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FROM THE SHOP FLOOR

In previous TDR magazines we've had input from repair shop locations and we've scattered the articles throughout the magazine. In this issue my thanks again goes to Andy Redmond. Andy operates a one-man, specialized repair shop in the north Dallas, Texas, suburb of Plano. In this issue Andy does a follow-up to his Issue 46 and 47 articles about front end suspension components. Additionally, Andy offers his opinion about the ongoing saga of fuel transfer pumps. I'm hopeful you'll enjoy the insight that Andy brings to the magazine.

SECOND GENERATION HANDLING AND SUSPENSION PROBLEMS, OPTIMAL ALIGNMENT SPECIFICATIONS AND TECHNIQUES

By Andy Redmond

In Issue 46 we discussed the wear of suspension components and a resulting wandering Turbo Diesel. We continued on related topics in Issue 47 as we discussed the addition of a steering gear stabilizer bracket and steering gear adjustment and replacement. For this issue, I would like to share a few suggestions to help you fine tune the handling of your Turbo Diesel. Additionally, I will briefly recap the Issue 46 and 47 columns and discuss feedback from other TDR members on these modifications.

In Issue 46, I discussed adding the Solid Steel Track Bar Retrofit kit to Second Generation, four-wheel drive Turbo Diesels. The benefits of the parts retrofit include tighter road feel, less wander and no more "death wobble" (at least in my case). Most of us are familiar with the death wobble, but it bears mentioning again. It is violent caster shimmy where the tire and axle shake after striking a pothole, un-even road surface or bump. This usually involves the right front wheel. We learned that a worn track bar can allow the axle to have some side to side movement (detrimental to maintaining proper alignment) and this likely contributes to the wobble.

Let's tackle front wheel alignment, as replacement parts were necessary according to the prior articles to maintain proper alignment specifications throughout the suspension travel. *Please note: when suspension adjustments or repairs are made, the vehicle should always be realigned.*

First, some alignment terms should be defined.

Toe: The amount that either front tire points inward (positive toe) or outward (negative toe) which is stated in degrees or fractions of an inch. Too much positive toe and the outside of the tire wears, too much negative toe and the inside will wear.

Caster: The amount the upper ball joint, pivot or kingpin is rotated ahead of vertical centerline or back beyond vertical. For illustration, let's imagine looking at the side of the front wheel. Let's also imagine that a clock face is painted onto the tire with

12 o'clock and 6 o'clock marking our vertical line or center point. Caster is expressed in a positive or negative manner by the rotation of the upper joint (12 o'clock) towards 10 o'clock position or towards 2 o'clock. It is also expressed in degrees or fractions of an inch.

Excessive positive caster can cause additional wear on suspension components, although proper amounts help with direction stability. Excessive negative caster makes steering effort easier at the sacrifice of directional stability. Both can have some effect on camber during suspension travel.

Cross caster: The amount of caster difference in the left front and right front wheels. Often a slightly larger value is used on the right front to compensate for the crown in the road. Upset the balance too much and the vehicle usually pulls towards the larger numeric value.

Camber: The measurement of how much the top of the wheel tips in towards the frame (negative camber) and how far it tips away from the frame (positive camber), with zero camber being a vertical centerline.

Cross Camber: The measurement of the difference between the left and right side camber values.

And now, my preferred alignment specifications for a four-wheel drive truck (with thanks to Brent, an ASE and Gold Certified Chrysler technician).

Alignment Specs in Degrees	Caster	Camber	Toe
Left Front	3.2°	-0.1°	
Right Front	3.5°	-0.1°	
Cross	-0.3°	0	0.0 to -0.25°

These specifications are close to most DC service manuals. My opinion is that camber and toe may be a bit aggressive for members who do not use the Turbo Diesel at near loaded capacity. I can only assume that once the truck is fully loaded the camber specs somewhat zero out. Should you desire to align your truck with its load or your trailer, you require the service of a heavy truck tire/alignment center that has a drive through bay. This too is likely preferable if your truck is loaded most of the time.

Most alignment shops will perform a four-wheel alignment. The values printed from the alignment shop can give some meaningful data. The number may point to poor caster, which can be corrected by shimming the axle at the spring attachment point. It might also

FROM THE SHOP FLOOR Continued

point to a misaligned rear axle. This could be due to a collision or worn spring bushings. But the rear axle does not typically require alignment, as there aren't any adjustments that a shop can perform.

