The M.G. Locost Construction Manual

A Guide to building an All-British replica of a 1963 Lotus 7

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The M.G. Locost Construction Manual
A Guide to Building an All-British Replica of a 1963 Lotus 7
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Preface

Our M.G. Locost was built over a two year span from August of 2011 through October of 2013. We had a great time both building the car and writing about it in our build log, and we learned a lot, mostly by trial and error. We received a bunch of encouragement and gleaned a great deal of information from the fine folks on the LocostUSA forum. Without their help, neither our Locost nor this manual would've been possible.

We wrote this manual for a couple of reasons, none of which had much to do with hoping that our experience would somehow help others who wanted to build their own M.G.-based Locost. We wrote it partly so we wouldn't forget what we went through, partly because we like to write, and partly because everyone else who's ever written a Locost build manual—and this seems to include just about everyone who's ever built a Locost—hasn't described the build process in enough detail.

Which is fine if you want to appeal to a wider audience. But that's not what we wanted. We think everyone who wants to build a Locost should start with an M.G. From the first time we ever saw a Locost, way back in the spring of 2006, we wanted to build one with M.G. parts. We knew at the time we couldn't actually do it, because we didn't have the knowledge or the skills, and the books at the time were more proof of this. So we didn't do anything for the next several years.

What we needed in 2006 was a manual like this one, with every detail spelled out and no assumptions made that we knew what we were doing. It would've saved us from dozens of unfortunate engineering decisions, hundreds of messy do-overs, and two years of believing there's no way we'd ever finish. We wanted something back then that would take out all of the guesswork and explain to us in detail how to build an exact copy of a known, working Locost.

So that's why we wrote this, and we only hope that if you do decide to build your own Locost, you don't take anything in here too seriously. It's as accurate as we could make it, but despite what you may have read on the Internet or elsewhere, we're not perfect. We hope you'll enjoy the manual just the same. If you do have any questions, or you find something in here that's either questionable or just plain wrong, we hope you'll find a way to contact us and let us know. We'll make updates.

Nick Jenkins
Novato, California
December, 2013

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1. Introduction

A recent resurgence in the construction of Locosts using an MGB donor has raised the potential number of M.G. Locosts worldwide from 2 to 5. Why the popularity of the MGB donor? We think it may have a lot to do with the increasing availability of rusted-out MGBs turning up in people's garages. Good for little else, these one-time fabulous sports cars still have a lot to offer as a Locost donor, including giant MOWOG castings, heavy-duty suspension bits, and famously unreliable Lucas electrics.

If you think you might want to build an M.G. Locost yourself, we expect this construction manual to convince you otherwise. If not, then it's possible that if you build your M.G. Locost exactly as described here, dedicating the better part of your life and livelihood for the next couple of years, you could one day be driving an M.G. Locost of your own. On the other hand, if you choose to build something that deviates from this manual in any way, except possibly for body color, you're on your own.

a. About Locosts and M.G.s

First thing you need to do if you're going to build a Locost is to find out as much as you can about Locosts. A good place to start is the Internet. There are many Locost forums around the world, although admittedly they are frequented mostly by Locost builders who are not using MGB donors. Still, many of their construction techniques will apply to your build, and if nothing else it's fun to read about the exploits of Miata-based Locost builders struggling to figure out their wiring harnesses.

Next thing you should try to do is obtain a copy of Ron Champion's book, *Build Your Own Sports Car*. The book is out of print but you can sometimes find used copies for criminally high prices on Amazon.com. The book describes a Locost build using some kind of British car, but not an MGB, and although we don't know this for a fact, Ron Champion seems like the sort of gentleman who probably doesn't like M.G.s very much. But we do, and that's all that matters.

There are other Locost books out there which can probably be obtained for far less than the Champion book, and we've read them but we won't comment. So get the Champion book, read it cover to cover like the rest of us, and ignore for now anything you don't understand or that doesn't seem to make sense, because the book is not entirely accurate in every instance, a fact that has over the years sort of endeared the book to many frustrated Locost builders.

If you don't know much about M.G.s and would like to learn more, we've found two resources to be invaluable. The first is the British television series, An M.G. Is Born, one of the Mark Evans Is Born shows. Over ten hour long episodes, Mark and crew dismantle, repair, and reassemble a 1972 MGB roadster, all the while describing the inner workings of the car in entertaining detail.

The second resource is a YouTube series by John Twist of University Motors in Grand Rapids, Michigan, or thereabouts. John is quite a good speaker, refreshingly intelligent, and with an excellent sense of that dry British humor we all know and love. John knows more about M.G.s and British sports cars than just about anyone still alive, and he has been generously sharing that knowledge on the Internet for the last several years. When it comes to M.G.s, John has seen it all, and 40 years of experience can tell you a lot about what works and what doesn't. Ignore the video quality and you'll learn a lot.

b. Using This Manual

This manual contains a chapter for each major task in the build. Chapters are arranged more or less in build order, and we think it's a good idea to complete all the steps in one chapter before moving on to the next. You may disagree. In any case we can't stop you from reading ahead, and that might actually be a good idea in case you want to order stuff in advance. Some vendors seem to handle shipping better than others.

We originally planned to start each chapter with a table containing all the steps in the task, and the amount of time each step should take. We decided against that, in part because it might be discouraging if you took a lot longer, or worrisome if you took a lot less. On the other hand, you might just be really good. We don't know anyone like that, so we can't really advise you one way or the other. But figure around 100-200 hours per chapter. Not counting this one.

This manual describes the Locost build process in great detail, but not so much the processes of troubleshooting, refurbishing, and overhauling M.G. parts. This is left to the many fabulous workshop and repair manuals published over the years by the M.G. Car Company, British Leyland, and others. For the purposes of this manual, we're going to assume that the M.G. parts you install in your Locost are all in excellent working condition. Or if not excellent, then at least good enough to get you down the street and back.

c. The M.G. Locost Prototypes

As you embark upon this project, you should take a certain measure of pride in knowing that you will be building your M.G. Locost in the finest tradition of all the early M.G. Locost pioneers, men and women who persevered against the odds to be among the first to cram dozens of parts from a rusted-out MGB into a book-sized Locost space frame chassis. The history of these erstwhile pioneers is sketchy at best, but some information can still be found.

The first known example of an M.G. Locost was built by the late Ken Walton, somewhere on the east coast of the U.S. The details vary, but a few photographs of the car can still be found on the Internet. The car's use as a prototype is somewhat limited by the lack of any sort of documentation on the vehicle's construction, other than the aforementioned photographs.

The second known M.G. Locost prototype was built by Martin Keller of either northern Oregon or southern California. For some reason the exact location of M.G. Locost pioneers seems to be difficult to pin down. Mr. Keller's car is well-documented in photographs on the Internet, but not a lot was written about the actual build process, or at least nothing we've been able to uncover so far. Not that we looked very hard. But the pictures of the Keller Locost are very nice and Mr. Keller is warmly regarded in the Locost community.

The M.G. Locost prototype used in the production of this construction manual was built by Nick Jenkins of Novato, California, not coincidentally the same Nick Jenkins who penned this manual. This particular vehicle incorporated a couple of features not found on the Walton or Keller Locosts, including an unsightly bulge in the hood (bonnet) to accommodate the too-tall M.G. B-series engine, and five degrees of caster in the front suspension. Several features from the Walton and Keller Locosts were incorporated in the Jenkins Locost, although we can't recall exactly what they were at the moment.

d. The Build Plan

No matter what you might've read elsewhere, you can't scratch-build a Locost in 500 hours. Not even close. Take some time to think about it as you read over the following build sequence and major steps.

Build Step	Tasks Involved	Minimum Hours
Stripping the Donor	Transporting the donor to the build site, dismantling the car, fixing parts, cleaning parts, painting parts, finding places to store parts, and finding a new home for the remains	100
Building the Frame	Cutting over 100 tubes, constructing a build table, tack welding the frame, bending tubes, welding the entire frame, top, bottom and sides.	150
Building the Scuttle	Cutting out more tubes, welding the scuttle frame, constructing the steering column support, dashboard support, and firewall, sheeting the scuttle and attaching it to the frame	50
Front Suspension	Cutting tubes, building A-arm jigs, cutting pickup brackets, welding the A-arms, building jigs for the pickups, and welding on the pickups	150
Steering	Constructing a mount for the rack (more tubes), two more mounts for the column, modifying the column to fit, shortening the tie rods	50
Rear Suspension	Dismantling the rear brakes and hubs, sawing off the leaf spring brackets, constructing trailing links, Panhard rod and brackets, shock brackets, and welding everything in place	100
Mounting the Engine	Constructing the mounts, chopping down the M.G. transmission mount, stripping the chassis, fitting the chassis over the engine, test-fitting the mounts, and welding in place, plus shortening the driveshaft	100
Cooling and Exhaust	Constructing the complete exhaust system, hanging the exhaust, constructing radiator mounts, fitting hoses, and fitting the electric fan	50
Detailing the Frame	Constructing and welding 40 tabs for routing plumbing and wiring, 12 sheet metal panels plus the floor, roll bar, spare tire mount, capping open tube ends, and painting the frame	200
Fuel System	Constructing the fuel tank and fuel pump mounts, installing the lines, the tank, the filler hose, pump, and sender unit	100
Brake System	Constructing a pedal box support, routing brake lines, refurbishing brake components, and assembling wheel hubs	50
Wiring	Routing the harness, soldering connectors, mounting the battery, fuse box, starter, and alternator	50
Dashboard	Constructing the dashboard, fitting gauges and switches, wiring the electrics, fitting the choke cable	50
Bodywork	Cutting, fitting, trimming, and bending 6 large aluminum sheets, drilling 500 rivet holes and riveting panels, fitting the nose cone, constructing front fender supports, fitting front and rear fenders	200
Windshield	Fitting the glass to the frame, fitting the stanchions to the scuttle, fitting the wiper motor and wiper assembly	100
Lights	Building a headlight support, fitting headlights, turn signals, taillights, license plate lights, back-up lights, and wiring everything	150
Paint	Stripping the car, prepping the bodywork, priming, sanding, finish coat, and reassembling everything	150

To save you the math, that's 1800 hours, and building a complete Locost in 1800 hours would be some kind of record. Also, the tasks listed in the above chart are not all-inclusive, so consider this to be just a sampling of the sort of work involved. On the plus side, building a Locost is mostly fun work, although it can get overwhelming at times, and the sorry fact is only about one Locost project in five ever makes it to the finish line.

The single biggest reason for that poor finishing record is underestimation of the total work involved. The thinking goes something like this: Building a Locost frame looks easy, and hanging the engine and suspension doesn't seem that tricky either. You're going to have to do some wiring, and build some body panels, but those are down the road and the frame is the main thing. Get that done, and the rest will sort of fall into place.

What's missing from this thought process are the thousands of other details that have to happen if you want to be able to drive the car. A few brief lines in the Locost book about cleaning this or fitting that can take hours or days. And there are hundreds of little steps like that. It's not like you're building a car from a kit. You have to start by building the kit.

The idea here is not to discourage you. We tried that already. The idea is to prepare you. Building a car from scratch is not going to be easy. Fun maybe, but not easy. And sometimes discouraging. The whole build process may start to feel like one big obstacle after another. You may start to wonder if you can possibly overcome them all.

It's best not to think about that. Take the obstacles one at a time. The more you overcome, the more confident you'll be that you can overcome the rest. However you look at this thing, you're going to be doing it all. And it will be a lot of work, and it will be worth it.

The second reason for the poor Locost finishing record is one you shouldn't have to face. Building a Locost typically requires you to make hundreds of engineering and construction decisions, because the Locost book is necessarily vague in a lot of areas. Sometimes those decisions work out well, and other times not so much. When they don't work out, the builder may try to fix the problem, but it's just as common to abandon the project altogether, especially if this is the second or fifth, or 100th problem they've run into, and they were none too happy with the results of some of the previous fixes.

You won't have to face that issue because every design and construction decision has been made for you in this manual. And we tend not to be vague. We understand this probably takes some of the fun and excitement out of the build process, but you can look forward instead to the fun and excitement of driving your Locost.

One word of caution, though. Okay, several words. It will be tempting during the course of your build to deviate from the plans in this manual. You may not like the way we did everything, and who could blame you? You may want to customize a few things, and generally that's fine. But try to avoid major changes. Altering things like the size or shape of the frame will render most of this manual useless, and may also reduce the odds of you completing your build. The M.G. Locost is not a car for everyone. It's not even the Locost for everyone. Be sure this is what you want to build.

e. Tools

If you have a good set of SAE automotive tools, that's really nice, but it won't get you much further than dismantling your MGB donor. Tools we consider essential for building a Locost are a welder, a grinder, and a drill. Plus a tape measure and carpenter's square, unless you're really, really good at eyeballing. Even then. Beyond these, some kind of metal cutting tool, like a band saw or chop saw, would be handy, as would a hammer or two, and some metal files. You can build a Locost with just these tools, but anything else you can bring to the party, like a lathe or a mill, might make the job go a little faster or easier.

Welders

Most Locosts are built with MIG welders, and actually, MIG welding is probably the most common type of welding throughout the DIY automotive community. A good 110-volt MIG welder will easily handle all of the welding tasks on your Locost, and the only reason to go bigger would be a) You have future projects in mind, or b) You already have a bigger welder.

A word about TIG welding. TIG welding is really nice. If you could TIG weld your entire Locost, you'd have a really awesome car. And you'd save a lot of time grinding away massive MIG beads. But TIG welders are expensive and TIG welding takes a lot more practice. So unless you're already a TIG welder, you should probably pass on this idea.

We're not going to cover welding techniques in this manual. That's a whole different book. We will expect you to know what we're talking about when we refer to various joint types or metals or any of the other stuff you can learn in a simple 12-week course at your local community college. If your welding career is just now getting underway, we would recommend a lot of practice with your new MIG welder. You will be making close to two thousand welds on your Locost, and when you're done, your welding technique will still be improving. So you can't get too much practice. Watch YouTube videos.

Grinders

A bench grinder is nice, but a hand-held angle grinder is essential. It can be used to cut metal, shape metal, and make metal fit in places that it didn't fit before. A new, although possibly not the best, angle grinder can be purchased from one of the discount tool stores for around $20. A 4" grinder will work fine, although the cutting and grinding wheels will last longer on larger models.

Even though grinding wheels sound like they would be appropriate enough for grinding metal, we never used them much on our Locost. What worked a lot better were flap discs. For fast cutting you can use a 40- or 50-grit flap disc, but an 80-grit disc will cut almost as fast, and won't dig into the surrounding metal as much if you miss.

Drills

You will need an electric hand drill, and you can probably build an entire Locost with a hand drill, but I'm not sure you'd want to. A drill press makes rounder holes and it makes them more consistently, although you should note that a drill press only makes round holes if you clamp the work to the table. Bigger is better, but a $150 table model will work fine.

Among the accessories you'll need of course will be a nice set of drill bits, and also a nice set of wire brush wheels. These won't last long, and they tend to fire off sharp bits of wire when they start to wear out, so get a few in different sizes. A set of circle-cutting hole saws are also great to have, but they're kind of expensive, so get your first one with a removable mandrel, and then just get the others as you need them.

Other Tools

We've been trying to keep the tool costs as cheap as possible here, but the fact is you get what you pay for, and expensive tools are always cheaper than cheap tools in the long run. So if you have a long run in mind, and I think most of us do, then get the best tools you can afford.

Now that we've lifted the cap on spending, let's talk about a couple of other useful items. You'll be working with old and crusty car parts, and in many cases the threaded holes in these parts will be equally crusty. A nice tap-and-die set will come in handy when you need to chase those threads. It doesn't have to be a high-speed set with plug, taper, and bottom taps, unless you plan to do a lot of other tapping or thread cutting, but you will need at least one high-speed 1/2"x20 taper tap for making parts of the front suspension.

Clamps in all shapes and sizes will make life with your Locost build a lot easier. You should try to have at least one really deep C-clamp (G-clamp), lots of spring clamps, and a few of those vise-grip-type welding clamps. Plastic clamps are okay, but not great when you're welding. As a general rule you should also try to avoid welding metal clamps to your Locost. A cleco tool and a big set of 1/8" clecos will be equally helpful when attaching sheet metal panels, and you can also get little bitty clamps to use with your cleco tool.

A nice table sander with a good, sturdy table and miter bar will help you get your frame tubes and brackets lined up properly. A rotary tool (e.g. Dremel) will be useful for cutting or grinding (very slowly) in really tight places. Punches (drifts) and chisels always work better than screwdrivers for the type of job you need a punch or chisel for. And finally, any sort of tool that lets you cut large pieces of sheet metal easier than an angle grinder with a cut-off wheel, like a hydraulic shear or a nibbler, would be awesome.

f. Getting Started

Every construction manual needs a section called getting started, so that's what this is doing here. The thing is, if you've read this far, you've already gotten started.

I know we said earlier that we wanted to prepare you for taking on a project of this magnitude, but the thing is, unless you've already done something like this before, that's not really possible. Building a car from scratch is a long and fascinating journey, one that not a lot of people start, and fewer finish, but one that can be very gratifying and inspiring. It'll also be highly educational, because you'll learn a lot about cars, and even more about yourself.

2. The Donor

Although it's possible to start building your M.G. Locost without a donor, especially if you stay true to the plans in this manual, we're going to start with the donor here because a) you'll need one eventually, b) getting a donor is one of the biggest obstacles you'll face in building an M.G. Locost, and c) unless you have an awesome build space, trying to dismantle a donor and clean up parts and find room for all the parts will be a lot harder if you have a Locost chassis and build table taking up half your garage.

So we'll begin with what to look for in a donor. If you already have a donor, that's excellent, but don't skip to the next chapter because there may be something in here you'll need to know.

a. Selecting your Donor

Any model year MGB can be used as a donor. You could probably even use an MGA, although that would be kind of sacrilegious, so we won't go there. Even the use of an MGB is offensive to some, so we have to assure them that our donor is in an impossible state of disrepair after dozens of years of neglect, except of course for the specific parts we need, and so we're actually resurrecting the vehicle as a classic British sports car in the only way possible, as a replica of a 1963 Lotus 7.

There weren't a lot of changes made to the MGB during its 18-year production life. The most significant changes came in 1975 with the introduction of lowered suspension pickups and giant rubber bumpers. From 1968 on, the engine was saddled with increasing emissions controls, and as a result horsepower dropped just about every year. However, because a 1963 Lotus 7 doesn't have any serious emissions equipment, depending on where you live (hint: California), you can easily get full power out of any year engine with the proper engine parts.

In order of availability and price, the rubber bumper cars are going to be your best bet for a donor, followed by the 1968-1974 model years, and at the rare and expensive end of the spectrum, the pre-68 cars, which everyone wants. Depending on which model year you get, a few details of your Locost build may be different from the descriptions in this manual, but if you end up with a 1972 MGB roadster with steel wheels and no overdrive, you're golden.

A word about wheels—and this is one of those things you need to read if you already have a donor—your MGB must have steel wheels. If you already have a donor and it has wire wheels, get on eBay or Craigslist right now, and order up a rear axle and front hubs from a steel wheel MGB. Although M.G. Locosts have been built with wire wheels, we're not sure how they did it because the rear axle in a wire wheel MGB is too narrow for a Locost, and a wire wheel axle can't be easily extended.

Similarly, overdrive. We understand a four-speed gear box is a little archaic these days, and anything to reduce freeway RPMs could be considered a bonus, but the MGB overdrive unit just won't fit in a Locost, or if does it'll be such a major hassle that you'll wish you hadn't, and in any case freeway driving in a Locost is not such a relaxing experience that you'll even notice the RPMs.

Start your search for your donor early, and don't jump at the first basket case you find. A car that's running is great, but will probably cost more than you need to pay. An M.G. that's been sitting around for a few years can usually be brought back to life with fresh oil, clean gas, new plugs, and a good scrubbing of the carburetors, so that's not a show-stopper.

Do make sure that the car you buy has a clear title, because proving you acquired your parts legally can be a big sticking point when it comes time to register your completed Locost. Get both the pink slip and a signed bill of sale.

b. Inspecting your Donor

Before you disassemble your donor, it might be a good idea to see if you can get it running. This is an excellent way to ascertain the general condition of the engine, transmission, rear axle, and brakes, and also to alert your neighbors that you're about to introduce a whole new type of automotive experience into their midst.

First thing to do is pop the hood and check the brake and clutch master cylinders for fluid, and add some Castrol LMA if either is too low. Check the coolant level in the radiator and add distilled water as needed. Check the engine oil. If it's black sludge, change it with non-synthetic 20W50. You'll change it again before you pull the engine, but don't run any really old, cruddy oil through the engine. You should also check the oil level in the transmission and differential if you have any reason to believe that either may have been drained.

If the car has been driven in the past six months, it should be okay to take a short drive to see what's working on the car and what isn't. First thing to check is the brakes. Keep in mind that brakes that have been sitting awhile might have rusted a bit, so you may need to really stomp on them to get the car to slow down. Avoid traffic and small children. And big children.

If the car has been sitting for a while, like for instance several years, you will need to check the fuel tank and carburetor float bowls for varnish. On early HS carburetors (pre about 1971), the float bowls sit alongside the carburetors and can be inspected by removing the three screws that secure the cover. On later HIF carburetors, the float bowls are underneath the carburetor bodies, and so the carburetors have to be removed from the car to check the float bowls. So big improvement there.

With the cover off the float bowls, check that the float is free to move, and that the bowl is clean and dry. This is highly unlikely. It's much more likely that one or both of the carburetors will need to be disassembled and scrubbed clean with a toxic solvent and possibly steel wool. When that's done, replace the carburetors on the car and change the fuel filter.

A cruddy fuel tank will have crud on the bottom, and you can see the crud through the filler hose if you shine a light in there. If the tank is dry and crud-free, you got lucky. If it's crud-free but has liquid fuel in it, drain all of the fuel out of it, because you don't know where it's been.

If the fuel tank is really cruddy, walk away from it. You won't need it anyway. Get a one- or two-gallon plastic fuel container to use for engine testing, and run the inlet line from the fuel pump into the container. It's not the world's safest arrangement, but we're not driving anywhere.

Pull all of the spark plugs and check the gaps and color. Gaps should be around .025 to .035. If not, set them to .025. Electrodes should be a nice dull tan. If not, you might want to replace them if you hope to get the engine to start. Or you could take your chances. Either way, spray a teaspoon or so of your favorite light machine oil down each cylinder bore. Try to get it all on the cylinder walls. Replace the spark plugs and torque them to about 15-17 ft. lbs.

You might be tempted at this time to do a compression test, but honestly, it won't do you much good. Your number two and three cylinders will probably be low, and sooner or later you'll need to pull the head and replace a few valves. But there are likely several other problems with the engine as well, like a bad rocker arm, worn cam lobes, tapered cylinders, and leaky gaskets.

What's important is not that your engine isn't in perfect working condition, but that an M.G. engine will start and run reliably with all of those problems and more. So unless you're prepared to completely overhaul a perfectly serviceable engine, skip the compression test for now. Once the Locost is complete, we can discuss overhauls.

Next thing to do is check the condition of the battery, or batteries, and put it (them) on a charger if necessary. With batteries charged, turn the ignition key to the start position (second stop) and listen for the fuel pump.

The fuel pump may not work either, because S.U. fuel pumps don't take well to sitting around with their contact points rusting away. You can buy a new set of points, or a new pump, your choice, but replacing points in an S.U. fuel pump is a little tricky. If the pump does work, it'll click when you turn the key. If it clicks fast, like about 10 clicks per second, it's pumping air. It should click once or twice a second while the carburetor float bowls fill up, and then stop.

If your fuel pump doesn't work, it's not a show-stopper. You can start the engine with a gravity feed line running down to the carburetors. Just be sure that all of your jury-rigged connections are secure and leak-free. And keep a fire extinguisher handy.

Pull the distributor cap and make sure there's a rotor under there, then remove the rotor. Now get in the car and turn the starter over. Watch the oil pressure gauge. After about six or eight revolutions, maybe fewer, you should see the oil pressure start to come up. On the starter alone oil pressure can reach as high as 50 psi, but even 10 psi is okay for now. If that checks out, replace the distributor rotor and cap. It's time to roll.

With the gearbox in neutral and the handbrake on, pull the choke all the way out and turn the starter over. If the ignition timing is close to correct and the carburetors are in working order, the engine should cough, stumble, and fire up within one or two seconds. If it doesn't, call it a day. We're not going to describe the entire M.G. troubleshooting procedure here, but suffice it to say it's long and painful and best performed after a good night's sleep.

If the engine starts, push in the choke until the idle is stable. Let it run for a minute and spew out all that oil you sprayed into the cylinders. Watch the coolant temperature gauge until it starts to move. Check under the car for leaks. Small leaks are expected and not a big deal at this point, but gushers of water or oil should prompt you to shut the engine down right away. In any case, shut down the engine once it's up to temperature, and then change the oil and filter, even if you just changed them an hour ago. Use a non-synthetic 20W50 oil.

If the engine starts and you have a secure fuel tank attached to the car, check to see if the clutch and brakes are working. If everything looks good, it should be okay to take a short drive to see what's working on the car and what isn't. Run through each of the gears. The later full-synchromesh gearboxes are nearly bullet proof, so if you have problems shifting it may be the clutch. Listen for clunks or whines from the rear axle, and try to feel for any vibration from the drive train. Keep an eye on oil pressure and coolant temperature while you drive.

Minor problems with any component of the car should not be an issue at this point, but make notes on things you might want to fix. It's up to you whether you fix them now, before you install them in the Locost, or after the Locost is running, but we vote for after. Getting the Locost running, even with a few suspect parts, is huge. Once the car is done, you can start fixing or replacing things to your heart's content. It really is not difficult to remove and replace anything on a Locost, and by the time you're done building it, you'll have an up-close and personal relationship with every nut and bolt on the car.

One note of caution: While working on your donor, interested parties may occasionally wander by to admire your new M.G. They may ask a few harmless questions about the car and what you plan to do with it. At this point, we recommend that you not engage them. Later on when it's more obvious what you're doing you'll have to be more forthcoming, but for now just nod, smile, and be friendly but non-committal. It'll save you a lot of time and odd looks.

c. Dismantling your Donor

Once you've done all you can for your donor, it's time to start taking it apart. Figure out in advance where you're going to put everything, because you're going to have a lot of loose parts. Any method you have for organizing and storing parts will work so long as it keeps you from losing anything and allows you to find a part when you need it. Start a nut and bolt bin for general hardware, but keep parts-specific hardware like the driveshaft bolts and transmission turret bolts with the parts themselves.

The order in which you remove parts from your MGB is up to you, but we like to start with the engine and transmission, because we think they're easier to remove while you can still roll the car back and forth. Also, it's easier to remove stuff from the engine bay if the engine isn't in there hogging all the space. Once the engine is out, strap it to a flat dolly, maybe with a tarp underneath, so you can roll it around the garage when it starts to get in the way. Which it will.

d. Donor Parts

The main parts you need for your Locost are the engine with all accessories, transmission with mount, clutch slave cylinder, radiator, driveshaft, rear axle with hubs and brakes, wheels and tires, including the spare, handbrake assembly, and front axles with hubs, brakes, and spindles, i.e. everything but the lower A-arm and upper shock absorber (damper).

Also save the fuel pump, fuel tank evaporator canister, carbon canister, all switches and gauges, choke and accelerator cables with cable stops, the complete pedal box with master cylinders and pedals, including the accelerator pedal, steering rack, steering wheel, column, and u-joint. Along with the wiring harness, get all of the electrical components you can find, like the horns, wipers, ignition coil, and fuse box. You don't have to know what everything is just yet, but if it has a wire attached to it, save it.

While you're at it, get as many bits and pieces off the car as you can, even pieces that have seen better days or you think you may not be able to use. We can't stress this enough. You can always buy a replacement later, but if you need a license plate light right now and you're short on funds, that crusty one in your box of parts will start looking a lot better. Save your defroster vents, windshield washer bottle, and interior panel screws. Save the fuel and brake lines, not so much for your Locost, but to practice on before routing the new lines. Save everything.

If the exhaust is seriously rusted, you can trash it, but save the manifold and the two cast iron flanges that bolt to it. You'll have to saw through the downpipes to retrieve them. If the exhaust looks like it'll clean up with a little wire brushing, hang onto it. You'll have to do some clever welding, but except for the tailpipe, the stock exhaust has everything you need to construct the Locost exhaust.

One of the most tedious extraction jobs will be the wiring harness. You could buy a new one, but they're expensive and the one in your donor is probably more than serviceable. Just be sure to label every connection in the harness before you remove it. A 1" square scrap of paper wrapped in cellophane tape will work. Take pictures of complex junctions like the alternator and starter motor. Reconnection of these wires will be detailed later in this manual, but our descriptions may say something like, "take the wire labeled 'right rear taillight'..." So label everything.

The wiring harness is actually two separate parts, a front and rear harness that connect up at the front of the transmission tunnel, not coincidentally exactly where they'll meet up in the Locost. The rear harness is easily dislodged, and except for the tedious task of labeling of every connector, will be easy to remove from the car. The front harness is much trickier because of all the connections under the dashboard. It would be easier to remove the dash first, if you could reach the six bolts along the top that attach it to the cowl. Good luck with that.

The front harness runs through a large grommet on the far offside firewall. Do not attempt to feed the wires under the dashboard through this opening. You'll break things, like for example the windshield wiper motor plug. Instead, work all of the wires in the engine bay back through the opening into the passenger compartment. This won't be easy either, so be careful and try not to cram too many wires through at a time.

