interesting. It completed the exercise in a straight line however the weight transfer kept changing as the surface changed. No side-to-side direction change was noted during the exercise.</p>

**DEBRIS FIELD BRAKING**  
**SANDY SURFACE – 40 MPH TO ZERO**

**2007 HARLEY-DAVIDSON – ELECTRA GLIDE**

RIDER	STOPPING DISTANCE
DEPUTY S. BRYANT, LASD	41.3 MPH - 90 feet - 3.20 sec
OFFICER M. NOWLEN, LAPD	41.3 MPH - 89 feet - 2.76 sec
DEPUTY M. BROWN, LASD	40.3 MPH - 83 feet - 2.60 sec
OFFICER P. WALTERS, LAPD	41.3 MPH - 93 feet - 2.82 sec

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            Brakes well in straight line. You can feel the front brake pulsating with ABS. You can hear the tires skidding and releasing, when this is happening the bike is rocking back and forth. The front tire skidded at the end of the run for approximately 18 feet.</p>
<p><u>OFFICER M. NOWLEN:</u>            The motorcycle comes up to speed good, very easy to level-off speed. Easier to track speed due to speedometer location. Brakes apply well with good feedback. Good transition from clean roadway to debris field. Very predictable.</p>
<p><u>DEPUTY M. BROWN:</u>            The bike stopped well through the debris field. There was a fair amount of pulsing feedback felt mostly in the front brake lever; the front wheel skidded in the last 2-3 feet of the exercise. During the stop, the bike lunged forward and back in conjunction with the slow pulsing of the ABS.</p>
<p><u>OFFICER P. WALTERS:</u>            Stopping the Electra Glide was very similar to the Road King. The pulsation felt in the braking system was the same. No direction change while in the debris field and the motorcycle stopped under control.</p>

**DEBRIS FIELD BRAKING**  
**SANDY SURFACE – 40 MPH TO ZERO**

**2007 HARLEY-DAVIDSON - ROAD KING**

RIDER	STOPPING DISTANCE
DEPUTY S. BRYANT, LASD	39.5 MPH - 81 feet - 2.84 sec
OFFICER M. NOWLEN, LAPD	40.9 MPH - 94 feet - 2.93 sec
DEPUTY M. BROWN, LASD	37.9 MPH - 84 feet - 2.94 sec
OFFICER P. WALTERS, LAPD	40.9 MPH - 97 feet - 2.96 sec

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            Brakes well in a straight line. You can feel the front brake lever pulsating with the ABS. You can also hear the tires skidding and releasing. The ABS works rather slowly and you can feel the bike rocking back and forth on the clean surface.</p>
<p><u>OFFICER M. NOWLEN:</u>            The motorcycle comes up to speed good. Very easy to level-off the speed. The brakes apply well, with good feedback. The transition from clean roadway to debris is almost unnoticeable. The motorcycle tracks well and provides a predictable feeling.</p>
<p><u>DEPUTY M. BROWN:</u>            The motorcycle stopped well in a straight line. There was a significant amount of feedback and pulsing, felt mostly in the front brake lever. The front wheel locked in the last 3-4 feet after transitioning back onto the clean surface. The ABS pulsed at a slow rate, both in and out of the debris field, causing the bike to rock forward and back during the exercise.</p>
<p><u>OFFICER P. WALTERS:</u>            Braking into the debris field at 40 mph with the Harley Road King is very different than the BMW or Honda. The ABS is working very well, however the pulsating that is felt through the lever and brake pedal is very pronounced. As the motorcycle stops I found my upper body lunging forward while stopping. After a few practice runs I felt confident in the fact that it would stop without locking up or causing any direction change.</p>

**DEBRIS FIELD BRAKING**  
**SANDY SURFACE – 40 MPH TO ZERO**

**2005 HONDA – ST 1300 PA**

RIDER	STOPPING DISTANCE
DEPUTY S. BRYANT, LASD	40.6 MPH - 71 feet - 2.51 sec
OFFICER M. NOWLEN, LAPD	40.3 MPH - 68 feet - 2.54 sec
DEPUTY M. BROWN, LASD	42.4 MPH - 86 feet - 2.77 sec
OFFICER P. WALTERS, LAPD	42.1 MPH - 81 feet - 2.62 sec

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            When transitioning from clean asphalt to asphalt with sand and gravel, there was a slightly noticeable difference in braking. Most noticeably you can hear the sound of the tire starting to skid on the gravel then releasing. In the middle of the braking exercise, I felt the front tire slightly turn while on the sand and then straighten out.</p>
<p><u>OFFICER M. NOWLEN:</u>            Good applied pressure in controls, plenty of front lever and rear pedal left during the entire run. Easy to maintain control. Both front and rear tires track well; no direction change at all. Can feel each wheel working independently towards the end of the run. Suspension compresses quickly and provides good control to the rider.</p>
<p><u>DEPUTY M. BROWN:</u>            Braking through the debris field caused the Honda to enter ABS mode immediately. The Honda brakes locked and released very quickly allowing for overall control of the motorcycle. The desired braking line deviated only slightly during the exercise.</p>
<p><u>OFFICER P. WALTERS:</u>            At 40 MPH, braking into the debris field caused the front end to move slightly from side to side. I could feel the ABS working as the surface changed, however the motorcycle stopped in a straight line each time. Overall control during the stop was excellent.</p>

**TRANSITORY BRAKING**  
**DRY TO WET - 40 MPH TO ZERO**

**2006 BMW POLICE MOTORCYCLE – R 1200 RT-P**

RIDER	DRY STOP	DRY TO WET STOP
DEPUTY S. BRYANT, LASD	41.8 MPH, 60 feet	39.9 MPH, 57 feet
OFFICER M. NOWLEN, LAPD	38.8 MPH, 56 feet	40.8 MPH, 67 feet
DEPUTY M. BROWN, LASD	42.8 MPH, 62 feet	40.3 MPH, 63 feet
OFFICER P. WALTERS, LAPD	39.5 MPH, 59 feet	39.6 MPH, 57 feet

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            Good braking feel when transitioning between dry to wet asphalt with standing water. Upon initial braking you can feel the front end dive, the rear suspension rebound, and the rear end get light momentarily. ABS seems to react the same from dry to wet asphalt.</p>
<p><u>OFFICER M. NOWLEN:</u>            Good feedback through controls, suspension compresses a lot (almost feels like front end dives), easy to control through entire run, tends to lighten up in the rear at the end of the run, easy to maintain upright body position under heavy braking, did not feel any brake fade or braking loss on wet surface.</p>
<p><u>DEPUTY M. BROWN:</u>            The BMW entered ABS mode on the dry pavement and continued onto the wet pavement. The feedback through the brake controls provided a consistent, firm feel. The motorcycle stopped in a straight line without any skidding of the tires. The rate of deceleration was constant throughout the stop.</p>
<p><u>OFFICER P. WALTERS:</u>            During the dry surface testing the motorcycle stopped in a straight controllable manner. The weight transfer to the front end was noticed however the rear wheel felt as if it lifted off the ground.</p>

**TRANSITORY BRAKING**  
**DRY TO WET - 40 MPH TO ZERO**

**2007 HARLEY-DAVIDSON – ELECTRA GLIDE**

RIDER	DRY STOP	DRY TO WET STOP
DEPUTY S. BRYANT, LASD	Not Done	39.3 MPH, 62 feet
OFFICER M. NOWLEN, LAPD	Not Done	39.1 MPH, 61 feet
DEPUTY M. BROWN, LASD	Not Done	41.1 MPH, 72 feet
OFFICER P. WALTERS, LAPD	Not Done	38.8 MPH, 63 feet

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            Brakes in a straight line. You can feel the ABS functioning through the front hand brake. Smooth transition from dry to wet, no noticeable difference. You can feel yourself bouncing back and forth as the ABS is working.</p>
<p><u>OFFICER M. NOWLEN:</u>            The motorcycle levels off well. The brakes come on hard and consistent. Good feedback through brake controls. The motorcycle tends to rock back and forth at times. Steering and overall control was great. The transition from dry to wet was almost un-noticeable. Easy to maintain riding position, even under hard braking.</p>
<p><u>DEPUTY M. BROWN:</u>            The motorcycle stopped well and in a straight line while transitioning from dry to wet. The bike entered ABS mode on the wet surface and it came to a controlled stop without any deviation. The ABS system caused some pulsing in the front brake lever and the bike surged forward and back during the latter part of the stop.</p>
<p><u>OFFICER P. WALTERS:</u>            Braking into a wet surface under full ABS was smoother than on a dry surface. The brake lever and foot pedal still pulsated but not as pronounced. I noted no change of direction and the motorcycle stopped in a straight line.</p>

**TRANSITORY BRAKING**  
**DRY TO WET - 40 MPH TO ZERO**

**2007 HARLEY-DAVIDSON – ROAD KING**

RIDER	DRY STOP	DRY TO WET STOP
DEPUTY S. BRYANT, LASD	Not Done	41.9 MPH, 67 feet
OFFICER M. NOWLEN, LAPD	Not Done	40.6 MPH, 64 feet
DEPUTY M. BROWN, LASD	Not Done	39.1 MPH, 63 feet
OFFICER P. WALTERS, LAPD	Not Done	40.9 MPH, 71 feet

RIDERS COMMENTS
<p><u>DEPUTY S. BRYANT:</u>            Brakes in a straight line. You can feel the ABS functioning through the front hand brake. Smooth transition from dry to wet, no noticeable difference. You can feel yourself bouncing back and forth as the ABS is working.</p>
<p><u>OFFICER M. NOWLEN:</u>            The motorcycle accelerates quickly. The speedometer is in a bad location for monitoring speed. Good feedback through the braking controls. Brakes apply quick and hard. Very consistent tracking, through the surface transition (dry to wet) easy to maintain riding position under hard braking.</p>
<p><u>DEPUTY M. BROWN:</u>            The motorcycle stopped well and in a straight line while transitioning from dry to wet. The bike entered ABS mode on the wet surface and it came to a controlled stop without any deviation. The ABS system caused some pulsing in the front brake lever and the bike surged forward and back during the latter part of the stop.</p>
<p><u>OFFICER P. WALTERS:</u>            Braking into a wet surface under full ABS was smoother than on a dry surface. The brake lever and foot pedal still pulsated but not as pronounced. I noted no change of direction and the motorcycle stopped in a straight line.</p>

