Steering Bracket Reinforcement
Alpine Coaches, 2004-2009 Model Years

The Problem

A number of Alpine Coach owners, or their service techs, have noticed a significant amount of bending of the bracket that holds the steering box. The bracket is located behind the left-front bulkhead, below the driver's side fuel cap, or just below the driver's seat, and ahead of the left front wheel's front bulkhead.

These concerns have always been noted while the coach was standing still (not rolling), and while the steering wheel was operated left to right and back.

At the Alpine Coach Association's 8th annual Desert Rat Rally (DRR8), in Quartzite, Arizona, in January, 2009, about 30 Alpine Coach owners volunteered to have their steering brackets inspected. Coach model years in the inspection ranged from 1999 to 2009. Based on the inspections done at DRR8, it appears Western RV went through 3 versions of the steering bracket.

The initial two versions of the bracket were apparently designed by Gary Jones in conjunction with overall design of the Alpine Coach chassis. These two versions were of 5/16" steep plate, and had two internal stiffener plates at an angle and a top plate, all welded internally. These early brackets on coaches from model years 1997 through 2003 did not exhibit the significant bending shown by the later model brackets. They did show some stress cracking of internal welds, particularly the rear lower weld, running left-right and connecting the internal angled stiffener plate to the bracket's outer box. In some cases these weld cracks were up to 2" long on vehicles that had 75,000+ miles.

Later model coaches, model years 2004 through 2009, had brackets similar in geometry to the earlier brackets. However, the later brackets are made of 1/4" steel for the box, top plate, and the internal stiffener plate. Also the internal stiffener is one piece rather than two, and is bent to end about 2" higher than the early angled plates. The internal stiffener is welded at front & rear lower edges, and along the left edge, to the bracket box.

Two coaches have been noted as missing the front & rear lower edge welds from the factory, although the one coach inspected at DRR8 did not appear in the visual inspections to exhibit visibly more bracket deflection while operating the steering.

The Author's Solution

Based on the DRR8 inspections, owner discussions, and a review of the design, the author decided to fabricate and install a Steering Bracket Bracket (SBB). The purpose of the SBB is to overcome the weaknesses of the factory's steering bracket design and the weaknesses of the factory mounting, to minimize bending of the steering bracket and hopefully to forestall early bracket failure from metal fatigue induced by the bending.

What follows is some discussion about the weaknesses of the factory's version 3.0 bracket design, and its mounting. Then the SBB design is presented along with fabrication and installation tips, and very importantly- WARNINGS. After all, Alpine Coach owners who undertake this modification need to acknowledge the seriousness of altering the factory design of this important frame member.

Why the Steering Bracket Bends (see photo below for abbreviations)

