Range Rover axle conversion

By Peter Matusov

Once the 4-bbl Buick 350 from a 1972 Le Sabre replaced the tired original Buick V8 in the Wagoneer, I figured that was time to start enjoying this classic ride. Guess what… Back in 1968, it was perfectly okay for a truck to sport non-self-adjustable drum brakes on all four corners. Apparently, cars were few and far between, and people on the road may have been exercising courtesy to the fellow drivers. I wouldn't know, having been 3 years old then.

In the year 2004, however, I found driving an unstoppable 4600-lb vehicle in Southern California traffic a bit upsetting. It seemed like not a week passed without me getting under the jeep with a big flathead screwdriver to ratchet up the star wheel a few clicks – on every wheel. If you didn't know, the proper way to adjust the drum brakes is to crank them up until they seize, and then back off a few clicks. Naturally, when the drum brakes work well, they also drag like bungee cords on the carrier's landing strip. So, during every Monday morning's drive to work, I first enjoyed nice and solid feel of the brake pedal, gradually yielding to familiar smell of fried brake shoes at the end of my 7.5-mile commute.

There was something else about the Wagoneer. The first owner, a physicist and avid traveler, ordered it with 4.30:1 gears in the axles – to tow his trailer all over the country. On my maiden voyage about 2 years ago, still on 225/75R15 whitewalls, I found the jeep being able to smoke the late-year Mustang during an aggressive on-ramp acceleration. Literally – smoke; in the rearview mirror I saw the plume of bluish-gray cloud, coming from both unspent fuel and burnt rubber. It was a bit flattering, but – given these traits together, and 18-gallon tank, I found myself at the pump way sooner than I anticipated.

So… something should have been done about it.

I procrastinated until my '89 Range Rover blew the head gasket, and that triggered me to action. I felt the Wagoneer, besides being a "timeless classic," would be a more reliable vehicle as a daily driver; since I had 4 other 4x4s, two of which were built for and used extensively off pavement, I didn't need to ruin the '68 by building an off-road monster out of it.

The first step would be to convert it to disk brakes – at least, in front, at best, on all four corners. As a starting point, I had Jimmy Nylund's ages' old article about disk brake conversions on 5-lug CJ axles. The projected price tag of ~$200 looked attractive; however, it would still leave me with low axle gears, baby-sized Dana 27 front, two-piece, 19-spline, ages-old Dana 44 rear, and no clear further upgrade path.

The better option was to procure the pair of Dana 44s from a ’74-79 Quadratrac Wagoneer or narrow-track Cherokee; the axles would have the proper width, have spring perches at or close to the right places, and have generously-sized GM front discs and calipers, and, most likely, be geared much taller. However - I quickly found out that they enjoyed just enough popularity among baby-jeepers building little tractors out of their quarter-ton rigs to make close to $1K dent in my wallet. Besides, none were available locally – add a few C-notes for shipping. That got me thinking laterally…

At the time of this conversion, I owned three Land Rovers – besides poor surfer-dude-owned ’89 Range Rover, there were ’95 LWB Rangie and ’96 Discovery. All of them being very high-mileage trucks, I was rather familiar with all the bells and whistles these rigs had for running gear, and already had a decent collection of Land Rover axle parts in my garage.

Here’s the short list of potential benefits of using LR axles:

- disk brakes front and rear;
- the axles are of the 3rd-member design, like many Ford and Toyota axles. From my experience, I’d much prefer to pull the 3rd member to swap the gears or the diff than the entire Dana 44 assembly…
- All NAS Range Rover Classics and Discovery Is came with 3.54:1 axle gearing – not as tall as late-year Wagoneer 2.73 or 3.31, and not as low as original 4.3;
- the rear RRC/D1 axles are full-floating; with steel wheels, one could swap a broken axleshaft in 10 minutes, without having to take a wheel off!
- there’s enough aftermarket support for Land Rover axles to have nearly any axle part delivered to my doorstep next day – something that couldn’t really be said about the WWII – heritage axles on my Wagoneer.
- The detailed examination of my Rovers, the Wagoneer, and TSMs revealed that the axles were within ¾ of an inch in nearly every dimension!!!
- also, I counted on the side benefit of reducing the number of wheel bolt patterns in the family. The Wagoneer had old 15” jeep/Ford 5x5.5” pattern; the big Cherokee shared 15” 6x5.5” with myriad of GM and import trucks, and three Land Rovers sported the rather rare 5x6.5”. I had plenty of 16” Rover-patterned wheels, so being able to swap wheels/tires between the majority of my vehicles was very appealing. The choice of 16” tires is not as wide as 15”, but the tires are more likely to be of better quality, and D or E load rated.

