# TORQUE STEER

The internet is a wonderful thing. It can be an excellent source of information, and disinformation. It is great way to share views and increase your knowledge, via chat groups.

For those of you who are not aware the Yahoo website is host to a number of groups that are relevant to Citroën. There are groups for most models from the marque, and of these the most active is the CX group. I think that for every one GS related message in my email inbox, there must be 10 from the CX-afflicted.

The following is the majority of a recent conversation thread regarding torque steer.

CXs do not torque steer. Only front wheel drive cars I know that do not.
Gary

No properly designed FWD car – with equal length driveshafts [which is why there is that centre support bearing] will.
Adrian Chapman

Proving most of them are not properly designed. Especially Honda, even the 2007 I test-drove a few months ago. Citroën was way ahead of the Japanese guys years ago.

Don't you think Diravi has something to do with it too?
Gary

No, because Gs and 2CVs do not torque steer. Nor do [proper] Saab 900s. Equal-length driveshafts…
Adrian Chapman

Do not forget the DS and the SM… for that matter the Traction Avant then eh?

Sure, if the engine is going straight then it is easier, but I was really referring to the transverse types and dealing with the design limitations well.

I mentioned it before but just wanted to add that the WORST car I have ever driven in this regard was a Ford Probe that my sister-in-law had… if you gave it even SOME gas when you had the wheels turned to the right it would just about LOCK the wheels there… it was… startling

I always wanted to like Hondas because when I needed a gas miser during the gas crisis back when, I loved the economy of the Honda 600 I had, but I cannot believe I put up with the other limitations of the horrible little beast for 7 years.

Bad seats, bad doors, bad suspension, bad heating, bad noise… all the plastic was 'barbie' quality… but I had a lot of fun driving that car all over the US and 25,000miles around Europe living in it after I altered it to be the smallest camper in the world… I presume that title until I see something on the internet to take the crown… probably tomorrow. It would have to be an original Mini or Issette made into a camper.

I keep thinking I might fall for a BMW Mini, if they would make a Maxi version and stretch it… just stretch it and maybe bump the top up from the back of the doors rearward… just a little raised roof of about 3inches for more room. I think they could sell boat loads of them as kind of hatchbacks with fold down seats in back....put in a surf board, snowboard etc…

Sorry off topic but still about cars at least
Gary

Ds and SMs do not have equal length drive shafts. In fact, the D engine is located to the right of centre – presumably to offset the weight of the driver. The reason that Ds and SMs have no torque steer it that the steering has centre point geometry. That is, the wheels pivot around the centre of the contact patch. This is also why it is virtually impossible for road irregularities to cause deflection of the steering wheel – that and the design of the steering system [in order for the rack to move, a valve in the rotating union has to open to allow fluid to move in the rack. CXs also have centre point geometry, but it is achieved differently from in the D and SM.

The D and SM pivot point is vertical through the top of the tyre and down to the contact patch. The CX steering pivot is on a diagonal axis through the upper suspension arm ball joint through the lower ball joint and the contact patch. If the tyre and wheel combination on the car results in either a larger or a smaller rolling radius, the pivot point will no longer pass through the centre of the contact patch.

Many cars have a steering pivot point that is well inside of the centre of the contact patch. If you turn the wheels on these cars while it is stationary, you will often find marks that form an arc. Such vehicles will often suffer from torque steer even if the drive shafts are of equal length.

In order to reduce, or eliminate, torque steer in these vehicles, the diameter of the drive shaft segments must be greater on the 'long' side to compensate for the natural twisting tendency of the shaft. In effect, if the shaft on one side is 2feet long and the shafts on the other are 4feet long total [using an intermediate shaft with support bearing], when torque is applied the 2 outer end of the 2 foot long shaft will receive more torque than the outer end of

the other. Preventing this would require the intermediate shaft to be made either larger in diameter or of a more tortionally rigid material so that the moment of rotation is the same at both ends. This is not necessary on the CX due to the steering geometry [and Diravi does help, but only slightly].
Bob


And I, unfortunately, must disagree. Your argument would be quite correct, but you have neglected the action of the differential, whose function is exactly to deliver equal torque to both wheels, regardless of relative speed or relative angular position.