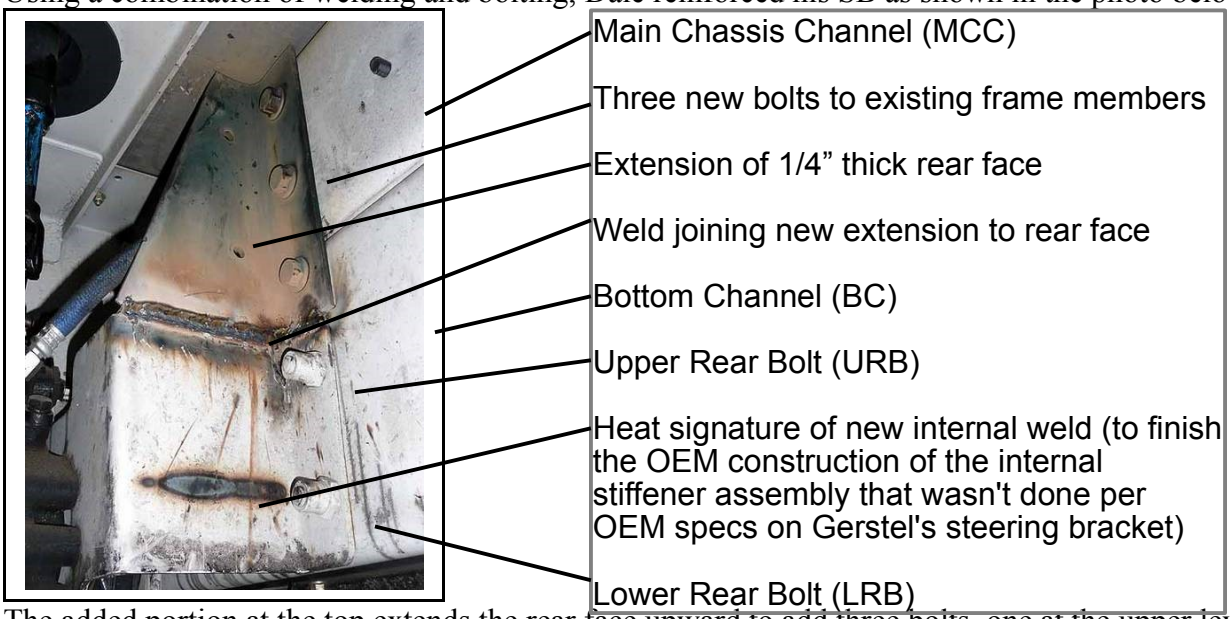
There are several reasons contributing to the significant deflection (bending) of the OEM SB. First, it bends up & down at the rear face, in a torsional deflection of the SB "box," because the steel (1/4") and the internal reinforcing plates are too thin to fully resist this torsional force. Second, the upper rear bolt, fastening the bracket to the BC at about mid-height of its channel, deflects in and out (left to right on the coach centerline) because the tall BC is a "thin plate" and the mid-height section is a long way structurally speaking to the reinforcing edges (flanges) of the channel. The BC can therefore warp from a flat plane channel. The MCC by contrast, is much more compact so the mid-height section is much closer to its reinforcing "flanges." Third, the SB box deflects fore-aft due to its thin plates. Finally, the rear flange is subject to prying action that deflects the flange toward & away from the BC.

On Dale Gerstel's 40' 2007 coach (photo below is Dale's SB), the bending had caused a stress crack downward, more or less along the bend between the rear bolt flange and the rear face of the SB. This was from a combination of prying action on the flange and torsional bending of the SB box. The crack was a serious structural issue and may have become a safety hazard over time. Dale's bracket might have seen more bending than properly welded brackets, remembering that it was missing some internal welds that are part of the factory SB design. However, a similar non-internally-welded SB observed at DRR8 behaved visually about the same as other properly welded SB's.

So to resolve excessive bending of the SB, we could try to:

1) arrest the up-down motion of the rear SB face,
2) further reinforce the BC's thin plate problem for the upper rear bolt,
3) perhaps reinforce the rear face against fore-aft bending, and
4) create better resistance to prying action on the rear flange.

Using a combination of welding and bolting, Dale reinforced his SB as shown in the photo below.