**TRANSITORY BRAKING**  
**DRY TO WET - 40 MPH TO ZERO**

**2005 HONDA – ST 1300 PA**

<b>RIDER</b>	<b>DRY STOP</b>	<b>DRY TO WET STOP</b>
DEPUTY S. BRYANT, LASD	39.8 MPH, 53 feet	39.9 MPH, 55 feet
OFFICER M. NOWLEN, LAPD	40.5 MPH, 54 feet	41.2 MPH, 57 feet
DEPUTY M. BROWN, LASD	40 MPH, 59 feet	42.9 MPH, 64 feet
OFFICER P. WALTERS, LAPD	39.9 MPH, 52 feet	41.7 MPH, 65 feet

<b>RIDERS COMMENTS</b>
<p><u>DEPUTY S. BRYANT:</u>            When transitioning from dry to wet asphalt with standing water there was no noticeable difference in the ABS brakes. It was a smooth continuous application of the brakes. Very confident braking.</p>
<p><u>OFFICER M. NOWLEN:</u>            Good feel on both dry and wet, consistent pressure through the controls, very predictable; even through dry to wet application, at times difficult to maintain straight-up riding position; due to forward position bars (almost full arm lock at times), great controllability overall.</p>
<p><u>DEPUTY M. BROWN:</u>            The Honda entered ABS mode on the dry surface with very brief lock and release of the brakes. Upon transition to wet pavement, the lock and release of the brakes was less apparent as the motorcycle came to a very controllable, upright stop. Rider feedback through the controls was very good.</p>
<p><u>OFFICER P. WALTERS:</u>            The transition between a dry surface and a wet surface was seamless. The front end moved very little from side to side. I had very little movement in the front brake lever as the motor went from dry to wet conditions. I was in complete control during the entire stop from 40 MPH. This was a confidence building exercise in the ABS system.</p>

**HOT BRAKING**  
**60 MPH TO ZERO**  
**IMMEDIATELY FOLLOWING 32 LAP COURSE**

<b>2006 BMW POLICE MOTORCYCLE – R 1200 RT-P</b>	
Braking Distance	64.1 MPH - 3.05 sec - 137 feet
Evidence of Severe Fading Prior to Stopping?	No
Did the Bike Stop in a Straight Line?	Yes

<b>2007 HARLEY-DAVIDSON – ELECTRA GLIDE</b>	
Braking Distance	60.6 MPH - 3.52 sec - 156 feet
Evidence of Severe Fading Prior to Stopping?	No
Did the Bike Stop in a Straight Line?	Yes

<b>2007 HARLEY-DAVIDSON – ROAD KING</b>	
Braking Distance	60 MPH - 3.31 sec - 145 feet
Evidence of Severe Fading Prior to Stopping?	No
Did the Bike Stop in a Straight Line?	Yes

<b>2005 HONDA – ST 1300 PA</b>	
Braking Distance	61 MPH - 2.88 sec - 127 feet
Evidence of Severe Fading Prior to Stopping?	No
Did the Bike Stop in a Straight Line?	Yes

**ERGONOMICS**  
**157 MILE RIDE**

**ERGONOMICS EVALUATION**  
**SUBJECTIVE EVALUATION – 157 MILE RIDE**

**2006 BMW POLICE MOTORCYCLE – R 1200 RT-P**

<b>RIDING POSITION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Seat Comfort	Padding, Springs, Width	8.25
Seat Position	Range of Adjustment	8
Riding Position	Lean Angle, Comfort	8.25
Floorboards / Pegs	Access to Foot Controls	8
<b>RIDER COMMENTS</b>		
<p><u>DEPUTY S. BRYANT:</u>            Comfortable upright riding position. The seat was comfortable for extended period of time. The foot pegs are in a natural position and there is easy access to controls.</p>		
<p><u>OFFICER M. NOWLEN:</u>            The seat is firm, but padded enough to provide a comfortable ride for prolonged periods. Riding position feels natural for riding or sitting while parked. Pegs are at a position to allow plenty of room to move your feet.</p>		
<p><u>DEPUTY M. BROWN:</u>            Seat comfort was very good. The padding was comfortable for all day riding. I preferred the lower seat position. I noticed only a slight lean forward position, which was not objectionable. There was good access to foot pegs and foot controls.</p>		
<p><u>OFFICER P. WALTERS:</u>            The seat is very comfortable and the riding position allowed for an upright position with no forward lean.</p>		
<b>INSTRUMENT PANEL</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Controls	Position, Usability	8
Visibility	Instruments	8.75
Reflection / Glare	Windshield, Instruments	8.25
Instruments	Adequacy, Legibility	8.5
<b>RIDER COMMENTS</b>		
<p><u>DEPUTY S. BRYANT:</u>            Controls are simple and easy to use. There are a few switches you need to remove your hand from the grip to operate. The speedometer lock is a nice feature for pacing violators. There is a 5 MPH difference between the digital display and the speedometer. Instrument panel is laid out nicely and is easy to see in direct sunlight.</p>		
<p><u>OFFICER M. NOWLEN:</u>            The controls are well placed and easy to manage (out of the way, but can refer to comfortably). The center digital display is great. There are no problems reading it, even in bright sunlight. Pace speedometer is a great idea. Analog speedometer can be referred to quickly. Good instrument lighting.</p>		

DEPUTY M. BROWN:

The instruments were useful and well positioned. The locking digital speedometer is a nice feature for pacing speed violations. The analog gauges were easy to read and glare free.

OFFICER P. WALTERS:

Instruments are easy to read. Gear selector indicator is a nice touch.

MIRRORS	CONSIDERATIONS	RATING
Road Visibility	Distortion, Obstruction	7.25
Reflections	Instruments, Controls	7.67
Mirror Coverage	Adjustment, Rear Visibility, Flat or Convex	7.25
Mirror Location	Accessibility, Visibility, Obstruction	7.0

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The mirrors were a little low but have good visibility to the rear. A slight portion of the mirror is blocked by the handgrips. There was no major reflection of the dash on the windshield.

OFFICER M. NOWLEN:

Mirrors are mounted out of the way, but take some getting used to. Possibly more convex to increase visibility. Obstructed slightly in the reflection (by the hand grips).

DEPUTY M. BROWN:

The mirrors were low mounted and provided good visibility. The convex mirror allowed visibility from the side of the motorcycle into the adjoining lanes. Head and eyes needed to be lowered to clearly view the mirrors and the traffic behind.

OFFICER P. WALTERS:

Rear visibility was good however 15% of both mirrors displayed my hands on the controls. No distortion was noted at freeway speeds.

WIND SCREEN	CONSIDERATIONS	RATING
Height / Width	Wind / Debris Protection	8.75
Adjustability	Electric or Manual, Ease of Use	9.25
Top Edge	Clear View Over Top of Windshield, (Bifocal Effect)	9.13

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The height and width of the windscreen provide great protection. The windshield adjusts with ease. At high speed you can't lower the windshield very much before you start getting wind in the face. The "V" shape in the top of the windshield makes it easy to see over.

OFFICER M. NOWLEN:

The windscreen is configured to provide great wind protection while allowing high visibility. Top edge is great when in the full upright position. Adjusts good to allow airflow, when at lower speeds. Keeps noise level down. Makes the ride comfortable.

DEPUTY M. BROWN:

Windscreen height and width was very good. Providing good wind and debris protection. The shape of the windscreen (low in the center) gave an excellent view over the top without sacrificing wind protection. The electronic adjustment was excellent.

OFFICER P. WALTERS:

The windscreen is wide and tall in the up position. It provides excellent torso protection at freeway speeds.

<b>CONTROLS</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Handlebars	Angle, Size, Position	8.5
Shift Levers	Usability, Shift Pad Position	8
Switches	Reach, Markings, Visibility, Accessibility	7.75
Rear Brake Pedal	Location, Feedback, Ease of Use	8.25
Front Brake Lever	Location, Feedback, Adjustability	8.5
Clutch Lever	Lever Resistance, Adjustability	8.25

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The handlebar position allows for a comfortable upright riding position. All the switches are larger and work well. There are a few switches you must remove your hand from the grip to operate. Both the clutch and front brake lever are adjustable.

OFFICER M. NOWLEN:

Handlebar position is natural when riding for long periods of time. Starter button on top of the right handle bar is a great location. Clutch operation takes some getting used to, dry clutch. Switch position placement is good, easy to access without looking for them.

DEPUTY M. BROWN:

The handlebar position felt very natural. The brake pedal and shift lever were also well positioned. The handlebar switches worked well and were easily accessible. The front and rear brake controls gave excellent feedback and braking was positive and predictable. Clutch lever had a medium pull and smooth operation.

OFFICER P. WALTERS:

The handlebars are set back far enough to allow an upright riding position. All the controls give good feedback and are easy to use.

<b>MOUNT / DISMOUNT</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Trunk Height	Ample Leg Swing Room	5.75
Foot Peg / Floorboard	Interferes With Mounting / Dismounting	8
Lean Angle	Side Stand of Adequate Length	8.25

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The trunk height was very high; having to swing your leg over it was a stretch. A short rider would have a difficult time. The foot pegs were positioned to provide adequate room for mounting/dismounting. The side stand was easy to find without looking down.

