E46 M3 Structural Foam Installation

After installing an ESS VT2-525 supercharger I decide to reinforce my subframe mounts with BMW structural foam. Prior to installing the supercharger, I removed the subframe for a bushing refresh and verified that there were no cracks. I was mildly surprised given the 96k miles on the car - but I'll take it. The car is a 2003.

I spent a lot of time reading the many (mostly high-quality) threads on the topic but they left me with a lot of confusion. The exact shape of the rear cavity to be filled was unclear to me. In particular, some reported that the left and right sides were asymmetrical and the BMW foam injection procedure for the left rear side (the only side actually specified as needed by BMW) would not work for the right side. The procedure for injecting foam only on the inner side of the mount seemed odd since it did not appear that it would allow the foam to completely surround the mount. This BMW procedure also specifies injecting gap filler in an area 135mm in front of the cavity in an area that looks to be completely unconnected. (The BMW foam injection procedure only specifies reinforcing the left rear mount, though it is common to do it on both rears; the front mounts can also be reinforced.)

To clear up my confusion, I decided to buy a boroscope to determine the exact shape of the front and rear cavities to be filled with foam.

I bought an Oiiwak WiFi 5MP Borescope Inspection Camera from Amazon, which cost about $60 shipped. It is a wireless model that connects to a mobile phone (iPhone or Android) to display and capture images or videos. Despite the relatively decent 5 megapixel resolution, the image quality is not all that great - but it worked fine for this low-demand task. There are many equivalent models on Amazon.

I did the rear mounts first, followed by the front mounts.

Rear Subframe Mounts

For reference, here is a top view of the area above the rear mounts (facing towards the front of the car).

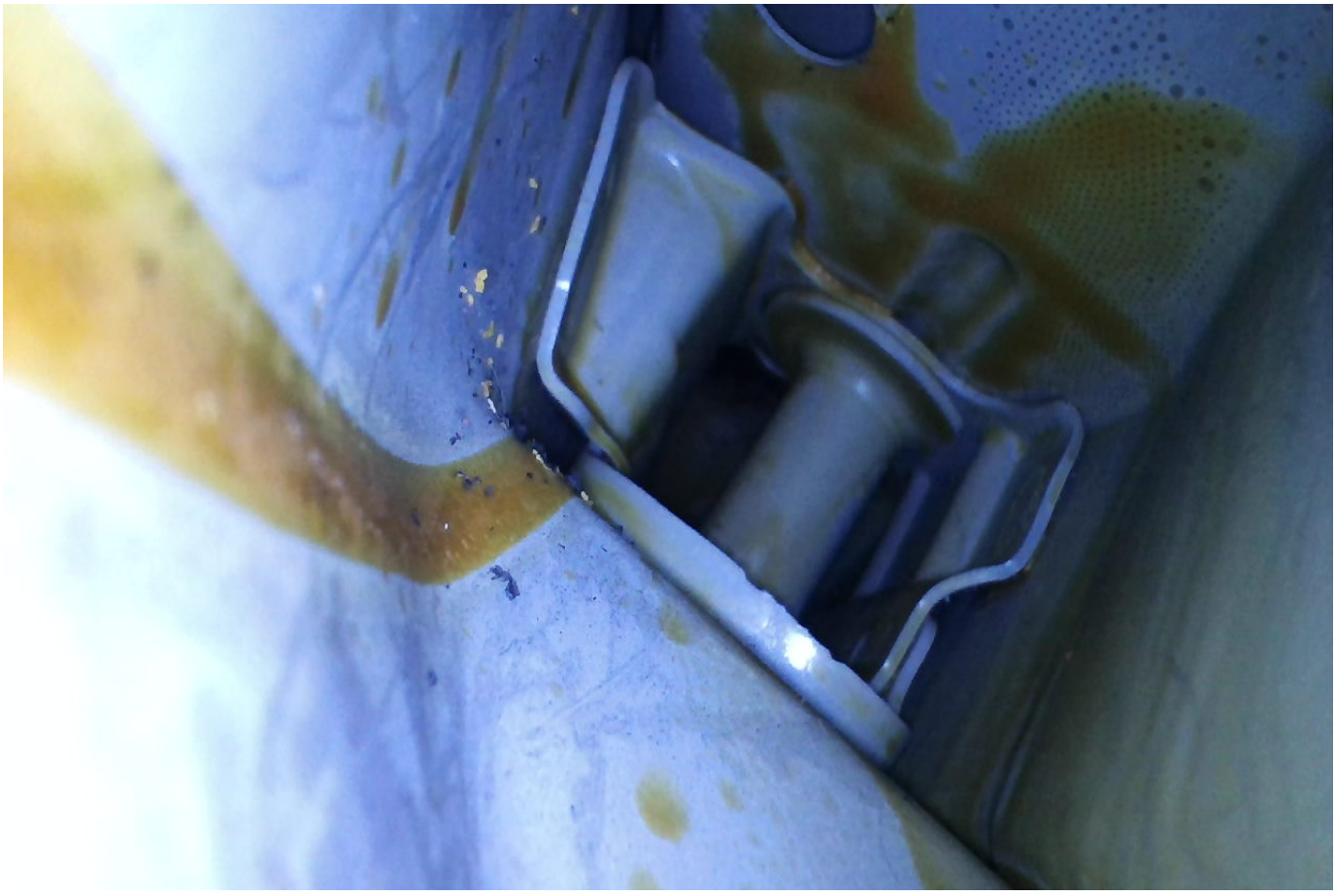
A total of five holes can be seen. Four are existing factory holes (A, B, D, E) and are plugged from the factory. Hole C is user-drilled. A 1cm tall cavity extends the width of the trunk under the area from A to E. A taller cavity containing the mounts sits directly under this. The left rear mount sits in this lower cavity between holes A and B and the right rear mount sits between holes D and E. The five holes have matching holes in the roof of the lower cavity so there is direct access to it.