The worst torque steer car I have driven is an early '90s VW Golf GTI. It handled quite well and had lots of power, but hard acceleration would more or less freeze the steering wherever you had it. On neither my DS with power steering or my rather primitive early CX with, as we say in the States, Armstrong power steering, is any torque steer perceptible. The CX is very subject to shaking on acceleration if the CV joints are not in rather good nick, but no torque steer.

Yours for productive discussions,
Scott

Scott, The only thing wrong with your argument is the fact that torque steer does exist. Torque steer causes the car to veer right or left when power is applied with the wheels pointing straight ahead. The effect is exaggerated if the wheels are turned in the direction of the torque steer. If the differential did, indeed, always apply equal torque to both drive shafts, there could be no torque steer. The function of the differential is to allow the driven wheels to turn at different speeds in order to prevent skittering in turns [skittering being a technical term].

Whenever you have two rods of the same diameter but differing lengths, the shorter rod will transfer more torque than the longer rod – provided they have the same stiffness characteristics per unit of length.
Bob

I was always under the impression that CXs did not [have centre point geometry] – the outboard brakes made it impossible – and that Diravi used brute force to provide a similar effect in the event of a blown tyre.

Also, if the tyre and wheel combination on the car results in either a larger or smaller rolling radius and therefore the pivot point no longer passes through the centre of the contact patch, what size tyre does it work for? Remember, CXs had about five sizes fitted by the factory through the life.
Adrian Chapman

The original CX suspension has centre point steering when fitted with the original tyres [175 14 – '80s from memory] when the suspension was at the normal ride height & tyre pressures. Project the swivel axis [it is at about 10 or 15°] down to the road surface and its contact point coincides with the centre of the tyre. This unique designed coincidence can only occur with the designed tyre diameter/rim/tyre pressure etc.

As well as tyre size changes there have been rim offset changes, originally 49 mm. then with the wide track it changed to 45mm, maybe they reconsidered the centre point – who knows? This offset change occurred when they went to TRX and 195 14 70 tyres – which have the same diameter. Before this tyre size changes had the same rolling diameters as the original 175 '80s.
Chris Stuart, Perth, Aus

After this interesting, but not quite fruitful discussion, I headed to the internet and did a search. The first link was to Wikipedia. [www.wikipedia.com].

Torque steering is the influence of the engine torque on the steering for some front-wheel drive vehicles. For example, during full acceleration the steering may pull to one side, which may be disturbing to the driver. This either causes a tugging sensation in the steering wheel, or else the car veers from the intended path. As the Torque Steer Effect is directly related to the engine torque capabilities this problem becomes more and more evident with high output engines with strong low rpm range torque.

Torque steering may be confused with steering kickback.

Causes

Root causes for Torque Steer are [1]:

Nonsymmetric driveshaft angles, e.g. due to

Nonsymmetric design of the vehicle, e.g. different driveshaft length

Transient movement of the engine

Tolerances in engine mounts

Different driveshaft torques left to right

Suspension geometry tolerances

Unequal traction forces due to road surface [μ-Split] in combination with Kingpin Offset

The open differential cannot fairly distribute torque between the two driveshafts, the power may be transmitted to only one driveshaft

Ways to reduce the effect of torque steer

Have both driveshafts of the equal

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length by using an intermediate shaft [or 'lay shaft'] on one side of the transmission. This is already implemented on most modern cars [2]. When the driveshafts have different length and excessive torque is applied, the longer half shaft flexes more than the shorter one, thus causing one wheel to momentarily spin more slowly than the other, resulting in a steering effect. So the equal length of the driveshafts reduce the torque steer effect.