The engineers at M.G. managed to find a different way to attach every gauge, switch, and control on the dashboard. They all come out, eventually, except for the indicator lights in early seventies models. These have a one-way, pressed-on backing plate that allows the indicators to be installed, but not removed. Fortunately, indicator lights can be purchased off the Internet and probably other places as well. Along with the gauges, retrieve the speedometer cable, oil line for the oil pressure gauge, and any other gauge-specific hardware.

At some point you're probably going to want to clean up the parts you've removed, and who can blame you? It's not a bad idea to do this sooner rather than later, before you actually need the part. It can be tough to motivate yourself to install a part on your Locost if you know you're going to have to first clean it, paint it, and then wait for the paint to dry.

Most of your rusty old M.G. parts will clean up nicely with a wire wheel, either on your bench grinder or attached to your hand drill. Really greasy parts may need to be cleaned first with solvent before you find any rust, but keep at it, it'll be there. If you can't get rid of all the rust, don't worry, they make primers for that. Get the part painted and it'll look good as new. Or not that good, but you know, definitely better than it did.

Donor parts will keep you busy for a while, and after you've refurbished a bunch of them you may start to feel like you've got just about everything you need to build your Locost. Not even close. The good news is that all of the parts you still need will be either Locost-specific or universal parts, not anything thing from a Ford, Chevy, Toyota, or other lesser brand. Your Locost will be a true single-donor car. You are going to be building a Locost using parts from an MGB roadster, and not just a few of them. As many M.G. parts as you can stuff in there.

e. Recycling your donor

There's one more thing you might want to do with your donor before you shove it out the door. At some point during your build, you're going to need to weld motor mounts to your Locost frame. Getting these in exactly the right place will mean using your engine as a jig. But engines are big and heavy and don't really make the best jigs.

You can build a much simpler jig with just a little bit of welding and a couple of scraps of steel. Start by making four engine mount plates as shown in figure 10.2. You'll only need two right now, but you'll need two later on, and it wouldn't hurt to make them all now, and all the same size. The plates are made from 1/8" cold rolled steel, with four 5/16" holes in each. The holes are positioned exactly as they are on the motor mounts in the donor.

Bolt two of the plates to the motor mounts in the donor with four short 5/16" bolts through each. Next cut a steel tube to fit between the plates, angling the ends of the tube until you have good contact with the plates. Now weld the tube to the plates. These welds don't have to be super strong, but you don't want the plates to be able to move at all. When the welds have cooled, unbolt the plates. Welding may have shortened or otherwise warped the tube, so do what you have to in order to make sure the plates are still a perfect fit to the motor mounts in the donor. This is your new engine mount jig. Don't lose it.

If your MGB chassis is in decent shape after you've stripped it bare, and by decent we mean it still has doors and a trunk lid, you may be able to find a good home for it. You may even be able to recover some of your original purchase price. There is a pretty decent market out there for salvageable MGB shells, and by salvageable we mean it has only about a dozen or so rusted-through sheet metal panels.

We should note that this only applies to the chrome-bumper cars, 1963-1974, which everyone still wants. If your donor is one of the unfortunate rubber-bumper models, call the scrap yard.

3. Basic Frame

Even if you haven't found that perfect donor yet, you can start building the frame so long as you build it exactly to the plans in this manual. We may have mentioned this before. It's important, because a lot of M.G. parts are going to fit in your Locost with not a lot of clearance, and so without the donor, the only way you can be sure they'll fit is to build your frame as close as you can to the plans. In general, a tolerance of a 16th of an inch or so won't be a problem, but try for better.

For some reason, even though the frame construction sequence is spelled out in great detail in the original Locost book, many Locost builders seem to have questions about this. Maybe they haven't read the book. Whatever you may have read, the sequence described here will work well and ensure your frame comes out straight and accurate. More or less. As straight and accurate as you can make it.

a. Buying Steel

We are going to build most of the frame out of 16 gauge 1" square tubing and 16 gauge 1"x1/2" rectangular tubing. And by "we" of course we mean you. All of the tubing will be mild steel, and seam welded (a.k.a. ERW). Mild steel has good machinability, ductility, weldability, and strength, all the things we want in a Locost frame. However, mild steel is not an actual alloy so you may need to be more specific, for example SAE 1018. If you can't find a specific alloy, just look for a mild steel with a minimum yield strength of 36,000 psi, which isn't all that high, so it shouldn't be hard to find.

There are two basic types of mild steel finishes, hot roll and cold roll. Cold roll looks slightly better, and is slightly more expensive. Hot roll will work fine for our purposes, it just won't look as nice. After you paint the frame, no one will know the difference.

There are many higher strength alloys with equally good machinability and weldability as mild steel, like for example SAE 4130. So obviously there's a reason we aren't using them. The biggest reason of course would be price. Another excellent reason would be the lack of availability of square or rectangular tubing in those alloys. So mild steel it is.

If you have a local metal supplier who is easy to work with and has what you want, great. Our local metal supplier isn't like that, so we tend to order what we need over the Internet. If you prefer to use your local metal supplier, be very specific about what you want, and don't let them tell you what you need. That's our job. Here's what you need for the basic frame:

120 feet of 16 gauge 1" square tubing
40 feet of 16 gauge 1"x1/2" rectangular tubing
20 feet of 16 gauge 3/4" square tubing
20 feet of 16 gauge 3/4" round DOM tubing
4"x12" of 1/8" thick steel plate or bar

You don't have to buy all of your steel at once, and let it all rust away in a corner while you slowly piece together the frame. A good start would be about 60 feet of 1" square. You can get a lot done on the frame with just that. Next time, get the rest.

b. The Build Table

Every Locost build needs a build table. These are universally eight feet long by four feet wide, not coincidentally the exact size of a sheet of 3/4" thick MDF, which is the universal surface material for a Locost build table. You will need two sheets of the stuff, and don't cheap out and get particle board, which won't hold a flat surface for more than a couple of days.

A pair of plastic sawhorses rated at 1000 lbs. or better will support the table. The only other parts you'll need are five 8-foot lengths of 4x4, your choice of redwood or fir, and some flathead wood screws to hold it all together. Some Locost builders substitute metal beams for the 4x4, and that's fine if you want to impress the neighbors, but good old Douglas fir will do the job, and will burn nicely in the fireplace when you're all done with the table.

Some Locost builders eschew the elegant MDF-on-sawhorse table design because of its perceived lack of stability. We believe these Locost builders have never actually seen an MDF-on-sawhorse build table, because they are in fact quite strong and short of backing your pickup truck into it, you're not going to knock it over. And these tables have the added benefit of being easily dismantled when your Locost is on its wheels and you need to get the table out of the way.

So let's build your table. Set the sawhorses about 5 feet apart. If they have extensions, extend them all the way. Make sure any mechanism that locks the sawhorses in the open position is fully engaged. Center the first sheet of MDF over the sawhorses, then lay the five 8-foot lengths of 4x4 on top of that, spacing them each about a foot apart. Finally, lay the second sheet of MDF on top. You're done. It's that simple. If only the rest of the Locost build was this easy.

Okay, it's not quite that simple, but almost. The key component of a Locost build table is flatness. Level is good too, but flat is essential. Check your table for flatness with a long straightedge of known straightedge-ness. If it's off anywhere, you're going to gain some valuable experience in the use of shims. A discrepancy across the table of 1/16" is not a show-stopper, but try for better. Once you have the table flat and level, screw the table top to the 4x4s around the perimeter with your flathead wood screws and you're good to go.

c. Frame Tubes

You need to know that there are two types of tubes in a Locost frame, and only two types of tubes. The first type is tubes you cut to length. These are cut as close as possible to the length in the plans. These tubes determine the exact size and shape of your Locost. We'll note as we're building which tubes are cut to length.

The second type is tubes you cut to fit. The length of these tubes is determined by the frame, not the plans. The plans may give you an idea what the length should be, but the actual length is whatever fits your frame. If your build is going well, the plan length and actual length should be close to the same.

You have two options when cutting a tube to fit. Either measure the length on the frame as accurately as possible, or cut the tube a little longer than the length shown in the plans, then trial fit the tube and trim as necessary. We like the second option.

As important as it is to cut tubes to the length shown in the plans, it's even more important to cut them the same size. Take for example the two main frame rails, A1 and A2. These are 32" long according to the plans. If you cut them both 32-1/4", the only effect it would have is that your Locost would be 1/4" longer than the plans. No one would notice, because the frame would be straight and look nice. So the fact that the tubes weren't exactly to plan hardly made a difference.

Now imagine cutting A1 to 32" and A2 to 32-1/4". If you built the frame with those tubes, the frame would never be straight. One side would be longer than the other and everyone would notice. So whether you happened to cut A1 and A2 to 31" or 32" or 33", as long as they were the exact same size, your Locost would turn out okay. More or less.

We're still going to try to cut all of the tubes as close as possible to the length in the plans, because it'll make the build go easier. But if we're off by .02", we're not going to sweat it, so long as we can place the tubes side by side and see that they're exactly the same length. This applies to all frame tubes that have an identical twin on the opposite side of the car, and it applies to all 6 H tubes, which determine the height of the chassis. Note that it doesn't apply to tubes you cut to fit, but if your cut-to-length tubes are accurate, your cut-to-fit tubes will be too.

All of the tubes in a Locost chassis have names. Actually just letters and numbers, but we like to think of them as names. Later attempts by certain Locost books to rename the tubes have mostly failed, and the original names are still more commonly used. It would be a good idea to familiarize yourself with these names before you start cutting up tubes.

Tubes are lettered A through Z. For some reason, the letter I was skipped. A couple of tubes were named with two letters, like for example the FU and RU tubes, and a couple of small tubes weren't named at all, and have to be referenced by location. Tubes can share the same letter if they're identical but on opposite sides of the car. These tubes are distinguished by adding a number after the letter, for example A1 and A2. There are exceptions to all of this of course, because the naming convention is not sufficiently confusing on its own. Tubes will be assembled more or less in alphabetical order, if that helps at all.

d. Bottom Dozen (A-G)

In this step we're going to cut the dozen tubes that form the bottom of the Locost frame, lay them out on our build table, and tack weld them all together. This will take a while, probably longer than any other step in the basic frame assembly, but it's important to get it right since it's going to establish the overall accuracy and straightness of your frame.

We'll start by drawing some carefully measured lines on the build table in pencil. We could use a pen, but that would almost guarantee one or more lines would be off. Pencil marks can be easily sanded away, ink marks not so much.

On the surface of your build table, using figure 3.1 as a guide, draw a straight line right down the center, the long way. Next, draw four lines perpendicular to the centerline all the way across the table. The first line should be 2" from one end of the table, the second 32" from the first, the third another 21-1/2" from the second, and the fourth 28" from the third. Next draw two lines 21" out from the centerline and parallel to it, crossing the first two perpendicular lines. Draw two more lines parallel to the centerline and 16-7/8" out from it, crossing the third perpendicular line.

Finally, draw two more lines 5-5/16" from the centerline, between the fourth perpendicular line and the end of the table. Your table should look something like figure 3.1. If you're sure all of your lines are nice and straight and perfectly square, you're ready to lay out your bottom dozen frame tubes.

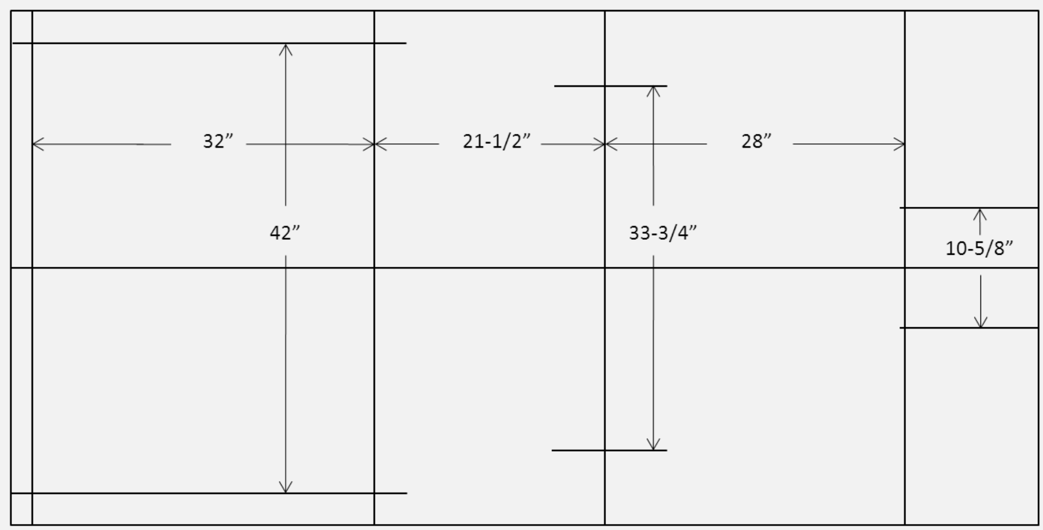

Figure 3.1

Ten of the tubes that make up the bottom of the frame will be cut to length. Two will be cut to fit. Start by cutting 1" square tubes in the following lengths:

2 @ 32" (A1 & A2)
2 @ 40" (B1 & B2)
1 @ 32-1/2" (C)
2 @ 23" (D1 & D2)
1 @ 15-1/4" (E)
2 @ 39-1/2" (F1 & F2)

The two remaining two tubes (G1 and G2) will end up close to 27-1/4", but we'll cut them 1/8" longer than that for now, to 27-3/8", or alternately you can wait until all the rest of the tubes are fitted, and then measure the length of the G tubes directly from the frame.

Cut or file the ends of the 32" and 40" tubes (A1, A2, B1, & B2) perfectly square. Cut, grind, or file the ends of the 23" tubes (D1 & D2) at a 10 degree angle, with the angles parallel. Also cut the ends of the 32-1/2" tube (C) to 10 degrees, but with the angles opposing. Cut the ends of the 39-1/2" tubes (F1 & F2) at an 18 degree angle, with the angles parallel, and finally cut the ends of the 15-1/4" tube (E) to 18 degrees, with the angles opposing.

A quick note about tubes. Your frame tubes were made from flat steel bent into a square tube and welded at the seam. The weld is sufficiently strong that the orientation of the tubes is unimportant from a structural standpoint. However, some people prefer to position the tubes so that the welded seams are somewhat hidden, or otherwise neatly arranged. You can do that if you like, but after its all painted no one will ever know.

When we line up our frame tubes along our pencil marks, we're going to need something to fix the tubes on the table so they can't move around when we bump into them or lean against them, which you really can't avoid. What we're doing then is converting the build table into a temporary frame jig. Two dozen 1- or 2-inch blocks of wood screwed to the table will do the job, the first dozen laid out as shown in figure 3.2.

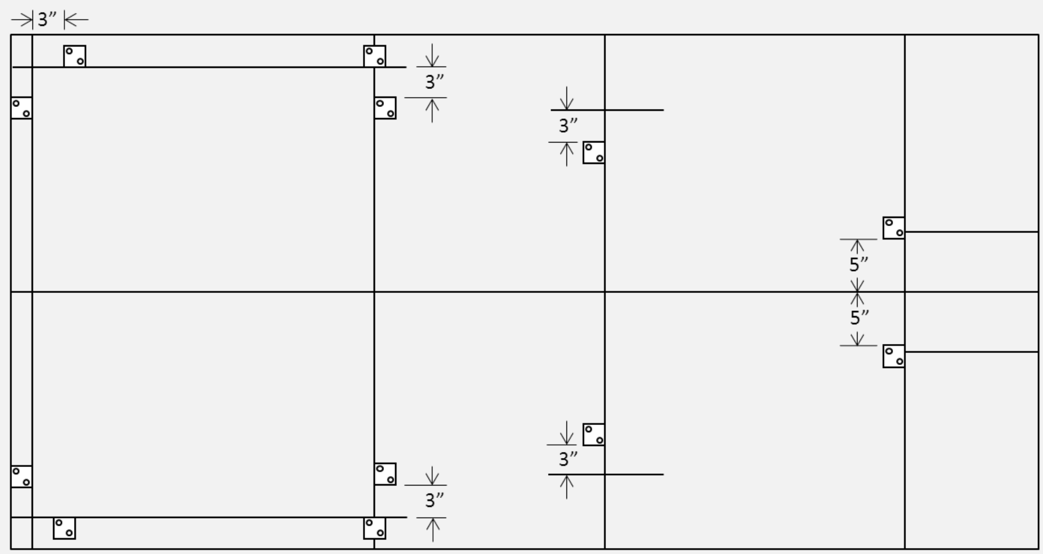

Figure 3.2

Place your two 32" tubes (A1 & A2) along the sides of the large rectangle, up against the wood blocks. Each end should be lined up with the perpendicular lines forming the front and back of the rectangle. Place wood blocks along the inside edge of each A tube close to the middle, and screw the blocks to the table to lock the tubes in place.

Next fit the 40" tubes (B1 & B2) against the fore and aft blocks, inside the two 32" tubes. They should just be a snug fit. If they're too long, that's going to be a problem because we can't really afford any extra frame width. Trim them down so they fit. If the B tubes are short by a 1/16" or less, just center them between the A tubes. A gap of 1/32" or less won't be a problem for your MIG welder. Place wood blocks along the inside edge of each B tube in the middle, and screw the blocks to the table, locking the tubes in place. Your table should be starting to look like figure 3.3.

Take your 32-1/2" tube (C) and place it against of the wood blocks along the third perpendicular line. Center it exactly on the table. Place a wood block along the forward edge of the C tube at the table centerline, and screw the block to the table to lock the C tube in place.

Next take your 23" tubes (D1 & D2) and place them as shown in figure 3.3, with the aft ends snug against the A tubes and the forward wood blocks that secure the A tubes. The forward ends of the D tubes should extend to the forward edge of the C tube, and lie just inside the pencil lines on either end of the C tube. Make sure the forward ends of the D tubes are exactly centered between the pencil marks. Make really sure.

If you're really sure, place wood blocks along the outside edge of each D tube, far enough forward that they extend past the front of the tubes, just like the forward blocks on the A tubes. This will lock the D tubes in place, and the blocks will also serve as guides for the next tubes (F1 & F2).

Now take your 15-1/4" tube (E) and place it against of the wood blocks along the forward perpendicular line. Center it exactly on the table. Place a wood block along the forward edge of the E tube at the table centerline, and screw the block to the table to lock the E tube in place.

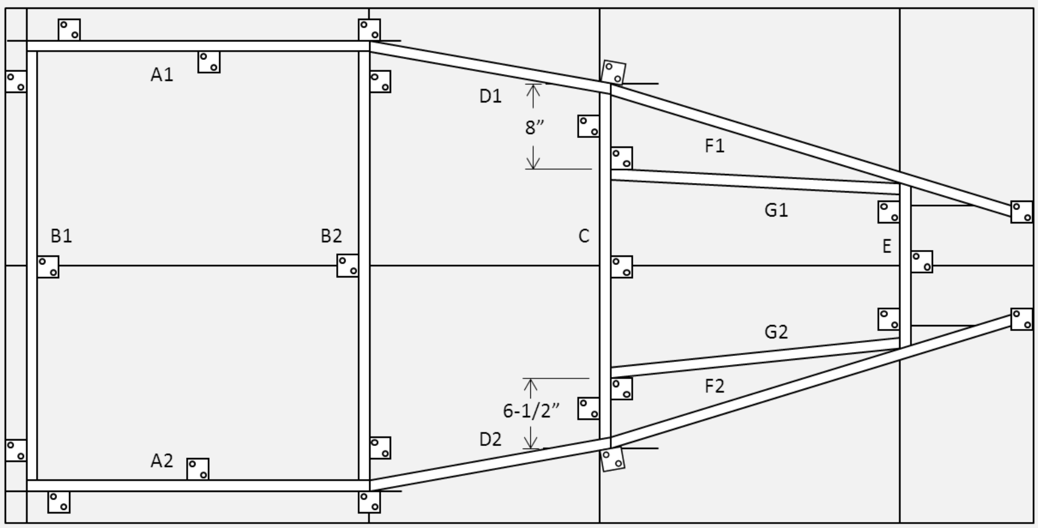

Figure 3.3

Finally, take your 39-1/2" tubes (F1 & F2) and place them as in figure 3.3, with the aft ends snug against the D tubes and the wood blocks that secure the D tubes. The forward ends of the F tubes will extend to about an inch from the end of the table. More importantly, they will lie just inside the pencil lines at the end of the table, exactly centered. Make really sure, then place blocks at the front of the F tubes and screw them to the table, locking the F tubes in place. If the blocks are large they may overhang the edge of the table slightly, which is okay.

Your table should now look exactly like figure 3.3. Except for the G tubes. So not exactly. But almost. To make it look exactly like figure 3.3, screw two blocks to the table along the forward edge of the C tube. Place the nearside (driver's side) block 8" from the outer pencil mark. This will be 8-7/8" from the centerline. Place the nearside (passenger's side) block 6-1/2" from the outer pencil mark, or 10-3/8" from the table centerline. These dimensions are fairly critical for fitting the transmission, so get them within at least 1/16" of the correct measurements. And double-check them.

Now trim and fit your G tubes to fit snugly against the blocks and the corners of the E and F tubes. Although it's not shown in figure 3.3, it would be a good idea to unscrew the blocks behind the E tubes and move them outboard slightly until they snug up against the G tubes. This will lock the whole assembly in place. We're now ready to tack weld these tubes together, but first we're going to take some diagonal measurements across the frame and make sure it's totally square.

The most important diagonals are from the corners of B1 and the A tubes, to the corners of C and the D tubes. These two measurements have to be exact. A difference of 1/16" won't be a show-stopper, but try for better. We may have said this before. A difference of 1/8" or more means that your Locost will look bent when it's done, and we can't have that. Make the corrections now. Check the squareness of the A and B tubes with a big carpenter's square, and place shims between your wood blocks and the frame tubes as necessary to get it all perfect.

Go ahead and tack weld the tubes together. If you're new to welding, a few tips about tack welding. It's tempting to place tacks on the center of the tubes, because it feels like you're less likely to miss. If you do that, however —and we're not saying you can't—later on you'll wish you hadn't. The best place for tacks on square or rectangular tubing is at a corner of the tube. That way, when you're ready to fully weld the joint, you can run a bead all the way across the seam, and stop at the tack. Your beads will look better and the welds will probably be stronger as well.

Another tip for novice welders. Be sure you melt both tubes with your tack bead. Move the arc back and forth across the joint. The arc is small, so it's really only pointed at one tube at a time, and it's very easy to get only one tube hot enough to melt. The tack will look good, and the bead will stick just a little to the unmelted tube, but you can pull the joint apart by hand. This is a cold weld. If you suspect after tacking a joint that only one tube melted, add another tack between the first bead and the unmelted tube. This will be less of an issue when you're fully welding the joints, because you have to move the torch, and you can add a slight weave or circle motion to be sure both tubes melt.

After all the tubes are tack welded together and the frame has cooled, get out your grinder and sand down any part of any bead that sticks up higher than the frame tubes. That way, when we flip the frame over to tack weld the other side, which we're about to do, the frame will sit flat on the table.

If you tack welded in the corners like we asked, you won't have to grind away as much of the tack beads. If you tack welded in the middle of the tubes, you have to grind away most of the beads. This not only takes longer, but the frame will be a lot more flimsy and you'll have to be really careful when you flip it over. Don't worry if you did that, it'll still work.

Remove the wood blocks locating the G tubes on the table, and then carefully flip the frame over. If your lines on the table were exactly square and your frame is straight, it'll fit inside the blocks. If it almost fits, and you're sure your pencil lines were accurate, it's okay to nudge the frame tubes until it fits.

If the frame doesn't fit the blocks at all, check your diagonal measurements again. If they're accurate, then your pencil lines might not be, and it's okay to remove blocks until the frame lies flat on the table. If your diagonal measurements are off, then tack welding has tweaked the frame a little, which is not unexpected. This is why we only tack welded. Use whatever means necessary, short of bending tubes, to get the frame straight again. This may mean grinding some tacks away completely and tack welding joints a second time.

With the frame flipped over, tack weld all the joints again. If you tack welded the corners on top, tack weld in the opposite corner on the bottom. When the frame has cooled, grind the tops of the tack beads flush with the frame tubes, and flip the frame back over. The bottom of the frame is done. It was a big job because of all the measuring and jigging, but the worst is over. Okay, maybe not, but the rest of the frame won't seem nearly as bad.

e. Nose Tubes

Actually, the nose tubes aren't so easy either. There are only four of them, so you wouldn't think it would be that hard. But they have odd angles at the ends, or at least some of them do, and there isn't any easy way to arrange them so you can tack them together. But we'll try.

The nose tubes are designated LA through LD. We're not sure why, but that's just how it is. LC is 24-1/2" long, with the ends angled at 50 degrees, opposing. LD is 13-1/2" long, with square ends. LA and LB are about 13-1/2" long, but these will be cut to fit after we get LC and LD positioned exactly where we want them.

LC sits in the frame exactly 12" higher than LD. It also sits 3" farther back. So we can't lay both tubes flat on the build table and expect to get them properly lined up. What we need is a block of wood exactly 3" high on which we can lay the LD tube. Wood doesn't usually come in 3" blocks, but you can make a 3" block by stacking four sheets of 3/4" wood on top of each other. Cut each sheet to 6" by 11" and glue them all together. Make at least one of the long edges perfectly square.

Referring to figure 3.4, draw a centerline across the top of the LD support block and down the square side. Fix the LD support block to the table, either with clamps or other wood blocks, so the centerline on the block is lined up with the centerline on the table, and exactly 10" from one of the perpendicular lines. Screw two wood blocks to the table along that perpendicular line, approximately 10" either side of the centerline Screw two more blocks to the top of the LD support block 3" from the square edge.

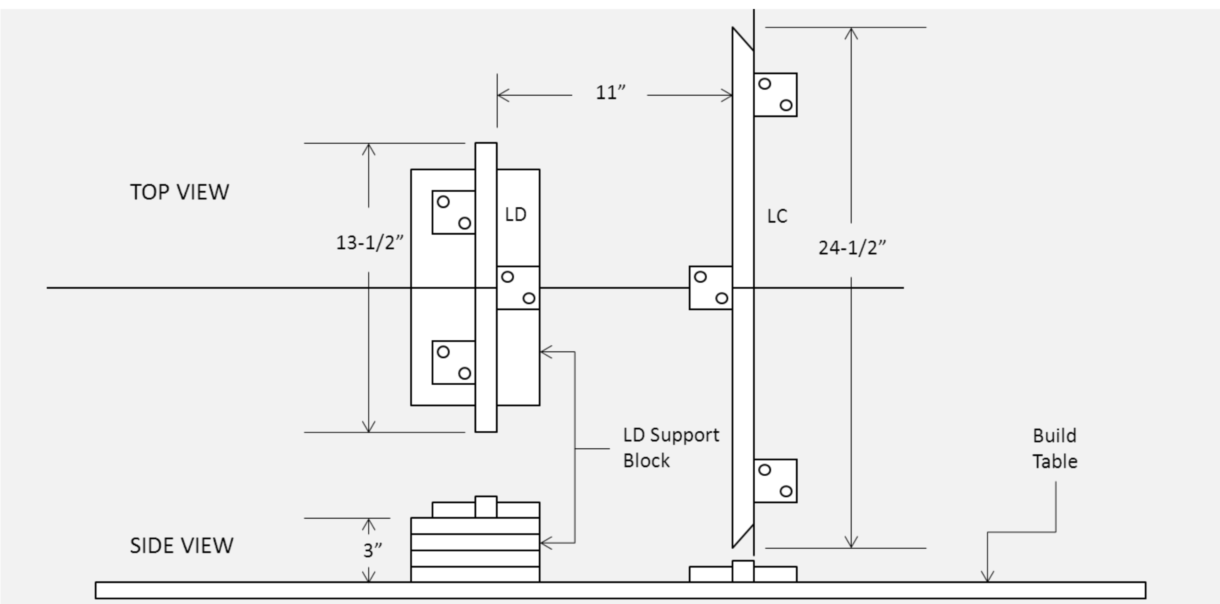

Figure 3.4

Draw centerlines around your LC and LD tubes. Place the LD tube against the blocks on top of the LD support, with the centerline of the tube lined up with the centerline on the block. Screw another block in front of the LD tube to lock it in place.

Place the LC tube against the blocks on the table, also lined up with the table centerline. Screw another block in front of the LC tube to lock it in place.

The LC and LD tubes are now arranged exactly as they'll sit in the Locost frame, and all you have to do is cut the LA and LB tubes so they fit between the ends of the LC and LD tubes. This is actually more difficult than it sounds.

Start with a 13-1/2" tube. Cut each end at a 63-degree angle, with the ends parallel. Set the tube between the LC and LD tubes. It won't fit yet, but note that the straight sides at each end need to be filed at a 14-degree angle, while still maintaining the 63-degree angle on the other sides. It takes some patience and a lot of trial-fitting. And you have to make two of them. However, you should note that the LA and LB tubes are identical, i.e. interchangeable, even though they look like mirror images of each other.

When the tubes have been cut to fit, you'll notice that they don't match up squarely with the LC and LD tubes. That's because the cut ends aren't square, but are actually more diamond shaped. To locate the suspension pickup brackets correctly, it's critical that the sides of the LA and LB tubes are square with the sides of the frame. This means the front of the tubes will angle back a few degrees, but that's okay. You'll barely notice after you get everything welded up.

Tack the LA and LB tubes to the LC and LD tubes. One tack at each corner should do it. After the assembly has cooled down, remove it from your makeshift jig and set it upright on your build table, with the LD tube centered in front of the F1 and F2 tubes. The LC tube should sit a foot above the bottom of the frame, and 3" back from the LD tube. After verifying the nose assembly is centered, clamp the LD tube to your build table snug against the F1 and F2 tubes.