OFFICER M. NOWLEN:

The first thing you notice is how high you have to lift your leg over the top box. You have to bend your knee or it can get painful. Foot pegs provide enough room to move your feet and foot controls easily within reach.

DEPUTY M. BROWN:

Trunk height was on the high side. A little extra leg lift was needed when mounting and dismounting the motorcycle. The foot pegs were well positioned and the side stand length

proved adequate under most parking conditions. High crowned roadways required angled parking.

OFFICER P. WALTERS:

This is a tall motorcycle and requires a level surface to mount or dismount on the right side. Side stand was easy to find and no looking down was required.

SUSPENSION	CONSIDERATIONS	RATING
Quality of Ride	Dampening, Rebound	8.38
Rider Size	Adjustability	8.25

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The quality of ride on the streets and freeways is excellent. Once in a while the rear suspension would bounce or pogo with certain bumps in the road. The seat was most comfortable in the low position (5'9" rider).

OFFICER M. NOWLEN:

The suspension works great. It compresses well to provide a smooth predictable ride. Seat adjusts in two positions. Low setting was the most comfortable (6'0" rider). High setting was a bit high.

DEPUTY M. BROWN:

The ride quality on most streets and freeways was very smooth. Significant dips caused the rear suspension to bounce or pogo briefly before recovering. Rear suspension adjustment controls are found under the seat.

OFFICER P. WALTERS:

The ride is very smooth. The suspension absorbs almost all road hazards transferring only the largest bumps to the rider.

STORAGE	CONSIDERATIONS	RATING
Saddlebags	Angle, Size and Position of Opening	8.75
Locks	Same Key, Security, Sturdiness	8.75

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The saddlebags were big and would work well. You no longer need a key to open and close them. It would be nice if they were still removable.

OFFICER M. NOWLEN:

Side-bags are small enough, as to not stick out (great for splitting traffic). Top opening lets you keep things organized and accessible. Top-box (when not used for a radio) is a little lacking. Would be hard to keep things secured without some kind of box modification.

DEPUTY M. BROWN:

The saddlebags were top opening and were hinged so they opened forward. Saddlebag design allows for file folders, clipboards, cite books and other materials to be held upright for easy access. One key controlled the ignition and saddlebag locks.

OFFICER P. WALTERS:

Saddlebags open from the top and required no dividers. The bags are deep but are not very wide.

**ADDITIONAL RIDER COMMENTS**

DEPUTY S. BRYANT:

This is an easy and comfortable motorcycle to ride. The bike has great braking and handling characteristics. It is a good bike for law enforcement.

OFFICER M. NOWLEN:

Very easy to ride motorcycle provides a strong platform to do traffic enforcement and police work. Rider will definitely have confidence in the equipment.

DEPUTY M. BROWN:

The BMW was very easy to ride and get accustomed to. The ergonomics, suspension and seating position provided all day comfort. After 158 miles and a short break, I was ready for more riding. The BMW had smooth power, excellent braking and excellent handling.

OFFICER P. WALTERS:

Riding 160 miles in a variety of traffic conditions I was ready to go again. This motorcycle is very comfortable to ride as an enforcement vehicle for 8-10 hours a day. The BMW was equipped with full emergency lighting.

**ERGONOMICS EVALUATION**  
**SUBJECTIVE EVALUATION – 157 MILE RIDE**

**2007 HARLEY-DAVIDSON – ELECTRA GLIDE**

<b>RIDING POSITION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Seat Comfort	Padding, Springs, Width	8.25
Seat Position	Range of Adjustment	7.5
Riding Position	Lean Angle, Comfort	8.38
Floorboards / Pegs	Access to Foot Controls	7.5
<b>RIDER COMMENTS</b>		
<p><u>DEPUTY S. BRYANT:</u>            The air-ride seat is a great feature, it smoothes out most minor bumps in the roadway. The seat heights are good, but are not adjustable. The riding position is comfortable, but I had to adjust to my feet being very forward of center.</p>		
<p><u>OFFICER M. NOWLEN:</u>            Seat is large and air cushioned, but lacks padding. The seat position is not adjustable at all, the upright sitting position provides comfortable riding, and is easy to sit on when parked (good for watching traffic) floorboards need more clearance.</p>		
<p><u>DEPUTY M. BROWN:</u>            The air-suspended seat worked well and provided all-day comfort. Riding position was upright with legs kicked forward, floorboards mounted forward of the seat.</p>		
<p><u>OFFICER P. WALTERS:</u>            The seat is the same as the Road King however the handlebars do not go back as far causing a slight forward lean position. I moved forward in the seat slightly and it felt more comfortable. Floorboards are the same as the Road King.</p>		

<b>INSTRUMENT PANEL</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Controls	Position, Usability	8.13
Visibility	Instruments	8.13
Reflection / Glare	Windshield, Instruments	8.67
Instruments	Adequacy, Legibility	8
<b>RIDER COMMENTS</b>		
<p><u>DEPUTY S. BRYANT:</u>            Controls are positioned and work well. The dash lights are a little too small and could be brighter for daytime visibility.</p>		
<p><u>OFFICER M. NOWLEN:</u>            The instrument panel is configured well and is easy to read at a glance. Instrument lights are small and hard to see in bright sunlight.</p>		
<p><u>DEPUTY M. BROWN:</u>            The fairing-mounted instrument panel is positioned well and was easy to read. The speedometer indicated about 8% to 10% high at freeway speeds. The dual trip meter is a nice feature. Instrument lights were small and hard to see during the day.</p>		

OFFICER P. WALTERS:

The speedometer, tachometer and all other instrumentation are located in the upper portion of the fork-mounted fairing. This location makes it easy to monitor speed and RPM while keeping my attention on the traffic. Clear, easy to read instruments make for no confusion.

<b>MIRRORS</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Road Visibility	Distortion, Obstruction	6.25
Reflections	Instruments, Controls	7.75
Mirror Coverage	Adjustment, Rear Visibility, Flat or Convex	5.75
Mirror Location	Accessibility, Visibility, Obstruction	8

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The mirrors are placed in a good location with good visibility to the rear. The view is flat; a pair of convex mirrors would greatly increase visibility.

OFFICER M. NOWLEN:

Mirrors are small and do not provide adequate visibility. I found myself constantly adjusting the mirrors (very little range of view).

DEPUTY M. BROWN:

The handlebar mounted mirrors were well placed and provided a good range of adjustment. The mirrors were “flat” and offered limited visibility. The use of “convex” mirrors would provide a wider angle of visibility increasing rider safety.

OFFICER P. WALTERS:

The mirrors vibrate at freeway speeds however the rear vision is clearer than the Road King’s. Perhaps due to being mounted on the fairing.

<b>WIND SCREEN</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Height / Width	Wind / Debris Protection	7.88
Adjustability	Electric or Manual, Ease of Use	N/A
Top Edge	Clear View Over Top of Windshield, (Bifocal Effect)	8.25

**RIDER COMMENTS**

DEPUTY S. BRYANT:

Protection is better than the Road King with minimal wind hitting your upper body. Clear view over the windshield with no noticeable distortion.

OFFICER M. NOWLEN:

The windscreen and shield provide good protection from wind and debris at moderate speeds. But there is little to no protection for the rider, at the bottom of the windscreen. At higher speeds the windscreen tends to make the air mad and turbulent for the rider.

DEPUTY M. BROWN:

The height of the windshield was adequate for a 6-foot rider. Airflow over the windshield was level with the visor of my helmet. Taller riders would likely choose a taller windshield. The handlebar-mounted fairing provided good wind/debris protection for upper body, hands and arms.

OFFICER P. WALTERS:

The fairing affords very good wind protection for my upper torso including my hands and arms. I noted no buffeting of my helmet during the freeway ride.

<b>CONTROLS</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Handlebars	Angle, Size, Position	7.75
Shift Levers	Usability, Shift Pad Position	7.5
Switches	Reach, Markings, Visibility, Accessibility	8.8
Rear Brake Pedal	Location, Feedback, Ease of Use	8
Front Brake Lever	Location, Feedback, Adjustability	8
Clutch Lever	Lever Resistance, Adjustability	8.25
<b>RIDER COMMENTS</b>		
<u>DEPUTY S. BRYANT:</u> All the controls are comfortable and work well. I think an adjustable front brake lever would be a great addition to the bike.		
<u>OFFICER M. NOWLEN:</u> The handlebars felt short. I had to lean over at the hip for sharp turns. Heel-toe shifter configuration tended to take up a lot of room, often making foot placement difficult, even with a size 11 boot. The rear brake pedal felt out of place. I found myself lifting my right foot completely up off the footboard to apply the brake, rather than pivoting the ball of my foot around keeping my heel in place. Good feedback through the hand controls.		
<u>DEPUTY M. BROWN:</u> Handlebar size and position was good. Access to the shift lever was ok for downshifting and awkward for up shifting. The heel shift pad was high and difficult to reach. Switches were well placed and easy to use. Rear brake, front brake and clutch were easy to use and provided good feedback to the rider. Clutch pull was medium to heavy. Good friction point control.		
<u>OFFICER P. WALTERS:</u> The switches were easy to reach and functioned properly. The clutch and front brake levers are large and easy to operate. The wet clutch is smooth and gives good feed back during friction point riding. During non-ABS operation the brakes give excellent control and feedback. During ABS situations the front and rear brake controls pulsate quite a bit.		

<b>MOUNT / DISMOUNT</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Trunk Height	Ample Leg Swing Room	N/A
Foot Peg / Floorboard	Interferes With Mounting / Dismounting	7.25
Lean Angle	Side Stand of Adequate Length	7.5
<b>RIDER COMMENTS</b>		
<u>DEPUTY S. BRYANT:</u> The bike had no trunk during testing. Floorboards are forward of center so not to interfere with mounting and dismounting. Kickstand worked well on moderately crowned roads. With dismounting your right ankle/leg always seems to end up against the exhaust pipe.		
<u>OFFICER M. NOWLEN:</u> The footboards are comfortable, and positioned at a good angle. The footboard mounting is attached from the bottom, allowing very limited movement once the floor boards drag. Very limited lean angle. I dragged the frame often.		
<u>DEPUTY M. BROWN:</u> The motorcycle's low profile and absence of a trunk made mounting and dismounting quite easy. The floorboards did not interfere with mounting or dismounting from either side. The side stand allowed adequate lean even on crowned roadways.		