That rounded up the list of my “general” excuses to use them. I shared this thought with Behr from Sport Utility Motorcar in San Diego (the only person I trust to turn wrenches on my vehicles – more than myself), and he casually mentioned that he just happened to have a pair of axles, sitting under yet another ’95 LWB Range Rover behind his garage. The price - $300 – became the final argument in my moral battle to keep the Jeep all Jeep. The deal was struck, and next weekend the vultures landed on one of only 3000 or so of LWB Classics built in 1995.

The axle and assorted hardware took residence in the back of my full-size Cherokee for quite some time. Meanwhile, I started looking at the layout of the future suspension. The Jeep was leaf-sprung, under-axle in front, and over-axle in the rear, and all NAS Land Rovers are coil-sprung or with air suspension – with a generous assortment of brackets welded to the axle housing, but no spring perches. One way of dealing with that was to use the complete LR front coil suspension – which would need the brackets for trailing arms and Panhard rod welded to

the frame. The main obstacle appeared – the Jeep's frame is about 5" wider above the front axle than Land Rover's, which eliminated any chance of jamming Land Rover springs between the wheels and framerails. There seemed to be a choice of coilover shocks – Bilstein made a set for a Toyota Tacoma that looked like it had perfect dimensions – but at $400 apiece, it wouldn't classify for a low-budget "restification." The desire to keep the most of the Jeep factory features also contributed to the final decision to convert LR axles to leaf spring suspension.

Spring perches were procured from Off Road Warehouse (just try to explain what part do you need to one of them spike-haired youths with odd number of earrings). The front axle was in pieces, so it was an easy task to have the shop weld on the perches. One of the pleasant surprises was that the LR and Jeep used the same castor angle – 3 degrees – which made the task even easier. The axle was then assembled – from an odd housing, '87 Range Rover Classic "outers," and '98 Discovery brake calipers. Being very proud of myself, I stepped back and enjoyed the sight. It didn't take very long to realize that the jeep front leaf springs were going to reside where the Land Rover intended the tie rod to be (behind the axle, under the axle centerline).

That discovery had me slightly blown off my tracks… The vision of the tie rod attached to the knuckles' arms via 5"-tall spacers didn't associate with the concept of a safe daily driver; something needed to be cooked up. My only obvious solution was to procure a right-hand-drive, left-side, steering knuckle – so I could attach the tie rod between the points where the RHD and LHD drag links were supposed to go. And, somehow, make the drag link attached to the same spot. The only problem was – where would I find the RHD, left-side, steering knuckle in Southern California?

As it turned out, three miles from home.

On my way to work, I recalled that Behr had a RHD Rangie in some state of disassembly; I stopped by, and the RHD/LS steering knuckle came to my possession for $50. Had to wait until the end of the week to pull it off – and in a couple of hours my front axle received the RHD-spec transplant. Then, I could not wait any longer, and found "just right" solid stainless-steel tie rod in my garage, already tapped for LR-spec ends. After some minor hacking, the tie rod filled the void between the knuckles' arms. I moved the tie rod side-to-side, enjoying smooth movement of knuckles turning in unison. Then, another discovery dawned upon me.