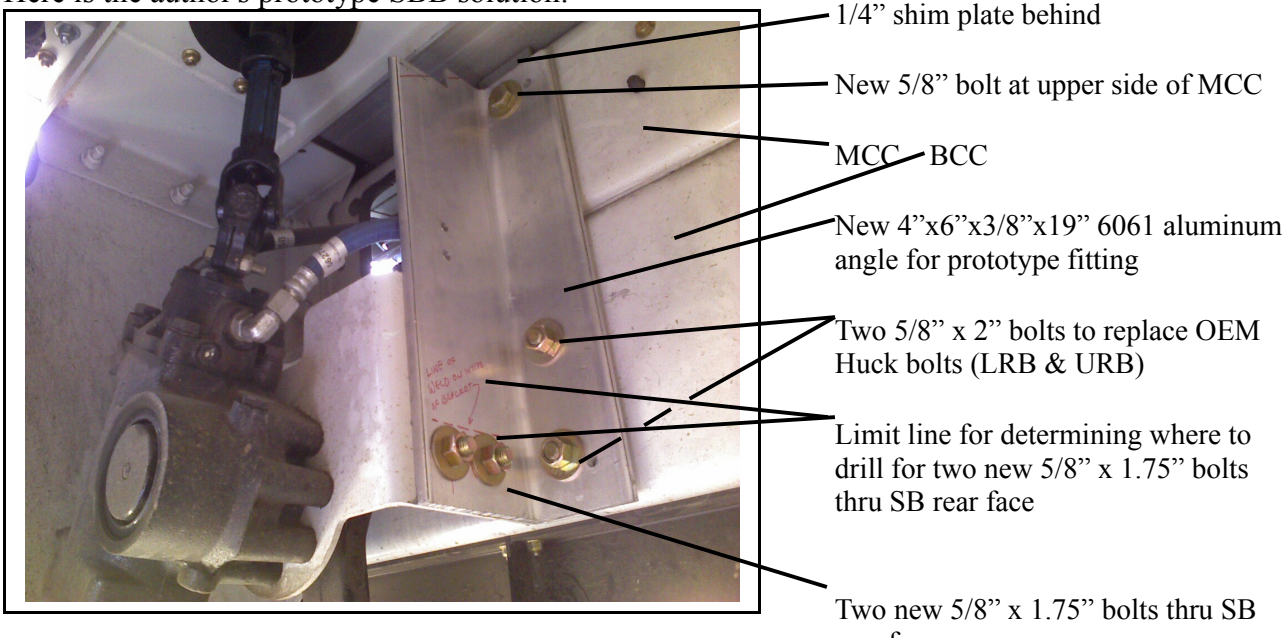


The added portion at the top extends the rear face upward to add three bolts, one at the upper level of the BC, and two in the MCC. This ties the BC & MCC together with a stiffener (the enlarged rear face), addressing the "thin plate" issue of the BC. It also ties the rear face, with three new fastening points, to more of the frame to arrest up-down torsion. Insofar as it uses a longer rear face/flange section, it also improves resistance to prying action on the URB & LRB.

The Steering Bracket Bracket

Another way to address multiple aspects of the excess SB bending is to provide a bolt-on solution. Since we would like to add both torsional reinforcement for the rear face, and some way to overcome the BC's thin plate problem, this will mean drilling both the frame and the SB to receive new bolts. And since any reinforcing assembly that will tie the BC and MCC together will need to use the URB & LRB bolt positions, we will need to remove the two 5/8" Huck bolts fastening the SB to the frame & replace them with something adequate.

Here is the author's prototype SBB solution:



The above method buttresses the factory design by providing:

1) a thick, large, flat pressure plate mashing the rear bolt flange to the chassis frame members under the oversized Grade 8 washers. The Huck bolts are replaced with 5/8" Grade 8 fine thread bolts torqued to approximate the slip-critical Huck bolt fastening which is important if anyone is going to remove the Huck bolts. The large hold-down-plate will add resistance to prying action on the rear flange.
2) added stiffness of the new angle to the rear-face/rear-flange fold in the SB plate steel. This will add resistance to out-of-plane bending of the rear face (fore-aft) that contributes to prying action on the original Huck bolts.
3) a long and therefore torque resistant, thick and therefore stiff, extension to the rear-face/rear-flange portion of the assembly
4) a remote and therefore torque resistant fastener into the upper portion of the MCC. This combined with the two bolts into the rear SB face will better resist in-plane torquing of the rear face.
5) a long plate/angle spanning past the "thin plate" center area of the BC to obviate its warping which doesn't provide sufficient stiffness to keep the SB in place without movement

The prototype is made of 3/8" aluminum for ease of fabrication. Ideally a permanent SBB will be 1/4" steel, although the thinner steel solution will require some additional fabrication that the thicker aluminum prototype didn't.