OFFICER P. WALTERS:

Getting on and off the Electra Glide was easy due to the lack of a top box (trunk). Getting on and off on the right side of the motorcycle was easy with long legs. The Electra Glide side stand has an extender mounted on it. Like the Road King I found the side stand with no problems while keeping my attention forward during traffic stops.

<b>SUSPENSION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Quality of Ride	Dampening, Rebound	8.25
Rider Size	Adjustability	6.88

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The air-ride seat absorbs most of the bumps. The bike has adjustable rear air shocks. I found big bumps would bounce you off the seat. The bike sits low, so good for shorter riders, only handle bar really adjustable.

OFFICER M. NOWLEN:

The overall ride was comfortable, with very little fatigue to the rider, during long distance rides. There was little adjustability to the seat or handlebars.

DEPUTY M. BROWN:

The air-assisted rear suspension and front forks provided good ride quality. Good dampening and rebound smoothed out rough roadways. The rear shocks and rider's seat are both air adjustable to accommodate rider size and comfort level.

OFFICER P. WALTERS:

The air-adjusted shocks in addition to the air bladder under the seat give a very comfortable ride. The suspension absorbed all roadway irregularities giving a smooth ride after 160 miles.

<b>STORAGE</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Saddlebags	Angle, Size and Position of Opening	7.5
Locks	Same Key, Security, Sturdiness	8.25

**RIDER COMMENTS**

DEPUTY S. BRYANT:

Saddlebags are large and top opening. The "ABS system" takes half of the right saddlebag. This is your main bag you work out of. A clipboard will fit but not a posse box. The ABS really should be moved to the other bag.

OFFICER M. NOWLEN:

The saddlebags were large, but limited in the right bag due to the placement of the ABS unit. Locks worked well. Easy to operate saddlebag latches, even with gloves on.

DEPUTY M. BROWN:

Saddlebag lids had a twist knob closure. Lids opened outward which provided good access to the compartments. Storage space was limited in the right saddlebag due to the mounting of the ABS braking components.

OFFICER P. WALTERS:

The saddlebags open from the top using a hockey puck looking device that turns allowing easy access to the bags. The ABS takes up about 1/3 the storage space in the right bag. The locks are located on the rear section of the bags and use the same type key as the ignition. This bike had the same key for the bags and the ignition.

**ADDITIONAL RIDER COMMENTS**

DEPUTY S. BRYANT:

After the first five minutes of the ride, the back of my right thigh became hot from the engine, and remained that way all day. Even at freeway speed I could feel the heat. In stop-and-go traffic it was really hot. It was very noticeable and annoying. If you put your left leg down at a stop your ankle/leg hit up against the clutch cover of the transmission which is all very hot!

OFFICER M. NOWLEN:

The rider is subjected to extreme heat at the inside of the thighs. Even with double thick riding pants, I noticed this right away. It only got worse as the ride went on. The engine drops to one cylinder when idling at high temperature. I had to compensate by throttling-up early to slip the clutch, when accelerating from a stop.

DEPUTY M. BROWN:

The engine's rear cylinder head and exhaust system provided a significant amount of heat. The insides and backs of both of my legs were hot to the point of discomfort. The heat generated by the engine was by far the greatest fatigue factor noticed throughout this 158 mile evaluation.

OFFICER P. WALTERS:

Another day of 75 degrees in the morning and climbing into the low 100's throughout the day. The similarities between the two bikes are many, engine performance, engine heat, suspension, storage, controls, mounting and dismounting and riding position. The bikes handled about the same with the exception of the Electra Glide feeling a bit heavy in the front-end possibly due to the fairing. The fairing offers better protection from the wind and the elements and made an even better ride at the end of 160 miles. Different handlebars would also make for a more comfortable riding position.

# ERGONOMICS EVALUATION

## SUBJECTIVE EVALUATION – 157 MILE RIDE

### 2007 HARLEY-DAVIDSON – ROAD KING

RIDING POSITION	CONSIDERATIONS	RATING
Seat Comfort	Padding, Springs, Width	8.25
Seat Position	Range of Adjustment	7.5
Riding Position	Lean Angle, Comfort	8.38
Floorboards / Pegs	Access to Foot Controls	7.5
RIDER COMMENTS		
<p><u>DEPUTY S. BRYANT:</u> The air-ride seat is a great feature, it smoothes out most minor bumps in the roadway. The seat heights are good, but not adjustable. The riding position is comfortable, but I had to adjust to my feet being very forward of center.</p>		
<p><u>OFFICER M. NOWLEN:</u> The seat is air-cushioned and can be slightly adjusted with air pressure. I found that the higher the air pressure the better the ride. There is no height adjustment to the seat. Floorboards were mounted at a comfortable angle.</p>		
<p><u>DEPUTY M. BROWN:</u> The air suspended seat worked well and provided all day comfort. Riding position was upright with legs kicked forward. Floorboards were mounted forward of the seat.</p>		
<p><u>OFFICER P. WALTERS:</u> The Road King seat is well-padded and large enough to change positions during a long day of riding. The seat has a small adjustable air bladder underneath it that gives the rider additional suspension. The handlebars are further back than on the Electra Glide. The riding position was more comfortable after a day in the saddle. I felt no forward lean angle and my hands rested naturally on the handle bar controls. The floorboards are large and roomy enough to move my motor boots around during the trip once again making for a more comfortable ride.</p>		

INSTRUMENT PANEL	CONSIDERATIONS	RATING
Controls	Position, Usability	7.38
Visibility	Instruments	5
Reflection / Glare	Windshield, Instruments	7.67
Instruments	Adequacy, Legibility	6
RIDER COMMENTS		
<p><u>DEPUTY S. BRYANT:</u> The controls are positioned well and can be operated by both thumbs. The speedometer is placed on the gas tank causing you to look down and take your eyes off the roadway, adding the visor to your helmet can also block your vision. It would be nice if the tachometer and speedometer switched positions. The “dash lights” are a little too small and could be brighter for daytime visibility.</p>		

OFFICER M. NOWLEN:

The speedometer is mounted on the gas tank and can be hard to read at a glance. I noticed a slight glare from the sun, due to the chrome around the speedometer and gas tank area. Indicator lights were small and almost unreadable in bright sun.

DEPUTY M. BROWN:

The tachometer was mounted above the handlebars and was easy to read. All other gauges were mounted on the gas tank. Eyes have to be taken off of the road to read speedometer, trip meter, gas gauge, etc., creating a visual safety issue for the rider. Instrument lights were small and hard to see during the day.

OFFICER P. WALTERS:

The first instrument that you see while looking forward is the tachometer. It's large enough and easy to read even at freeway speeds. The speedometer is located on the fuel tank. Every time I needed to monitor my speed or check the turn signal indicator my attention was taken away from the roadway for a moment. The mid-day sun tended to reflect off of the speedometer and chrome housing causing more distractions while looking at the speed. The small sixth gear lighted indicator emblem is also located on the face of the speedometer. It's difficult to see during the day.

MIRRORS	CONSIDERATIONS	RATING
Road Visibility	Distortion, Obstruction	6.25
Reflections	Instruments, Controls	7.25
Mirror Coverage	Adjustment, Rear Visibility, Flat or Convex	5.75
Mirror Location	Accessibility, Visibility, Obstruction	8

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The mirrors are placed in a good location with good visibility to the rear. The view is flat; a pair of convex mirrors would greatly increase visibility.

OFFICER M. NOWLEN:

The mirrors are mounted on the handlebars, but seem small and provide limited coverage to the sides. I found myself constantly adjusting the mirrors to compensate for the poor visibility, the mirrors also vibrated out of adjustment at times.

DEPUTY M. BROWN:

The handlebar-mounted mirrors were well placed and provided a good range of adjustment. The mirrors were "flat" and offered limited visibility. The use of "convex" mirrors would provide a wider angle of visibility increasing rider safety.

OFFICER P. WALTERS:

The mirrors vibrate enough at freeway speeds making it difficult to identify the vehicles behind me. The rear view is not large enough compared to after market mirrors available. At surface street speeds the mirrors were adequate.