I made the same dumb mistake as one Russian self-taught car mechanic made while converting my RHD Ford Transit van to left-hand drive. Moving the tie rod from the back to the front of the axle without changing its length results in "reverse" Ackerman angle – the inner wheel in a turn cuts to a smaller angle than the outer! I had to live with that in the Transit for almost two years – a previously perfectly stable vehicle exhibited severe oversteer, and the steering wheel would tend to gravitate heavily to the full-lock position. Made for some exciting handling on ice and snow… Not good… The knowledge that, in fact, many cars come with wrong or reverse Ackerman angle from the factory didn't inspire confidence. The tie rod ends had to be placed outboard of the kingpins – which left nearly no space inside the 16" Rover rims. After some reflection, I resorted to the solution I tried desperately to avoid – drilling holes in the steering knuckles' arms, fabricating brackets for tie rod ends, and using heim joints instead of stock Rover or jeep tie rod ends. Needless to say, using the 5/8"-18-threaded heim joints required purchasing some 0.120"-wall DOM tubing, and bungs with the proper thread, and taking the parts to the shop to fabricate the new tie rod.

Few days later… The new tie rod, fitted with heim joints, and attached to the brackets with grade 14 bolts, seemed to have done the trick. The steering angles, measured with the protractor, were very close to perfect values calculated for the Wagoneer's wheelbase and track width. The next task was to fabricate the drag link. I had a nearly-ideal drag link made from Land Rover tie rod bent in San Bernardino Mountains; the first try to fit it revealed that –

… there was no way for it not to interfere with the tie rod. My spirits were a bit undermined at this point; I knew that there was no way to stack another heim joint on top of the tie rod's and have both fit inside the rim. Decided to take the dog for a walk – and look under the '79 Cherokee's front end to see how could Jeep solve this issue. The big jeep's drag link was attached to the tie rod, about 10" from the knuckle. While this solution could have a potential for bump steer, it seemed the only way to go. So, the tie rod was off again, and again to the shop – to have a pair of "ears" welded to it, so I could attach a heim joint between them.

Trips to the professional hardware store and Off Road Warehouse became frequent… But, at least, I thought I was done with the front end!

The rear axle was complete, hub-to-hub, and I felt no desire to strip it and open up the floodgates for gear oil. Took us some fiddling to get the spring pads welded; looking back, we shouldn't have welded the pads parallel to the spring mounting surfaces of Land Rover axle – we ended up about 6 degrees off the proper pinion angle – but that was beyond my skill in estimating the scope of the project. Also, the abundance of brackets still remaining on both Rover axles convinced me that I'd find plenty of ways of attaching the shock absorbers, so I didn't bother with that.

Yet another annoying little problem appeared – the Rover axle tubes are roughly 3.25" in diameter (they aren't quite round), while old jeep axles measured at 2.5". Enter need in new U-bolts and spring plates. The former were ordered online from a shop in Vermont at about $6 apiece (including two square-U-shaped once needed for the front). The latter… Time to hit the Pick-n-Pull – to find out that the late-80's Isuzu Troopers had Toyota-made axles that could be a perfect swap candidate for the Wag, in pair with the disk-brake front Dana 44! Oh well, talk about unorthodox axle swaps… As a benefit, the spring plates were of the right size, and very well-designed. It should be mentioned that out of 8 U-bolts I took off the two Isuzus, every one came off as easy as they get, and they still had factory anodizing on the threads! I won't mention Dodge's hardware of the same vintage…

I hit a little streak of luck – jeep used common-style U-joints with yokes on the differential pinions, while the Rover axle had a flat round flange attachment, and the rear (that came off the '95 Classic) was designed for a Rotoflex joint (a rubber doughnut that somewhat functions as a constant-velocity joint, at the same time supposedly taming the vibrations and noise). I already had the flange conversion "kit" – flange, spacer, seal, and nut – to replace the Rotoflex attachment; still, the flanges needed something else to mate with the common folks' U-joints. And that turned out to be a stock Spicer part number, which DriveLine Service of San Diego had sittin' and waitin' for me to come.

All the parts were scooped up now. I somewhat ran out of steam, and procrastinated a few weeks more. That is, until the '89 blew the head gasket again. That set things in motion again; the wounded Rangie was parked on the street and covered up, and the Wagoneer made its last call into garage atop the Spicer axles.