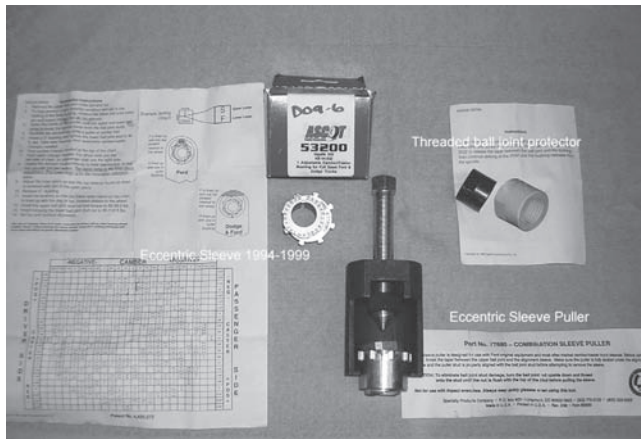
A rare exception would be corrections to thrust angle and rear axle alignment. The rear axle, although mounted perpendicular to the frame rails, is designed to offer parallel geometry to the frame. If it is not, then the axle is crooked and the rear end of the vehicle may "dog track." Although the springs, blocks and mounts are doweled for alignment, small adjustments can be made. Correction involves the U-bolts being loosened and shifting the axle slightly fore or aft to square it back to the frame. If these adjustments do not correct the problem, a qualified frame shop should measure the frame for irregularities and/or an axle shop will have to check for a bent axle tube.

Most front wheel alignments include resetting the toe. The four-wheel Turbo Diesel does not have any provision to adjust camber, only toe and caster. The alignment results routinely show that the caster parameters are about 2 to 4°. Guess what? If it falls in that

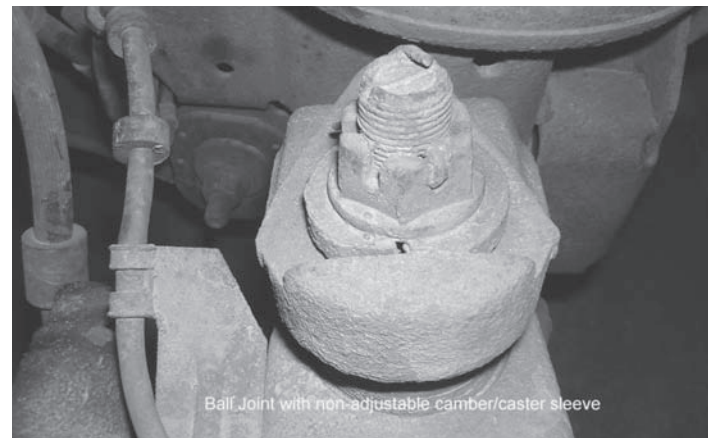
range, wanna bet the caster didn't get moved? Still doubt me? Go look at the alignment report "before and after." Did the alignment technician adjust the caster? Unless you asked for it, I'm guessing no. Or they may have said, "I can't adjust the caster to 3.5 degrees!" What gives, as I'm suggesting 3.2 to 3.5°? On most '94-'99 Turbo Diesel four-wheel drive trucks the factory eccentrics in the lower trailing arm won't allow for much more than 2.8 degrees of positive caster. Let's present a solution.

Ingall's Engineering (located in Colorado) specializes in the manufacture of alignment components. They do not sell to individuals, only tire shop product distributors, like McGee Paris Rubber Supply (Southwestern States) or through Ascot (Georgia based).