Place one end of a carpenter's square against the back of the LC tube, and the other end flat on the table. Measure the distance between the square and the LD tube. This distance should be exactly 3". If it's not, try adjusting the clamp on the LD tube, or else clamp the upper side of the carpenter's square to the LC tube, and slide the square back or forth until the LC tube is 3" aft of the LD tube. With the LD tube centered on the F1 and F2 tubes, and the LC tube exactly 3" aft of the LD tube, tack weld the F1 and F2 tubes to LC.

f. H & J Tubes

With all of that out of the way, we're going to be moving along a little faster now. Our frame jigging days are mostly over, and all we need to do now is cut more tubes and tack them onto the frame. We'll start with the six H tubes. These determine the height of your Locost space frame chassis, and because we want that height to be the same everywhere along the frame, all six H tubes need to be exactly the same length, even if they're not exactly 11" long. But try to make them all 11" long.

Place the six H tubes according to figure 3.5. Note that the forward outboard H tubes are turned at a 10 degree angle to match the alignment of the D tubes. Magnets will help to hold the H tubes in place, but we prefer clamps.

Note that the four outboard H tubes are placed at tube joints, specifically the A-to-D and D-to-J joints. We think it's a good idea to fully weld the top of these joints first, and then grind the welds flat before fitting the H tubes. You're unlikely to get full penetration at these joints if you fit the H tubes first. It's particularly important to get good welds at these joints, because a lot of these weld beads are going to be ground away later to make room for the floor and bodywork.

The positions of the two H tubes that rise up from the C tube need to be measured exactly, because the big hulking full-synchromesh MGB transmission has to be able to fit through them. If you have an earlier, pre-1968 transmission, clearance won't be as much of an issue, but we're going to build the transmission tunnel big enough for the giant gearbox anyway, partly in case you ever have to swap out the non-synchromesh gearbox for a later one, and mostly because we don't have an earlier gearbox on hand to measure.

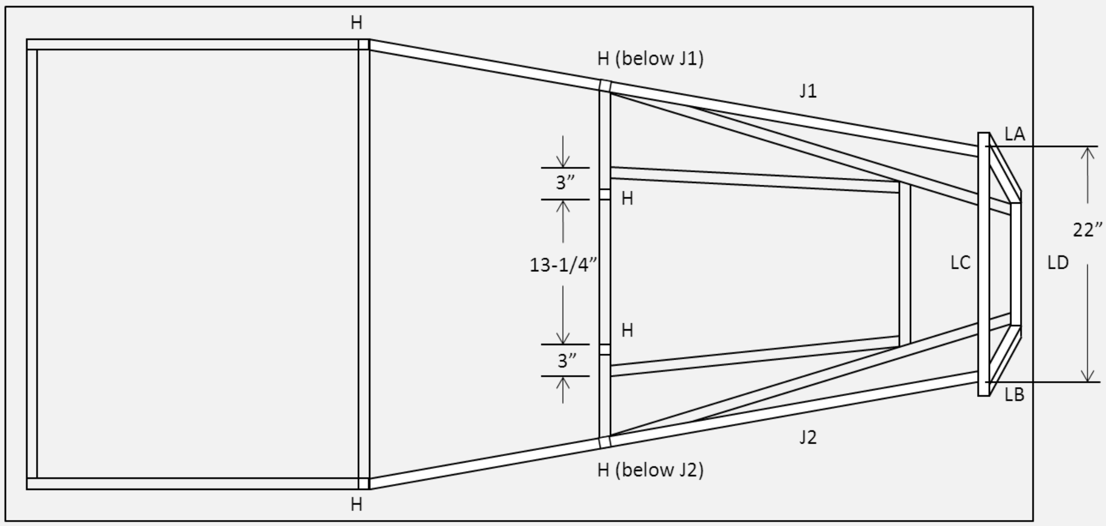

Figure 3.5

Make sure each H tube is as vertical as possible, then tack weld just one corner at the base of each. We want them all fixed to the bottom of the frame, but we're not going to worry too much if the tops can move around a bit before the upper frame rails are in place.

The J tubes are the longest tubes in the entire space frame chassis, and in fact the only tubes longer than four feet. Cut them to 58", with the ends angled at 10 degrees, parallel. Position each one so it rests on top of the forward outboard H tube, and just reaches the LC tube 11" out from the center of the frame. The rear of the tube should just reach the rearmost outboard H tube, but no part of the J tube should rest on the rear H tube.

Secure the J tube in position by clamping a block of wood to the forward side of the rearmost H tube, flush with the top of the H tube. Clamp the J tube to the top of the block of wood, right up to the edge of the J tube. Next clamp the J tube to the forward H tube so it can't fall off. Welding clamps are perfect for this, because they also ensure that the J tube is directly over the H tubes. Finally, clamp the forward end of the J tube to the LC tube.

The J tubes play an important role in the alignment of the whole frame, so we need to check a few things before we tack weld them into place. First, verify that the LC tube is still exactly 3" behind the LD tube. This is a critical measurement for the front suspension. If you need to correct it, keep the J tube clamped to the LC tube and move the J tube fore or aft on the forward H tube until the LC tube is exactly 3" aft of the LD tube.

Next, verify that the rear portion of the J tube sits directly over the D tube. Check this with a carpenter's square. If it's off, then either your H tubes aren't perfectly vertical, or the forward end of the J tube needs to be moved inboard or outboard on the LC tube. Or both. If you measured the position of the J tube on the LC tube correctly earlier, you shouldn't need to move it much. It's not critical that it's exactly 11'' from the centerline, but it shouldn't be off by more than a quarter inch either way.

Once the J tube is aligned over the D tube and the correct position of the LC tube has been confirmed, check that both H tubes are vertical in the fore and aft direction. A good way to do this is to stand back from the car and sight across the frame from one outboard H tube to the other. They should be parallel. That doesn't prove they're both vertical, but it's almost more important that they're perfectly parallel than perfectly vertical. Tap the top of the H tube fore or aft with a hammer as needed until they line up.

Finally, check the gap between the aft end of the J tube and the top of the rear H tube. The tubes should just meet, but not overlap. If they overlap, the J tube is too long, and if a gap exists, the J tube is too short. 1/16" either way isn't a showstopper, but more than that and you'll need to take corrective action.

Of course you can always lean the rear tube slightly fore or aft until the tubes meet, and it won't have a lot of effect on the integrity of your frame, but you're the one who's going to have to answer the questions whenever someone notices the tube's not perfectly vertical. And they will notice, because there's a crease in the bodywork along the outer corner of this particular tube, and the crease will only be as vertical as the tube behind it.

When you're satisfied with the alignment of the J tube, tack weld it at the FC junction and the top of the forward H tube. If you want, you can also tack the inside joint between the aft end of the J tube and the rear H tube, but be prepared to do some grinding later on when it's time to attach the N tubes.

g. K & O Tubes

We need to clear a little space on the build table for the next part of the frame. We're going to lay out the rear bulkhead, formed by the K3 and K4 tubes on the sides, and the O tubes in the middle. All of the tubes can lay flat on the table except the top O tube, which will have to be shimmed at a 17-degree angle. We'll do that later. Start by cutting 1" square tubes in the following lengths:

2 @ 31-1/8" (K1 & K2)
2 @ 20-1/8" (K3 & K4)
1 @ 42" (O)
2 @ 17-1/2" (O1 & O2)
1 @ 38" (O3)

We're also going to need two 4" square pieces of 1/8" steel plate, and two 4" lengths of 3/4" square steel tubing. These pieces don't have names, but they won't be too hard to identify when the time comes.

Cut one end of the K1 & K2 tubes to 40 degrees, and the other end to 50 degrees, with the angles opposing. Cut both ends of the K3 and K4 tubes to 17 degrees, with the ends parallel. Leave the O and O3 tubes with squared ends, and cut the ends of the O1 & O2 to a steep 55 degree, parallel. These will have to be modified later to fit, but this is good enough for now.

On your build table, lay out the K3, K4, and O3 tubes as shown in figure 3.6. The K tubes should be arranged so that the angle at the top (where it will contact the O tube) is face up, and the angle at the bottom is face down. Be sure the dimensions are correct and the angles between O3 and the K tubes are square, and then tack weld the O3 tube at each end to the K3 and K4 tubes.

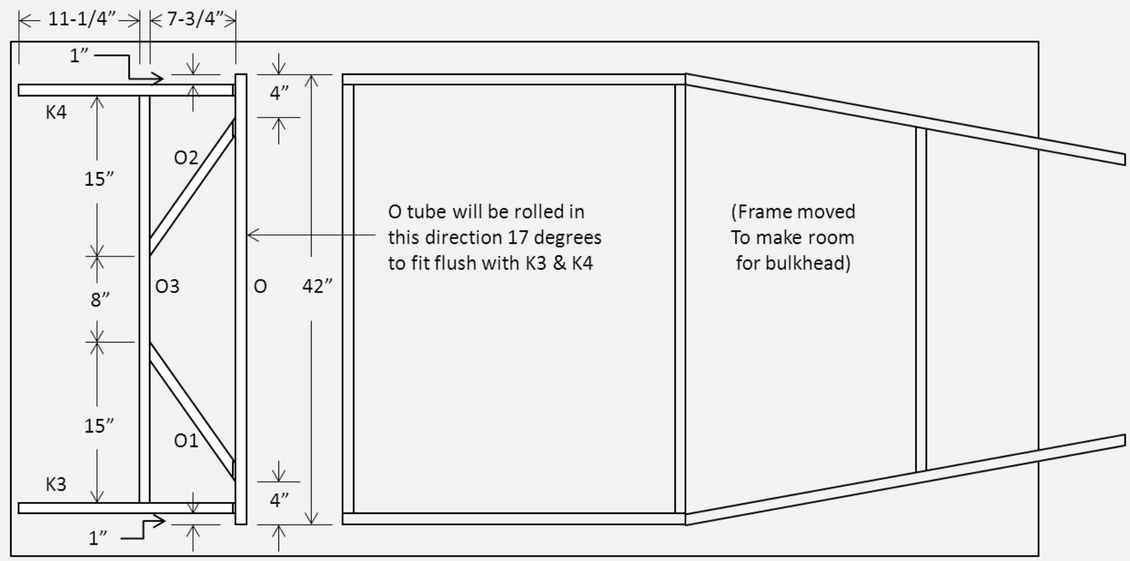

Figure 3.6

Next, place the O tube at the top of the K3 and K4 tubes. Each end should stick out 1" past each K tube. Because the ends of K3 and K4 are angled, the O tube won't sit flush against them. Find something like thin wood or metal that you use to shim the O tube so it sits flush against the K tubes. Then double-check that each end of the O tube sticks out exactly 1" from the K tubes. A good way to do this is to clamp a short length of 1" square tube to the O tube, flush with the end, and then clamp it to the K tube. When the O tube is correctly positioned, tack weld it to the K3 and K4 tubes.

The last step in constructing the bulkhead is fitting the O1 and O2 tubes. The bottom of these tubes will fit flush against the O3 tube, but the tops won't fit flush against the O tube because the O tube is angled 17 degrees. The straight edges on the top of O2 & O3 need to be filed to 17 degrees, while maintaining the 55 degree angle on the opposite edges.

It'll be easier to trial fit the O1 & O2 tubes if you clamp two wood blocks to the O tube 2" inside each K tube, and two wood blocks to the O3 tube, 4" each side of the centerline. Grind or file the O1 and O2 tubes until they fit between the wood blocks, and the ends are flush with the O and O3 tubes. Don't worry too much about getting them perfect. In the overall scheme of things the position of these tubes isn't all that critical. But try to make them look nice, or at least look the same. When you've got a good fit, tack weld the ends of O1 & O2 to O and O3.

Next thing to do is weld the two shock support plates to either end of the O tube, as shown in figure 3.7. The shock support plates are 4" squares of 1/8" thick steel. Earlier we said these pieces didn't have names, and officially they don't, but we're calling them shock support plates. So get used to it.

Before welding the shock support plates to the O tube, weld 4” lengths of 3/4" tubing along one edge, as shown in Step 1 of figure 3.7. Weld the 3/4" tube to the plate on both sides, but be careful about laying down too wide a bead on the inside, where the upper shock bracket will eventually go.

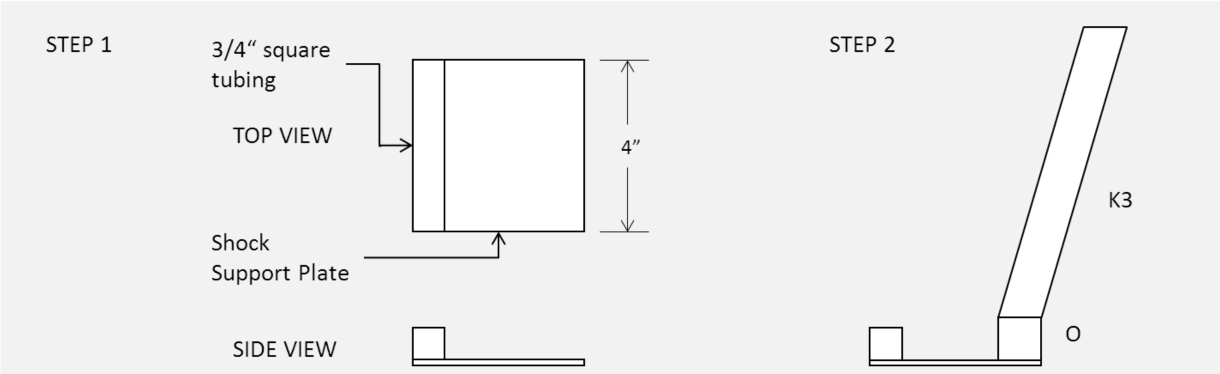

Figure 3.7

After the shock support plates have cooled, set the bulkhead assembly upside down on top of the plates, with each end of the O tube resting flat on edges opposite the 3/4" tubing. The best way to keep the bulkhead from falling over during this operation is to clamp the center of O tube to the table, with a 1/8” shim in between so the O tube wont bend when you clamp down on it.

Fully weld the O tube to both shock support plates. Weld both sides of the tube, but again be careful not to lay down too large a bead on the inside.

When the bulkhead assembly has cooled, tack weld it to the B1 tube at a 17 degree angle, as shown in figure 3.8. To do this, clamp the frame to the table with the B1 tube a few feet from the edge. Measure back 6” from the B1 tube and draw a line at this distance parallel to the B1 tube. Place a large carpenter’s square on the table with the corner on the line you just drew, one end pointing away from the frame, and the other end pointing straight up.

Now place the bulkhead assembly on the B1 tube, centering it exactly, and lean the assembly back until the O tube just contacts the carpenter’s square. The bottom of the K3 & K4 tubes should be flush with the top of the B1 tube, and just inside the A1 & A2 tubes. It might help if you clamp short lengths of 1” square tubing to the top ends of A1 & A2, and then K3 & K4 should fit just inside those tubes. With the bulkhead positioned correctly, tack weld the bottoms of K3 & K4 to B1.

The last step in this operation is to tack weld the K1 & K2 tubes between the O tube and the A1 & A2 tubes, as shown in figure 3.8. K1 and K2 are cut to plan, so no fitting is needed, but we do want to be sure the bulkhead assembly is completely square before we lock it in place with the K1 & K2 tubes.

Start by tack welding the 40-degree ends of K1 & K2 to either end of the O tube. The ends should stick up above the O tube by no more than the height of the shock support plates (1/8”, in case you weren’t paying attention earlier), and they should both stick up the exact same amount. You will probably need to grind flat some of the weld bead on the shock support plates so that K1 & K2 can fit squarely against the O tube.

When you've tacked K1 & K2 to the O tube, the forward ends of K1 & K2 should rest on the A1 & A2 tubes, about 12" from the aft H tubes. We're not going to worry about the exact distance for now.

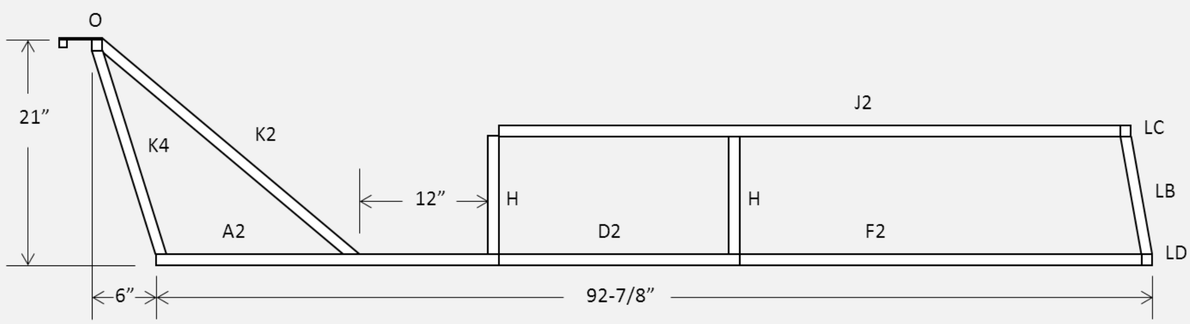

Figure 3.8

Loosely clamp K1 to A1 and K2 to A2. From above the frame, sight down on the O tube. This tube should be exactly parallel with the B1 tube below it. If it isn't, you'll need to slide either K3 or K4 along the A tube until it is. As you do this, check with your carpenter's square that the O tube is still 6" behind B1. If it isn't, slide K3 & K4 together along A1 & A2 to correct it. Once the O tube is exactly 6" behind B1 and exactly parallel with it, go ahead and tack K1 to A1 and K2 to A2.

We can now re-check the distances between the bottoms of K1 & K2 and the aft H tubes. They should be close to 12", and the measurements should be within 1/4" of each other. If they're off by much more than that, either K1 & K2 are not welded at the same height on the O tube, or K1 & K2 are different lengths, or more likely the bulkhead is not perfectly square, and the O tube is not parallel with B1. This would be a really good time to grind off tack welds and correct any misalignments.

h. M & N Tubes

M1 & M2 are about as critical as any tubes on the entire frame. The M tubes absorb the full output of the mighty MGB powerplant, multiplied by the 3.9:1 ratio of the differential gears, and transmit that massive force through the rear trailing links to the entire frame and the whole rest of the car. These are also the shortest of the named tubes at only 10-1/8", and they're definitely cut to fit, so we'll start by cutting them to 10-1/4", with one end at a 40-degree angle.

Place M1 & M2 exactly 5-1/2" from the aft ends of A1 & A2 as shown in figure 3.9. You really want to get both M1 & M2 the exact same distance from the ends of A1 & A2, and as vertical as possible. Keep trimming the square edge of each tube until they just fit.

When you think you've got them in the right place, clamp the bottom ends to A1 & A2, and clamp the upper ends to K1 & K2, Now stand back from one side of the car and sight across the frame from one M tube to the other. They should be parallel, and as with the H tubes it's more important that they be perfectly parallel than perfectly vertical. But try to get them vertical as well. When you're satisfied with the alignment, tack weld each M tube to its corresponding A and K tube.

N1 & N2 are cut to fit. Start at 27-3/8" with one end of each angled at 50 degrees. The forward end of each N tube will rest on top of the aft H tubes, and butt up against the aft ends of the J tubes.

Fitting the N1 & N2 tubes is one of the few places on your M.G. Locost build where you can get away with a little customization. On a Locost, these tubes are perfectly horizontal, and that's the way we're going to describe the build. On a Lotus 7 or a Caterham, these tubes are sloped down in back. We don't know what the exact angle is, but it looks like around 10 degrees.

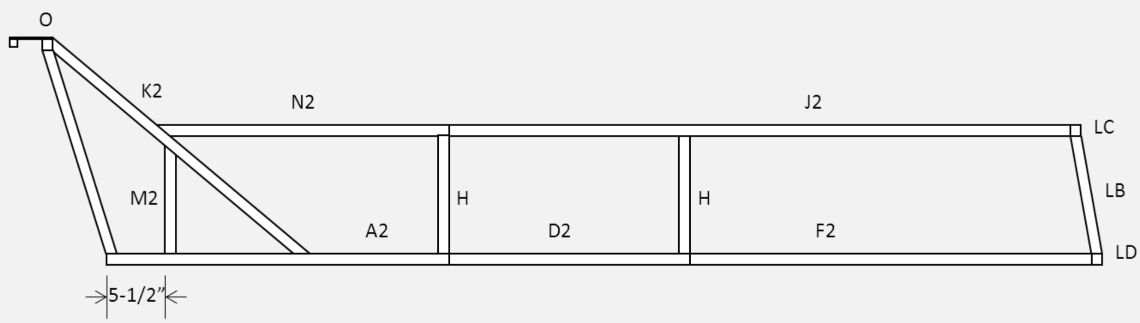

Figure 3.9

You can do that if you want. For structural reasons it might not be a good idea to place the back of these tubes any lower than the tops of M1 & M2, but it's not that critical. There is no ergonomic reason to slope the tubes—either way, N1 & N2 are well below your elbow when you're sitting in the car—so it's just a matter of looks. Personally, we prefer the straight line look, and see it as an improvement over the original Lotus 7 design. But you may feel otherwise.

If you slope the tubes, you will have to file the tops of the aft H tubes to the same angle as your desired slope. Also, be prepared later on for more deviations from the plans when we start to fit the rear fender supports and the bodywork.

When you've gotten the N tubes properly fitted, clamp them in place and check their alignment against the A tube below each N tube. If either is not parallel with the A tube, the aft H tube is likely not vertical, and the J tube is likely not aligned directly over the D tube as well. There should be enough give in the J tube to correct any misalignment, but if necessary grind down the tack welds where the J tube meets LC enough to allow you to move everything back into place. When you're satisfied with the alignment, go ahead and tack N1 & N2 to their respective, H, J, and K tubes.

i. P & Q Tubes

The Q tube will lock in the shape of your frame, so we're going to be checking the straightness of the frame a lot before we tack weld it into place. Cut the Q tube to 32-1/2", with each end angled 10 degrees, opposing. Lay the Q tube on top of the inboard H tubes as shown in figure 3.10. The Q tube should be directly over the C tube below it, and just fit between J1 and J2. It should also be exactly parallel to the C tube. If it looks good, clamp the ends to the J tube.

The inboard H tubes can now be set exactly vertical. The fore-aft position of these tubes is fixed by the Q tube, so if the Q tube is directly over the C tube, the H tubes will be vertical fore and aft. Check them both with a carpenter's square to make sure they're vertical left and right, and then clamp them to the Q tube.

We next want to check to make sure our outboard H tubes haven't moved out any. Check them with a carpenter's square, and then by eye. If you sight from the side of the frame across the forward H tubes, all four should line up. Take one more set of diagonal measurements across the frame, and if you're convinced everything is still straight, go ahead and tack the Q tube to J1, J2, and the inboard H tubes.

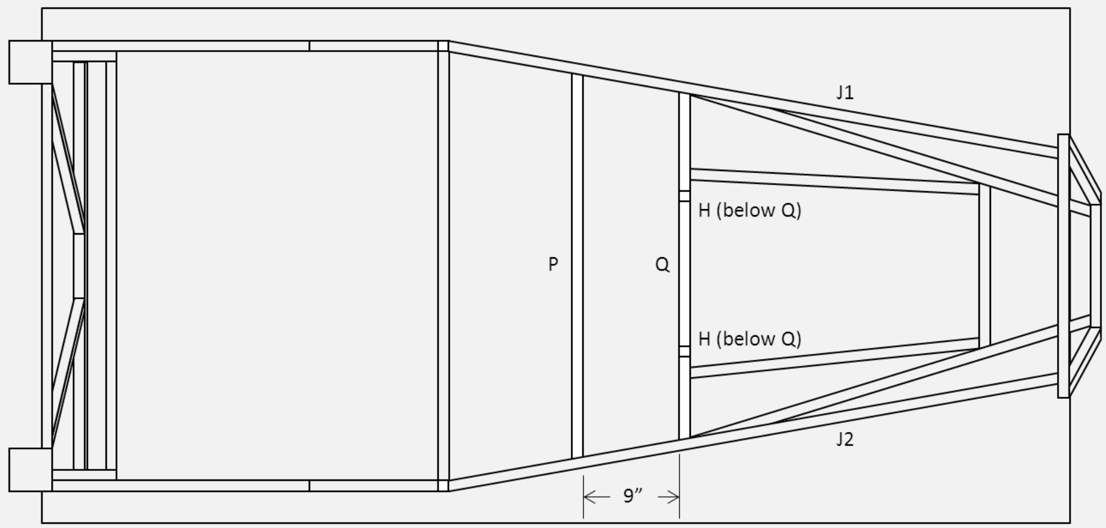

Figure 3.10

Fitting the P tube is really simple now. Cut it to 36" with the ends at 10 degree angles, opposing. Fit it to the frame as shown in figure 3.10, and clamp the ends to J1 & J2. Measure the distance between the P & Q tubes at either end. It should be 9". This is another area where you can vary from the plans if you want, but you need to know the effects of going with anything other than 9".

First of all, anything shorter than 9" is a bad idea. It'll reduce the size of the engine bay shelf, raise the steering wheel, and generally give you more clearance issues. Increasing this distance to, for example, 10" will give you more space on the engine bay and allow you to lower the steering wheel a bit if needed. It'll also reduce the size of the scuttle, which shouldn't be a problem, and lengthen the hood (bonnet), which should be okay as well.

However, all of the plans in this construction manual for the scuttle, steering, pedal arrangements, and hood will be based on a P tube exactly 9" aft of the Q tube. So if you change this measurement, be prepared for a lot more customization down the road. Also, if you move the P tube back at all, be sure to cut it slightly longer initially.

Whatever you decide to do, make sure the distance between P and Q is the same at both ends. When you're satisfied with the position of the P tube, tack weld each end of the tube to J1 & J2.

j. R, S, and T Tubes

The R, S, and T tubes help triangulate the engine bay. Probably not as much as we'd like, but the engine has to go somewhere, and so we need to make some room for it. The S and T tubes will strengthen the J tubes where the front suspension uprights (FU) attach, so they're not completely useless. The R tube has to be positioned so it'll clear the distributor cap, and also clear the oil filter if you've got one of those aftermarket inverters, so it's not optimal but it's better than nothing.

S and T will be cut to plan, while R will be cut to fit. Start by cutting 1" square tubes in the following lengths:

2 @ 13-3/4" (S & T)
1 @ 27-1/4" (R)

S & T will each need steep 56 degree angles on one end, and 44 degree angles on the other, with the angles opposing. The R tube will need to start with a 40-degree angle on one end a 5 degree angle on the other, also opposing.

Clamp the S and T tubes to J1 & J2 and the LC tube as shown in figure 3.11, with the ends of S and T just touching at the center of the LC tube. The opposite ends of the S & T tubes should also be the same distance back from the forward end of J1 & J2. If you're satisfied that the tubes line up, go ahead and tack weld them to the J tubes and LC.

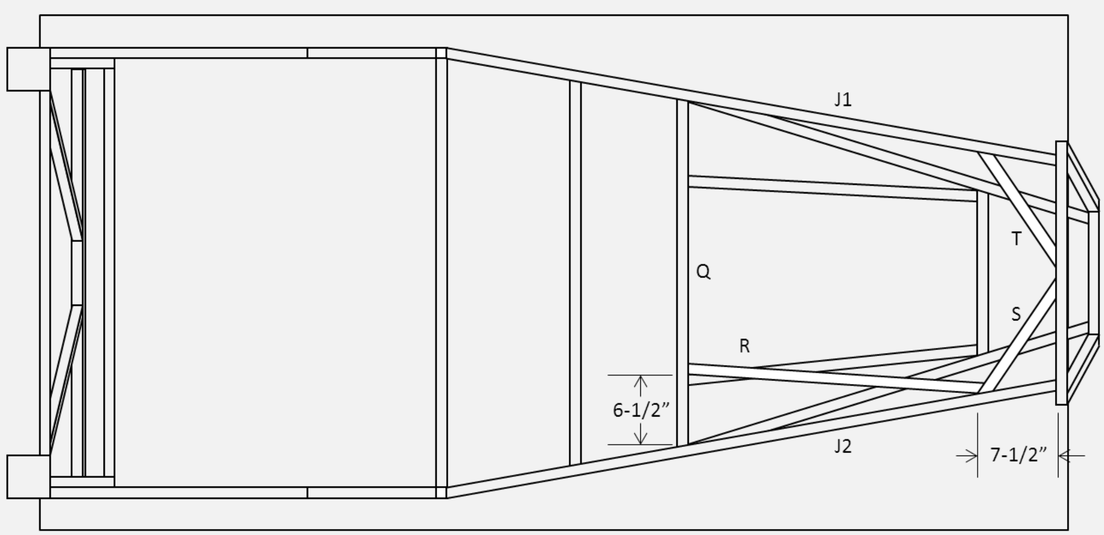

Figure 3.11

When the R tube is in place, it won't be possible to fully weld the S tube to J2, so go ahead and do that now. It's only necessary to weld one side at this time. When the weld has cooled, grind or file down the bead leaving only a small rounded fillet.

Test fit the R tube between the S and Q tubes. It will no doubt fit, but the distance between the aft end of R and J2 where it meets the Q tube will probably be more than 6-1/2”. This distance can’t be any greater than 6-1/2”, or else you’ll have a tough time fitting the distributor cap to the distributor with the engine in the car. This distance can be less than 6-1/2”, but that would only further reduce The R tube’s already meager effectiveness in triangulating the engine bay.