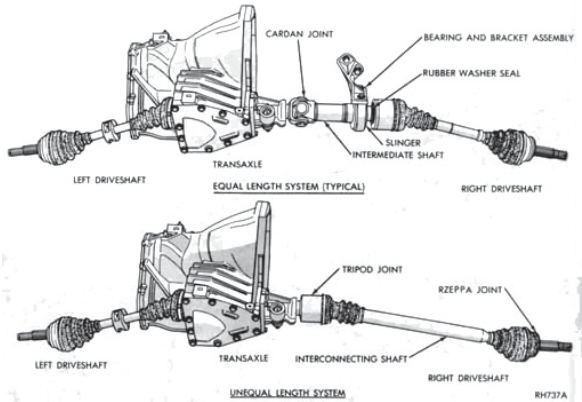
Implement double wishbone suspension [3] [4] or multi-link suspension [5].

Distribute the torque better between the driveshafts. Automobile transmission manufacturers like Quaife, Torsen, TrueTrac, Gold Trac offer worm-gear-based torque-biasing limited slip differentials for front-wheel drive vehicles, which help to reduce the amount of torque steer [6] [7] and improve cornering.

Reduce the amount torque from the front axle by passing part of torque to the rear axle. This is achieved on all-wheel-drive [AWD] vehicles with full-time AWD, e.g. with mechanical gear-based transaxle differential.

Power-assisted steering [set on most modern cars] make the torque steer effect less noticeable to the driver. Steer-by-wire [8] also hides the effect to torque steer from the driver.

Note that the rear-wheel-drive vehicles do not suffer from the torque steer, since the engine is not connected to the steering gear unless it has all wheel steering.




References

[1] Jens Dornhege. Torque Steer Influences on McPherson Front Axles.
[2] What is Torque Steer?. MPH Magazine.
[3] Handling. AutoZine Technical School.
[4] Technobabble: Multilink and the Beam. Sport Compact Car - November '98.
[5] Suspension Geometry. AutoZine Technical School.
[6] Why use Quaife?.
[7] Storm Transmission Modifications.
[8] Paul Yih. Vehicle State Estimation Using Steering Torque. Stanford University.

Source: Wikipedia

The view that torque steer is related to unequal length driveshafts is very common in articles on the internet. A dissenting voice is from www.diseno-art.com.

Torque steer is a phenomenon which adversely effects the handling on front wheel drive cars with high torque motors. It is the name given to the tendency for some front wheel drive cars to pull to the left or right under hard acceleration. It is a result of the offset between the point about which the wheel steers [which falls at a point which is aligned with the points at which the wheel is connected to the steering mechanisms] and the centre of its contact patch. The tractive force acts through the centre of the contact patch, and the offset of the steering point means that a turning force about the axis of steering is generated. In an ideal situation, the left and right wheels would generate equal and opposite forces, cancelling each other out, however in reality this is less likely to happen. Torque Steer is often incorrectly attributed to differing rates of twist along the lengths of unequal front drive shafts or CV joints.

So, I don't know about you, but I am still lost.

Leigh F Miles



# PRODUCT TEST

I recently decided to check out the performance of some structural adhesives as an alternative to silver soldering or brazing.

In particular, I was looking at a couple of Henkel products – Loctite 319 and Loctite 326.

Loctite 319 is a modified acrylic ester and is a general purpose structural adhesive recommended for bonding metals, glass, ceramics and plastics. The product cures when confined between close fitting parts with the aid of Activator 7649.

Loctite 326 is a polyurethane methacrylate which offers higher shear strength and faster cure than 319.

Technical data sheets on both products can be found at www.loctite.com

OK, so off to my local bearing supplier to purchase some Loctite 326.

'Sorry mate, we don't stock that any more. We had a number of complaints that it didn't work – shelf life problem'.

Ah well, how about 319?