WIND SCREEN	CONSIDERATIONS	RATING
Height / Width	Wind / Debris Protection	5.75
Adjustability	Electric or Manual, Ease of Use	N/A
Top Edge	Clear View Over Top of Windshield, (Bifocal Effect)	8.25

<b>RIDER COMMENTS</b>
<p><u>DEPUTY S. BRYANT:</u> The Road King has a windshield that is not adjustable, but removable. Protection is adequate but slightly windy. You would want more protection on a cold day on the freeway. You have a clear view over the top of the windshield with no noticeable distortion.</p>
<p><u>OFFICER M. NOWLEN:</u> The windshield was tall and provided good protection to the rider's face. But was thin at the bottom and did not block much wind to the body. The windshield has no adjustability, but can be removed easily. Wind was loud and turbulent at speeds of 70+ mph.</p>
<p><u>DEPUTY M. BROWN:</u> The height of windshield was adequate for a 6-foot rider. The windshield width was narrow and provided no wind or debris protection for hands and arms. Upper body debris protection was good. There was no fairing or lowers on the Road King.</p>
<p><u>OFFICER P. WALTERS:</u> The removable non-adjustable windshield gives good protection to my upper torso only. I noted that my hands and forearms were exposed to the wind and debris especially at higher speeds. No distortion or obstructions were observed while looking through the windshield. Looking over the windscreen was easy for my 6'2" frame. I did experience some buffeting of the helmet while on the freeway.</p>

<b>CONTROLS</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Handlebars	Angle, Size, Position	8.25
Shift Levers	Usability, Shift Pad Position	7.25
Switches	Reach, Markings, Visibility, Accessibility	8.25
Rear Brake Pedal	Location, Feedback, Ease of Use	8
Front Brake Lever	Location, Feedback, Adjustability	7.75
Clutch Lever	Lever Resistance, Adjustability	8

<b>RIDER COMMENTS</b>
<p><u>DEPUTY S. BRYANT:</u> All the controls are comfortable and work well. I think an adjustable front brake lever would be a great addition to the bike.</p>
<p><u>OFFICER M. NOWLEN:</u> The handlebars were approximately 2" longer than the Electra Glide model. This was noticeably more comfortable, putting the rider in a more up/down position. Better handlebar transition when negotiating slow tight turns. Heel and toe shifter was a bit bulky and seemed in the way at times.</p>
<p><u>DEPUTY M. BROWN:</u> Handlebar size and position was good. Access to the shift lever was ok for downshifting and awkward for upshifting. The heel shifter was high and difficult to reach. Switches were well placed and easy to use. Rear brake, front brake and clutch were easy to use and provided good feed back. Clutch had a good friction point with a medium to heavy pull.</p>
<p><u>OFFICER P. WALTERS:</u> The handlebar position and angle was good and is comfortable throughout the days of testing. The shifter lever was set high enough to allow my boot to use heel and toe shifting or position the toe of the boot under the front shifter to upshift. The switches were easy to reach and functioned properly. The clutch and front brake lever are large and are easy to operate. The wet</p>

clutch is smooth and gives good feed back during friction point riding. During non-ABS operation, the brakes give excellent control and feed back. During ABS situations the front and rear brake controls pulsate quite a bit.

<b>MOUNT / DISMOUNT</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Trunk Height	Ample Leg Swing Room	N/A
Foot Peg / Floorboard	Interferes With Mounting / Dismounting	7.75
Lean Angle	Side Stand of Adequate Length	8

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The bike had no trunk during testing, floorboards are forward of center, so as not to interfere with mount/dismounting. Kickstand worked well on moderately crowned roads. With dismounting your right ankle/leg always seems to end up against the exhaust pipe.

OFFICER M. NOWLEN:

The floorboards are mounted at a good angle for normal riding, but quickly get in the way and start dragging, when riding aggressively in the turns. The rider definitely runs out of lean angle quickly and the frame begins to drag.

DEPUTY M. BROWN:

The Road King's low profile and absence of a trunk made mounting and dismounting quite easy. The floorboards did not interfere when mounting and dismounting from either side. The side stand allowed adequate lean angle even on crowned roadways.

OFFICER P. WALTERS:

Getting on and off the Road King was easy due to the lack of top box (trunk). Getting on and off on the right side of the motorcycle was easy with long legs. I did make contact with the pipe with my right boot causing some boot polish transfer onto the hot pipe. The Road King side stand had no extender mounted on it. I was able to deploy the side stand with no problems while keeping my attention forward during traffic stops.

<b>SUSPENSION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Quality of Ride	Dampening, Rebound	8.5
Rider Size	Adjustability	7.88

**RIDER COMMENTS**

DEPUTY S. BRYANT:

The air-ride seat absorbs most of the bumps. The bike has adjustable rear air shocks. I found big bumps would bounce you off the seat. The bike sits low, so good for shorter riders, only handlebar really adjustable.

OFFICER M. NOWLEN:

The overall ride was comfortable through the entire day of riding. The riding position was natural and provided a good platform for doing traffic enforcement.

DEPUTY M. BROWN:

The air-assisted rear suspension and front forks provided good ride quality. Good dampening and rebound smoothed out rough roadways. The rear shocks and rider's seat are both air adjustable to accommodate rider size and comfort level.

OFFICER P. WALTERS:

The quality of the ride was extremely good considering the size of the Road King. The air-adjusted rear shocks in addition to the air bladder under the seat gives a very comfortable ride. The suspension absorbed all roadway irregularities giving a smooth ride after 160 miles.

<b>STORAGE</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Saddlebags	Angle, Size and Position of Opening	7.5
Locks	Same Key, Security, Sturdiness	8.25
<b>RIDER COMMENTS</b>		
<u>DEPUTY S. BRYANT:</u> Saddlebags bags are large and top-opening. The “ABS system” takes half of the right saddlebag. This is your main bag you work out of. A clipboard will fit but not a posse box. The ABS really should be moved to the other bag.		
<u>OFFICER M. NOWLEN:</u> The saddlebags were long and deep with a hinged cover, which locked into place with a large knob type latch. This was easy to operate even with gloves on; the locks were locked with a sturdy rotary key.		
<u>DEPUTY M. BROWN:</u> Saddlebag lids had a twist knob closure. Lids opened outward which provided good access to the compartments. Storage space was limited in the right saddlebag due to the mounting of the ABS braking components. The rear mounted saddlebag locks worked well.		
<u>OFFICER P. WALTERS:</u> The saddlebags open from the top using a hockey puck looking device that turns allowing easy access to the bags. The ABS takes up about 1/3 the storage space in the right bag and the bags have no dividers. The locks are located on the rear section of the bags and use the same type key as the ignition. This bike had keys for the bags and the ignition.		

<b>ADDITIONAL RIDER COMMENTS</b>
<u>DEPUTY S. BRYANT:</u> After the first five minutes of the ride, the back of my right thigh became hot from the engine, and remained that way all day. Even at freeway speed I could feel the heat. In stop-and-go traffic it was really hot. It was very noticeable and annoying. If you put your left leg down at a stop your ankle/leg hit up against the clutch cover of the transmission which is all very hot!
<u>OFFICER M. NOWLEN:</u> The first thing I noticed when riding in slow city traffic was the extreme heat. The heat was fatiguing to the back of the thighs and calf area. The motorcycle was fun to ride at cruising speeds, but a little challenging at high speed cornering.
<u>DEPUTY M. BROWN:</u> The engine’s rear cylinder heat and exhaust system provided a significant amount of heat. The insides and backs of both my legs were hot to the point of discomfort. The heat generated by the engine was by far the greatest fatigue factor noticed throughout this 158-mile evaluation.
<u>OFFICER P. WALTERS:</u> The day of this test it was 75 degrees in the morning then climbed into the low 100’s throughout the day. The first thing I noticed was when the bike gets hot the rear cylinder shuts down allowing only air into it for cooling. Before taking off, it is necessary to apply the throttle for a moment to get the rear cylinder to fire-up again. Not doing this caused the motorcycle to hesitate while accelerating. I started the test with an assumption that the bike produced more heat due to the larger displacement engine. I was surprised to find that compared to the 88 cubic inch engine the heat generated was about the same. With that said it is still a lot of engine heat to contend with during the summer months. The other assumption was that the floorboards and frame would drag during the canyon sections. I maintained a good speed through the canyons with the

boards touching only a few times. The 103 cubic inch engine produces an outstanding power curve. Lots of torque in the mid range makes for good third gear riding during the surface street sections and in the canyons. Good roll-on power made down shifting unnecessary. After riding the Road King for a full day I felt a little tired due to the heat however the ride was not fatiguing, and I was ready to go farther due to the comfort of the motorcycle. The windshield does not give as much protection as the Electra Glide however it was adequate.

# ERGONOMICS EVALUATION

## SUBJECTIVE EVALUATION – 157 MILE RIDE

### 2005 HONDA – ST 1300 PA

RIDING POSITION	CONSIDERATIONS	RATING
Seat Comfort	Padding, Springs, Width	5
Seat Position	Range of Adjustment	6
Riding Position	Lean Angle, Comfort	5
Floorboards / Pegs	Access to Foot Controls	6
RIDER COMMENTS		
<p><u>DEPUTY S. BRYANT:</u> The seat is very firm and can be uncomfortable after a long ride. The riding position leans slightly forward, putting pressure on your palms. You have good access to foot controls, but the pegs and the bike sit low which causes you to drag your boots in some turns.</p>		
<p><u>OFFICER M. NOWLEN:</u> The seat lacks padding, very noticeable when riding or just sitting on the bike. Riding position is a little too far forward. I found it a struggle to keep my head up. Foot pegs don't allow enough ground clearance. Cramped with controls.</p>		
<p><u>DEPUTY M. BROWN:</u> Seat padding felt hard after about 100 miles. Seat position was good. I was comfortable in the mid-position. Riding position lean angle was too far forward. Lean angle caused pressure points on heel of the palms. Mostly noticeable during sustained freeway riding. Good access to foot controls.</p>		
<p><u>OFFICER P. WALTERS:</u> The riding position is cramped for a 6'2" rider with motor boots on. Placing the balls of the boots on the pegs was necessary to prevent dragging the boots while turning. The riding posture also put my upper body weight forward applying pressure on the palms of both hands. After 160 miles of riding my hands started to feel numb. At the end of the day, my first comment was that the seat padding was not adequate.</p>		

INSTRUMENT PANEL	CONSIDERATIONS	RATING
Controls	Position, Usability	7.5
Visibility	Instruments	8
Reflection / Glare	Windshield, Instruments	7.25
Instruments	Adequacy, Legibility	7
RIDER COMMENTS <sup>25</sup>		
<p><u>DEPUTY S. BRYANT:</u> All the controls are placed well and are reachable without removing your hand from the grip. The speedometer is easy to read, but the digital portion is small and a little dim in direct sunlight. There is no noticeable glare from the handlebars in the windshield.</p>		

<u>OFFICER M. NOWLEN:</u> Controls are placed well, with good spacing. Easy to see in bright sunlight. A little too far down, more than just a glance down to see. Speedometer stands out, easy to read for pacing.
<u>DEPUTY M. BROWN:</u> Controls were well positioned and easy to use. Speedometer and tachometer were easy to read. Digital gauges required more attention in direct sunlight. I did not notice any significant glare issues in windshield or instruments.
<u>OFFICER P. WALTERS:</u> The instrument panel is a little cluttered with too much information in a small area.