Grind or file the ends of the R tube until it fits neatly between S and Q with the proper distance from J2. You will have to round the forward end of the tube slightly to fit the fillet you left after welding and grinding the rear edge of the S tube. When you’re satisfied with the fit of the R tube, tack weld the ends to the S and Q tubes.

k. Transmission Tunnel

We’re going to build the transmission tunnel now, before we add any of the tubes aft of the bulkhead, because they’ll just get in the way. All of the transmission tunnel tubes are made out of 1”x1/2” 16 gauge rectangular tubing, and most will be cut to fit. All but one of the tubes will be oriented with the 1” sides vertical and the 1/2” sides horizontal, which will give us some extra space in the cockpit while increasing the bending strength of the chassis.

Even with the skinny tubing, there isn’t going to be a lot of extra space in the transmission tunnel for the transmission, driveshaft, handbrake, wiring and plumbing, so we want to be as accurate as possible and not make anything smaller than shown in the plans. Slightly bigger is okay, within reason, but any space you add to the tunnel is space you take away from the driver and passenger.

The Locost book has names for all of the transmission tunnel tubes, but we’re not going to use them because our transmission tunnel is a little different from theirs, and their names are too confusing anyway. We should be able to get through this with a few diagrams and a couple of makeshift jigs. Pay attention.

We’ll start by cutting the uprights and cross tubes from 1”x1/2" 16 gauge rectangular tubing. Cut six 9” uprights and five 5” cross tubes. Make sure the uprights are all exactly the same length, even if they’re not exactly 9”. Don’t make them any shorter than 9” or you’ll run into clearance issues with the shifter turret. Similarly, make sure the cross tubes are all exactly the same length, and as close to 5” as possible.

We can now cut and lay out the five tubes that make up the base of the tunnel, as shown in figure 3.12. Start by cutting one 30” tube and one 22” tube, with squared ends. Next, measure the distance between A1 and A2 at both the B1 and B2 ends. These measurements should be 40” exactly. It’s not a big deal if either is off by 1/8” or so, but we want the transmission tunnel to run right through middle of the frame, so if either measurement is not exactly 40”, adjust the measurements in the rest of this description accordingly.

Clamp the 30” tube to B1 and B2, exactly 17” from A2. Measure at both ends to be sure the tube is parallel to A2. Now set the 22” tube in place against B1, using a couple of your 5” cross tubes between the 30” tube and 22” tube as spacers, so we get the width of the tunnel correct. The distance between the 22” tube and A1 should now be 17” at both ends, at least if your measured distance between A1 and A2 was exactly 40”. If it wasn’t, this is the part of the job where you need to adjust accordingly.

Once the measurements look good and you're sure the tunnel is running directly through the center of the frame, tack the 30" tube to B1 and B2, and tack the 22" tube to B1. Also tack one of the 5" cross tubes between the 30" and 22" tubes, 5" forward of B1, as shown in figure 3.12.

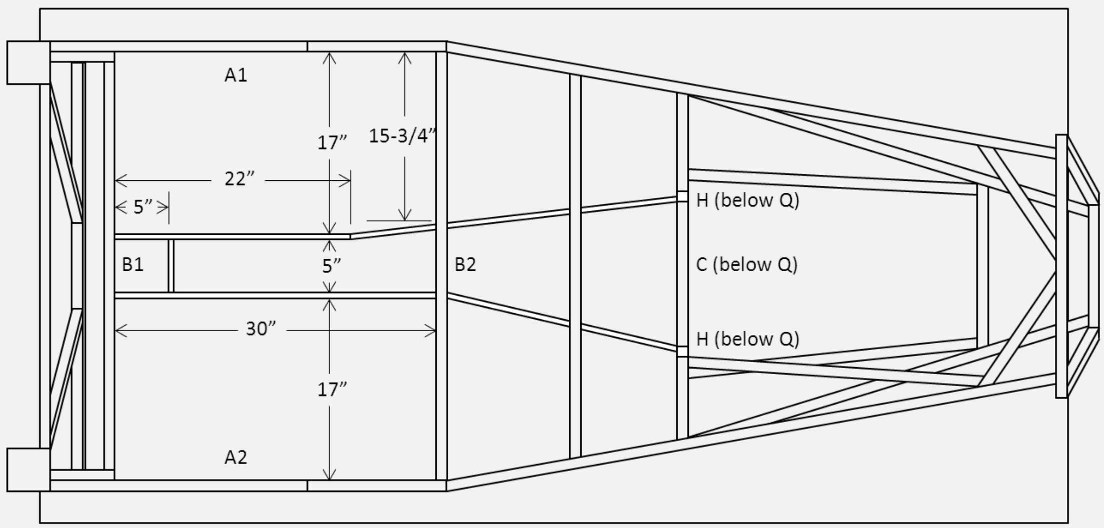

Figure 3.12

Now cut the two angled tunnel tubes that fit between B2 and the C tube. The forward ends of these tubes align with the inboard ends of the H tubes, and the aft ends align with the forward ends of the 30" and 22" tubes. Because the 22" tube doesn't reach all the way to B2, you'll need to use a straightedge to line up the angled tube on that side. Use the 15-3/4" measurement in the plans as a guide only. When these tubes are in position, tack them to the B2 and C tubes.

Finally, cut the short angled tube to fit between B2 and the forward end of the 22" tube. This tube will start out about 8-3/8" long, with the ends angled at 6 degrees, parallel. When tacking this tube in place, it's a good idea to clamp one of the 5" cross tubes between the forward end of the 22" and the 30" tube, to keep those tubes parallel. Use your straightedge to make sure the angled tubes line up.

We're going to build the sides of the transmission tunnel next, but to do that we first need to make a bracket for the handbrake lever. Cut a 4" x 6" plate out of 1/8" thick steel, and drill four holes as shown in figure 3.14. The center hole is 1" in diameter, and the three holes around it are all 5/16". If you drill the holes exactly to the pattern, your handbrake lever should fit, but you might do better to first drill the holes undersize, and then dig out your handbrake lever to make sure the holes are all in the right place. If everything looks good, drill the holes out to the proper size.

We'll tack weld the transmission tunnel sides flat on our build table, as shown in figures 3.13 and 3.14. Use five of the 9" uprights you cut out earlier and two more pieces of 1" x 1/2" tubing cut to lengths of 14-1/2" and 23-1/2".

The nearside tunnel is pretty simple, but make sure the corners are all square before and after tack welding the pieces together. The offside tunnel side incorporates the handbrake mounting bracket, which should also be flat on the table so it ends up flush with the outside of the tunnel. Tack weld the bracket in place for now, with two tacks at the top and two on either side.

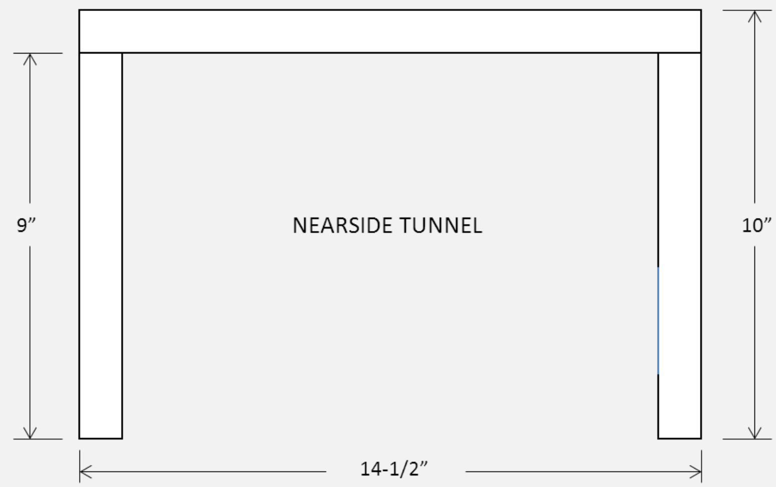

Figure 3.13

Before tack welding the tunnel sides to the frame, fully weld the top only of the 30” bottom tunnel rail to B2, and then grind or file this weld flat. Do the same at the forward end of the 22” tube, where it attaches to the short angled piece.

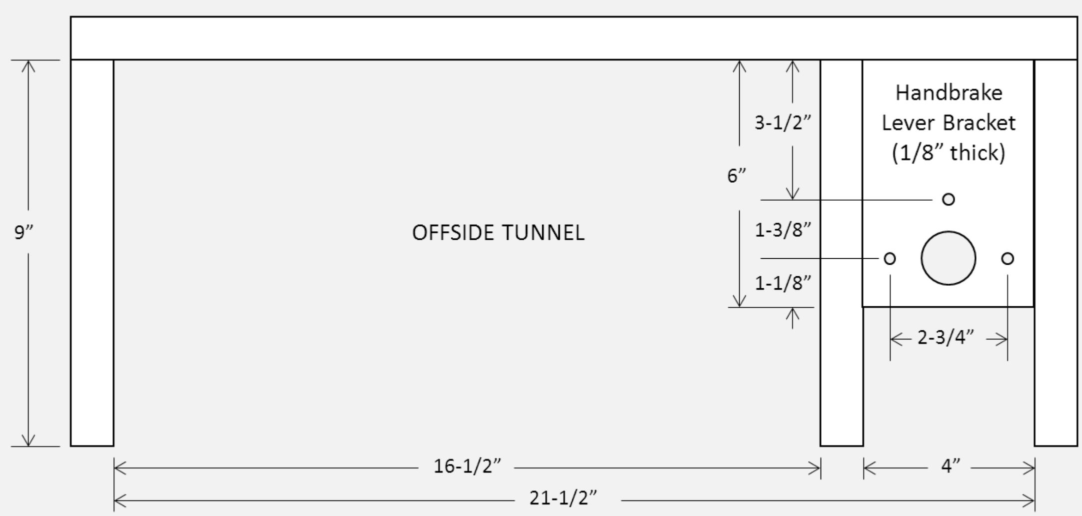

Figure 3.14

Now set the offside tunnel side above the 30” bottom tube, with the forward upright sitting on B2 and the aft upright 7-1/2” from B1, as shown in figure 3.15. The center upright and handbrake bracket should be toward the rear. Make sure the side is perfectly vertical, and tack the bottom of each upright to the bottom frame rails.

Tack the other tunnel side in place on the 22-1/2” bottom rail, making sure the tops of the tunnel sides are exactly 5” apart, and the rear upright of each side is 7-1/2” from B1. Now tack a 5” cross piece between the top of the two tunnel sides at their aft ends.

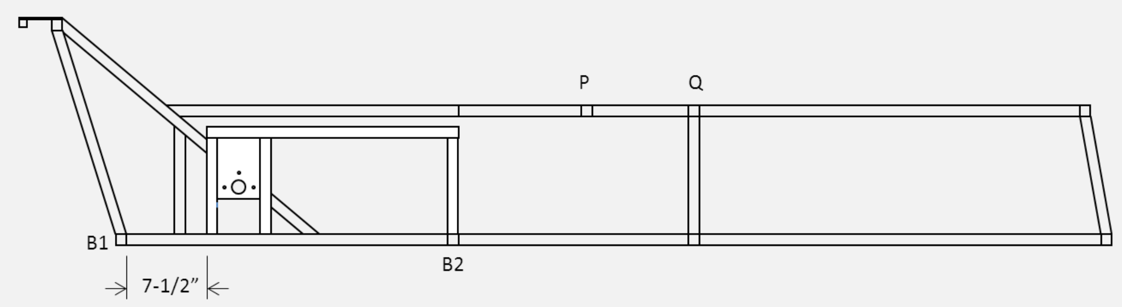

Figure 3.15

The tunnel is taking shape, but we still have eleven tubes to cut and fit before it’s complete. Start by tack welding your last 9” upright to the B2 tube in line with the nearside angled tubes, as indicated in figure 3.16. Make sure the upright is perfectly vertical.

Cut a 6-3/8” cross tube and fit it between the forward upright on nearside tunnel side and the upright you just tack welded to B2.This is the only tunnel tube that will lay flat instead of on edge. It should fit all the way down at the bottom of these uprights, right above B2. Trim it to fit as needed, and then tack weld it to the top of these uprights. If you sight down from above this cross piece, it should be directly over and exactly parallel to B2.

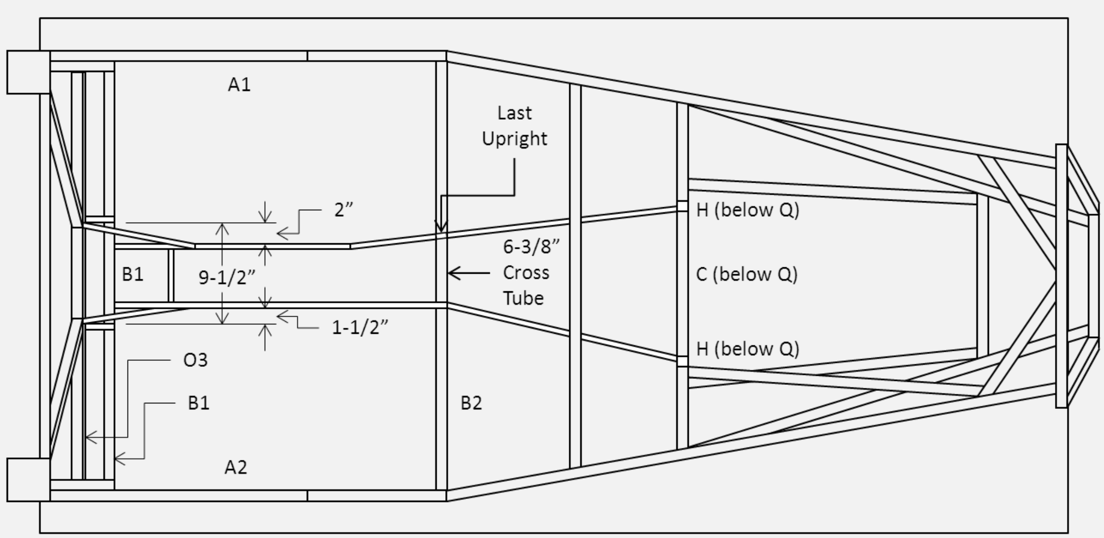

Figure 3.16

Now fit another short angled tube between the top of the forward upright on the offside tunnel side and the last upright you just tack welded to B2. This tube should be the same length as the angled tube below it, and parallel to it after tacking it in place.

We're now going to cut two vertical tubes that fit between the B1 and O3 tubes on the rear bulkhead. These tubes will establish the opening for the massive MGB differential, and so we're going to pay careful attention to the plans so as not to make the opening too small, since that's already been done a few times with unfortunate results, and we don't need a repeat of that.

Cut the two slanted uprights out of 1" x 1/2" rectangular tubing, each to a length 11-1/2". Angle the ends 17 degrees, parallel. Fit these between O3 and B1 as shown in figure 3.16, trimming as necessary. Note that the tubes are not equidistant from the chassis centerline. The nearside tube is 1/2" farther from the centerline than the offside tube. Make sure the tubes are parallel and vertical side-to-side, and then tack weld them to B1 and O3.

Now fit the two rear angled tubes between the aft end of each tunnel side and O3, using figures 3.16 and 3.17 as a guide. The ends of these tubes have compound angles, so a lot of trial fitting will be needed. The aft ends of these tubes should fit just inside the angled tubes you just attached to B1 and O3, and the forward ends match the aft ends of the tunnel sides. When you've got the two pieces whittled down to fit, tack weld them in place.

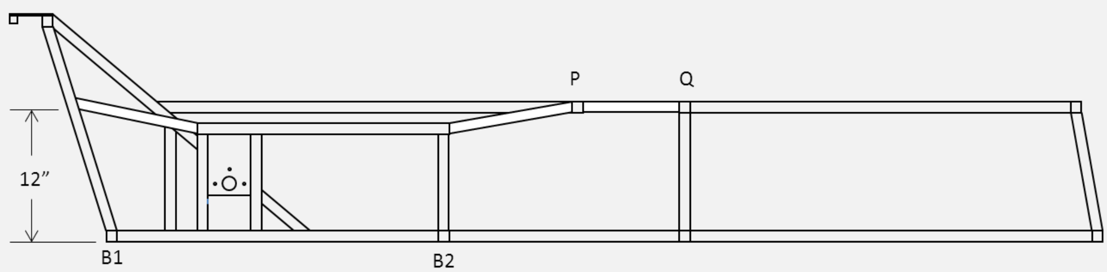

Figure 3.17

The last four tubes form the upper front of the tunnel, and are positioned as shown in figures 3.16 and 3.17. They fit directly over the lower tunnel rails. The forward tubes are level, and fit between the P and Q tubes. The aft tubes are sloped to fit between the P tube and the forward ends of the tunnel sides, and the ends have compound angles. Use clamps, spare tubing, and anything else you can find to line up each tube before tack welding it into place.

I. RU, V, W, Y, and Z tubes

Your Locost frame is now looking pretty spiffy, and should be surprisingly strong despite being only tack welded together. The next tubes we add will make the frame look more like a car. Structurally, they're not quite as critical as what you've put together so far, since they mainly support only the fuel tank and rear bodywork, but we still want this part of the frame to be as solid as we can make it.

There exist a few schools of thought on the exact construction of this section of the frame, because the Locost book is not entirely clear on it, and by not entirely clear we mean wrong. So everyone gets to interpret it in their own unique fashion. One picture in the Locost book we like is called "Rear view of the finished chassis", and while it doesn't agree with the plans in the book, it at least makes sense, and so that's what we used to draw up our own plans.

Before we start we're going to need to clear a little space on the build table. Your frame is probably sound enough to remove it completely from the table, but we only need about 2-1/2 feet, so sliding it forward with the front end of the frame hanging off one end of the table is okay too.

All of the tubes for this part of the chassis except W1 & W2 will be cut to plan. W1 and W2 are also different in that they're made from 3/4" square tubing instead of the usual 1". Start by cutting 1" square tubes in the following lengths:

2 @ 25" (RU1 & RU2)
1 @ 34" (V)
1 @ 33-1/4" (Y)
2 @ 3-3/8" (unnamed)
1 @ 21-1/4" (Z)

Cut W1 and W2 to 24-3/4" for now. Remember to cut these from 3/4" 16-gauge tubing, not 1" as suggested by some.

Cut each end of the RU tubes at a 5-degree angle, with the angles parallel. Cut one end of each of the 3-3/8" unnamed tubes to 5 degrees, and cut both ends of Y to 5 degrees, opposing. Cut the ends of the Z tube to 47 degree angles, opposing. Cut one end of each W tube to 48 degrees, and the other to 52 degrees, with the angles opposing. Since 48 and 52 degree angles might be hard to eyeball when it's time to fit the W tubes to the frame, it's a good idea to label each 52-degree end of W1 & W2 as "top".

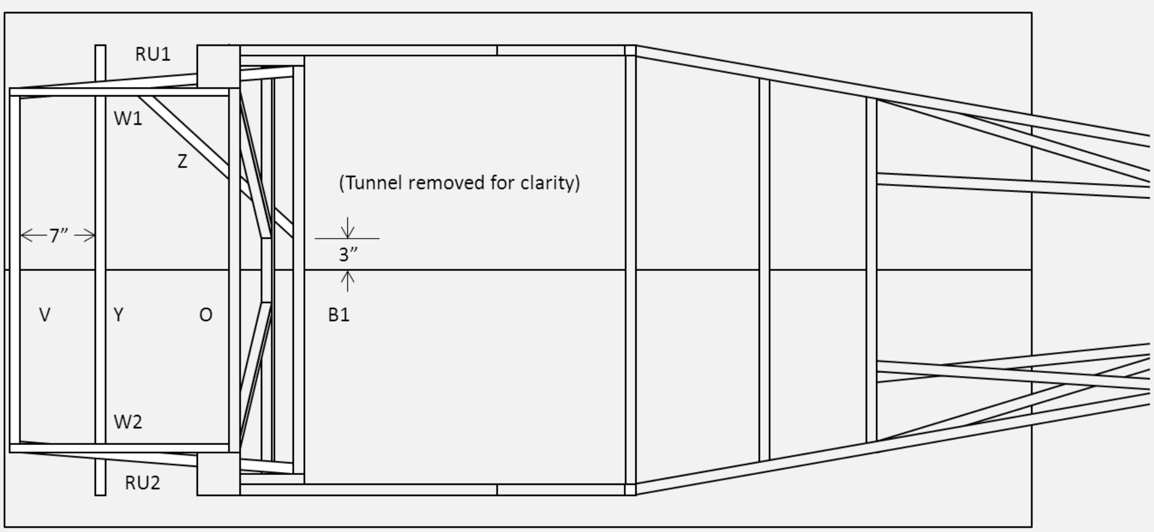

Figure 3.18

Mark the exact center of the V tube, then lay out the RU and V tubes as shown in figure 3.18. Be sure he V tube is exactly perpendicular to the table centerline, and the outer forward ends of RU1 & RU2 are each 19" from the centerline, and then tack weld R1U & RU2 to the ends of the V tube. Be careful this doesn't bring the forward ends of RU1 & RU2 closer to the centerline. To keep the angles correct, this might be one time when it's best to tack the top of the joint instead of a corner.

Now fit the Y tube between RU1 & RU2 as in figure 3.18. The distance between Y and V should be close to 7”, and once again it’s more important that this distance is the same at both ends than the distance is exactly 7”. Verify that the distance between the forward ends of RU1 & RU2 is exactly 38”, outside to outside, and then tack weld the Y tube to RU1 & RU2.

You can now fit the short unnamed tubes to the outsides of RU1 & RU2. To be sure they’re lined up with the Y tube, clamp a 1” square tube on top of the Y tube, with each end extending several inches past the RU tubes. Clamp the short unnamed tubes directly under this tube, up against the sides of RU1 & RU2. The distance between the ends of the unnamed tubes should be 42”, or exactly the width of the chassis. If they’re a little long you might want to shave them down. When you’re happy with the alignment and width, go ahead and tack weld them to RU1 & RU2.

The next step is to attach this assembly to the B1 tube at a 10-degree angle. To do this, place a 4-3/8” block under the V tube as shown in figure 3.19. You could go 1/8” to 1/4” lower than that, but don’t go any higher because the RU tubes restrict suspension travel enough already, and we don’t want to make it any worse. You next need to grind the forward ends of RU1 & RU2 to a 10 degree angle so they’ll fit flush against B1. When this is done, be sure the outboard edges of RU1 and RU2 are exactly lined up with the inboard edges of K1 and K2, and then tack weld RU1 & RU2 to B1.

Now fit W1 & W2 between the V and O tubes. Be sure the 52-degree angle ends are facing the O tube, and the 48 degree ends are resting on the V tube. W1 & W2 should be positioned so they’re exactly 34” inches apart on the outside (32-1/2” inside), which is all the way out to the ends of the V tube on the bottom, and just inboard of the upper shock mounting plates on top.

The tops of W1 &W2 should not stick up any higher than the top of O, and the bottoms should not sit any farther back than the aft end of V. Shorten the tubes as necessary to get a good fit, or alternately you could lower the V tube slightly if you haven’t already, so long as it’s at least 4-1/8” off the table. With the support block still under the V tube, you’re ready to tack weld W1 & W2 to the O and V tubes. This will lock the whole rear assembly in place, so be sure everything is as straight as you can get it before you commit.

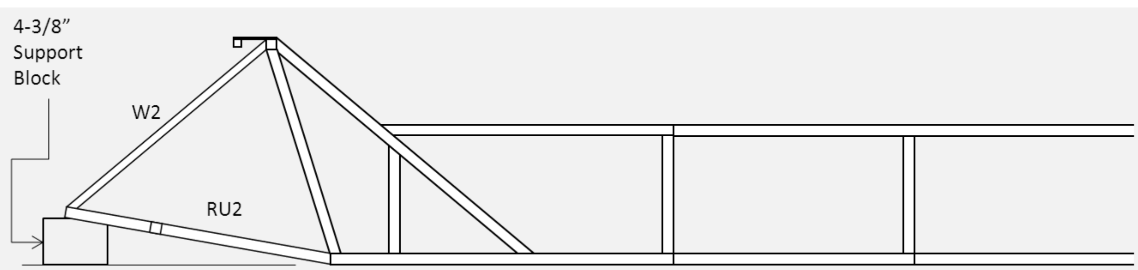

Figure 3.19

The last step is to tack weld the Z tube in place. This tube goes on the chassis nearside, between RU1 and B1, as shown in figure 3.18. The distance between the forward end of the Z tube and the chassis centerline is much more important than where Z meets RU1, so get this distance correct. The best way to do this is to clamp a wood block to the back of B1, with the outside of the block 3” from the chassis centerline.

You will then need to file the other end of Z along the bottom edge, because RU1 angles up slightly. When one end of your Z tube fits snugly against the wood block clamped to B1, and the other end is flush with RU1, go ahead and tack weld Z to B1 and RU1.

m. X tubes

The X tubes are all made from 3/4" round 16-gauge DOM (drawn over mandrel) tubing. There are five of these tubes, and the trickiest of the bunch is the hoop that forms the top rear of the car, as shown in figure 3.20. Oddly, this hoop doesn't have an official Locost name, so we'll just call it "the hoop".

The hoop has to be bent perfectly flat, with no twist, and when you're done bending it the distance between the outer tubes has to be exactly 42". Since roll bars tend to have similar bending constraints, it's obviously possible to do it, but not without the proper tools, i.e. a hydraulic bender and plenty of experience.

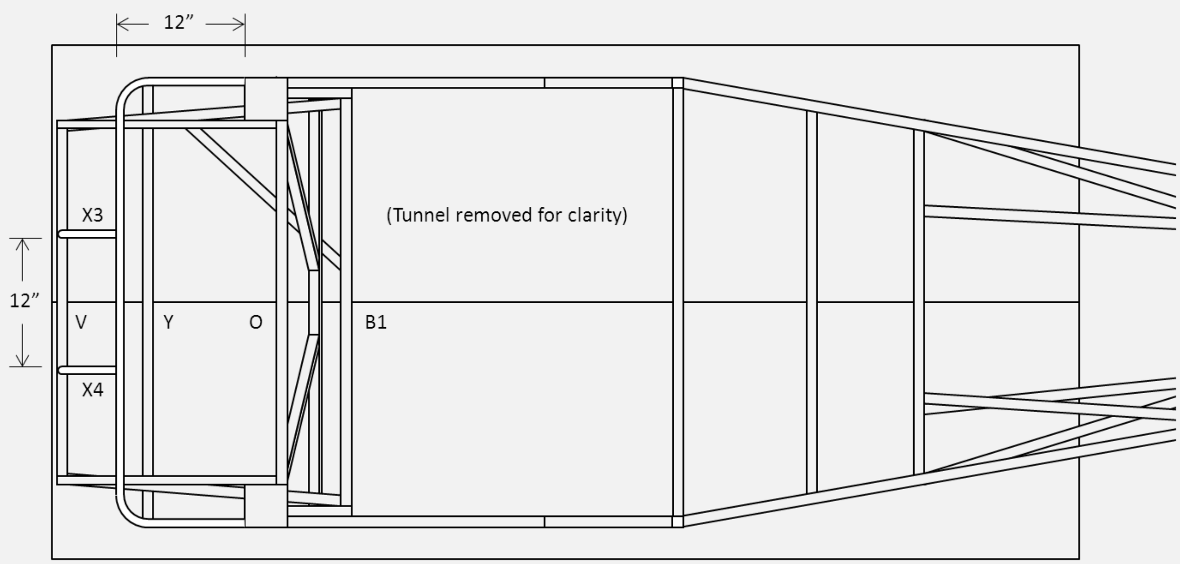

Figure 3.20

The radiuses of the bends are not critical. A 4" radius will probably look better, but will make it harder to form the aluminum bodywork over it. A 6" radius would be about as big as you'd want to go. That's about the radius of your average conduit bender.

Typical conduit is thin gauge galvanized steel tubing that you can almost bend by hand. It has a diameter of about .7". Our hoop is made of thick 16 gauge tubing with a .75" diameter. It's not easily bent by hand. It does, however, just fit in a conduit bender. For the conduit bender to work, you need a) a good length of tubing for more leverage, b) plenty of muscle, and c) a distinct lack of concern for the welfare of the conduit bender.

We don't want to waste a lot of metal tubing, but you can try to make the hoop as a single piece once. Start with a 60" length of 3/4" 16 gauge tubing, and bend one end about 10 inches inboard to 90 degrees. Now make your second bend at the other end in the exact same plane as the first, using whatever technique you think will allow you to If you end up with a 42" wide hoop. If you get really lucky and the hoop is flat and exactly 42" wide on the outside, great. Trim each end so the hoop has an overall width of 12", and wait for the rest of us to catch up.

If the hoop is not flat or isn't the correct width, it's easy to fix. Cut off each end until you have two 90-degree sections that measure 12" on one side and 15" on the other. Now cut a straight length of tubing 12" long. Bevel the each end of the 12" tube, and each of the 15" lengths of your bent tubes. Now lay the three tubes on your build table in the shape of the hoop, with the beveled ends of the tubes butted up against each other.

Use whatever clamps, boards, straightedges, magnets, or what have you to keep the hoop lined up, and then tack weld the beveled joints. Flip the hoop over, and after making sure it's still straight and all lined up, tack weld each beveled joint in a couple of places. You can now carefully fully weld each joint, but don't rush it and let the metal cool between each weld so you don't distort the hoop needlessly. When you're done you can grind the beads down, and if you're really good you'll end up with a hoop that looks just like it was bent from a single piece of tubing.

Tack weld the hoop to the back of the 4" lengths of 3/4" square tubing that are welded to the rear shock mounting plates, as shown in figure 3.21. Use some sort of support for the aft end of the hoop to ensure that it's level with the bottom of the frame. Not critical if you're off a bit. You'll have a chance to get it exactly level when we add the X3 & X4 tubes.

