

## Objective

To identify reasons for rear wheel hop and thrust sidestep on acceleration.

The report documents results from road test and physical inspection of suspension systems. Report then makes recommendations in terms of reducing wheel hop and possible ways to introduce compliance into the whole car.

## Road test results

1. With steering wheel straight ahead car gently slips to the right at 5 and 50mph.
2. Suspension springs and dampers are very firm.
3. On hard acceleration on left cambered road (water collects in drains on the left) car thrusts to the right, i.e. climbs camber. On a right cambered road car darts right.
4. On roundabout balance in turn test, the car exhibits neutral to mild under steer (cold tyres).
5. On hitting potholes the front left wheel / suspension makes a loud clunk noise and is not compliant, almost as if the damper high speed bump damping is broken. This may be a feature of the Bilstein damptronic damper.
6. On Belgian pave at circa 5mph, rattling (snooker balls) from rear axle left and right.

## Physical inspection

### Front Axle Right

1. Outer toe rod end is worn and knocking
2. Minor knock between strut and damper insert at collar bearing on full droop

3. Rubber spring isolators x 3 are ripped or are being pushed out by spring and thus affecting corner balance results
4. Ride height collar is loose, captive bolt ineffective
5. Anti-roll bar drop link bootees split allowing water ingress

### Front Axle left

1. Lower brake duct missing.
2. Tie rod inner rod worn and knocking
3. Anti roll bar bootees split

### Rear axle left

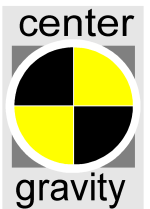
1. Inner and outer toe control rod ends worn
2. Front dog-bone control arm outer rod end worn
3. Spring slap on full droop (not failure in the UK)

### Rear axle right

1. Inner and outer toe control arm rod ends worn
2. Spring slap on damper, tender spring not long enough
3. Rear dog-bone control are outer rod end worn

### Geometry baseline

See attached geometry report. In summary 2.5 and 2.00 degrees negative camber front and rear cambers respectively. There is small cross camber on the front axle. The front toe is slightly higher than factory, likely to offset extra power. Rear toe-in total is high also again to compensate for higher power output. Toes are unequal likely to contribute to different grip levels and wheel hop/side step on throttle.



### Corner weight baseline

Vehicle ballasted to 80kg driver and ¼ fuel +33kg fuel ballast. Both anti roll bars disconnected. Total weight 1645.5kg

front		345.5kg	312kg		Delta 33.5kg
rear		497kg	491kg		Delta 6kg
Cross weight	49.2%	809kg	Delta 27.5kg		

There is a minimal cross axle difference on rear axle, unlikely to be cause of wheel hop.

Car left and right turn performance however will not be balanced.

### Ride heights

Ride heights were measured ballasted as per the corner weights. Rake circa 0.5degree nose down. Car has a 997 GT3 stance.

	Left	Right	Delta
Front	104mm	105mm	1mm
Rear	131mm	128mm	3mm

### Damper test

All dampers tested on in ground damper tester using the Lehr principle. Each damper shows good match per axle and all are in excess of 0.3 damping factor which is healthy.

### Recommendations

#### Addressing wheel hop and rear thrust

1. Replace rear axle toe control rod spherical joints with good quality rod ends to remove rear steer.
2. Synchronise rear toe in.
3. Increase loaded contact patch size by removing small amount of negative camber circa 0.5degree.
4. Replace worn dog bone inner and outer rod ends to remove rear steer.

### Other observations requiring action

Replace worn steering control rod inners and rod ends for better steering accuracy and front end stability

Replace missing front brake duct

Replace rear tender springs with longer ones to remove spring slap.

Fit spring perch locking rings to front struts to prevent changes in corner balance on turn. Locking bolt currently fitted on right wheel is ineffective.

Replace rod ends on both front anti roll bar drop links.

Adjust geometry to achieve symmetry in toe-in front and rear.

Adjust corner weights to achieve minimal rear cross axle difference.

Replace rear toe adjusters with RSS toe lock out kit to remove risk of toe movement.

Further replace rear monoball bearings in track control arms for better compliance.

If rear camber eccentric bolts have had more than 4 geometries done then they should be replaced as they tend to stretch and do not properly torque up.



**Measurement printout**

Car standard measurement

Beissbarth © \* ML 8 R Easy

M \* R+ \*\* OK \* PORSCHE\_STANDARD / 13.00 / 208 / C

Date: 29.09.2012 19:37:11

Version (program) v5.0b1408/v5.0b1402	Version (CCD) v5.0b1900	Version (target data) PORSCHE STANDARD v13.00	Serial number C00000757	Service 12.09.2011
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Customer

Name:

Vehicle

Registration

2 / 001

Vehicle: **PORSCHE STANDARD v13.00**

PORSCHE (EU) \* 997 Turbo \* Carrera \* PASM \* Production: 2007 - \* 19"

Rear Axle		Initial Measurement	Target Data	Final Measurement
Camber	left	-1°56'	-0°15' [-1°40'] +0°15'	-1°56'
	right	-1°56'		-1°56'
Cross Camber		+0°00'	[0°20']	+0°00'
Individual Toe	left	+0°15'	-0°05' [+0°10'] +0°05'	+0°15'
	right	+0°19'		+0°19'
Cross Toe		-0°04'	[0°05']	-0°04'
Total Toe		+0°35'	-0°10' [+0°20'] +0°10'	+0°35'
Setback		+0°00'		+0°00'
Geometrical driving axis		+0°02'		
Front Axle		Initial Measurement	Target Data	Final Measurement
Camber	left	-2°28'	-0°15' [-0°40'] +0°15'	
	right	-2°19'		
Cross Camber		-0°09'	[0°20']	
Individual Toe	left	+0°13'	-0°02' [+0°03'] +0°03'	
	right	+0°09'		
Total Toe		+0°21'	-0°05' [+0°05'] +0°05'	