MIRRORS	CONSIDERATIONS	RATING
Road Visibility	Distortion, Obstruction	7.75
Reflections	Instruments, Controls	7
Mirror Coverage	Adjustment, Rear Visibility, Flat or Convex	7.5
Mirror Location	Accessibility, Visibility, Obstruction	7

RIDER COMMENTS		
<u>DEPUTY S. BRYANT:</u> The mirrors are a little low but have good visibility to the rear. A small portion of the mirror reflects your handles on the grips.		
<u>OFFICER M. NOWLEN:</u> Mirrors are out of the way, but quick to check due to the far forward riding position. Good coverage. Just a little obstruction at the tops from grip reflection.		
<u>DEPUTY M. BROWN:</u> The low-mounted mirrors had good visibility. The convex shape provided good coverage from the side of the motorcycle into the adjacent lanes. The low mounting position required lowering head and eyes to use the mirrors.		
<u>OFFICER P. WALTERS:</u> Rear visibility was very clear at all speeds; no distortion or obstruction was noted.		

WIND SCREEN	CONSIDERATIONS	RATING
Height / Width	Wind / Debris Protection	7.5
Adjustability	Electric or Manual, Ease of Use	8.75
Top Edge	Clear View Over Top of Windshield, (Bifocal Effect)	8.5

RIDER COMMENTS		
<u>DEPUTY S. BRYANT:</u> The height of the windshield is good, but it would be nice if it were a little wider. You have a clear view over the top and it is easy to adjust.		
<u>OFFICER M. NOWLEN:</u> Windscreen goes way up, but seems a bit skinny. You still get a lot of wind around the side. You feel it at freeway speeds on the arms. Seems a little noisy. Good range in adjustability. Good protection for open face helmets.		
<u>DEPUTY M. BROWN:</u> Windscreen height and adjustability provided good debris protection and good visibility over the top. Windscreen width allowed some wind to hit the shoulders.		

**OFFICER P. WALTERS:**

The windscreen control switch was easy to locate and operate. The windscreen provides good torso protection at freeway speeds however my jacket cuffs needed to be tight due to the airflow.

<b>CONTROLS</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Handlebars	Angle, Size, Position	5.75
Shift Levers	Usability, Shift Pad Position	6.25
Switches	Reach, Markings, Visibility, Accessibility	7.75
Rear Brake Pedal	Location, Feedback, Ease of Use	7.25
Front Brake Lever	Location, Feedback, Adjustability	8.5
Clutch Lever	Lever Resistance, Adjustability	7.25

**RIDER COMMENTS**

**DEPUTY S. BRYANT:**

The bars are low causing a forward lean. I thought the diameter of the handlebars was a little small which could be fixed with thicker grips. The switches are easy to reach and well located. The clutch and front brake levers are adjustable. I thought the clutch pull was heavy causing my hand to ache in stop-and-go traffic.

**OFFICER M. NOWLEN:**

Handlebars seem to come up from the tank, but not far enough. Feels a little narrow (close together). When riding, the shift lever is tricky at times. The placement for your toes is limited when leaned over (makes gear selection very important) shift lever is short and is difficult to down shift with uniform riding boots. Boot keeps slipping off the lever. Rear brake pedal position is way down.

**DEPUTY M. BROWN:**

The handlebar position was low and caused a forward leaning ride position. The shift lever and brake pedal were well positioned. The handlebar switches were easy to use and were well located. The front brake lever was easy to adjust and provided good feedback. Clutch lever pull was heavy.

**OFFICER P. WALTERS:**

Handlebar angle and position places the rider into a forward location on the motor. The starter button is low and was not easy to reach. Front brake lever and clutch lever are very smooth and give good feedback.

<b>MOUNT / DISMOUNT</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Trunk Height	Ample Leg Swing Room	8
Foot Peg / Floorboard	Interferes With Mounting / Dismounting	5.5
Lean Angle	Side Stand of Adequate Length	6.75

**RIDER COMMENTS**

**DEPUTY S. BRYANT:**

Fairly easy to swing your leg over the trunk. It is difficult putting the side stand down. You have to put your foot perpendicular to the bike to get the side stand down. It is placed between the foot peg and the center stand.

**OFFICER M. NOWLEN:**

The motorcycle is easy to swing your leg over. Great for shorter riders. Lean angle is noticeably forward (good for fast aggressive riding) but not for day-to-day patrolling. Not enough ground clearance in the turns.

<p><u>DEPUTY M. BROWN:</u> It was reasonably easy to mount and dismount the Honda. The right foot peg contacted my right bootleg during right side dismounts. Trunk height was good.</p>
<p><u>OFFICER P. WALTERS:</u> Both pegs drag during moderate lean angles. Every time I stopped the motorcycle it was necessary to look down to locate the side stand. The position is so close to the foot peg and center stand that it was impossible to find while keeping my attention forward.</p>

SUSPENSION	CONSIDERATIONS	RATING
Quality of Ride	Dampening, Rebound	5.5
Rider Size	Adjustability	6.5

**RIDER COMMENTS**

<p><u>DEPUTY S. BRYANT:</u> The ride was a little stiff. You get good feedback from the road. Your knees are slightly cramped for example; you notice the expansion joints on the freeway.</p>
<p><u>OFFICER M. NOWLEN:</u> The ride is good for roadway feedback, but for comfort and ride ability it is lacking. Too rough. Seems a bit cramped for a 6-foot rider, knees are bent too much and position is too far forward.</p>
<p><u>DEPUTY M. BROWN:</u> The quality of the ride was stiff. The suspension seemed better suited for short distances and for sport riding. Adjusting the rear suspension via the left side adjuster knob did marginally improve the ride quality.</p>
<p><u>OFFICER P. WALTERS:</u> The suspension is too stiff. This caused most of the roadway irregularities to be transmitted directly to my hands and lower torso, resulting in fatigue.</p>

STORAGE	CONSIDERATIONS	RATING
Saddlebags	Angle, Size and Position of Opening	6.5
Locks	Same Key, Security, Sturdiness	8

**RIDER COMMENTS**

<p><u>DEPUTY S. BRYANT:</u> The saddlebags have a large opening but are strangely shaped inside. This may make it difficult for files and notebooks etc.</p>
<p><u>OFFICER M. NOWLEN:</u> Saddlebags are big with plenty of room for stuffing jackets and clothing, but hard to keep files and books etc. organized and easy to access. No dividers. The bags open in the middle and lay out to the side difficult to open in confined area (parked side-by-side with other motorcycles).</p>
<p><u>DEPUTY M. BROWN:</u> The saddlebags opened “clam shell” style with a wide opening. There was ample room to stow an open-faced helmet. There were no compartment dividers one key operated all locks on the motorcycle.</p>
<p><u>OFFICER P. WALTERS:</u> Saddlebags are large and easy to open. No dividers were installed to hold gear upright.</p>

**ADDITIONAL RIDER COMMENTS**

DEPUTY S. BRYANT:

This bike can be tiring at the end of a long ride due to the seating position (forward lean), stiff ride and hard seat. Feels like more of a sport bike. In stop-and-go traffic you notice the bike getting hot. The heat radiates through the frame that runs by your legs and feet. This part of the frame got so hot it burned my fingertips. The fairing in that leg area also got very hot.

OFFICER M. NOWLEN:

None submitted.

DEPUTY M. BROWN:

The Honda was enjoyable to ride for short periods of time. I noticed a significant amount of engine heat while riding the Honda in stop-and-go city traffic. At the end of 158 miles, I was ready to park the bike. The motorcycle accelerates to top speed very quickly. In my opinion, it may not be the best choice for newer, less experienced riders.

OFFICER P. WALTERS:

Emergency equipment was not mounted on this motorcycle for testing. Riding 160 miles with simulated traffic stops was a good test for a workday. I was fatigued due to the harsh suspension and poor padding in the saddle.

# **ACCELERATION & FUEL EFFICIENCY**

## ACCELERATION EVALUATION

<u>SPEED</u>	<u>BMW</u>	<u>HD – ELECTRA GLIDE</u>	<u>HD – ROAD KING</u>	<u>HONDA</u>
0-30 MPH	2.64	2.21	2.53	2.69
0-60 MPH	5.47	5.52	6.02	4.85
0-100 MPH	10.59	18.57	16.86	10.49
30-60 MPH	2.52	3.16	3.42	2.56
60-100 MPH	5.69	11.76	10.33	5.82
¼ MILE	13.22 @ 110.7	14.29 @ 98.3	14.69 @ 95.2	12.95 @ 107.6

## FUEL EFFICIENCY EVALUATION

<u>MOTORCYCLE</u>	<u>COMBINED AVERAGE Four 157 Mile Loops</u>
BMW POLICE MOTORCYCLE, 2006 MODEL YEAR R 1200 RT-P	41.4 MPG
HARLEY-DAVIDSON, 2007 MODEL YEAR ELECTRA GLIDE	37.9 MPG
HARLEY-DAVIDSON, 2007 MODEL YEAR ROAD KING	38.7 MPG
HONDA, 2005 MODEL YEAR ST 1300PA	38.6 MPG

# **HEAT EVALUATION**

**HEAT EVALUATION**  
**IMMEDIATELY FOLLOWING 32 LAP COURSE**

<b>2006 BMW POLICE MOTORCYCLE – R 1200 RT-P</b>		
<b>ITEM</b>	<b>MANUFACTURERS RECOMMENDATION</b>	<b>TEST RESULT</b>
Radiator Water	N/A	N/A
Engine Oil	Maximum 260° to 300°	200°
Transmission Oil	N/A – Part of the engine case.	N/A
<b>RADIANT HEAT</b>		
Radiator	N/A	
Brake Rotors	L/F 115°    R/F 117°    R/R 200°	
Engine	79°	
Transmission	Same as Engine	
Exhaust	92°	