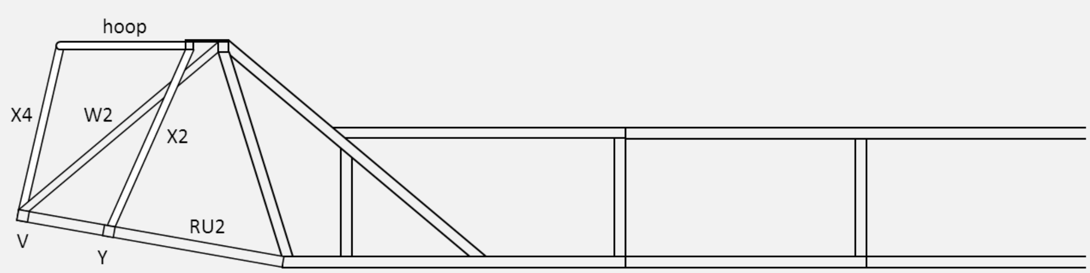

Figure 3.21

Add the X3 & X4 tubes. These need to be cut to fit, and for the first time we'll get some practice making fish mouth cuts in round tubing, something we'll need to be good at by the time we get around to making the front suspension control arms. X3 & X4 are going to be about 15-3/4" long, but start with 16" and trim from there. One end will be beveled about 6 degrees, and the other end will be cut to fit perfectly around our old friend hoop.

There are many ways to make fish mouth cuts, including everything from fancy machines to rigging a drill press with a hole cutter. A lot of those methods are fun to try and they're fine if you're making a whole bunch of tubes, but they usually require a lot of set up time. If you're only making a couple of tubes, a simple grinder and file will probably be faster in the long run.

A great aid in making fish mouth cuts by hand is a half-round file with a round side that has the same diameter as the tube. Conveniently, half round files are easy to find in the sizes we need. You can start the cut with a grinder, and then use the file to whittle it down to the right size and shape. Keep a short length of 3/4" tubing handy for test fitting. The X3 & X4 fish mouth cuts will be straight across, which makes things a little easier. Have a metal square handy, and when fitting your X tube to the test tube, make sure they join at 90 degrees.

A good fish mouth has all the sharp edges filed down to about three-quarters of the thickness of the tube wall, as shown in figure 3.22. This will give you a much stronger welded joint.

Figure 3.22

After you've perfected the fish mouth ends on your X3 & X4 tubes, fit them in between the hoop and the V tube as shown in figures 3.20 and 3.21. They should be slightly long, so trim the flat ends down until they fit. They'll need a slight angle, about 6 degrees, to sit flush on the V tube. Keep the hoop level, and make sure you're not forcing it up when you squeeze in the X3 & X4 tubes. The inside edges of X3 & X4 should be 12" apart, equidistant from the frame centerline, and vertical when viewed from the rear. When everything looks good, verify the hoop is level, and then tack X3 & X4 to the hoop and the V tube.

Now fit the X1 & X2 tubes between the Y tube extensions and the outer end of the 4" lengths of 3/4" square tubes that are welded to the aft end of the upper shock mounting plates, as shown in figure 3.21. These tubes will be slightly less than 19" long, so start there and trim and angle the ends until you get a good fit. The tube should sit all the way to the outside edge of the frame, and at the forward edge of the Y tube. When you're happy with the fit, tack weld the tubes in place.

n. Diagonals

Your frame should feel pretty rigid right now, and you're probably tempted to start welding the whole thing together. Or maybe not. In any case we have to weld a couple of joints right now, before we add the diagonals, to make sure we get a complete weld on the inside corners.

There are six diagonals in the frame, three on each side. Two are made from 3/4" square tubing, and four are made from 3/4" round DOM tubing. We have no idea why. It seems to us you could make all the diagonals round, or all of them square. But round looks cool, and there's no reason to mess with a proven design, so we're going with the book on this.

However, we're not going to add all six diagonals right now. We're only going to add four. Some of you may have noticed that we've left off two important frame tubes, FU1 & FU2. Without those tubes in place we can't add the front diagonals. The reasons for not adding FU1 & FU2 at this time are a little complicated, but will become clear later on when you read the chapter on the front suspension.

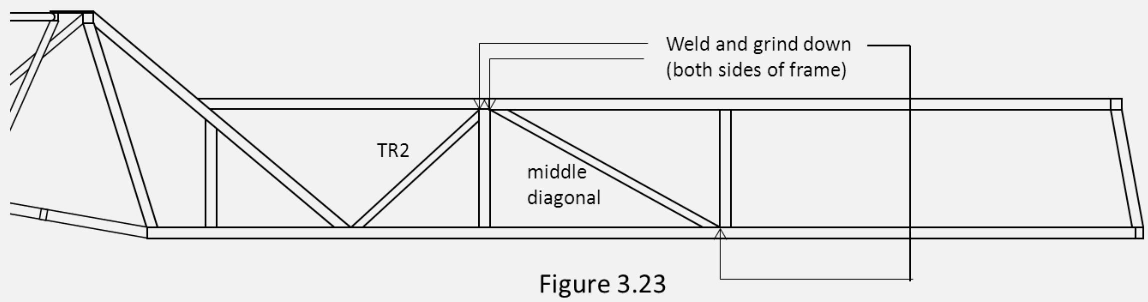

Figure 3.23

Before you add any diagonals, weld the inside joints on both sides of the frame where we've marked in figure 3.23. After welding, grind or file the welds down to a nice radiused fillet. A small rat tail file will do the job. Not quickly of course, but maybe you can find a Dremel bit that will do it faster.

Add the TR1 & TR2 diagonals to the frame first. These are cut from 3/4" square 16 gauge tubing, with 45-degree angles at either end. You'll have to round the ends to match the fillets you filed down, but the ends should fit snugly in the corners. Center the tubes between the 1" K and A tubes at either end. That way you won't have much of a bead to grind down after they're fully welded. Tack them for now to the A and H tubes

The middle diagonals are a little trickier, in part because they're round, and mostly because the sides of the frame angle inward here. I know it doesn't look too bad, but trust me, getting the angles right won't be easy. Just grind or file a little bit at a time until you get a snug fit, and make sure the ends reach all the way to the H tubes. Center the tubes on the 1" frame rails as you did with TR1 & TR2, and then tack the diagonals in place.

o. Aussie Mods

It's a well-known fact that you can't register a book-frame Locost in Australia. The Australian automotive authorities have rules that stipulate how stiff a home-built chassis must be, and sadly, the Locost book frame does not meet them.

Aussies, unhappy with this state of affairs and occasionally as clever as they're portrayed in the movies, have come up with a set of enhancements to the standard Locost frame that increase torsional stiffness to a level acceptable to the aforementioned Australian automotive authorities. These enhancements are collectively known throughout the worldwide Locost community as the Aussie Mods.

We won't be incorporating all of these mods, only three that we've deemed will do the most good with the least amount of work. So our Locost will be stiffer than a book frame Locost, though probably not as stiff as an Aussie Locost. If you live in Australia, this could be a problem. You can still probably build an M.G. Locost, but you'll need to do further research to determine which Aussie mods we've left out, because we're not 100% sure what they are.

The first Aussie mod we've adopted is the cross tube for the nose. This is a straight length of 16 gauge 3/4" DOM tubing that runs from the LA-LC joint in the nearside upper corner of the nose, to the LB-LD joint in the offside lower corner, as shown in figure 3.24. Before welding in this tube, fully weld the inside corner of these two joints, and then grind the welds to a nice radiused fillet.

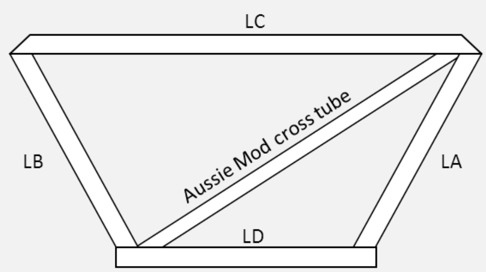

Figure 3.24

Grind the ends of the cross tube until it fits snugly in the nose. Like the middle diagonals, you'll need to do a lot of trial-fitting to get the angles right. Once you've gotten it to fit, center the tube between the 1" nose rails and tack it into place.

For the second Aussie mod we'll need two 17" lengths of 16 gauge 1" x 1/2" tubing, like we used for the transmission tunnel. These will be tacked in place between the bottom tunnel rails and the outer A tubes, at the point where the K tubes intersect the A tubes, as shown in figure 3.25. Make sure the tubes are lined up, and parallel to the B tubes, and then tack them into place.

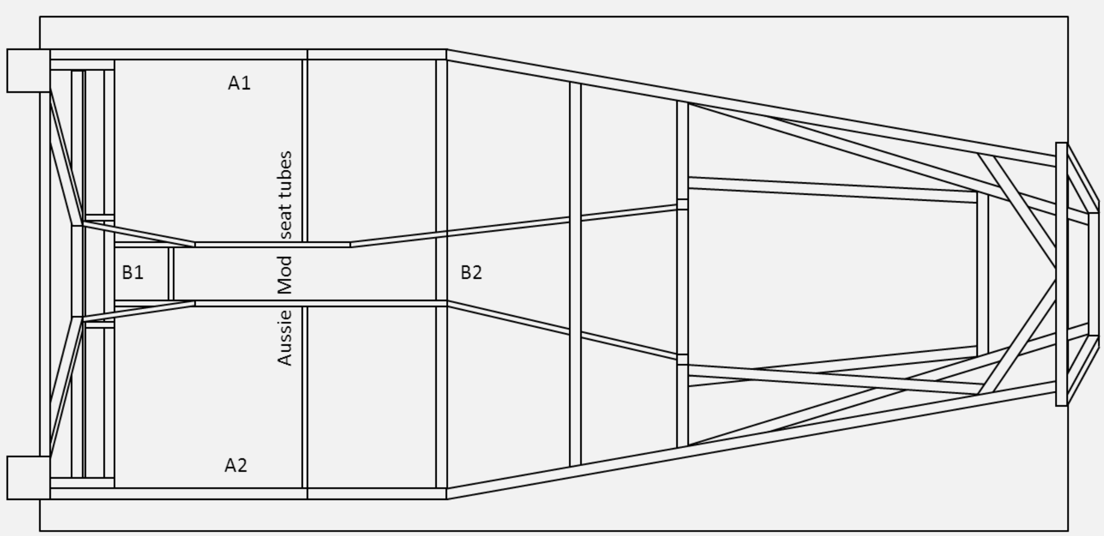

Figure 3.25

The third Aussie Mod will help triangulate the engine bay. However we will not be installing this mod until later in the build, after we've welded in a particular bracket for the steering column. We'll try to remember to include this mod in the chapter that covers installing the steering column.

Of course none of the Aussie Mods is critical on an M.G. Locost, and you could leave them off if you like and save a few pounds, but we think you'll appreciate the added stiffness next time you're blasting down the Mulsanne straight at Le Mans.

p. Welding

You still have a couple more tubes to add, but your basic Locost space frame is now complete. It's time to weld everything together. Before you start, though, we have a couple of things we need you to do, and then afterwards we'll take you through the welding process step by step.

First, take some final measurements on the frame to make sure it's still straight. If anything is off, this is the appropriate time to correct it. You can still change things around after the frame is welded, but we can guarantee it won't be fun. You really want to avoid that if at all possible. Measure the frame diagonally to make sure it's not bent, and take lots of sightings along tubes that are supposed to be parallel, to make sure they're still parallel.

We'll continue to take measurements and make these checks throughout the welding process, because it's all too easy for the frame to move around when it gets hot. Until the last joint is welded, we can't trust the frame to stay straight between one minute and the next. We'll do what we can to reduce the risk, and if we start to see some changes in the chassis we'll take corrective action before it gets out of hand.

Although it looks like fun, and sometimes it is, welding a Locost space frame chassis is a lot of work. The frame has about 85 tubes. Each tube has two ends, and each tube end has four sides. A few tubes you won't weld both ends, but most tubes you will. If you do the math—and we have—that's roughly 700 welds. And we can't just start at one end of the frame and work our way to the back. We'd end up with a banana-shaped car.

To keep the frame straight, we'll weld one edge of a tube up front, then move to the back of the frame and weld another tube. We'll next move around the frame until we're across from our first weld, and weld the edge of a tube on the other side. We'll then move to the rear of the frame again and weld another tube back there. What we're trying to do is avoid welding any tube that isn't completely cool. If we can do that, we'll limit our chances of ending up with a banana.

We also don't want a rocker. If we weld the tops of all the tubes before we weld any of the sides or bottoms, the frame will end up with a bow in it. The center of the frame will be 1/4" to 1/2" lower than the front and back of the frame, and the frame will rock back and forth on your build table. To avoid this, after about 5 circuits of the frame, or about 20 welds, flip the frame over and weld another 20 seams on the bottom. Keep flipping the frame around like that after each 20 welds, until all the tops and all the bottoms of the tubes are welded, or you're completely exhausted. We'll take odds on the latter.

700 welds is 700 welds. You can't do it all in one day. You probably can't do it in a week. As more and more joints get welded, you'll spend more time looking for unwelded joints. You'll probably even miss a few. You're not allowed to miss any, so you need to be methodical and check every joint on a regular basis. You also need to stop every 100 welds or so and take measurements of the frame.

All this moving around the frame and flipping it over and figuring out which joint to weld next takes its toll. You may be having a blast, but you'll get tired, and as you get tired, your welds will get sloppier. So consider a break now and then, and don't try to weld your whole frame in one sitting.

When the tops and bottoms are all welded. It's time to weld the sides. Use the same method of moving around the frame, and flipping the frame from side to side every so often. Keep taking measurements.

If at any point you find your frame has started to bend, start looking for joints to weld that will help pull the tubes back in alignment. In general, welding shrinks the work metal, so try to picture which way your frame tubes will try to move with each joint you weld.

About 80% of your welds on the frame will be tee joints. It's sometimes hard to get full penetration on a weld like this, especially in tight quarters. You need to keep the nozzle really close, even bumping the work, and move the arc back and forth or in little circles to make sure you're melting both tubes.

You have to be able to see the arc and see the joint. Good ambient lighting is essential. The best lighting is just below the threshold where your auto-darkening helmet turns dark. Also, don't raise your helmet between welds. Wait for the screen to clear, or look at something dark to clear it. You want to keep your eyes adjusted to the dim light.

The next most important thing is placing yourself in position for the best possible view of the joint. You'll push most of your welds, so stand ahead of the bead and get your face really close to the joint. You should be able to see the wire, and where it's pointing in the joint. If you wear glasses for nearsightedness, you may be able to see better close up without your glasses.

It's amazingly easy with MIG welding to get a good-looking fillet that never melted one or the other of the tubes. Because of the inherent strength of the Locost frame design, you might never notice this until one day down the road when the car's been around the block a few times, and you see cracks in the paint at the edge of the weld. The best and only real defense against this is to watch the arc, keep it at the leading edge of the puddle, and move it back and forth between both pieces. Your fillets don't have to look beautiful, but they need to be fused to both tubes.

Among the tricky welds will be the inside corners where two tube meet at an acute angle. There are a few schools of thought on how to do this, and one of those schools says don't bother. We don't like that school. A joint with only three sides welded can easily crack. What we like to do is reach in with a long stickout and build up a decent fillet, then weld each tube to the fillet. That doesn't have to add a lot of weight if you're careful.

The only inside seam we found impossible to weld was the one between J2 and the R tube. The best you can do is weld down into the seam as much as possible from the top and bottom, and then hope this tube doesn't see a lot of bending stress.

When you think your frame is fully welded, go over it from one end to the other and look for skipped welds. It's very easy to miss a few. The transmission tunnel seems to have more than its share of missing welds, but there are a lot of short little tubes in there and some of them can be hard to get at.

q. Frame Maintenance

For the next several weeks or months you're going to be working on your frame, adding tabs and brackets and sheet metal and the like. During those weeks and months your frame will be exposed to the elements, such as they are in your part of the world. For most of us, that means the frame will start to rust. Many builders don't seem to worry about this too much, and if it doesn't bother you, go ahead and let it rust. You can always sandblast the thing when it's all done. Just be sure to clean off the rust on any part you're going to weld.

We find it's a lot more motivating to work with a rust-free frame. The best way to keep the frame clean is to go over it every few days with a 3M finishing pad. You won't find but a couple of tubes that need cleaning each time, and those 3M pads really seem to go after the rust without taking off much metal. They're a little expensive and they don't last forever, but they really do the job.

If frame building goes on for a long time, and it probably will, you may decide at some point to coat the frame with a good penetrating oil like WD-40. There are a whole bunch of similar products on the market that are made especially for keeping bare metal clean. The downside of these products is that you will have to be meticulous about cleaning the stuff off with acetone any time you need to weld something to the frame. For this reason alone, I would hold off on coating the frame as long as you can.

Some people also use a type of paint known as weld-through primer. Supposedly, the material in this paint will not affect bead strength. We didn't use it.

4. Front Suspension

Construction of the front suspension is a critical step in a Locost build, and getting it right will have a major impact on how well your M.G. Locost handles. What we'll be doing in this chapter is building two upper and two lower A-arms, and fitting the FU frame tubes and suspension pickup brackets. For this part of the build we're going to need the following bits:

8 feet of 3/4" round 14 gauge DOM tubing
3 feet of 3/4" round 16 gauge DOM tubing (for the forward diagonals)
2 feet of 3/4" round 3/16" wall DOM tubing (3/8" inside diameter)
2 feet of 1" round 3/32" wall DOM tubing (13/16" inside diameter)
2 feet of 2" square 1/8" wall tubing
1 foot of 2" x 4" rectangular 1/8" wall tubing
2 feet of our standard 1" square 16 gauge tubing (for the FU tubes)
1 foot of 1-1/2" wide 3/16" thick steel strip
6" x 12" sheet of 1/8" thick cold roll steel plate
8 Triumph Spitfire/Herald Metalastik suspension bushings
2 QA1 1/2" rod eyes from Summit Racing

A word about suspension bushings: There are many bushings floating around the Internet that purport to be replacement bushings for a Spitfire, Herald, Vitesse, or other oddball British car. As surprising as it may seem, many of these bushings were not manufactured in the UK, and do not have a 3/8" hole in them. More like 10mm. Be very careful when procuring your bushings that you don't end up with these inferior products. Insist on genuine Metalastik brand bushings. Or at least bushings with a 3/8" hole.

a. Suspension Basics

The M.G. Locost uses a wishbone front suspension and a live axle out back. It doesn't get any more basic than that. We're going to pretty much duplicate the MGB suspension in our Locost, partly because the MGB was such a great handling car, and mostly because we have a bunch of MGB parts from our donor.

What follows in this section is basic suspension theory. You're not going to be quizzed about it later, and you don't really have to know any of it to build a Locost. But it might be helpful to understand why we're doing certain things the way we are, and in any case you never know when you'll have to answer questions from strangers or fellow Locost builders about what kind of suspension setup you have.

The MGB front suspension is a classic double wishbone design. The unequal lengths of the wishbones causes the top of the wheel to lean inward when the wheel rises in bump, because the shorter upper wishbone has to rotate farther than the longer lower wishbone for the same deflection. In a turn, this partly counteracts the outward lean of the car, the net result keeping the tire more or less vertical, where it can do the most good.

The suspension doesn't completely compensate for the lean of the car, because that would upset the tire too much when you hit a bump in a straight line. So the suspension design is a compromise that allows the wishbones to compensate for about half the lean of the car. The amount of compensation is called *camber gain*, and 0.5, or half the lean, is about what the MGB has. We won't be using the stock MGB control arms, but the Locost control arms we build will incorporate the same 0.5 camber gain.

In addition to trying to remain vertical, the front tires have to steer the car. When the car goes through a turn, the outer wheel travels in a slightly larger arc than the inner wheel. Because of this, the steering has to be designed to turn the inside wheel a little sharper than the outside wheel. A guy by the name of Ackerman was one of the first people to figure this out, so today we refer to the difference in steering angles of the two front wheels as the Ackerman. The MGB steering provides good Ackerman, so we're maintain the same tie-rod angles in the Locost.

We can get some additional compensation for the car leaning in a turn by moving the lower pivot point of the wheel farther outboard than the upper pivot. That way, when you turn the wheels, the bottom of the tire has to move farther than the top, and the wheel leans inboard. This pivot angle is called the *kingpin inclination*, or KPI. The best thing about KPI is that it compensates for lean only in turns, and not on bumps when the car is traveling in a straight line. KPI is another part of the suspension the folks at M.G. got right, so we're not going to change anything there.

KPI can only lean the tire inboard if the bottom of the tire is slightly outboard of the pivot axis. This distance from the bottom of the tire to the center of the pivot axis is called the *scrub radius*, and it's what causes the bottom of the tire to move farther than the top. You can easily change the scrub radius on any car by fitting wheels with a different offset, or adding wheel spacers, but too much scrub radius is bad because it increases steering effort, reduces Ackerman, wears the tires down faster, and makes the car feel less responsive to steering inputs. We like the stock MGB's scrub radius.

If we move the lower pivot point ahead of the upper pivot point, turning the wheel will cause the back of the tire's contact patch to turn more than the front of the contact patch. This stretches the contact patch, which sets up a force that tries to push the tire back in line. We can feel this in the steering wheel as the tires to try to straighten themselves out. This gives us an idea of how hard the tires are working, and how close they are to letting go. It also makes the car more stable in a straight line. This difference in fore and aft pivot points is called the caster angle. This may sound similar to KPI, but there's an important difference:

- Outboard/inboard angle: kingpin inclination
- Fore/aft angle: caster

Without any caster, you turn the steering wheel and it just stays there. It takes no effort to hold the car in the turn, and the car never tries to straighten itself out. This feels a little weird. So we want some caster, but only enough to be able to feel what the tires are doing, and not so much that we can't toss the car into Maison Blanche with a light flick of the steering wheel.

Caster is one part of the MGB front suspension that a lot of people think M.G. got wrong. The stock MGB suspension has 7 degrees of caster. The car is very stable, but steering effort is a little high. If M.G. got so much right on the rest of the suspension, why would caster be wrong?

What I think happened is this. Tires got better. The original MGBs were fitted with tall 5.60-section bias ply tires. The tall sidewalls and narrow bias ply tread gave the contact patch a lot of flexibility, so caster couldn't set up much of a straightening force. Seven degrees of caster on 1960 tires was probably pretty good. But that was then and this is now. On the M.G. Locost we're going to run low-profile 185-section radials. Five degrees of caster will be plenty.

There's one more suspension variable that you may hear a lot about: roll center. This is the point around which the body of the car rotates when it leans in a turn, or more precisely the point around which the center of gravity of the body and chassis rotates. This point is determined by the angles of the control arms, and is generally at the centerline of the car and about 3-4" above the ground. There isn't any magic in this number, but handling will feel a little different depending on the height of the roll center.

The lower the roll center—or more accurately the farther the roll center is from the center of gravity—the more the car leans in a turn. So we don't want the roll center too low. But raise the roll center and you reduce feel the driver has over what the car is doing. So you don't want it too high, either.

To complicate things further, as the car rolls about the roll center, the roll center moves. It can move up and down, and also left and right. This isn't great because it changes the feel of the suspension. So while we want to be concerned with the static roll center height, we really want to be concerned with the movement of the roll center as the car leans. You can drive yourself nuts trying to figure it all out, and even then you won't know if you're better off with the roll center at 2" or 8". Fortunately, there are rules of thumb, and an unequal-length wishbone suspension that follows those rules will have good roll center characteristics. We made sure the M.G. Locost front suspension follows those rules.

b. Alignment

By using the stock MGB swivel axles, hubs, steering rack, and wheels, we'll automatically get the same Ackerman, KPI, and scrub radius as the MGB. We're also going to install the control arm pickup brackets in a way that will fix caster at five degrees. The only part of the suspension that will be adjustable is the upper control arms, which we'll be able to lengthen or shorten to adjust camber.

Camber is the inward or outward lean of the tire. It's measured in degrees, starting at zero with the tire vertical, and increasing as you lean the top of the tire outwards. Of course we don't want the tire to lean outwards, so we want our camber to be zero or slightly less than zero whenever we're cornering.

As we noted earlier, camber changes as the suspension moves up and down, to compensate partly for the lean of the car. Caster and KPI also help compensate. With all this going for us, if our tires start out perfectly vertical when the car is rolling in a straight line, we can keep the tires pretty close to vertical in a turn. But not as close as we want. Fortunately there's one more thing we can do, because no one says we have to start out with the tires perfectly vertical. If we set the starting camber (a.k.a. static camber) to -1 or -1.5 degrees, the tires will still be leaning in the proper direction even with the car hiked all the way over.

We recommend a starting camber of -1.5 degrees for the front suspension. We'll allow enough adjustment in the design of our upper control arms to set the camber anywhere from +1 to -3 degrees, in case later on down the line you want to experiment with it.

c. Suspension Parts

The only front suspension parts we're going to need to build for our M.G. Locost are the upper and lower control arms, commonly referred to as the UCA and LCA. Getting the size and shape of these parts exactly right is going to be critical. As will be the quality of the welds.

If you're new to welding, you will probably have enough experience after fully welding the frame to weld the control arms yourself. But this is a judgment call. The LCAs in particular will have a lot of stress on them, and bad welds will crack. You can probably find the pictures on the Internet. In our judgment, the front suspension control arms should be TIG welded by someone with a fair amount of experience. It's your car, though, so we'll leave it up to you.

Before we can build the control arms, we have to fabricate a few parts. The first thing we're going to make is bushing tubes. We'll be using these in both the front and rear suspensions, so we'll go ahead and make them all because they're really easy to make. We need 17 altogether, cut from 1" round 3/32" wall DOM tubing. Each bushing tube will need to be exactly 1-7/16" long, so it's probably best to cut them all a little long and grind or file them down to size.

When you have all your bushing tubes cut to size, it's a good idea to chamfer the inside edge of both ends, not completely but maybe a little more than half way. This will give you a fighting chance when it comes time to press in your Metalastik rubber bushings. The best tool for chamfering the edges would be a countersink bit with a 1" diameter, assuming such a thing actually exists. Otherwise some kind of rotary grinding stone will do a decent job.

The next thing we're going to need is four 2" long pieces of 3/4" round 3/16" wall DOM tubing. These are going to need to be heavily modified. Well, maybe not heavily, but we have several steps to perform on each one and it may take some time.

1. Drill a 1/4" hole at one end of each tube, crosswise, about 3/8" from the end. This is strictly for manufacturing purposes. This end of the tube will be cut off later. For now, slip a screwdriver or other 1/4" rod through the hole so you can clamp that end of the tube in a vise.
2. Drill out the center bore of each tube to 29/64". This will be easier if you clamp the end of the tube with the 1/4" hole in it.
3. Tap the first 1-3/4" of each 2-1/2" tube with a 1/2x20 high speed taper tap. If you try doing this with a carbon steel plug tap, like the type normally found in a hardware store, you will fail. You can do the job with two cheap plug taps, but it's tedious. What you'll need to do is start by cutting 4-5 rough threads with one tap, and then chase those threads with the second tap. Switch back to the first tap and cut another 4-5 threads, then chase those with the second tap. Continue switching back and forth between the taps until you've cut 35 good threads.
4. Cut 3/4" off the end of each tube that you used for clamping, the cut or grind a fish mouth for a 3/4" tube at that end. The finished tubes should look like figure 4.1.

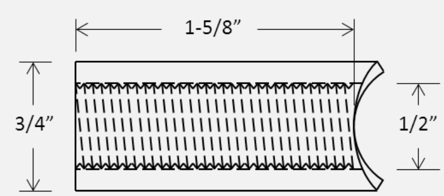

Figure 4.1

We're now going to need four 2" lengths of the same 3/4" round 3/16" wall DOM tubing, and four 1" lengths of 1" round 1/8" wall tubing. Cut the ends of the 2" tubes as straight as possible. If you have access to a lathe, use that to cut the ends.

Cut the 1” tubes in half lengthwise, slightly off-center so that one side covers a full 180 degrees. We won’t use the smaller sides, but we will file the edges of the larger sides until they’re exactly 180 degrees. What we want is two 180 degree half-pipes that form a perfect circle around a 3/4" tube, with no play and no gaps at the edges.

We now need two 4-1/2” long 3/8” bolts, with washers and nuts to go with them. Slip a washer on either bolt, then slide on two of the 2” tubes, another washer, and a nut. Torque the nuts to 30 ft.-lbs.

Next, clamp two half-pipes around the center of each tube and bolt assembly, so it covers the seam between the 2” tubes. On each of these assemblies, tack weld one of the half pipes to one of the 2” tubes, and tack weld the other half pipe to the other 2” tube. If you did it right, you can unbolt the assembly and the 2” tubes will come apart, each with one half pipe tack welded to it.

If it looks good, bolt the assembly back together and torque the nut, then fully weld the seams that you tack welded before, being very careful not to weld the two half pipes together anywhere. The finished assembly should look similar to figure 4.2.

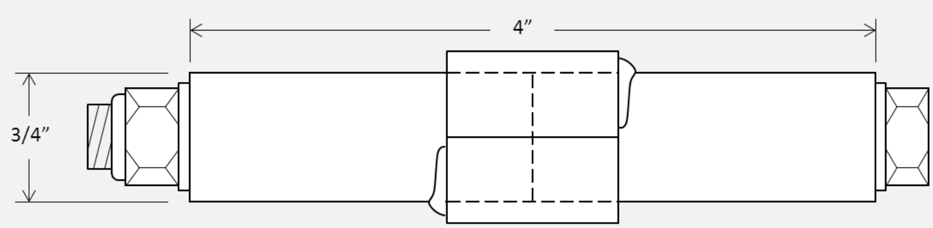

Figure 4.2

We now have all the pieces we need for the upper control arms, except for the arms themselves. These will be cut to fit from 3/4" round 14-gauge DOM tubing once we’ve built the UCA jig.