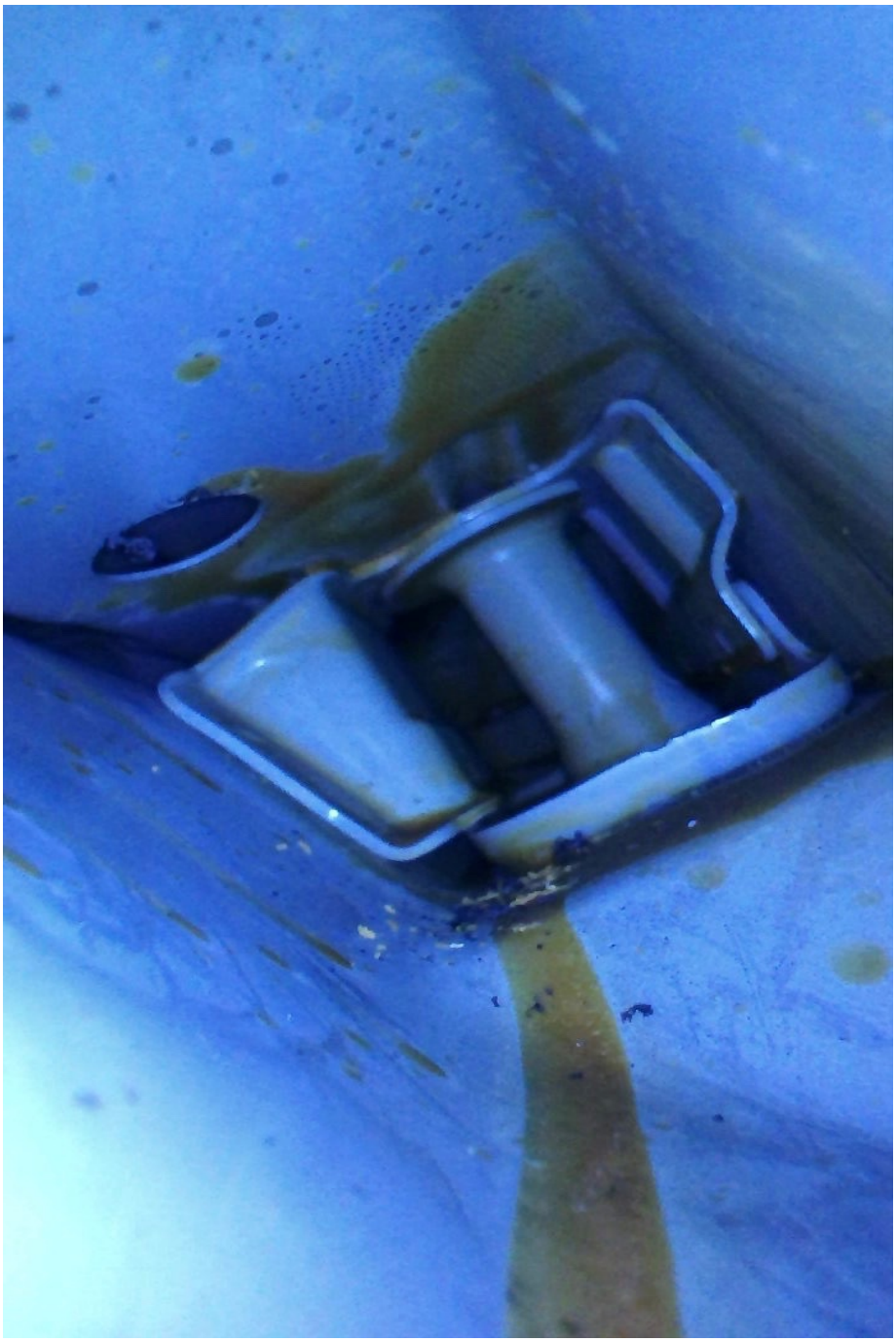
In inserted the boroscope into the various holes and used it to examine the upper and lower cavities.