<b>2007 HARLEY-DAVIDSON – ELECTRA GLIDE</b>		
<b>ITEM</b>	<b>MANUFACTURERS RECOMMENDATION</b>	<b>TEST RESULT</b>
Radiator Water	N/A	N/A
Engine Oil	280° TO 410° Maximum	248°
Transmission Oil	280° TO 410° Maximum	241°
<b>RADIANT HEAT</b>		
Radiator	N/A	
Brake Rotors	L/F 284°    R/F 335°    L/R    R/R 270°	
Engine	172°	
Transmission	152°	
Exhaust	250°	

## HEAT EVALUATION CONTINUED

<b>2007 HARLEY-DAVIDSON - ROAD KING</b>		
ITEM	MANUFACTURERS RECOMMENDATION	TEST RESULT
Radiator Water	N/A	N/A
Engine Oil	280° to 410° Maximum	240°
Transmission Oil	280° to 410° Maximum	241°
<b>RADIANT HEAT</b>		
Radiator	N/A	
Brake Rotors	L/F 132°    R/F 132°    R/R 270°	
Engine	120°	
Transmission	241°	
Exhaust	265°	

<b>2005 HONDA – ST 1300 PA</b>		
ITEM	MANUFACTURERS RECOMMENDATION	TEST RESULT
Radiator Water	208° to 216°	180°
Engine Oil	176° to 248° Infrared	200°
Transmission Oil	N/A – Part of the engine case	N/A
<b>RADIANT HEAT</b>		
Radiator	85°	
Brake Rotors	L/F 86°    R/F 79°    R/R 101°	
Engine	115°	
Transmission	Same as Engine	
Exhaust	101°	

# **SOUND LEVEL EVALUATION**

## SOUND LEVEL EVALUATION

<b>2006 BMW POLICE MOTORCYCLE – R 1200 RT-P</b>	
<b>SPEED</b>	<b>MEASURED db</b>
40 MPH (Sustained Speed)	82.8
60 MPH (Sustained Speed)	90.1
80 MPH (Sustained Speed)	97.5
Accelerate zero to 80 mph	107.2

<b>2007 HARLEY-DAVIDSON – ELECTRA GLIDE</b>	
<b>SPEED</b>	<b>MEASURED db</b>
40 MPH (Sustained Speed)	84.3
60 MPH (Sustained Speed)	88.7
80 MPH (Sustained Speed)	95.1
Accelerate zero to 80 mph	107.6

<b>2007 HARLEY-DAVIDSON - ROAD KING</b>	
<b>SPEED</b>	<b>MEASURED db</b>
40 MPH (Sustained Speed)	84
60 MPH (Sustained Speed)	89.7
80 MPH (Sustained Speed)	94.3
Accelerate zero to 80 mph	109.8

<b>2005 HONDA – ST 1300 PA</b>	
<b>SPEED</b>	<b>MEASURED db</b>
40 MPH (Sustained Speed)	82.1
60 MPH (Sustained Speed)	87.3
80 MPH (Sustained Speed)	91.1
Accelerate zero to 80 mph	105

# **MECHANICAL EVALUATION**

## MECHANICAL EVALUATION

### 2006 BMW POLICE MOTORCYCLE – R 1200 RT-P

ELECTRICAL SYSTEM	CONSIDERATIONS	RATING
Battery	Accessibility, Group, Size	4.25
Alternator	Accessibility, Amperage	N/A
Stator	Accessibility, Amperage	2.5
Starter	Accessibility, Power	6.75
Ignition	Accessibility	6.25
Spark Plugs	Accessibility	5
Lights	Accessibility of Headlight Adjustment, Ease of Replacement	4.75
Fuse Box	Accessibility, Serviceability	6
FUEL SYSTEM	CONSIDERATIONS	RATING
Fuel Injection	Accessibility, Serviceability	6
Fuel Pump	Accessibility, Serviceability	5.25
Fuel Filter	Accessibility, Serviceability	5.25
Fuel Tank / Lines	Accessibility, Puncture Resistant	5
COOLING SYSTEM	CONSIDERATIONS	RATING
Radiator	Accessibility, Protection, Adequate Size	N/A
Water Pump	Accessibility, Belt Arrangement	N/A
Hoses	Accessibility	N/A
Coolant Recovery	Accessibility, Capacity	N/A
TRANSMISSION	CONSIDERATIONS	RATING
Transmission / Gearbox	Ease of Removal, Serviceability	3.25
Drain Plug	Ease of Removal, Protection	9.5
Fluid Level Sight Glass	Accessibility, Night Usability	6
Clutch	Accessibility, Serviceability	2.25
Cooler	Accessibility, Protection	N/A
BRAKES	CONSIDERATIONS	RATING
Master Cylinder	Accessibility, Protection	8.25
Power Brake Assist	Accessibility	4.25
Front Wheel Brakes	Accessibility	8.6
Rear Wheel Brakes	Accessibility	8.6
ABS System	Accessibility, Serviceability, Reparability	4
EXHAUST SYSTEM	CONSIDERATIONS	RATING
Muffler	Accessibility	9.5
Pipes	Accessibility, Support	8.75
Header Pipes	Accessibility, Protection	9

## MECHANICAL EVALUATION

### BMW - Continued

<b>BODY</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Windshield	Ease of Removal	9.5
Crash Bars	Accessibility, Ease of Removal	8.75
Patrol Equipment, Lights	Ease of Installation	7.25
Instrument Panels	Accessibility, Serviceability	5
Body Wiring	Accessibility, Serviceability, Protection	4.5
Seat	Ease of Removal	9.5
Body Panels	Ease of Removal	6.75
Handlebar Controls	Accessibility, Serviceability, Protection	5
Foot Controls	Accessibility, Serviceability, Protection	7
Saddlebags	Accessibility, Protection	8.25
<b>ENGINE &amp; ACCESSORIES</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Engine	Accessibility, Ease of Removal	3.5
Cylinder Head	Accessibility, Ease of Removal	6
Valve Covers	Accessibility, Valve Train Serviceability	9.5
Cylinder Removal	Accessibility, Serviceability,	6.25
Drain Plug	Ease of Removal, Durability	9.5
Fluid Level Sight Glass	Accessibility, Night Usability	8.25
Oil Filter	Accessibility, Capacity, Protection	8
Engine Mounts	Accessibility	N/A
Oil Coolers	Accessibility, Protection	5.5
<b>STEERING &amp; SUSPENSION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Front Forks	Accessibility, Serviceability, Adjustability	6.5
Front Suspension	Accessibility, Serviceability	5.6
Rear Shock Absorbers	Accessibility, Serviceability	8
Rear Swing Arm	Accessibility, Serviceability	5
Front Tire	Accessibility, Ease of Removal	9
Axle Bearings & Seals	Accessibility, Serviceability	8.25
<b>REAR AXLE DRIVE SHAFT</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Rear Gearbox	Accessibility, Serviceability	6.75
Drive Chain	Accessibility, Serviceability	N/A
Axle Bearings & Seals	Accessibility, Serviceability	4.75
Drive Shaft	Accessibility, Serviceability	6.25
Universal Joints	Accessibility, Serviceability	6.5
Rear Tire	Accessibility, Ease of Removal	9.5

## MECHANICAL EVALUATION

### 2007 HARLEY-DAVIDSON – ELECTRA GLIDE

<b>ELECTRICAL SYSTEM</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Battery	Accessibility, Group, Size	8.5
Alternator	Accessibility, Amperage	N/A
Stator	Accessibility, Amperage	6.25
Starter	Accessibility, Power	5.75
Ignition	Accessibility	6.25
Spark Plugs	Accessibility	9.5
Lights	Accessibility of Headlight Adjustment, Ease of Replacement	8
Fuse Box	Accessibility, Serviceability	5.5
<b>FUEL SYSTEM</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Fuel Injection	Accessibility, Serviceability	6.6
Fuel Pump	Accessibility, Serviceability	6.25
Fuel Filter	Accessibility, Serviceability	6.25
Fuel Tank / Lines	Accessibility, Puncture Resistant	6.25
<b>COOLING SYSTEM</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Radiator	Accessibility, Protection, Adequate Size	N/A
Water Pump	Accessibility, Belt Arrangement	N/A
Hoses	Accessibility	N/A
Coolant Recovery	Accessibility, Capacity	N/A
<b>TRANSMISSION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Transmission / Gearbox	Ease of Removal, Serviceability	3
Drain Plug	Ease of Removal, Protection	9.25
Fluid Level Dip Stick	Accessibility, Night Usability	5.3
Clutch	Accessibility, Serviceability	6.25
Cooler	Accessibility, Protection	N/A
<b>BRAKES</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Master Cylinder	Accessibility, Protection	5
Power Brake Assist	Accessibility	N/A
Front Wheel Brakes	Accessibility	5.25
Rear Wheel Brakes	Accessibility	3.25
ABS System	Accessibility, Serviceability, Reparability	7
<b>EXHAUST SYSTEM</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Muffler	Accessibility	6
Pipes	Accessibility, Support	5
Header Pipes	Accessibility, Protection	5