We next need to make several pieces for the lower control arms. We’ll start with the trunion brackets. These are made from 1-1/2” wide 3/16” steel strip, cut as shown in figure 4.3. You’ll need four of them, and you should try to make all four identical. The hole for the trunion bolt is 1/2" in diameter.

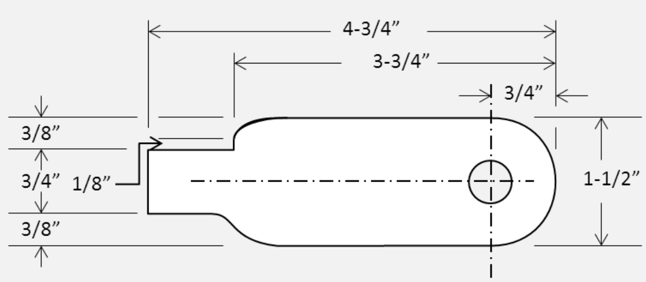

Figure 4.3

The exact shape of these brackets isn’t critical. The ends don’t have to be rounded off, but it looks better and saves weight if you do. The important things to get right are the 3/4" height on the inside end, and the 1/8” notch 1” from the upper end of the bracket.

We now want to make two spacers from 2” x 4” rectangular 1/8” wall tubing. These need to be exactly 2.782” long, which is the width of a fully compressed MGB lower trunion assembly. If you can’t get them exactly 2.782” long, it’s better to make them slightly too long than too short. You can always add shims.

After you have the spacers cut to the correct length, cut them longitudinally 3/4" from the bottom and 3” from the side so that you have two L-shaped piece 3/4" high by 3” deep as shown in figure 4.4. Cut a hole in each spacer as shown in diagram.

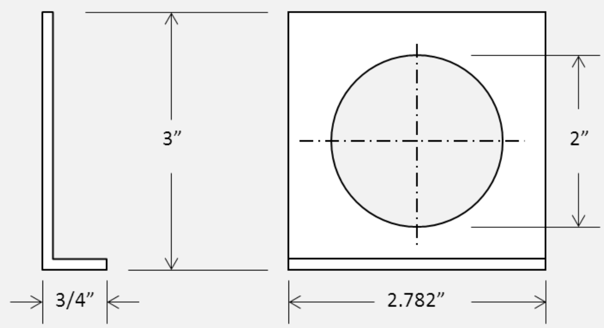

Figure 4.4

The last two pieces we need are the shock mounting plates. Cut these from 1/8” thick steel sheet, using the pattern shown in figure 4.5. It’s very important to cut out the rounded section, otherwise you’ll have a huge stress riser where the control arms meet the plate. Many Locosts have suffered control arm failure in this exact spot because of that.

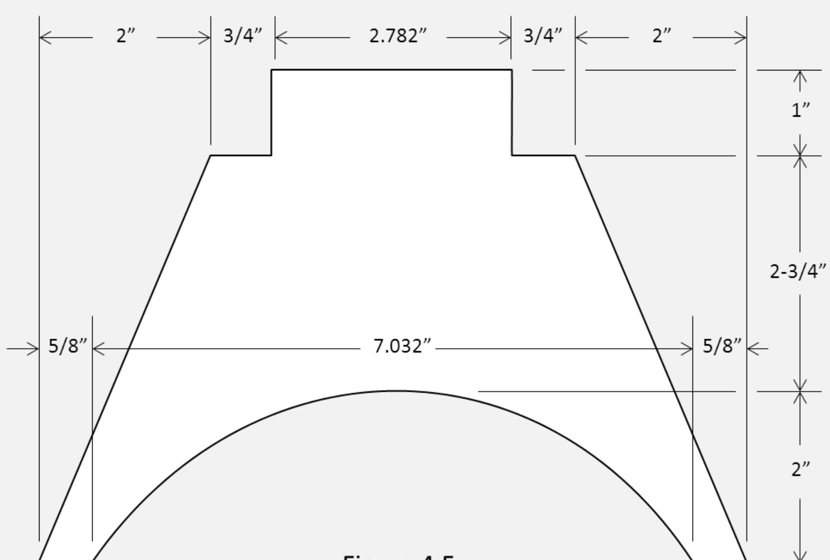

Figure 4.5

So far, so good. We’ve got all the miscellaneous parts for the suspension fabricated and we’re now ready to assemble the control arms. This is where the jigs come in.

d. Upper A-arm Jig

We're going to make our jigs out of wood, with 3/4" plywood bases. The UCA jig base needs to be about 14" square and the LCA jig base about 18" square. We're also going to need to cut about 20 blocks each 1-1/2" by 1-1/2" square, out of 3/4" thick wood, and two strips 1-1/2" wide by 14" long. The basic dimensions of the UCA jig are shown in figure 4.6, and the LCA jig in figure 4.7.

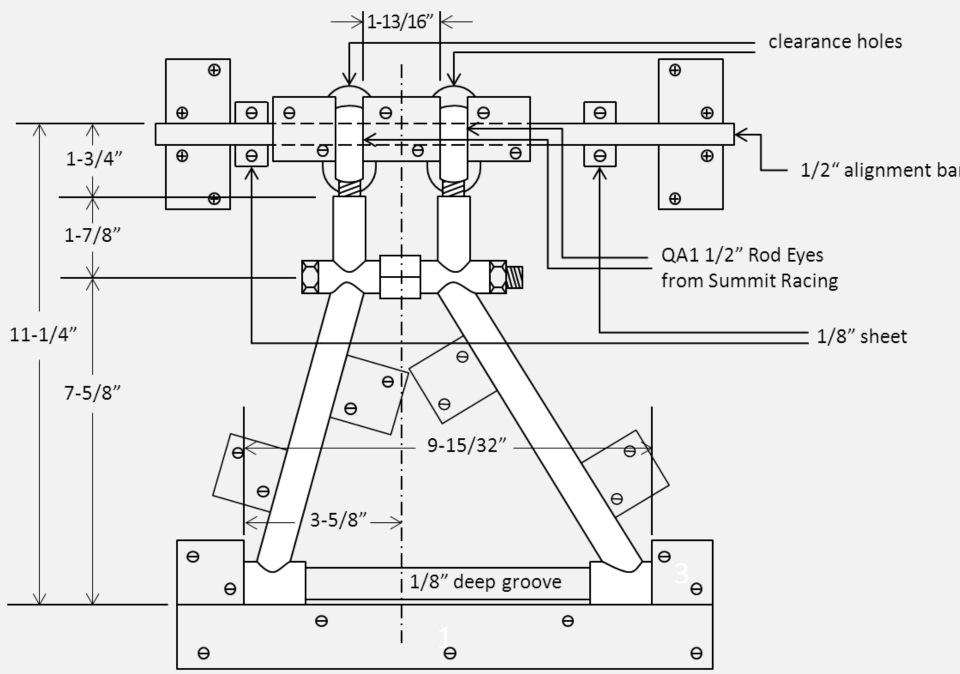

Figure 4.6

To get the height of all the tubes and brackets correct, we're going to need to cut a couple of 1/8"-deep grooves in the baseboards. The easiest way to do this is with a router, but in a pinch you can probably do the job with a good wood chisel. Alternately, you could create the groves by gluing some 1/8" thick ply or sheeting to the entire baseboard, except where the grooves are supposed to go.

The purpose of each jig is to line up the inboard bushing tubes with the outboard trunion brackets. Whatever happens in between these points is less important, but we want to be very accurate with the position of the bushing tubes and trunion brackets.

For the UCA, start by cutting a 3/4"-wide groove 2" from one end of the baseboard, then attach a 14" long strip of wood to the same end, so the center of the groove is 1/2" from the edge of the strip. We like attaching these things with wood glue and wood screws, but you're of course free to devise your own method.

Next place blocks in front of the strip at either end, with the distance between them exactly 9-15/32". Now measure 3-5/8" exactly from either block, and draw a centerline at that point all the way across the baseboard, perpendicular to the groove.

At the other end of the board, attach a block in either corner 11-1/4” from the bushing strip. Although 11-1/4” is the preferred distance, it doesn’t matter if you’re a little longer. What is critical is that the distance is exactly the same to each block. Try to get this within .01”. Seriously.

Draw a line across the baseboard 1/4” behind the blocks you just attached. This will be the centerline of the outboard rod eyes that will attach to the upper trunion bushing on the MGB kingpin. These rod eyes will be part of the jig assembly, and the bottoms of the rod eyes will be lower than the surface of the baseboard, so we need to cut some clearance for them. Two holes in the baseboard about 1” wide and 2” long will do it. The holes will need to be centered on the rod eye centerline you just drew, 1-3/8” from the A-arm centerline you drew earlier. Refer to figure 4.6.

We now need a block exactly 1-13/16” long and about 1-1/2” wide. Carefully drill a 5/8” hole through the length of the block. This will leave only about 1/16” of wood on either side of the hole, so try to be accurate. Next drill 5/8” holes through two more jig blocks.

We can now start to assemble the A-arm parts in the jig. Start with a 12” length of 1/2” steel rod. Make sure the rod is perfectly straight. Screw the rod eyes into the 1-5/8” tubes you threaded earlier, and assemble them with the drilled wood blocks as shown in figure 4.6. Make sure the 1-13/16” block is centered on the A-arm centerline, and attach the drilled wood blocks to the baseboard. Attach two more wood blocks behind the half inch rod at the ends, clamping it in place. The half-inch rod will sit 1/8” above the baseboard, so shim it as shown to that it’s exactly parallel to the baseboard.

You have all the parts you need to make your A-arms, except the two control arms. These are made from 14 gauge 3/4” DOM tubing, and obviously need to be cut and shaped to fit. These may be some of the trickiest parts in the whole car to get right, because the length of the tubes, the shapes and angles of the fish mouths, and the alignment of the fish mouths all have to be perfect. Or as close as you can possibly get them. Which had better be close to perfect.

Attach blocks to the baseboard inside and outside of the control arms so that when you test fit them, you’re always putting them in the same place. Make sure the inside blocks are close enough together so that the outboard ends of the control arms are no wider than the length of the split tube, and actually a little less to allow for welding. Also, as you shorten the arms, which you will continue to do in an effort to get the lengths and angles right, the distance between the outboard ends of the control arms will increase, so take that into consideration too.

The distance from the center of the split tube to the inboard wood block is shown as 7-5/8”. It may be of some help to you that this distance doesn’t have to be exact. As you trim your control arm tubes to get them all to match up, you’ll find this distance shrinks a bit. As long as it doesn’t go below 7-1/4”, you’ll be good to go.

When all of the tubes are in place, you’ll need to unscrew the threaded tubes from the rod eyes to take up any slack. To get the proper clamping force on the tubes, it’s best to unscrew the rode eyes a thread or two more than necessary, so that the split tube is supported about 3/4” above the baseboard by the control arms and threaded tubes. Press down on the split tube until it’s flat on the baseboard, and the A-arm will be locked in place and ready to weld.

e. Lower A-arm Jig

The lower A-arm jig will be similarly built, starting with a 1/8" deep groove 2" from the inboard end, and a 16" strip of wood attached 1/2" inboard of the groove. Refer to figure 4.7. Attach blocks to each end of the 16" strip exactly 14-3/16" apart. The lower A-arms are bilaterally symmetrical, so our centerline will be exactly 7-3/32" from the inside edge of either block.

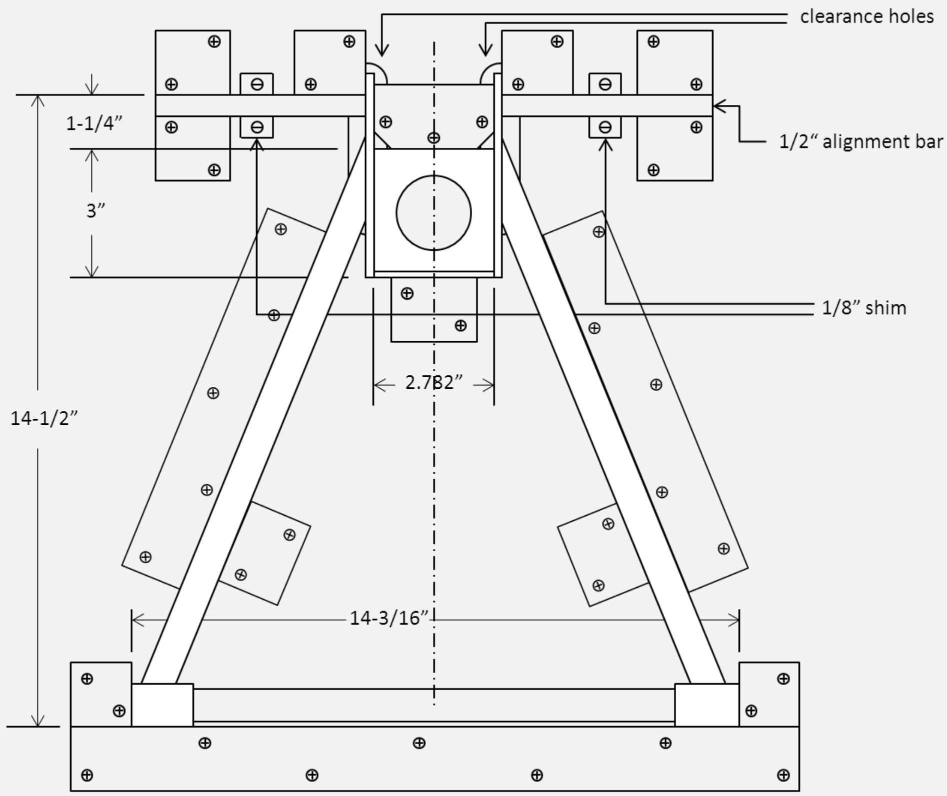

Figure 4.7

The bottom of the two trunion brackets will end up 3/8" below the surface of the baseboard, so holes need to be drilled in the baseboard for clearance. These holes need to be 3/4" wide by 3-1/2"long, positioned as shown in figure 4.7. The only part of the trunion bracket that will sit flat on the baseboard is the 1" tail—the front will be held up by the half-inch alignment bar.

Next cut a block exactly 2.782" long and about 1-1/2" wide. Notch the corners slightly for welding clearance. Carefully drill a 5/8" hole through the length of the block, leaving 1/16" of wood on either side of the hole. That's all we need for the lower A-arm.

Assemble the A-arm parts in the jig. Start with a 12" length of 1/2" steel rod and assemble the trunion brackets and drilled wood blocks as shown in figure 4.7. Make sure the 2.782" block is centered on the A-arm centerline. Attach two more wood blocks behind the half inch rod at the ends, clamping it in place. The half-inch rod will sit 1/8" above the baseboard, so shim it as shown to that it's exactly parallel to the baseboard.

Attach two more blocks at the outboard ends of the trunion brackets to clamp the front of the brackets in place, the set the spacer plate between the brackets with the 3/4" end flush with the tails of the trunion brackets and facing up. It's nice if the outboard edge of this spacer is up against the drilled wood block, but it's not critical so long as the inboard end measures 4" from the center of the half-inch alignment bar. For more details refer to the side view of the jig in figure 4.8.

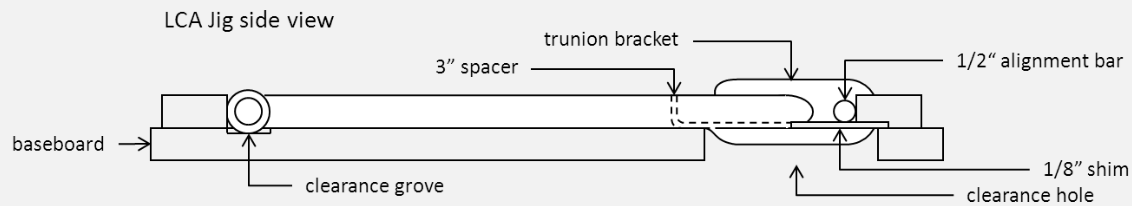

Figure 4.8

Fitting the lower control arm tubes is much simpler than fitting the tubes for the upper A-arms. If it helps, and it should, the exact length or position of these arms isn't critical because you've already aligned the inboard bush tubes with the trunion brackets. Just make sure you don't have any gaps at the ends of the tubes and you're good to go.

f. Welding A-arms

We need to make one more pitch for getting you're control arms professionally TIG welded, and then we'll explain what you'll be up against if you decide to weld them yourself. First of all, your front A-arms are one of the great visual attractions of the car. Everyone will want to look at them, so you want them to look nice. Second, you'll be welding some fairly thick metal, and getting good weld penetration is critical. The lower trunion brackets, for example, will be difficult to properly weld with a 110v MIG welder. Third, it might help you to know that Locost A-arms have failed in the past. So think about it.

Weld the upper A-arms first. These are fairly easy, with only six joints, and no difficult angles. With the tubes in the jig, tack weld each joint in two places, spaced apart by about 1/3 of the circumference of the tube. When the A-arm has cooled, remove it from the jig and tack weld each joint on top. When the A-arm is cool again, fit it back into the jig. It may not drop in easily, but as long as you can press it in there, you're good to go.

You can separate the upper A-arm at this point by removing the 4-1/2" bolt through the split tube. You can now fully weld each joint, 1/3 of the circumference at a time, i.e. between tack beads, but switch back and forth between each half so that neither heats up too much. When you're all done, reattach the two halves and make sure the A-arm still fits the jig.

The bottom A-arms are similar. Place all the parts in the jig except the shock mount plates. It may be hard to get a good clamping force between the inboard ends of the control arms and the bushing tubes, because the outboard ends of the tubes will slide against the trunion brackets, but secure them as best you can before tack welding the bushing tubes to the control arms. Next tack weld the outboard ends of the control arms to the trunion brackets, and then tack weld the spacer plate to each trunion bracket. Remove the A-arm and flip it over, then tack weld the same joints on the other side.

Make sure the A-arm still fits in the jig, then remove it from the jig to fully weld it. Be careful about getting it too hot. Weld the spacer plate to the trunion brackets along the bottom, and around the corner on the inboard side. Don't weld all the way to the top of the spacer, as the shock mount plate will need to sit flush against the spacer.

When the A-arm is fully welded, lay the shock mount plate on top, with the outboard end between the two trunion brackets. This should just fit, but the spacing may have widened when the bottoms of the spacer were welded to the trunions. If so, the trunions are no longer exactly parallel, and you may want to clamp the trunions together at the top before welding them to the shock mount plate.

Tack weld the shock mount plate to the control arms in a couple of places, and to the trunion brackets in two places. Then fully weld along each side of the shock mount plates, except for the 3/4" gap between the trunions and the control arms. When everything is cool, load the A-arm into the jig to make sure it all fits, keeping in mind that what's most important is the alignment is between the bush tubes and the trunion brackets, not where the tubes go.

g. Pickup Brackets

In automotive lingo, a pickup is a place on the chassis that the suspension control arms attach. Our front suspension will need eight pickup brackets, and our rear suspension will need four. The brackets for all of these—except the rearmost lower brackets in front—will be the same. We'll also use these same brackets to mount our Panhard rod to the chassis, and to mount the top of the rear shocks. If we did the math right, that's a total of 15 brackets, including the two oddball brackets for the lower front A-arms.

Since we're going to be in the bracket-making business for a little bit, we might as well make all 15 now. The brackets will all be made from 2" square 1/8" wall steel tubing. For 15 of them, we'll need a tube about 24" long. Maybe a little longer depending on the thickness of your cutting blade. Cut 13 1-9/16" sections from the tube, and two 1-3/4" sections. Square up all the ends on the 1-9/16" pieces.

On the 1-3/4" sections, square up one end and cut the other end at a 5-degree angle. It's a very good idea to cut these angles so that the ERW seam on the tube is on one of the two angled faces, and that it's on the opposite face on each of the tubes. If you can't figure out what we're talking about—and there's no good reason why you should—see figure 4.9.

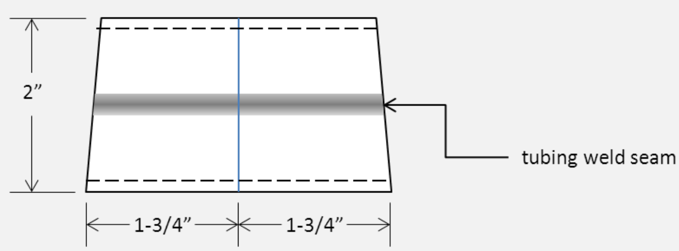

Figure 4.9

We next need to drill holes in the brackets. Almost all brackets have holes, and these are no exceptions. Drill 3/8" holes centered between the open ends, and exactly 3/4" from the closed end that does not have the tubing weld seam. If you're using a drill press, drill the holes all the way through both sides of each bracket. If you're using a hand drill, measure on both sides and drill each hole separately.

Make sure the hole through the angled bracket follows the square edge and not the angled edge. The holes need to be perpendicular to the face of the bracket. Also, the holes should be 3/4” from the square edge, not centered like the other brackets, otherwise you could have issues trying to fit a bolt through the bracket later on after it’s welded to the chassis.

You now need to cut off the “tops” of these brackets, which in our case is the face with the ERW seam. Referring to figure 4.10, cut below the corner on each side of the welded seam face, but make sure the bracket is still at least 1-5/8” tall after you lop off the top.

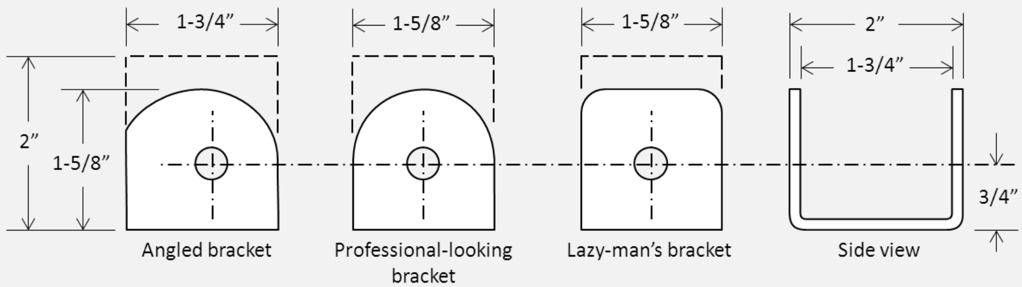

Figure 4.10

We want to put a nice finish on the cut ends of the brackets. The eventual shape of the brackets is up to you. Many people seem to like the tops squared off, although to us and possibly others that just looks like the builder was too lazy to make them round. We think rounded off brackets look much more professional, and they save weight besides. But it’s up to you, and we don’t want to influence your decision in any way.

The only exception to rounding off the tops would be the angled brackets, which should be left a little bit square, at least on the side with the angle, like the left bracket in figure 4.10.

h. Bracket Jig

If you want your front suspension A-arms to move freely up and down through their full range of motion, and I think we all want that, the rotational axes of your upper and lower A-arms have to be parallel. The rotational axis of each A-arm also needs to be parallel with the centerline of the chassis, and because we’re using trunions instead of ball joints, the axes need to be angled back five degrees from parallel with the ground.

The only way we’re going to be able to get all of that right is with a jig. The jig will hold four pickup brackets in the proper arrangement, and all we have to do is clamp the jig to the frame in the correct orientation and tack weld the brackets in place.

Before we do that, we need to weld in the FU tubes. We didn’t weld them earlier because we had no way to make sure they would be in the perfect spot for aligning all the pickups. Our bracket jig will help with that.

The bracket jig is built on an 11”x15” base of 3/4” plywood. Be sure the plywood is perfectly flat. Cut 6 blocks of hardwood, each 2-1/2”x2”x1-3/4”, as shown in figure 4.11, and drill a 3/8” hole through each block exactly 3/4" from the top.

Slip a pickup bracket over one of the wood blocks. The bracket should just fit over the 1-3/4" dimension of the wood. If not, you'll need to shave the block down until it does. Do this with each wood block until a pickup bracket can fit over them all.

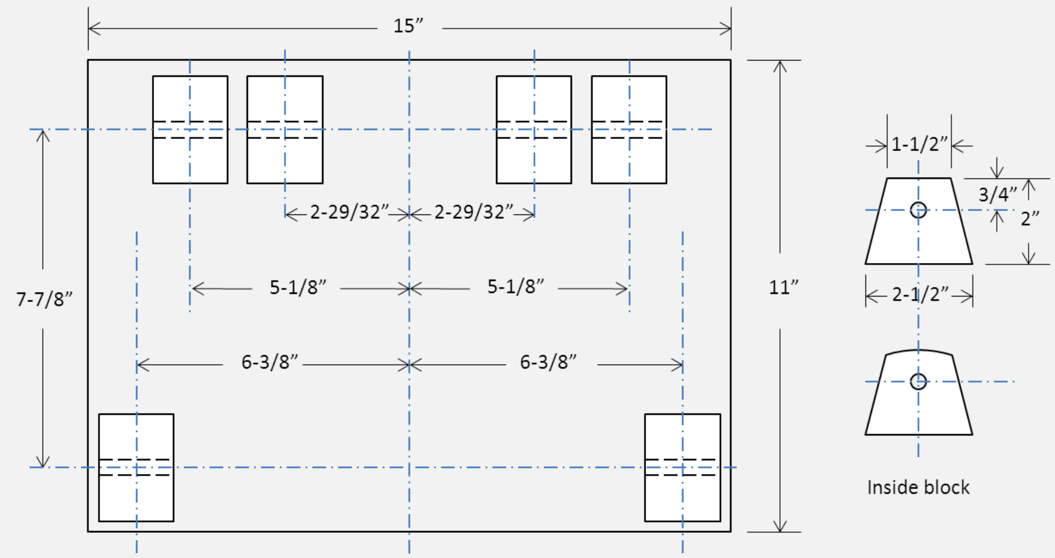

Figure 4.11

If you place the pickup bracket upside down over the top of a wood block, you'll notice it doesn't go all the way down, because the inside corners of the bracket have a slight radius. So now you need to round off the top corners of each block so that a pickup bracket can slide all the way down, and the holes in the pickup bracket line up with the hole in the block.

Arrange the blocks on the baseboard as shown in figure 4.11, measuring carefully. To ensure the blocks are perfectly straight, run two 12" lengths of 3/8 steel rod through the upper and lower blocks, and measure the distance between the rods at each end. This distance should be exactly 7-7/8", but once again, it's more important that they be the exact same distance than it is that they be exactly 7-7/8" apart. When you're sure you've got all the measurements right, attach the blocks *with the 3/8" rods inserted* to the plywood baseboard with wood glue or epoxy.

After the glue dries, you're going to have to do a little carving on the blocks. The tops of the two inner blocks will need to rounded off like the lower block in figure 4.11. This will allow the bracket to pivot on the bolt hole, which it will need to do. Both lower blocks will need to be carved as well, to provide clearance with the frame. When you go to fit the jig it'll be obvious exactly where to trim the blocks.

i. FU Tubes

We can now use the jig to weld our FU tubes to the frame. Start by assembling four pickup brackets onto the jib. The brackets go on upside down. The upper half of the jig has four blocks, but we're only going to use two at a time. Place one bracket over one outside block, and another over the inner block on the opposite side. Slide a 3/8" rod through brackets and blocks to lock the brackets in place.

On the lower blocks, place one of your angled brackets over the lower block on the side of the board that has the upper bracket on the outside block. The angled edge of the bracket should be on the bottom, and it should angle down toward the center of the jig. If it doesn't, the other angled bracket will. When you've got that sorted out, place another regular pickup bracket over the other bottom wood block, then slide a 3/8" rod through the bottom brackets and blocks to lock the brackets in place.

If the angled bracket is on the right-hand side of the jig, you've just arranged the jig for the offside (right side) of the car. If the angled bracket is on the left, the jig is set up for the nearside. Take your jig to the appropriate side of the car, and place it so the brackets are facing the chassis with the angled bracket on the bottom and towards the rear of the car. The angled bracket should rest on the F and G tubes, and the two forward brackets should be centered on the nose upright, LB or LC. You can use figure 4.12 as a guide, but consider the measurements in that diagram just a guide—the jig is king.

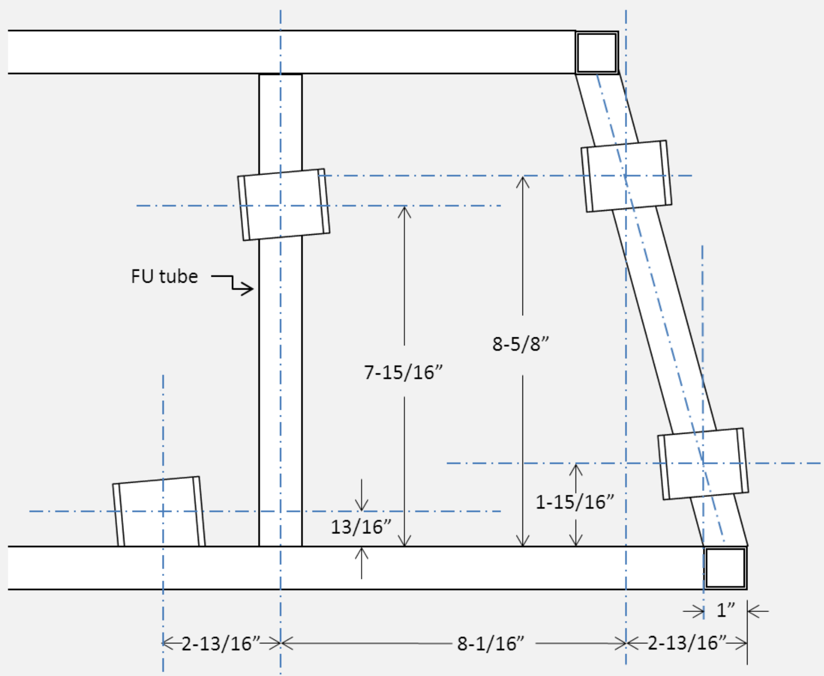

Figure 4.12

Clamp the forward part of the jig to the nose tube, with the brackets caught between the jig and the chassis. Recheck the position of the brackets, and what kind of contact they're making with the frame. The two forward brackets should be flush with the nose tube, and roughly centered on these tubes. Both bottom edges of the angled bracket should be resting on the G tube, and possibly a little bit on the F tube. More importantly, the jig should be slanted about 5 degrees from level, with the forward side higher than the rear. This will be your caster angle.