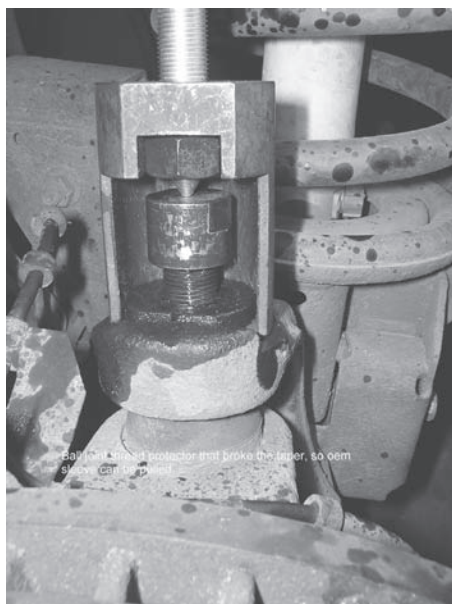
Ingall's makes a slick product for the '94-'99 Turbo Diesel called an adjustable ball joint eccentric sleeve, part number 532 or 53200 (Ascot), suggested retail price of \$45. The eccentric sleeve allows for caster and camber adjustment, which the alignment tech can then set to the preferred settings. It fits in place of the fixed alignment sleeve that resides on the upper ball joint stud in the spindle, which is retained by the upper ball joint nut and cotter key.



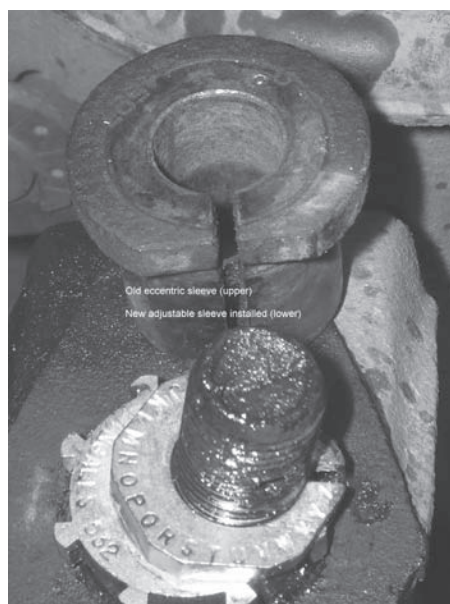
An assortment of front end parts.



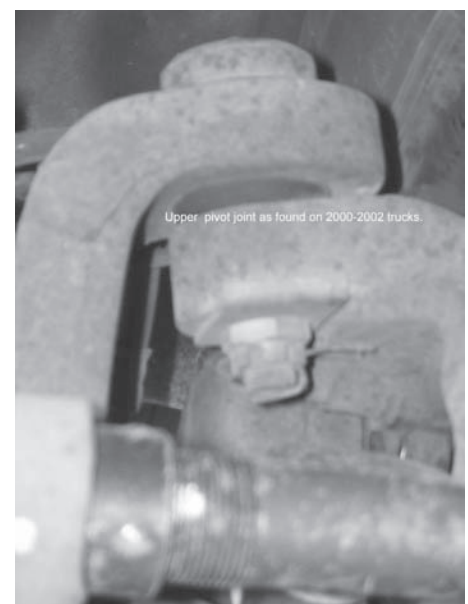
Ball joint with non-adjustable camber/caster sleeve.



Ball joint thread protector that broke the taper, so OEM sleeve can be pulled.



Old eccentric sleeve (upper).
New adjustable sleeve installed (lower).



Upper pivot point as found on '00-'02 trucks.

Ingall's also makes a product for the '00-'02 four-wheel drive Turbo Diesel. The addition of the twin piston brake caliper caused many changes to the suspension components in these trucks versus the '94-'99 models. The upper ball joint on the later trucks is referred to as an adjustable joint or pivot. Ingall's makes such a replacement, which is swapped out for the original (non-adjustable) design. The part number is 61500 (Ingall's and Ascot). I have seen it retail for nearly \$150 dollars, per side.



The later trucks seem to have ability to dial in greater caster settings than did the early Second Generation trucks (component changes). John Holmes reported a positive caster setting near 5° on his Turbo Diesel. Issue 34, page 119, has the details. The following is selected text from John's article. "I've been talking to Daryl, our head tech, about the customer complaints on 'road wander' with the four-wheel-drive Turbo Diesels. The 2000s and 2001s have more of a tendency to 'hunt'—try to follow every crack in the road—than the earlier models had. As I have mentioned before, front tire pressure is also critical. However, there is still some desire on the part of the truck to go its own way, especially with a trailer hooked up.