Here is a view of the upper cavity with the boroscope inserted into hole B. Here the boroscope is facing towards the right of the car, with hole C dimly visible in the distance.

This upper cavity does not have to be filled with foam according to the BMW procedure, though some have reported filling it in any case.

Here are some views of the left rear mount in the lower cavity with the boroscope inserted into hole C.





Hole B is clearly visible. Hole A is on the other side of the mount.

As can be seen, the mount is spot welded to the top and bottom and the front and rear sides of the lower cavity.

The right rear mount is identical.

Here is a view from hole B towards the center of the lower cavity. A red Zip Tie I inserted into hole C is visible.

The BMW procedure involves sealing off the left side of the lower cavity from the right by injecting the gap filler into hole C.

Here is a view of the area under hole C with the gap filler shown immediately after injection.

The filler effectively isolates both sides of the lower cavity.

Here is the final cured gap filler.

I also examined the extreme ends of the lower cavity through holes A and E and verified that the lower cavity terminates immediately after these holes.

It thus seems clear that the lower cavity is symmetrical from side to side and is completely enclosed. (Though note that there are holes at the bottom of the cavity that must be plugged from underneath the car before injecting the foam.)

As others have suggested before, it also seems that the BMW procedure that specifies injecting the foam only on the inner side of the mount (at hole B, with hole D being the equivalent on the right-hand side) might not be optimal.

The foam is actually pretty viscous even when heated to the specified injection temperature so it does not self-level inside the cavity.

Here is a picture of the foam injected into a box (I effed up my first injection attempt, which is why I ended up with $80 of goo in a box).

Here is a picture of the cured foam 24 hours later.

As can be seen, the foam does expand slightly when cured but is not self-leveling. Given this, I think it is pretty important to inject the foam on both sides of each mount since I don't think gravity will evenly distribute the foam. I suspect a lot of it could end up towards the center of the lower cavity if injected only in holes B and D.

So, when injecting I used both holes. Unfortunately, it is not possible to directly see where the foam actually goes after installation but it is possible to indirectly infer based on the (surprisingly brisk) heat from the injected foam.

After injecting on both sides of the left mount, the area between A and B was extremely hot. The heat extended all the way to the center hole at C, though it dissipated somewhat approaching C. I suspect the two 420ml foam containers specified by BMW do not fully fill the lower cavity, though the goal is to strengthen the area around the mounts so I don't think this is a problem.

Front Subframe Mounts

After examining the front cavity with a boroscope, it is clear that a similar same approach can be used to surround the left and right front subframe mounts with foam.

Here is a picture of the left top side of the RACP (facing towards the rear of the car).

All four holes are factory drilled. Holes A and D are tapped for the rear left seat hinge brackets, B is tapped to hold the rear left seatbelt, and C is unused and has a factory plug.

The left front subframe mount sits between holes B and C, though is slightly closer to hole B

In inserted the boroscope into hole C to examine the left side of the cavity.

Here is a view of the left front subframe mount inside the cavity. The top and bottom of this mount are welded to the ceiling and floor of the cavity.

Here is a view that also shows the underside of holes of A and B. A red ZipTie is inserted into hole B.

Unlike the rear cavity, which extends uninterrupted for the width of the car, the front cavity appears to have a panel in the middle, though it has a circular hole in it.

So, it is not reallly neccesary to inject seam sealer into this middle section to seal off both sides. (In fact, I don't think it really is needed for the rear either since the foam is unlikely to reach that point even when cured.)

Here is a view from hole C towards the left-hand side of the car.

As can be seen, the cavity terminates immediately after hole D.

The goal of foam injection process is to bond each mount to the RACP by completely surrounding it with foam.

For the left front mounts, holes B and C above make the most sense as injection points.

After injecting one 420ml container into hole B, I inserted the boroscope into hole C to see where the foam ended up.

Here is a picture of the left front mount immediately after the injection of structural foam into hole B.

As can be seen, the foam is beginning to surround the mount even before the curing expansion process - which is exactly what you want to see.

After foam is injected on the other side of the mount it will be completely enclosed - and bonded to the RACP permanently.

For completeness (and to verify that the cavity is symmetrical side-to-side) I also inserted the boroscope into the right side of the cavity.

Here is a view of the right front subframe mount inside the right side of the cavity.

And, finally, here is the right front mount after foam is injected on the opposite side of it.