As with any modification of of important safety elements of a moving vehicle, every Alpine Coach

owner should consider *at least* the following

WARNINGS: WARNINGS: WARNINGS: WARNINGS: WARNINGS:

1) The Western RV OEM factory design for the steering bracket has not been shown through any rigorous analysis to be defective. All claims, worries, musings, and fears that have accompanied this bracket deflection issue are based on lay person observations. ***Whether this issue is cause enough to mess with the factory design is an individual Alpine Coach owner decision***. No reliance can be made on any third party analysis (***including this one!!!***) or advice for any liability relief, should your modifications be found at a later date to have caused problems for your own coach or for someone else on the road. This is particularly true with Western RV out of business.
2) Portions of the OEM design must be respected in any modification attempt. This is particularly true of the slip-critical fastening method of the Huck bolt attachment for the OEM steering bracket to the chassis frame.
3) Any work performed on the frame of your coach should respect:
    1. proper methods for frame drilling
    2. necessary protection of hydraulic, electric, and other chassis and house wiring and plumbing as might be damaged in the improper performance of work
    3. proper ***safety methods for working under your coach and working within confined frame spaces of a heavy vehicle***
4) Any decision to proceed with modification of the steering bracket should be undertaken only when and if a complete job can be assured prior to needing to move the vehicle. While the steering bracket's mounting has been compromised you will not be able to move the vehicle under its own power.

Deciding to modify something as basic as the steering bracket of your coach is a serious undertaking, and should include full consideration of all liability and workability issues, including as a minimum those outlined above.

Fabrication and Installation Issues to Consider:

1) Do-It-Yourself installations of this type are strenuous and potentially dangerous for the uninitiated, and may result in injury to yourself, your coach, or your pride if things don't go well. Consider carefully whether you are up to a project of this scope.
2) All fasteners should be Grade 8, fine thread, with oversize Grade 8 washers, and Grade 8 nuts, and long enough for full thread capture by the nut.
3) New holes should not be oversized. On the prototype I drilled 5/8” holes for 5/8” fasteners. 5/8” Grade 8 fasteners are very slightly less than 5/8” diameter.
4) Spacing/location when fabricating holes of the Huck bolt replacement fasteners is extremely important for proper fit. These fasteners are where they are on the frame, and the offset to the rear face of the SB is fixed. Poor location of these holes on the SBB will result in much work to get a proper fit during installation. Slotting of holes in the frame ***must be avoided*** to maintain the integrity of the OEM design, so getting the SBB hole arrangement spot-on is important.
5) Spacing/location of the 3 new bolts is less critical than the Huck bolt replacements, since the new SBB can be used to locate the new frame & SB holes. If you fabricate the SBB first, then do a temporary fit to the frame, it is easy to mark new holes, remove the SBB & drill accurately.
6) Drilling the new upper bolt is the most awkward part of the installation. The 2 new bolt holes in the rear SB face were easier combined than the upper bolt.
7) Drilling holes: I used a 9/16” hole saw to drill all 3 new holes. Fastenal (www.fastenal.com)

sells a good bi-metal 9/16” hole saw for about $20 including mandrel. Oil it 3 or 4 times per hole. A good cutting speed will produce some smoke from the oil, but barely; too fast and you'll dull the saw teeth. You will be in need of plenty of oxygen while hurfing on the drill, I suggest big breaths blown out slowly over the spinning drill to clear the smoke. The holes will be larger than 9/16” but probably not 5/8” when done, and a little ragged; this is good for close tolerance location and sizing of the holes. You can use a rat-tail file to complete the holes, but I've found a 5/16” chainsaw file cuts faster and neater. Make sure to buy a file handle if the file doesn't come with it; you'll appreciate the comfort.

I used a 1/4” cobalt drill bit to make pilot holes for the hole saw mandrel. This makes the large hole drilling easier. This would be true using a 5/8” twist drill also.

If you use a 5/8” twist drill, you are braver than I am. They can catch & throw the drill, and the driller if s/he isn't careful. Getting thrown around in the small space by the steering bracket would be uncomfortable at best.

You can also drill the 1/4” hole then complete the hole with a die grinder.