## **MECHANICAL EVALUATION** **ELECTRA GLIDE - Continued**

<b>BODY</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Windshield	Ease of Removal	8
Crash Bars	Accessibility, Ease of Removal	6.75
Patrol Equipment, Lights	Ease of Installation	8.3
Instrument Panels	Accessibility, Serviceability	6.25
Body Wiring	Accessibility, Serviceability, Protection	6
Seat	Ease of Removal	8.75
Body Panels	Ease of Removal	7.5
Handlebar Controls	Accessibility, Serviceability, Protection	6.5
Foot Controls	Accessibility, Serviceability, Protection	5
Saddlebags	Accessibility, Protection	9
<b>ENGINE &amp; ACCESSORIES</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Engine	Accessibility, Ease of Removal	3.75
Cylinder Head	Accessibility, Ease of Removal	4.75
Valve Covers	Accessibility, Valve Train Serviceability	5.25
Cylinder Removal	Accessibility, Serviceability	4.25
Drain Plug	Ease of Removal, Durability	9.25
Fluid Level Dip Stick	Accessibility, Night Usability	7
Oil Filter	Accessibility, Capacity, Protection	7.75
Engine Mounts	Accessibility	3.5
Oil Coolers	Accessibility, Protection	3.25
<b>STEERING &amp; SUSPENSION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Front Forks	Accessibility, Serviceability, Adjustability	3.25
Front Suspension	Accessibility, Serviceability	3.25
Rear Shock Absorbers	Accessibility, Serviceability	6.75
Rear Swing Arm	Accessibility, Serviceability	3
Front Tire	Accessibility, Ease of Removal	5.75
Axle Bearings & Seals	Accessibility, Serviceability	5.25
<b>REAR AXLE DRIVE SHAFT</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Rear Gearbox	Accessibility, Serviceability	N/A
Drive Chain	Accessibility, Serviceability	2
Axle Bearings & Seals	Accessibility, Serviceability	2.6
Drive Shaft	Accessibility, Serviceability	N/A
Universal Joints	Accessibility, Serviceability	N/A
Rear Tire	Accessibility, Ease of Removal	2.5

## MECHANICAL EVALUATION

### 2007 HARLEY-DAVIDSON – ROAD KING

ELECTRICAL SYSTEM	CONSIDERATIONS	RATING
Battery	Accessibility, Group, Size	8.5
Alternator	Accessibility, Amperage	N/A
Stator	Accessibility, Amperage	6.25
Starter	Accessibility, Power	5.75
Ignition	Accessibility	6.25
Spark Plugs	Accessibility	9.5
Lights	Accessibility of Headlight Adjustment, Ease of Replacement	8
Fuse Box	Accessibility, Serviceability	5.5
FUEL SYSTEM	CONSIDERATIONS	RATING
Fuel Injection	Accessibility, Serviceability	6.6
Fuel Pump	Accessibility, Serviceability	6.25
Fuel Filter	Accessibility, Serviceability	6.25
Fuel Tank / Lines	Accessibility, Puncture Resistant	6.25
COOLING SYSTEM	CONSIDERATIONS	RATING
Radiator	Accessibility, Protection, Adequate Size	N/A
Water Pump	Accessibility, Belt Arrangement	N/A
Hoses	Accessibility	N/A
Coolant Recovery	Accessibility, Capacity	N/A
TRANSMISSION	CONSIDERATIONS	RATING
Transmission / Gearbox	Ease of Removal, Serviceability	4.25
Drain Plug	Ease of Removal, Protection	9.25
Fluid Level Dip Stick	Accessibility, Night Usability	5.3
Clutch	Accessibility, Serviceability	5.75
Cooler	Accessibility, Protection	N/A
BRAKES	CONSIDERATIONS	RATING
Master Cylinder	Accessibility, Protection	5
Power Brake Assist	Accessibility	N/A
Front Wheel Brakes	Accessibility	5.25
Rear Wheel Brakes	Accessibility	3.25
ABS System	Accessibility, Serviceability, Reparability	7
EXHAUST SYSTEM	CONSIDERATIONS	RATING
Muffler	Accessibility	6
Pipes	Accessibility, Support	5
Header Pipes	Accessibility, Protection	5

## MECHANICAL EVALUATION ROAD KING - Continued

<b>BODY</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Windshield	Ease of Removal	8
Crash Bars	Accessibility, Ease of Removal	6.75
Patrol Equipment, Lights	Ease of Installation	8.3
Instrument Panels	Accessibility, Serviceability	6.25
Body Wiring	Accessibility, Serviceability, Protection	6
Seat	Ease of Removal	8.75
Body Panels	Ease of Removal	7.5
Handlebar Controls	Accessibility, Serviceability, Protection	6.5
Foot Controls	Accessibility, Serviceability, Protection	5
Saddlebags	Accessibility, Protection	9
<b>ENGINE &amp; ACCESSORIES</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Engine	Accessibility, Ease of Removal	3.75
Cylinder Head	Accessibility, Ease of Removal	4.75
Valve Covers	Accessibility, Valve Train Serviceability	5.25
Cylinder Removal	Accessibility, Serviceability	4.25
Drain Plug	Ease of Removal, Durability	9.25
Fluid Level Dip Stick	Accessibility, Night Usability	7
Oil Filter	Accessibility, Capacity, Protection	7.75
Engine Mounts	Accessibility	3.5
Oil Coolers	Accessibility, Protection	3.25
<b>STEERING &amp; SUSPENSION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Front Forks	Accessibility, Serviceability, Adjustability	3.25
Front Suspension	Accessibility, Serviceability	3.25
Rear Shock Absorbers	Accessibility, Serviceability	6.75
Rear Swing Arm	Accessibility, Serviceability	3
Front Tire	Accessibility, Ease of Removal	5.75
Axle Bearings & Seals	Accessibility, Serviceability	5.75
<b>REAR AXLE DRIVE SHAFT</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Rear Gearbox	Accessibility, Serviceability	N/A
Drive Chain	Accessibility, Serviceability	2
Axle Bearings & Seals	Accessibility, Serviceability	2.6
Drive Shaft	Accessibility, Serviceability	N/A
Universal Joints	Accessibility, Serviceability	N/A
Rear Tire	Accessibility, Ease of Removal	2.5

# MECHANICAL EVALUATION

## 2005 HONDA – ST 1300 PA

ELECTRICAL SYSTEM	CONSIDERATIONS	RATING
Battery	Accessibility, Group, Size	5.75
Alternator	Accessibility, Amperage	N/A
Stator	Accessibility, Amperage	1.75
Starter	Accessibility, Power	2.5
Ignition	Accessibility	4.5
Spark Plugs	Accessibility	6.25
Lights	Accessibility of Headlight Adjustment, Ease of Replacement	6.25
Fuse Box	Accessibility, Serviceability	4.5
FUEL SYSTEM	CONSIDERATIONS	RATING
Fuel Injection	Accessibility, Serviceability	3.75
Fuel Pump	Accessibility, Serviceability	6.25
Fuel Filter	Accessibility, Serviceability	5.6
Fuel Tank / Lines	Accessibility, Puncture Resistant	5.6
COOLING SYSTEM	CONSIDERATIONS	RATING
Radiator	Accessibility, Protection, Adequate Size	6.25
Water Pump	Accessibility, Belt Arrangement	5.75
Hoses	Accessibility	5.25
Coolant Recovery	Accessibility, Capacity	8.25
TRANSMISSION	CONSIDERATIONS	RATING
Transmission / Gearbox	Ease of Removal, Serviceability	2
Drain Plug	Ease of Removal, Protection	8.2
Fluid Level Sight Box	Accessibility, Night Usability	8.2
Clutch	Accessibility, Serviceability	4.5
Cooler	Accessibility, Protection	N/A
BRAKES	CONSIDERATIONS	RATING
Master Cylinder	Accessibility, Protection	6.25
Power Brake Assist	Accessibility	N/A
Front Wheel Brakes	Accessibility	7
Rear Wheel Brakes	Accessibility	6.6
ABS System	Accessibility, Serviceability, Reparability	4
EXHAUST SYSTEM	CONSIDERATIONS	RATING
Muffler	Accessibility	6.5
Pipes	Accessibility, Support	4.3
Header Pipes	Accessibility, Protection	5.25

## MECHANICAL EVALUATION

### HONDA - Continued

<b>BODY</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Windshield	Ease of Removal	8.75
Crash Bars	Accessibility, Ease of Removal	N/A
Patrol Equipment, Lights	Ease of Installation	3.5
Instrument Panels	Accessibility, Serviceability	5.5
Body Wiring	Accessibility, Serviceability, Protection	4.75
Seat	Ease of Removal	3
Body Panels	Ease of Removal	3.75
Handlebar Controls	Accessibility, Serviceability, Protection	6
Foot Controls	Accessibility, Serviceability, Protection	6.25
Saddlebags	Accessibility, Protection	5.25
<b>ENGINE &amp; ACCESSORIES</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Engine	Accessibility, Ease of Removal	2.25
Cylinder Head	Accessibility, Ease of Removal	3.5
Valve Covers	Accessibility, Valve Train Serviceability	4.25
Cylinder Removal	Accessibility, Serviceability	3
Drain Plug	Ease of Removal, Durability	8.25
Fluid Level Sight Glass	Accessibility, Night Usability	8.25
Oil Filter	Accessibility, Capacity, Protection	8.75
Engine Mounts	Accessibility	3
Oil Coolers	Accessibility, Protection	N/A
<b>STEERING &amp; SUSPENSION</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Front Forks	Accessibility, Serviceability, Adjustability	6.25
Front Suspension	Accessibility, Serviceability	5.25
Rear Shock Absorbers	Accessibility, Serviceability	6
Rear Swing Arm	Accessibility, Serviceability	5
Front Tire	Accessibility, Ease of Removal	5.75
Axle Bearings & Seals	Accessibility, Serviceability	5.25
<b>REAR AXLE DRIVE SHAFT</b>	<b>CONSIDERATIONS</b>	<b>RATING</b>
Rear Gearbox	Accessibility, Serviceability	5.6
Drive Chain	Accessibility, Serviceability	N/A
Axle Bearings & Seals	Accessibility, Serviceability	5.6
Drive Shaft	Accessibility, Serviceability	5
Universal Joints	Accessibility, Serviceability	3.6
Rear Tire	Accessibility, Ease of Removal	5.6