Measure the distance from the angled bracket to the nose tube, and note this measurement down for later reference. We'll use this distance when we set up the jig on the other side of the car. Check that the inboard end of the angled bracket is close to the inner edge of the G tube. It can overhang a little or be slightly inboard, so long as it's close enough to weld that end to the G tube. Also, make sure the jig is parallel with the longitudinal centerline of the car. If you extended the 3/8" rod through the upper pickup brackets, it should go straight back through the frame.

You'll note that the upper rear pickup bracket is just kind of floating in space, not connected to anything but the jig. This tells us where our FU tube will go. Before we can attach the FU tube, however, we first need to grind away the weld beads where the E tube attaches to the F tubes, and the S and T tubes attach to the J tubes.

Cut an FU tube to fit between the E tube below and the J tube above, and move it outboard until it's snug up against our free pickup bracket. The tube should be vertical when viewed from the side, and angled laterally so that the upper end is centered on the J tube, and the lower end is lined up with the E tube and somewhere over the E and F tube junction. Clamp the FU tube to the E tube and the pickup bracket, then tack the upper end to the J tube and the lower end to the E and F tube junction. Remove the jig, and fully weld all four sides of the FU tube at both ends.

If you want, you can now tack your pickup brackets in place. Or you could wait and fit the FU tube on the other side, and check that the measurements are close to the same on both sides. You can imagine which option we'd prefer. With the FU tubes in place, you can finally fit and weld the two forward frame diagonals. These are made from 3/4" round DOM tubing, and you'll cut and weld them the same as you did with the rear diagonals, which was described in section 3.n.

j. Welding Brackets

You should now be fairly adept at setting up the jig for either side of the car. Arrange the offside brackets on the jig and clamp the jig to the nose and FU tubes, with the angled bracket flush on the F and G tubes, and the other three brackets centered on the suspension uprights. Tack weld the angled bracket to the G tube on both sides, and tack weld the other three brackets to the top and bottom on the suspension uprights. As always, try to place the tacks near the edge of each tube, not the center. When everything has been tack welded securely, slide out the two 3/8" rods and remove the jig.

It's a good idea to test your brackets before fully welding them in place. I'm sure they're fine, but just for us, assemble your offside MGB swivel axle onto an upper and lower A-arm. You'll note the A-arms are interchangeable side to side, the lower A-arms being bilaterally symmetrical and the uppers being the same when you flip them over, which is another kind of symmetrical but we're not sure what it's called.

Before we can test the A-arms, we're going to need to press in our Metalastik rubber bushings. We haven't talked about this much, or even at all, because pressing rubber bushings into small holes has to be one of the most aggravating and frustrating jobs you'll ever face. Unless you're good at it, but we don't know anyone like that so we'll just assume it's going to be as difficult for you as it was for us. In any case we think it's a good idea to press the bushings now, before you paint the A-arms, so any damage done to the A-arms by flying sockets or C-clamps won't ruin your nice finish. It helps to use a good rubber lubricant. Or a solution of water and dishwashing liquid, which is better than nothing. But not a lot better.

With the A-arms bolted to the swivel axle, you should be able to hang the A-arms from the tack welded suspension brackets. Have four 3/8" bolts handy, and fit the upper A-arm, then the lower. The bolt through the angled bracket will only go in from the rear, because the FU tube is in the way in front. Clearance between the bolt head and the F tube is going to be close, but if you drilled the hole through the angled bracket according to the plans, it should fit without any modifications to the bolt.

The A-arm bushings are only 1-7/16” wide, and the inside width of the brackets is 1-3/4”, so you have some clearance to play with there, but in general the bushings should be centered in the brackets. Not a showstopper if they’re off a little. The showstopper would be if you now lifted your swivel axle and the A-arms didn’t rotate freely upwards. That would mean either a) one or both of the upper or lower A-arm bushing tubes don’t line up, or b) The holes through the upper and lower blocks on the suspension alignment jig weren’t parallel. Since both of these are impossible, we’re certain your suspension assembly now moves freely up and down, and there’s no need to redo anything.

With the offside suspension working perfectly, we can move on to the nearside. Load up your jig with pickup brackets and clamp it to the nose and FU tubes. Compare the measurement between the angled bracket and the nose of the car (or the FU tube) on both sides of the car, and move the jig back or forth slightly if they’re off by more than 1/16”. Also compare the height of the lower forward bushing on both sides, and rotate the jig as needed to get this measurement the same. Make sure the bushings are still more or less centered on the suspension uprights. A little off is okay. The jig is king.

Tack weld the brackets to the suspension uprights and the G tube and then remove the jig. Bolt the nearside swivel axle to your A-arms and test fit the assembly in the brackets. If everything works, go ahead and fully weld the pickup brackets on both sides. Take your time, flip the frame around as needed, and don’t let the suspension uprights get too hot.

k. Shock Mounts

The lower shock mounts for the front suspension will be attached to the lower A-arms. These mounts can be welded on or bolted on, your choice. If you weld them on, they’ll be more or less permanent. If you bolt them on, you have the option of changing them around someday. We’re not sure what you’d change exactly, but you’d have the option. The mounting bracket shown in figure 4.13 is the bolt-on kind. Installing it will require you to drill holes in the shock mounting plate on the lower A-arm. The mounting holes should be 1/2” in diameter. The hole for the shock absorber bushing is 12 mm.

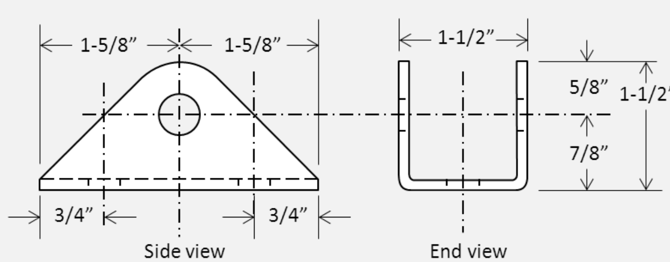

Figure 4.13

If you’d rather weld in a bracket, there’s no need for it to be as long as the bracket in figure 4.13. In fact you could just weld on a pickup bracket, although it doesn’t need to be that wide. Make sure the bracket is centered on the plate, and no more than 4” from the trunion bracket holes. That will place it over the vertical edge of the spacer below, which will help reinforce it. Before you weld the bracket to the A-arm, drill out the bracket hole to 12 mm.

The upper shock mounts for the front suspension are a little tricky, because they need to be precisely located so the shock doesn't bind, and they have to lay back at a five degree angle for the same reason. The upper shock mounts are also going to support the headlight bar, which means they have to line up with each other. The plans for the offside shock mount is shown in figure 4.14, and there is definitely a right side and a left side, and they're not interchangeable, so you'll have to reverse the diagram for the nearside mount.

Start by cutting two 8-1/4" lengths of 1/8" wall 1"x1-1/2" rectangular tubing. One end of each tube should be cut square. The other end should be cut to a steep 55 degree angle, which will match the angle of the S and T tubes on the frame. At the square end of each tube, drill a 12mm hole for the shock as shown in the plan. Note that this hole is square with the tube, not angled through it.

Next, trim away the inboard section. Note that you need to trim about 1/8" more along the back of the tube to get it to lay back at a 5 degree angle on the frame. Also, the vertical edges of the cutout need to be angled 10 degrees to match the angle of the J tube. Unfortunately there's likely to be a lot of trial fitting and grinding and filing until you get it them to fit.

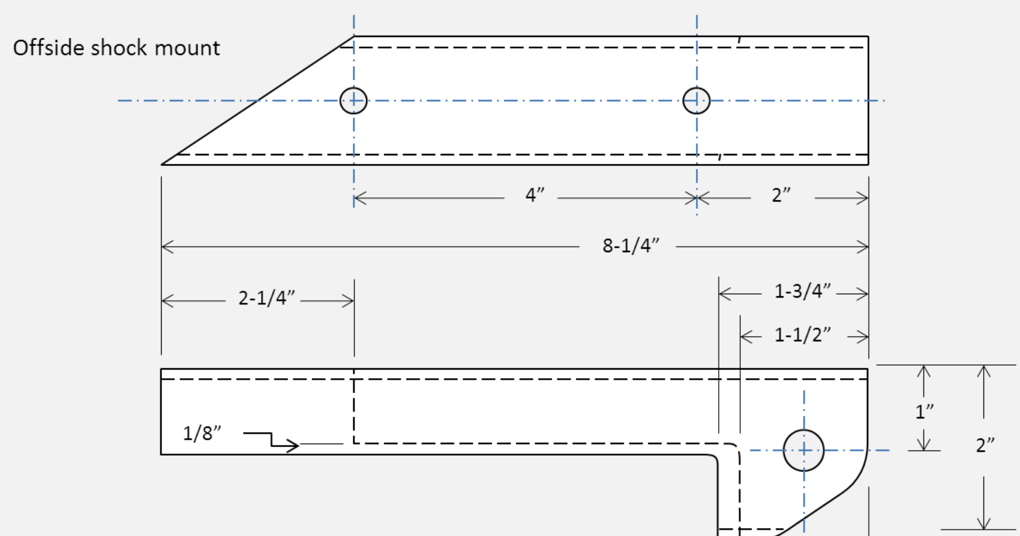

Figure 4.14

When you think you've got both upper shock mounts carved to the proper shape for the frame, go ahead and trim the ends as shown so the shock will be able to swing back and forth in the mount. After that, drill two holes on top of each mount as shown, and weld 5/16" nuts underneath so that we'll be able to bolt in the headlight bar later on.

We're going to be doing this a lot, welding in blind nuts. To do it right, you should buy nuts specially made for this sort of thing. McMaster Carr has a great selection of these for pretty cheap. Get a bag of 5/16", a bag of 1/4", and a bag of #10-32 nuts. In fact, get two bags of the #10-32. We'll use a lot of those throughout the build, and they'll make assembly of the car super easy later on.

When the mounting brackets have cooled, set them on the chassis in their locations shown in figure 4.15. Clamp a flat bar or tube to the tops of both brackets. This will ensure that the brackets have the same angle with respect to the frame, and also that the headlight bar mounting surface is even. Make sure both brackets are parallel with the bar, and that the bar is perpendicular to the centerline of the frame.

To get these brackets aligned exactly, we're going to need to attach the lower A-arms to the lower pickups on both sides of the car. The lower shock mount brackets need to be bolted or welded onto both A-arms. We're also going to need a pair of shock absorbers, or a respectable substitute in the form of a pair of 12" lengths of wood with 12 mm holes drilled 1/2" from either end.

Attach one end of each shock or shock substitute to the lower A-arms with a 12mm bolt, and then swing the shocks up until each fits into its respective upper shock mount. Fit two more 12 mm bolts through the upper shock mounts and shocks. The lower A-arm should be about level with the ground, or maybe angled up slightly. The upper shock mounts should be resting on the J tubes, with the inboard ends just reaching the S and T tubes.

If you got the angles right, both edges of each shock mount should be resting on the J tube, and the vertical edges of both brackets should be in contact with the inside edge of their respective J tube. Don't worry about small gaps. Anything up to 1/16" will be easily filled in by your MIG gun. The important things are 1) the shock mount brackets are clamped to a bar or tube so that their tops are in the same plane, 2) both mounts are perpendicular to the frame centerline, and 3) both mounts are the same distance from the front of the frame.

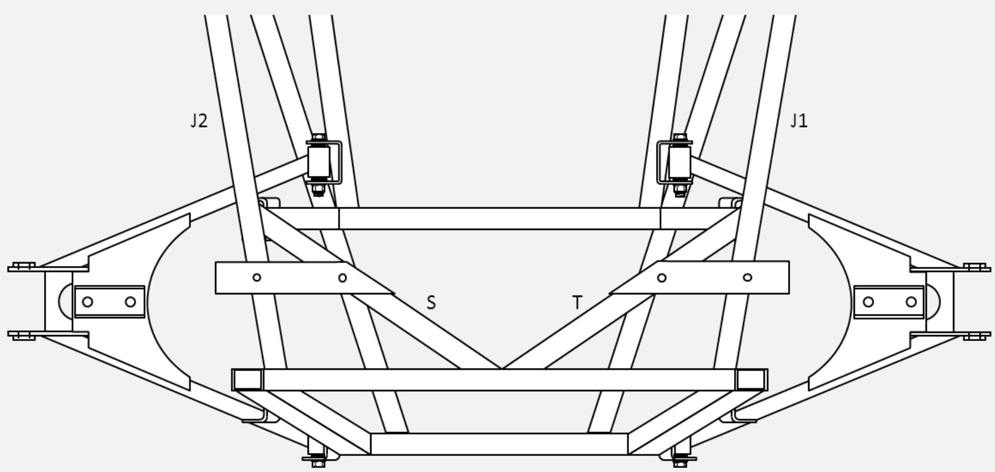

Figure 4.15

If you're happy with the alignment, go ahead and tack weld each bracket to the J tube and to the S or T tube, and then remove your shocks or shock substitutes. Fully weld both brackets to the tops of the J, S, and T tubes, and to the outboard side of each J tube on both sides and the bottom. Take your time, allow the brackets to cool between welds, and make sure you get a good weld bead at every joint. The entire front end of the car will be supported by these brackets.

5. Rear Suspension

The rear suspension incorporates one of the biggest and heaviest parts of the car, the rear axle. It's a lot simpler to fabricate the rear suspension than the front, but it needs to be just as accurate if you want your M.G. Locost to drive down the road in a straight line. For this part of the build we're going to need the following bits:

7 feet of 1" round 16 gauge DOM tubing
1 foot of 2" square 1/8" wall tubing
2 feet of 1-1/2" x 4" rectangular 1/8" wall tubing
5 Triumph Spitfire/Herald Metalastik suspension bushings
5 1/2" spherical rod ends
5 1/2" x 1" weld-in threaded rod ends for 1/16" wall tubing (7/8" diameter)

We didn't include the metal for the pickup brackets or bushing tubes, but if you didn't make these when you were making all the parts for the front suspension, like we asked, then you'll need to make them now. Refer to sections 4.c and 4.g for instructions, and then come back here when you're done.

a. Rear Suspension Layout

The rear suspension on a Locost is a traditional 5-link design, which is actually a step up from the MGB rear suspension, which was basically a 2-link design. More links are better because they keep the axle from moving around too much, but they can also be a problem if they're not setup perfectly, because they can keep the axle from moving at all, which we want it to do in a nice, controlled manner.

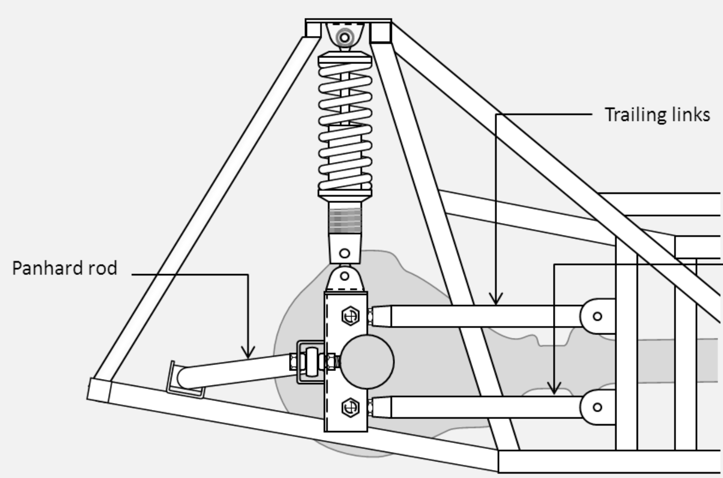

Figure 5.1

The axle is constrained longitudinally by four trailing links, and laterally by a single Panhard rod. This is just about optimal. Some will argue that a Watts linkage does a better job of locating the axle laterally, but it's overkill for us. The MGB did a pretty good job using only leaf springs for lateral location.

To make sure our axle moves in a nice, controlled manner, we need to make our four trailing links exactly the same size, and arrange them on the car so that they're all parallel to each other. This will still create a very slight binding stress when the axle is at full compression at one end and full droop at the other, but the Metalastik bushings will soak that up easily, so we're not going to worry about it.

When we build and set up the rear suspension, we're going to be concerned with maximizing travel, because this is somewhat limited in a Locost. So we'll want the rear axle tubes to have at least 2" of clearance from the RU tubes below, and 11" of clearance for the shocks and springs above. If we go with our standard MGB wheels and 185/65 tires, our ground clearance with the axle 2" above the RU tube will be 5-1/4". We can always lower it, but at the expense of shock travel, which means the car will be more prone to bone-jarring bumps when the shocks bottom out.

If you think 5-1/4" of ground clearance is too much (the front will be around the same with the lower control arms parallel to the ground), you should raise the pickup points on the M tube an appropriate amount so that your trailing links remain level with the car sitting still. Keep in mind that we'll be describing the construction of a Locost with 5-1/4" of ground clearance in back, so you'll have to do your own calculations for a different setup.

b. Links

When you're building a Locost rear suspension, you have a choice between supporting the links on nice, cushy Metalastik bushings, or hard, jarring steel spherical rod ends. Not that we're partial either way, but our rear suspension will use a combination of the two—Metalastik bushing where the trailing links attach to the frame, and spherical rod ends where they attach to the axle. This gives us the best of both worlds—adjustability with some amount of cushiness.

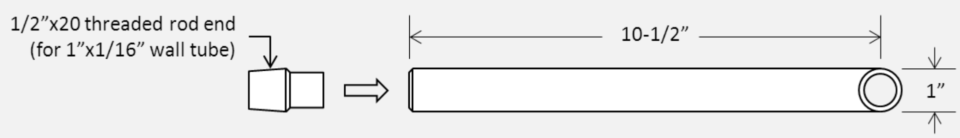

Figure 5.2

We need to make four trailing links, all exactly the same. After cutting and grinding control arm tubes for the front suspension, this will seem like a piece of cake. All you need to do is cut four 10-3/4" lengths of 16 gauge 1" round DOM tubing. Square up one end of each tube, and grind or file a fishmouth cut on the other end, as shown in figure 5.2.

The Panhard rod is just a long trailing link. Cut a 36" length from your 16 gauge 1" round DOM tubing, square up one end and fishmouth the other.

You should already have five 1-9/16" long bushing tubes, which you made from 1" round DOM tubing when you were building parts for the front suspension. You need to weld one of these tubes to the fishmouth end of each of your five links. To make sure you get good penetration, bevel the fishmouth ends as we showed in figure 3.22. These welds will be in compression under normal driving, but they'll be in tension when you really need them—under braking—so make these some of your best welds.

When the tubes have cooled, chamfer the outer edge of the square end of each link. Chamfer them all the way down at a 45 degree angle, so the whole edge is beveled. Now insert a 1/2" threaded rod end into each tube, and weld around the circumference of each link. You can use a lot of heat here without worrying about blowing through the 1/16" tube, because of the thickness of the rod end underneath.

c. Pickup Brackets

You should already have five pickup brackets leftover from building parts for the front suspension. Four of these brackets will be welded to the rear face of the M tubes, and the fifth will be welded to the nearside RU tube where it intersects the Z tube. All of these brackets need to be precisely located, so we're going to use a jig, as shown in figure 5.3. We'll also use a jig for the Panhard rod, but that jig will be the rear axle, and we can't use it until we modify it, which we'll do later, so hang on to the pickup bracket for the Panhard rod and don't lose it.

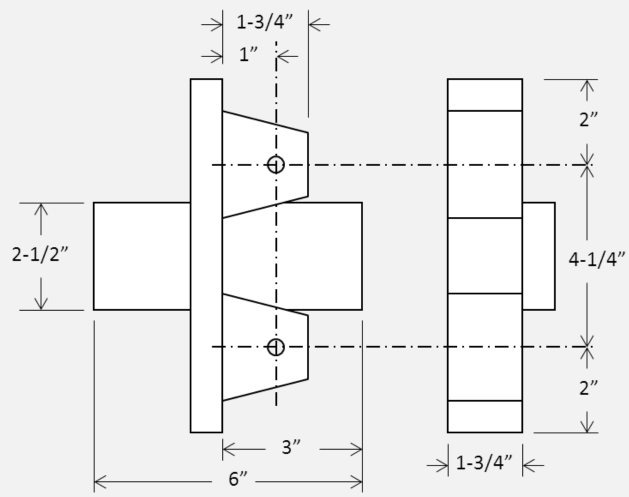

Figure 5.3

To build the rear pickup bracket jig, you'll need two blocks of wood like we used for the front suspension jig (figure 4.11), each 2" tall by 2-1/2" wide by 1-3/4" thick. If you're all done with the front suspension you could use two of the blocks from that jig, but either way attach them to a 8-1/4" long by 1-3/4" wide piece of wood so the holes are exactly 2" from either end. Then attach a 6" long piece of 2-1/2" wide wood to the side as shown.

Fit two pickup brackets over the wood blocks and secure them with 3/8" bolts. Clamp the jig to the M tube with the bottom of the jig resting on the A tube and the side board snug against the M tube as shown in figure 5.4. Your pickup brackets should intrude slightly (1/8") into the passenger compartment, and stick out from the car 7/8". If it looks good, tack weld the pickup brackets to the M tube, then do the same thing on the other side of the car.

Fully weld all four sides of each bracket to the M tubes. When the welds have cooled, grind down the fillet weld on the outside forward edge of each pickup bracket where it's joined to the M tube. We need to reinforce this cantilever section on each bracket, because the stress on the bracket from the trailing link will cause the back of the bracket to flex and eventually crack. Unreinforced, these brackets have failed on many Locosts. We're not going to let that happen to ours.

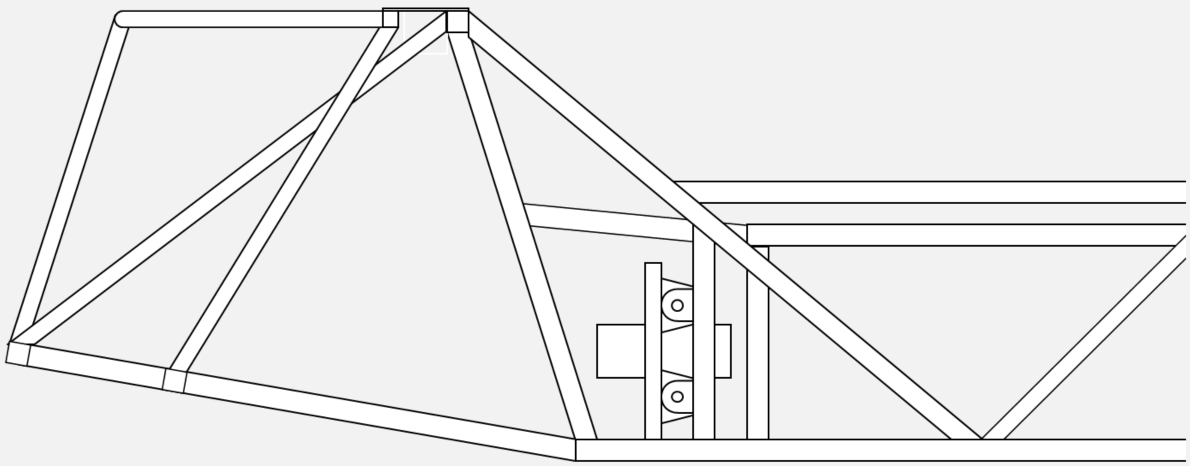

Figure 5.4

Cut four gussets from some 1” square tubing as shown in figure 5.5. These gussets will end up being pretty small, only about 3/4” on each side, but keep whittling them down until they fit completely within the cantilever section. Round off the inner point as needed so the gusset fits over the fillet weld you ground down.

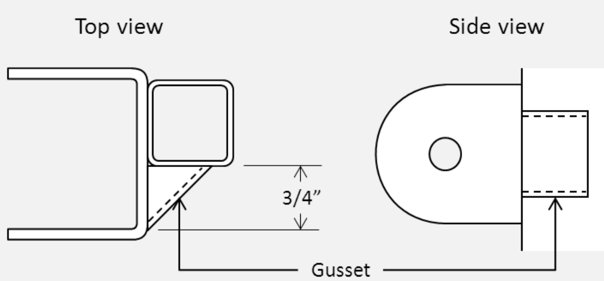

Figure 5.5

Tack weld each gusset in place, then weld the vertical edges of each gusset where it meets the M tube and the pickup bracket. You can try to weld the top and bottom of each gusset, but it’s difficult to get in there with a MIG torch, and in any case with just the vertical edges welded, the bracket will be able to do its job and not allow the pickup bracket to flex.

d. Rear Axle Modifications

This is a big step, converting your massive MGB differential and axle housing into a sleek and lightweight Locost differential and axle housing. This will involve cutting the old heavy leaf spring brackets off the axle, and welding on slightly less heavy trailing arm brackets.

But of course those trailing arm brackets aren’t going to make themselves. You need to cut them out of 4” x 1-1/2” 1/8” wall rectangular steel tubing, then drill a few holes in them, and finally trim them down to size. What you’ll end up with is something that looks exactly like the bracket in figure 5.6.

Start with two 6-1/4” lengths of 4” x 1-1/2” 1/8” wall rectangular steel tubing. Measure out the holes for the trailing links according to figure 5.6, and drill them out to 1/2". Now mark the center of the axle tube hole exactly in the center of the bracket, and cut a hole through both sides with a 2-3/8” circle cutter. This will make a 2-7/16” hole, which is slightly smaller than our 2-1/2” axle, but since we apparently don’t yet have the technology to make a 2-1/2” circle cutter that cuts a 2-1/2” hole, we’ll have to go one smaller and hog out the hole later with a half-round file.

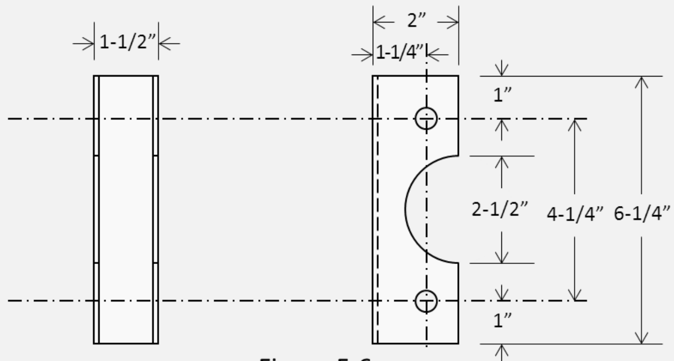

Figure 5.6

The last step is to cut the bracket in half. Make your cut just past the halfway mark on the 4” tube so you end up with a full 2” wide bracket and a full half-circle for the axle. Don’t throw away the other half, save it for later. We’re not done making brackets. Not by a long shot.

Okay, that wasn’t quite the last step. One of your brackets is done, the other one isn’t. The nearside bracket needs an additional hole and an additional bracket for mounting the Panhard rod. Drill a 1/2" hole through the back of the bracket, centered left to right and top to bottom. Next, cut a 1-1/2” section from a 2” square 1/8” wall tube, and chop 5/8” off one end so you have a bracket like the one in figure 5.7. Drill a 1/2” hole through the center of your new bracket.

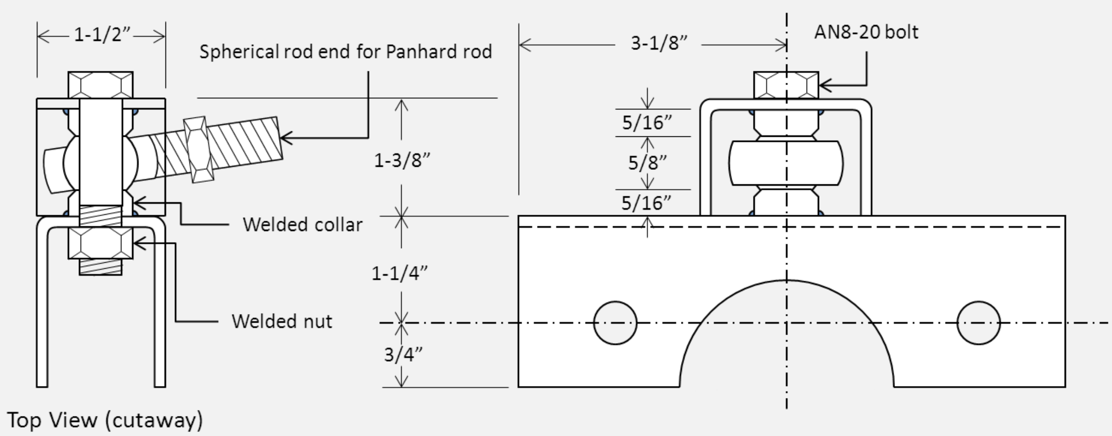

Figure 5.7

The new bracket needs to be welded to the back of the trailing arm bracket, with the 1/2" holes lined up. The spherical rod end of the Panhard rod will fit into this bracket as shown. To make it easy to install the Panhard rod, or even possible, it would be a good idea to weld a 1/2"x20 nut to the inside of the trailing link bracket. Again, we recommend buying a nut specifically made for welding.