Fast forward…

It took one complete weekend to yank the old jeep axles, and bolt the Rover axles under the Wagoneer. Things were looking good. The brake system lent itself for an easy hacking, with stainless-steel-braided Teflon hoses and custom fittings from Industrial Liquidators, and jeep master cylinder having come from Napa with no check valves installed (that discovery also partly explained why the jeep drum brakes were so crappy). Oh, and bleeding brakes has never been my strong suit.

The shocks, however… let's say my assumptions of painless shock installation were off the mark. I had to hack together drop brackets to mount the rear shocks to the axle – the stock-application Bilsteins that the big Cherokee had long since grown out of.

I went through the process of finding the "almost-right" Monroe SensaTracs for the front – that were discarded for good after the first two days of driving the Wagoneer, and making brackets for and reusing the front stock-application Bilsteins.

It seemed like the issues would never end, though. The front driveshaft was a bit too long… By an inch or so – but, I had to take it to the DriveLine Service of San Diego to get shortened. The rear driveshaft – the old Wagoneer had the "Detroit-style" rear driveshaft with the trunnion joint (yet another poor man's CV joint). That had to be discarded altogether, and a new rear driveshaft was stretched out of the one formerly made for the big Cherokee (then and now, by the same driveline shop!). But, of course, the Cherokee's Quadratrac transfer case had a standard style yoke at the rear – while the Wagoneer's Dana 20 sported the flange, much like Rover diffs, but with a different bolt pattern! The flange was yanked out and replaced by a yoke off the parts' Quadratrac case, also from my assortment of 4x4 parts, and rear driveshaft fitted. Wow, can I drive it now, really?

During the maiden voyage, the new and improved Wagoneer hit the "Death Wobble" at about 35 mph. I have never experienced it before, and have to admit being … not scared, but kinda upset. Back to the garage – adjusted the eyeballed ½" toe-in to more spec-like 1/16" toe-out, and hacked out the bracket to mount the steering damper (Bilstein, stock Land Rover application). That eliminated the Death Wobble, but not the very prominent rear driveline vibration. I found no consistent way to find by how much my pinion angle was wrong – because of the significant difference in axle suspension and driveshaft design between the jeep and Land Rovers – so I tried to shim the pinion 4 degrees up. Not sure whether it had solved the problem completely yet…

The beat-up 245/75R16 Futura Enforcer mudders gave way to Michelin LTX of the same size, mounted on Rover-pattern black steel wheels made by Unique. Note to self – the black wheels don't look right on the Wagoneer…

Two weeks later…

I am no more afraid of an idiot in a 911 cutting me off at the light – the brakes are nice and firm, more Range Rover than Discovery feeling. Still, I can't lock up the wheels – which may be the issue of master cylinder displacement or brake booster inefficiency, - but that's one gigantic leap from rolling halfway through the intersection with both feet on the brake pedal.

Neither I am afraid to take the old jeep to the freeway – it rolls nice, has plenty of power despite significant difference in axle gearing, and spins about 2200 rpm at 65mph. The expected quantum leap in fuel economy didn't quite happen – it seems to have gone from ~8 to ~11 mpg in frantic city traffic, but, on the other hand, even "fuel-efficient" Land Rovers rarely make it past 12-13 in town. I don't have to smell fried brakes by the time I get to work!

Yet, I don't have the feeling that I could take the jeep 1000 miles across the country. Some vibrations and odd noises remain. As a common consequence of disc brake conversions, I lost the parking brake entirely – without a clear concept in sight. There is a chance of finding a Dana 20 transfer case off an old J-truck with a parking brake on the rear driveshaft output (similar to what Land Rovers use to the day); there's a shade-tree option of installing the line lock. I may have to revise the tie-rod and shock brackets down the road, and replace many bolt joints with welds.

But – now I have to fight for the Wagoneer's ignition key with my family members!

P.S. To the day, the Wagoneer racked up 1300 miles since the "maiden voyage." The front had to be lifted 1" to level off the jeep, otherwise it's a delight to drive!

P.P.S. Front shocks changed to Heckethorn Hydro 8000, 8" travel, rear axle shimmed up 6^{o} to eliminate rear driveline vibration.