"I like straight-arrow people and straight-driving trucks, so we decided to experiment. Checking the front end on the 'Big Machine' showed everything within Dodge's specs. The toe was .2 degrees, the camber was .1L and .2R and the caster was 1.9 degrees. We focused on the caster. Dodge says to keep it at 2.74 +/- 1 degree. Since about half the vehicles through the shop are Jeeps, we took a hard look at their specs. I know this is apples and oranges, but we were searching.

"Jeep takes the caster out to 8 degrees...Hmmm. Let's try to see what maximum adjustment the Ram might allow? We set the truck at 5 degrees. Time for a test drive.

"Hot Dang! She drove straight as an arrow. Pulling the RV, the difference felt like night and day!

"This is out of spec for the truck. The good news is that it won't feather tires as it would if we cranked in a lot of toe. The bad news is that with that heavy diesel engine sitting on top, it puts additional strain on the ball joints, upper and lower control arm bushings, plus it makes a change in the front driveshaft angle.

"We'll observe, keep track, and later, let you in on what happened."

He offers the caveat that he may be diminishing the life of his upper ball joints. It would be necessary to add the Ingall's product if your cross caster is incorrect.

Here's a tip to see if your alignment shop knows their stuff. Caster is adjustable on the 4x4, by rotating the eccentrics on the lower trailing arms. I have personally experienced the alignment tech putting the axle in a bind by incorrectly adjusting the eccentric. The eccentrics should be rotated equally. I've witnessed technicians that will adjust them differently from side to side to attempt to correct cross caster. They are not doing you any favors as the truck will wander. The eccentric can be seen in the lower center of the second photo (look down between the brake line and the spindle). The correct procedure is to replace the non-adjustable pieces with a caster sleeve or replace the upper pivot joint to a unit which offers adjustment.

It's pretty simple to change the pieces with the tools that I used. However, I recommend the alignment shop perform the removal and reinstallation. One of the flat rate books suggests about .5 hours per side ('94-'99) and .8 hours per side ('00-'02). I would suggest many shops would charge a larger hour increment for either service.

I've had excellent luck with both Ingall products for some time. The important element is an alignment shop that will take the time to carefully inspect the front suspension for wear then apply some good alignment specifications.

These alignment specifications can also be used on the two-wheel drive trucks. And the specs can be used for those who have installed the Solid Steel Track Bar Retrofit kit. In the photo you will notice that the bracket does not fit tightly along the bottom of the truck's frame. Although there is an air gap, nothing is wrong with your bracket. The sturdy bracket is still doing its job, but it appears DC has changed the frame radius a small amount.

STEERING THE RAM: STEERING WANDER AND STEERING BOXES

In Issue 46's "From the Shop Floor" I wrote about the installation of a Third Generation track bar on to a Second Generation truck. Then, in Issue 47, the editor asked me to install and report on a steering stabilizer kit from the same vendor, Solid Steel Industries in Weyburn, Saskatchewan, Canada, (306) 842-4346.

Issue 46's track bar worked well to prevent the steering wander problem that is often associated with the Second Generation four-wheel drive trucks. Issue 47's steering stabilizer complemented the track bar and further improved the truck's stability and feel when traveling down the road. The following are selected quotes from Issues 46 and 47.

The Track Bar

What does the track bar do? It assists in axle alignment (cantering) between the frame rails and also controls axle alignment (side to side) during suspension travel. The problem: the original Second Generation track bar quickly wears out (reference TSB 19-05-96 which applies to vehicles built before 5/15/96). Another problem is that it puts tension on the axle at an angle. To date the common fix was to replace the track bar at your Mopar parts counter for about \$300 or use the Moog Problem-Solver replacement part number DS1413 (\$120-\$170). Or you could attempt to repair your old track bar with an Energy Suspension urethane bushing kit on the axle end and use a tie-rod end repair kit. Vendors that offer tie-rod repair kits are Lindstat Alignment or Luke's Link. Both should remove the play caused by the wear on the plastic tension bushing in the tie-rod end of the track bar.

A tie-rod repair kit can be used with good result if the track bar is not worn excessively. However, either vendor's product requires periodic lubrication and adjustment. The Solid Steel bracket setup is an install-and-forget component that should not require any maintenance and needs no periodic lubrication!

Why would one consider the Solid Steel Industries kit and a new Mopar track bar, admittedly a pricey bolt-on modification? Do a before and after test drive and you'll swear someone swapped the front end for the Third Generation truck for that of your old wandering Ram!

I've installed this track bar bracket on a myriad of different Second Generation trucks. On the post-installation test drive it always amazes me how much better the truck handles and steers. I installed one on my own truck as I have chased many potential steering wander solutions over 140,000 miles to improve handling and the elimination of the "death wobble." Guess what? I found my answer.

The Steering Stabilizer

The steering stabilizer was the first product offered to Turbo Diesel owners by Solid Steel (SSI). The purpose of the product is to provide a brace or support for the sector/pitman arm shaft as it gets worn over time. The sector shaft in your power steering gear is supported on the top by an upper bearing/bushing and a bushing on the lower end of the shaft. Over time the sector shaft will see some wear, as the tie rod forces a load on the lower end of the shaft when the steering wheel is moved. The DSS moves the strain of the push/pull of the tie rod to the rigidly supported frame rails.

Upon completion of the project a test-drive was in order. Uh-oh, Mr. Murphy has arrived. After the installation of the DSS, my steering gear seemed to be worn sufficiently to start weeping at the lower sector shaft seals. I removed the DSS. As luck would have it, I found a used steering gear that was recently removed as a preventative maintenance measure. I considered resealing the steering box myself. However, after talking to Tom at Power Steering Components (PSC) in Weatherford, Texas, I decided to have the box refurbished then rebuilt with some upgraded parts. I also asked Tom if modifications to the spool valve could be made to reduce steering effort at low speeds/engine rpms. The answer was yes, so off goes the gear on the "brown" truck. Tom exceeded my standards in every way and the gear was returned before his promised date.

Dateline: May 2006.

It has now been 1.5 years and 30,000 miles since I installed these two SSI products and replaced the steering box and I still give it an enthusiastic "two thumbs up."

A recent question from a TDR member about his steering box is the reason that I reviewed the previous material. As you may have noted my steering box was replaced when the steering stabilizer was installed. The vendor for the steering box was Power Steering Components (PSC) in Weatherford, Texas.

Tom at PSC got the call when I could not, with complete certainty, answer a question about the steering ratio that is used on Second Generation two-wheel and four-wheel drive trucks. Also the TDR member was pleasantly surprised by the tight feel of his newly installed remanufactured steering box. The explanation? As Tom spoke, I took notes.

Dodge used three different Saginaw steering gearbox combinations. The most commonly used were the HN (variable ratio 16-13:1) and the BN (fixed ratio 17.5:1). A driver will note 3 to 3.75 revolutions of the steering wheel before touching the steering stops on the left or right sides. The BN is usually found on the Turbo Diesel long wheel-base truck (extended cab, long-bed). Just to keep the aftermarket on its toes, Dodge had a steering box with a 20:1 ratio. This box was not used as often as the other two combinations. When used it was usually found that Dodge used a third ratio, of 20:1, on extended cab, long-bed trucks. This 20:1 ratio yields about 4.25-4.5 turns lock to lock.

I prefer the variable ratio HN steering gearbox. Regardless of preference, I would like to make sure owners are aware of DaimlerChrysler technical service bulletin 19-10-97 that was issued in November of '97. The subject of the bulletin is "steering wander." A summary of the bulletin: If when driving on a straight road, a higher than normal steering wheel movement (perceived as excessive play) is required to keep the vehicle going straight or if over-compensating the steering to keep the vehicle from wandering is a condition, the bulletin describes the diagnosis and repair procedure. The repair involves adjustment of the over-center and the worm thrust bearing preload adjustments on the steering gear.

I think the reason the owner is pleased is that the reman gear has a little pre-load compared to his stock unit that was likely on the far side of loose. His rebuilder may have played with the valving a little to get a tighter road feel. Usually you get this level of service from PSC as they are tricking up other internal components, too. I recommend, and use where practical, the 4x4, HN=16-13:1, 3.5 turn box on both the two-wheel and four-wheel drive trucks when swapping steering gears.

Dodge's TSB 19-10-97 is a "Cliff Notes" version of how to adjust the gear of the truck. It is amazing how tightening the pre-load nut all the way down, then backing off 9mm/.350" will tighten up the loose steering feel. It can't be bottomed out or the oil won't circulate properly and the bearing needs a little space to work.