Another helpful step would be to weld beveled collars 5/16” thick to the underside of the Panhard rod bracket and the back of the trailing link bracket as shown. Otherwise it’ll be necessary to fit washers or some other type of spacer when you’re trying to insert both the Panhard rod and the bolt at the same time, and it’ll end up being a big painful mess.

To make sure your collars have the correct spacing, assemble the Panhard rod bracket to the trailing link bracket with the collars welded in place, and a spherical rod end, or something else exactly .625” thick between them. Bolt them up solid and then weld on the Panhard rod bracket. If the bracket is too long, file it down until it fits. If it’s a little short and there’s a small gap on either side, up to 1/16”, the MIG torch will fill it in, but you could alternately file down your collars a little bit.

With our brackets ready to go, it’s time to take apart the rear axle. We’re not going to strip it bare, but we are going to drain all the oil, and remove the brakes and backing plates. To do that you first have to remove the giant nut on either end, using a 1-1/8” wrench or socket. You’ll need a lot of torque to do this, either with an impact gun or a long cheater bar, along with a healthy-sized rod between the wheel studs to keep the axle from turning. Be sure you bag up all the parts and label them left and right. Also remove the brake line from the axle, if you haven’t already, and the handbrake cable.

The next job is chopping off the leaf spring brackets. You can cut along the sides with an angle grinder and cutoff wheel, but be very careful not to damage the axle tube. Don’t even get close. Just get rid of the top of the leaf spring brackets, and then you can grind down the sides. Take off the last bit of the leaf spring brackets with an 80-grit flap wheel, and sand off all the paint around the axle as well, leaving a nice, bright shiny surface all the way out to the weld seam on the hub flange.

We’re now going to weld the trailing link brackets to the axle, and to do that we’re going to need a flat, level surface for the axle, three foot-long pieces of two-by-four, and a good bubble level. We also need to make sure that our trailing link brackets fit around the axles. Widen the semicircles in the brackets as much as needed to get good contact with the axle all the way around.

Set the trailing link brackets face up on the two-by-fours, and space them about 41” apart. The bracket with the Panhard mount won’t sit flat on one two-by-four, so use two, with a gap in between for the Panhard mount. Now set the axle in the brackets, with the differential flange pointing straight up and the Panhard bracket on the axle offside. Set the bubble level on top of the differential flange to make sure it’s perfectly vertical.

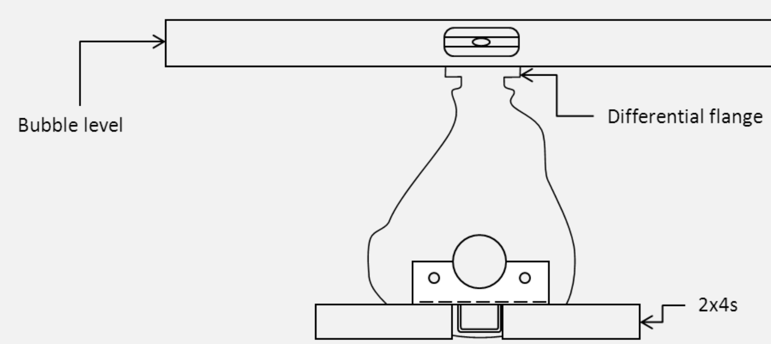

Figure 5.8

You'll notice a small bracket for the handbrake cable pivot bolted to the differential case cover. That bracket is on the axle nearside. The trailing link bracket with the Panhard mount needs to be on the opposite side, the axle offside. Make absolutely sure you get that right. You will not be happy if you don't.

On the frame, measure the exact distance between your top pickup brackets welded to the M tubes. Measure from the inside of one bracket to the outside of the other, so you get an on-center distance. This should be close to 41-3/4", but you want to know the exact distance to the nearest 1/32" or better.

On the axle, slide the trailing link brackets along the axle until the on-center distance between them is exactly what you measured on the frame. When that's done, measure the distance from each bracket to the back of the hub flange. These distances also have to match. Slide the trailing arm brackets back and forth together until you have them exactly centered on the axle, and exactly the right distance apart. By now your brackets are probably very close to the weld seam for the hub flanges, but that's okay.

A couple of things we want to watch out for when we're welding the axle. First, we don't want any residual oil in the differential case catching fire. If you drained it well this shouldn't be a problem, but it should be noted that the Locost book has you completely strip the axle and clean the insides of the case with solvent. So this is an at-your-own-risk type of thing.

Second, we don't want to weld the rear axle bearings to their races. Again, the book has you remove the axles and bearings completely, but we haven't done that, so in our case the best way to avoid welding up the bearings is to make sure the ground strap from your welder is attached to something inboard of the bearings, so they're not in electrical path of the welding current.

In case you hadn't noticed, the MGB axle is heavy. Part of that is because it's huge, but part of it is because of the thickness of the axle tube. We're going to need a lot of heat to melt it. If you have a 110v welder, you want to set it for 1/8" thick steel and a little more. But we also have to be careful about bending the axle from too much heat, so to avoid this, we're not going to weld more than four inches at a time, and we're going to allow the axle to cool for a good 15 minutes between each weld. The brackets need a total of 32" of welding, so that's eight separate welds and two hours elapsed time.

Start by tack welding the brackets to the axle in a couple of places. You'll find you have to keep the arc trained on the axle most of the time, and by the time it starts to puddle, the brackets with their skinny 1/8" walls will be ready to melt. Put about 8 to 10 tack welds on the axle to get a feel for starting the puddle, then go ahead and weld the entire half-circle on both sides of each bracket, about 1/4 circle at a time.

When the welding is all done and the axle has cooled, spin the axles at each end a few times to verify that a) you haven't welded the bearings together and b) you haven't bent the axle.

e. Shock Mounts

We now have everything we need to install the rear suspension, except for the brackets for mounting the shocks and springs. The upper mounts will be our standard pickup brackets welded to the underside of the 4" plates attached to the top of the O tube. We're not going to do this now, though. We'll wait until the suspension is installed so we can make sure the upper mounts are directly above the lower mounts.

The lower shock mounts will be welded to the top of our recently-installed trailing link brackets. But first we have to make them, and to do that we'll use the half sections of 4"x1-1/2" tubing that we cut away from our trailing link brackets, and then asked you to save.

The dimensions of the upper shock mounts are shown in figure 5.9. Each mount is made of three pieces: a 3" x 1-3/8" L-shape, a 1-1/8 x 1-1/4 x 1-1/2" U-shape, and a flat triangular gusset with 1-3/8" sides. Note that figure 5.9 shows an offside mount. The nearside mount will be the mirror opposite. Don't make two offside mounts.

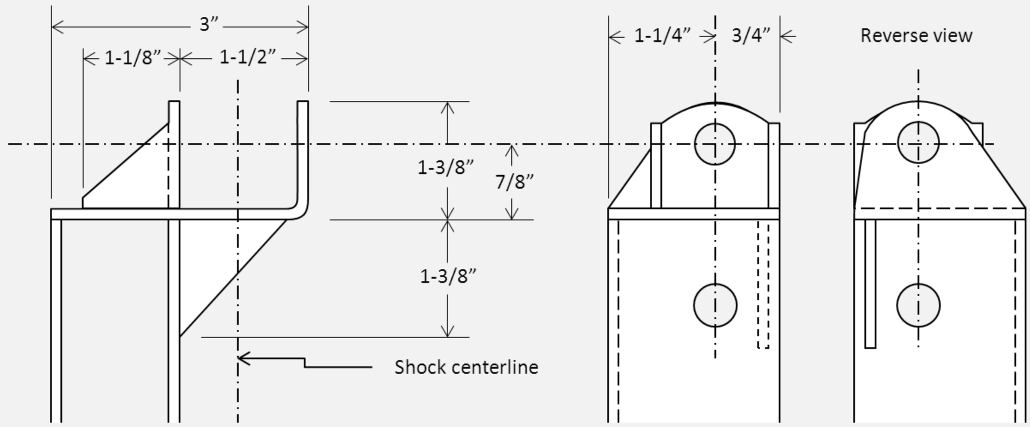

Figure 5.9

Cut the two L-shaped pieces first, these are 2" wide and 3" long, and the upper portion is shaped however you like it (we're partial to our design), but the 12 mm hole needs to be drilled exactly 7/8" up from the bottom and 3/4" in from the side. Remember to make a right-hand and left-hand version.

Next cut your outboard brackets as shown. These are symmetrical, so they'll both look the same. Again, the shape at the top is up to you, but make sure the 12 mm hole is drilled on center and 3/4" (not 7/8") from the bottom. Finally, cut your two flat gussets.

Weld the L-shaped brackets to the tops of your trailing link brackets first, on all three sides. Next, weld the U-shaped brackets on top. To make sure they're properly aligned, slide a 12 mm bolt or rod through the holes in both brackets, with a 1-3/8" spacer in between. Make sure the bolt is parallel to the axle, then tack weld the U-shaped bracket to the L-shaped bracket. Remove the bolt and spacer and weld around all three sides of the bracket.

Finally, weld the gussets in place as shown. These need to be close to the forward edge of the trailing link bracket. When welding along the inside vertical edge of the gusset, be sure to allow enough space around the 1/2" hole for a washer to lie flat.

f. Assembly

You're now ready to mount your rear suspension. Once you do that you can weld on the last couple of suspension pieces, the upper rear shock mounts and the pickup bracket for the Panhard rod, and your rear suspension will be complete.

It helps if you have a few extra people on hand to insert the axle into your Locost frame. You can do it by yourself, but you'll probably bang it into a few frame members, if you don't throw your back out first. The axle only goes in one way, with the nose of the differential pointing straight up. Once the axle is centered in the frame, you can rotate it down and fit the nose of the axle into the transmission tunnel.

With that chore out of the way, you next want to attach the four trailing links to the axle brackets and into the pickup brackets on the M tubes. Prepare the links first by pressing Metalastik bushings into the four bush tubes, and then screwing your spherical rod ends into the threaded ends of the tubes. Be sure to screw a jam nut onto the rod ends first.

Adjust the rod ends so that all four trailing links are exactly the same length, and as close as you can get to 11-1/2" between the centers of the bushing and rod end holes. A half-turn of a threaded rod end will shorten or lengthen the rod by .025", so you're allowed an overall variance in link length of .0125". Attach the links to the pickup brackets with 3/8" bolts, and to the rear axle with half-inch bolts. Place a block of wood under the differential, and you should now be able to move the axles up and down an inch or two without any binding.

Prepare your Panhard rod by pressing in your last Metalastik bushing and screwing on your last spherical rod end. Insert the spherical rod end of your Panhard rod into the mounting bracket on the rear axle offside, and lay the Panhard rod behind the axle and across the RU tubes. Bolt a suspension bracket onto the bushed end of the Panhard rod, and then set the bushing down on the RU tube near where it intersects the Z tube. You may need to grind smooth the weld bead where the Z tube joins the RU tube.

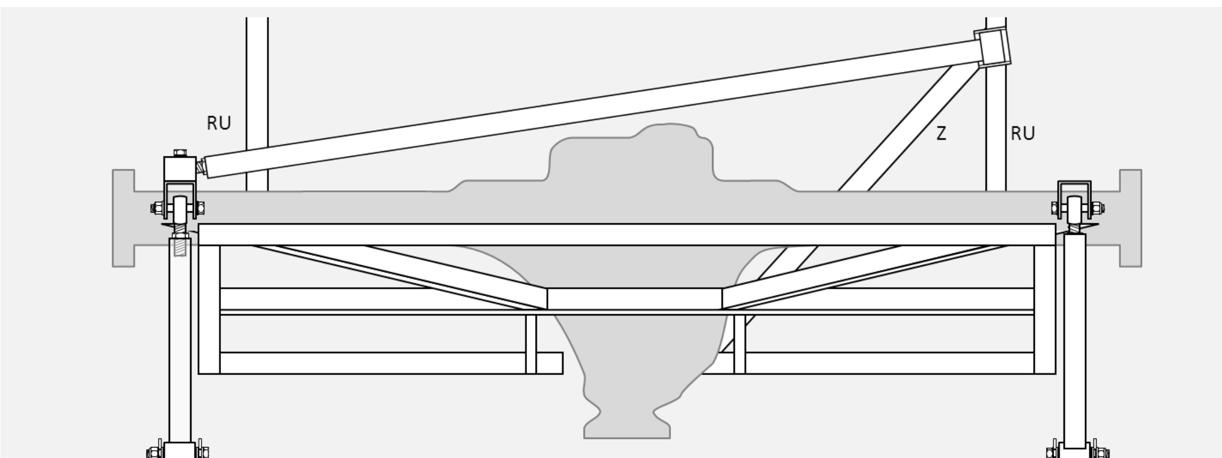

Figure 5.10

Now adjust the length of your Panhard rod until the outer edge of the pickup bracket is even with the outboard side of the RU tube, and the Panhard rod clears the rear of the differential case by about an inch. The bracket and the RU tube won't be at the same angle, but just make sure no part of the pickup bracket overhangs the RU tube.

When you're satisfied with the fit, go ahead and tack the bracket to the RU tube, then remove the Panhard rod and fully weld the bracket on all four sides. If part of the bracket gets welded to the Z tube, bonus. When the bracket has cooled, reinstall your Panhard rod and make sure you still have full up and down movement of the axle. When lowering the offside axle, the axle housing should contact the RU tube just before the Panhard rod, but don't worry if the Panhard rod hits first, so long as it's close.

The last step in the process is to locate the upper shock mounts directly above the lower shock mounts on the rear axle brackets. To do this, you'll need your shock absorbers or two shock substitutes (foot-long sticks or rods with 12mm holes drilled 11" apart). Attach your last two suspension brackets to the top end of each shock, and clamp the brackets to the underside of the 4" steel plates welded to the top of the O tube, with the shocks or shock substitutes hanging down.

Move the brackets around on the plate until the bottom eye of the shock is directly in line with the 12 mm holes in the bottom shock mount. You may have to raise or lower the axle to get them to line up, but make sure the axle stays reasonably level. This doesn't have to be an exact science, but we're not just trying to reduce the risk of binding, we also want the thing to look good. A little fore or aft lean is okay, but we want to avoid any side-to-side lean.

If there's not enough room on the underside of the 4" plate to get the shock to line up perfectly, get it as close as you can. When you're satisfied with the angles, you can tack weld the upper mount to the plate, however this is a difficult overhead weld, so you might prefer to leave the bracket clamped in place and wait to weld it until after you've stripped the chassis and can flip it over. Alternately you could drill a small (1/4" hole in the top of the 4" plate, right down to the bracket, and plug weld the bracket to the plate to hold it for now.

6. Scuttle

The Locost scuttle is a rather intricate bit of kit. It's not only part of the bodywork, but it supports the steering column, the dashboard, and the engine bay firewall. And it won't be fun to build. It has a lot of parts that have to be cut and fit, it needs a lot of welding and grinding, and it all has to be put together with close tolerances to locate all of the controls properly. There isn't a lot of room for error.

The Locost scuttle is designed to be removable. A lot of Locost builders don't take that route, and instead weld on a structure of their own design, which sometimes works and sometimes just looks odd. We think a removable scuttle is highly advantageous during the build process, although maybe not so much after the car is all put together. But that's what we're doing now, putting the car together, so we're building a removable scuttle. To do that we're going to need the following materials:

10 feet of 1" square 16 gauge tubing
10 feet of 1/8"x1/2" steel strip
4 feet of 2"x1" rectangular 16 gauge tubing
1 foot of 2"x1" rectangular 1/8" wall tubing
1 foot of 3-1/2"x3-1/2" square 1/8" wall tubing
1 sheet of 14 gauge steel measuring 8-1/2" x 10"
2 sheets of 16 gauge steel measuring 48"x12"
1 sheet of 20 gauge steel measuring 60"x 14"

The steel strip can be ordered in two 5-foot lengths if necessary. To assemble the scuttle together we're also going to need the steering column out of your donor M.G.

a. Engine Bay Shelf

Although not strictly part of the scuttle, we want to cut out our engine bay shelf now because the scuttle will sit on top of it, and a few things have to line up between the scuttle and this shelf. Cut the shelf out of 16 gauge sheet steel, using the plans shown in figure 6.1. Be as precise as possible with the holes for the pedals and steering column, as there won't be a lot of margin for error when it's time to fit those pieces.

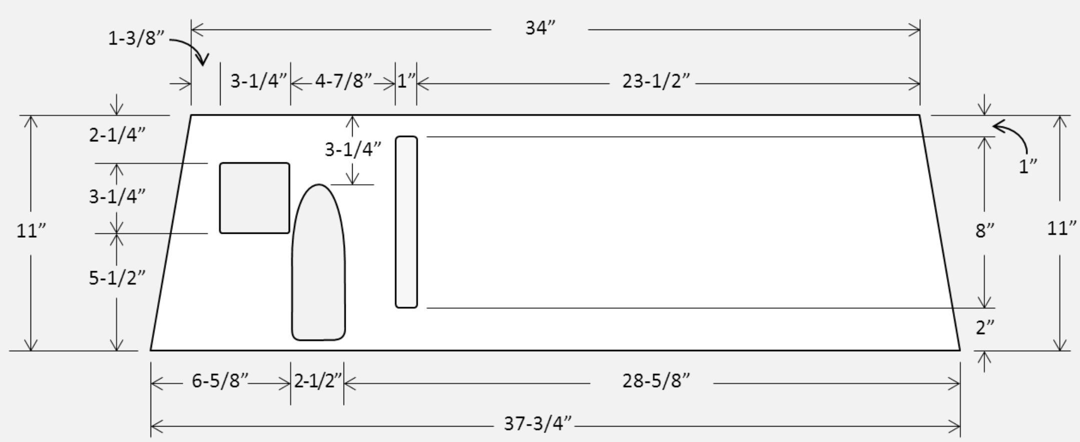

Figure 6.1

We won't be welding the shelf to the frame at this early stage in the build, and in any case the shelf will need to be modified further when we're working on the steering and pedals. But get it positioned as accurately as you can on the frame, and clamp it down. The edges of the frame should be trimmed so they're about 1/16" to 1/8" inboard of the outer edges of the J, P, and Q tubes. This will give you a good weld joint that you can grind flat on top.

b. Framing the Scuttle

The basic scuttle frame is a simple three tube affair that follows the lines of the P and J tubes. The dimensions are shown in figure 6.2 (ignore the 3-part steering column crossbar for now), however these tubes should all be cut to fit, so that they lie directly over the P and J tubes. All tubes are 1" square 16 gauge steel

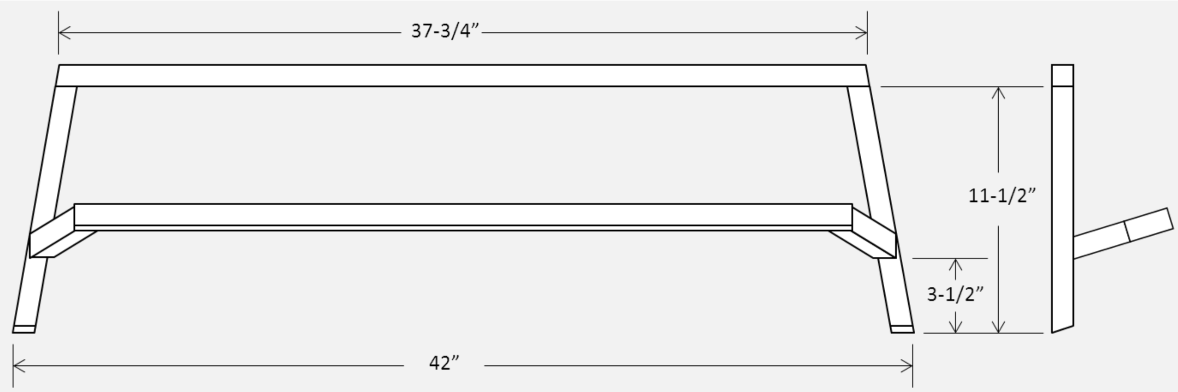

Figure 6.2

Cut the forward tube to 38" with edges angled 10 degrees, opposing. This will fit directly over the rear of the engine bay shelf, above the P tube. Cut two more tubes 11-5/8" long, with the ends also angled at 10 degrees, but parallel. Additionally, trim one end of each of these tubes at a 17 degree angle. Ignore for now the steering support shown in figure 6.2.

Place the three scuttle tubes over the J and P tubes, with 1/16" spacers or washers under the rear of the arms to keep them level. Clamp the scuttle tubes in place and tack weld the arms to the forward tube. It's best to place the tack bead on the outside of the joint so the arms don't try to bend inward.

The next step is to build the mount for the steering column. This is a rather complex process, due to the need to locate the steering column at the correct height, angle, and distance from the frame centerline, something we'll appreciate later on when we're driving the car. The steering column is mounted in two places, the scuttle and just below the Q tube. To make sure we get the column support bracket correctly located in the scuttle, we're first going to build and install the column support bracket on the Q tube. Plans for the bracket are shown in figure 6.3.

Cut the bracket from 3-1/2"x3-1/2" square tubing. First chop a 4-3/16" length from the tube, then shape the sides as shown in the plans. Next cut a hole in the face of the bracket with a 1-3/4" circle-cutting saw at the location shown in the plans. The height of the hole is critical, as it will determine the height and angle of the steering wheel, and also make it possible to install and remove the steering column, which will turn out to be kind of important.

Drill three 5/16” holes around the 1-3/4” hole in the pattern shown. The measurements in figure 6.3 are close enough, but if you want them exactly right, and we think you do, then use the actual steering column flange to mark their locations.

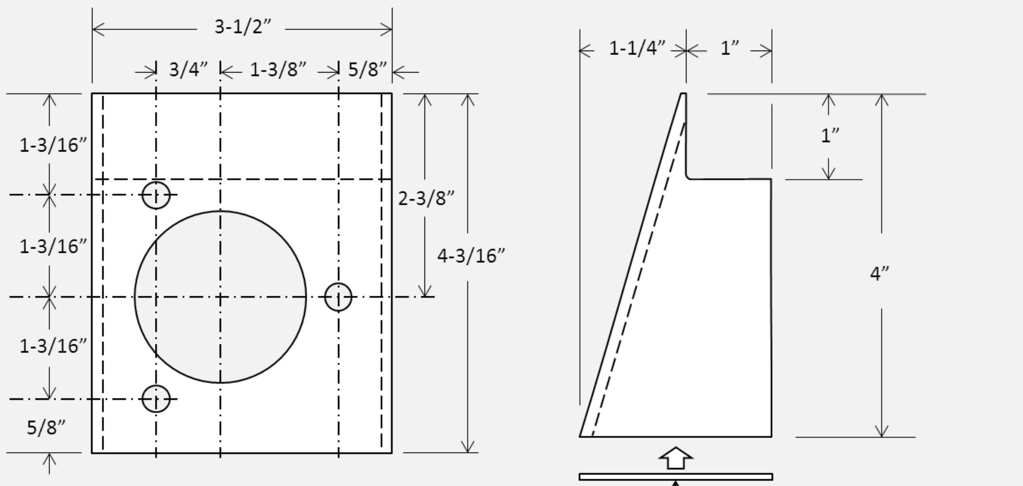

Figure 6.3

The last step in building this bracket is to weld a 1/16” steel plate to the bottom of the bracket. Weld the entire seam, as this bracket will need to seal off the passenger compartment from the engine bay. The dimensions of the plate are 3-1/2”x2-1/4”, but make sure the rear edge of the plate extends all the way to the open end of the bracket, as this end of the bracket will later on be fully welded to the lower firewall for the same sealing purposes.

When the bracket has cooled, clamp it to the Q tube about 5” from the nearside end of the tube. The 1” notch in the bracket should just fit around the Q tube, and the face of the bracket should be at a 17 degree angle from vertical. Now dig out your steering column. You’ll notice that when the column is in its normal orientation, with the ignition switch on the right, the three holes in the forward flange are in the same alignment as the holes in your bracket, or if not, they should be.

You will need to trim the round forward flange on the column by about 1/4" along the left hand edge, so that it’ll fit through the 2-1/2” slot in the engine bay shelf. Once this is done, fit the column through the 2-1/2” slot in the engine bay shelf. Because the flange is still 3-1/2” wide and the slot only 2-1/2” wide, you may at first have a little trouble. But it can be done. With the column slightly tilted, fit the shaved side of the flange through the slot, rotate the column 180 degrees, then fit the shaved side through again. It all works out.

Now lay the column over the P tube. Fit the forward end of the column through the bracket clamped to the Q tube. Line up the three holes, and loosely bolt the flange to the bracket with three 5/16” bolts.

Loosen the clamp on the bracket and slide it along the Q tube with the steering column, until the column is up against the left side of the slot in the engine bay shelf, and the column is aligned with the frame, i.e. not angled left or right. The column should now be in the exact center of the driver’s compartment, or if not exact then as close as we’re going to get. Secure the clamp on the Q tube, remove the steering column, and remove the engine bay shelf. Tack weld the steering column bracket to the Q tube, then fully weld it in place.

After all of that, we can now add the rear column support to the scuttle frame. Because the steering column is now lying on the P tube, it's in the way, and you can't fit your scuttle frame to the chassis. So the first thing we have to do is cut a section out of the forward tube for the steering column. Unfortunately, if we do that now we'll end up with our scuttle frame in two pieces. So first we're going to build a bridge over the section we intend to remove. The plans for this are shown in figure 6.4.

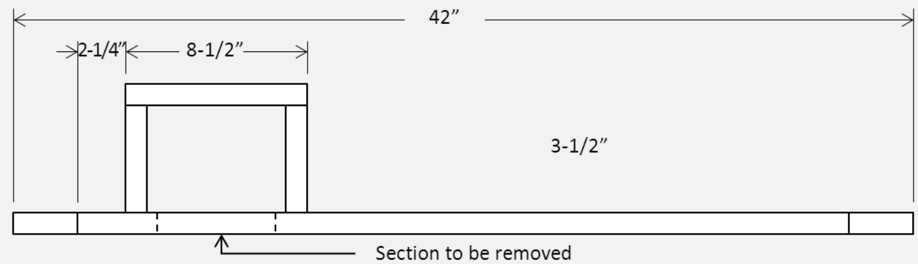

Figure 6.4

The height of the bridge is not important because we're going to chop it down later. Just make sure it's tall enough to clear the steering column. The width of the bridge *is* important. The aft mounting plate attached to the steering column is 6" wide, and it needs to fit easily between the sides of the bridge. The lateral position of the bridge is equally important, and you can verify that it's centered over the column location by measuring from the column slot in the engine bay shelf, remembering that the 2" column will not be centered in the 2-1/2" wide slot, but will be all the way to the left-hand edge.

Weld the bridge in place, then cut out the section of the scuttle tube below it. You may find after you do this that if you sight from one end of the forward scuttle tube to the other, your tube is no longer in perfect alignment. It's totally acceptable at this point to coax the bridge tubes as needed to get the forward tube back in shape. This coaxing could be in the form of a vise or hammer, but we generally prefer steady, firm pressure as opposed to sudden impacts. You may feel otherwise.

Once the bridge is built and the section of scuttle tube removed, you can set the scuttle frame in place on the chassis. Verify that the bridge is centered over the steering column.

We next need to construct the main steering support beam. This beam runs the width of the scuttle, and it's made from 16 gauge 1"x2" rectangular tubing. It's supported by two short lengths of 1" square tubing, which we'll cut to fit later. First we need to prepare the main tube by cutting a round notch in it, 2-1/2" wide by 1" deep, as shown in figure 6.5.

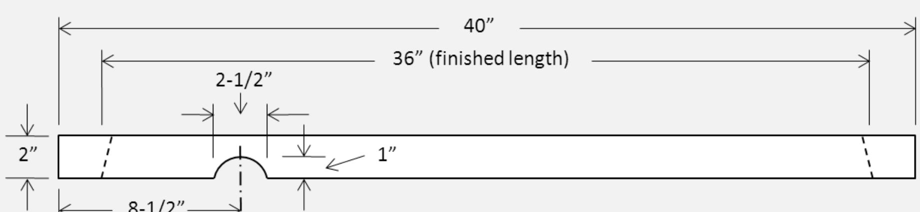

Figure 6.5

Don't cut this piece any longer than 40". You should be cutting it from a 48" tube, and we'll need an 8" length of this tube in the next chapter, for the accelerator pedal box.

The half-round notch in figure 6.5will need to be centered over the steering column, but getting that measurement exactly right is not a job for amateurs like us, which is why we cut the tube longer than necessary, 40" instead of 36". We will build the notch in approximately the right place, and set the bar on top of our steering column with the notch centered. We can then cut and fit the end supports, trim the excess appropriately, and in the end it'll be just like we cut and fit the thing like we knew what we were doing.

After you cut out the notch in the beam, you need to fill it in. Start with a 4" long strip of 1-1/4" wide 16-gauge steel. Bend the strip around a 2" pipe to approximate the shape of the notch, then clamp it into the cutout and weld around the edges. If you clamp it hard enough, the strip will conform pretty well to the shape of the notch. After the tube is cool, grind away most of the excess, but leave a little of weld bead to ensure the seam is well-sealed.

To fit the beam onto the scuttle frame, clamp your engine bay shelf to the chassis and then install the steering column and scuttle frame. Make sure the steering column is straight fore and aft. Lay the column support beam across the scuttle frame, just behind the aft steering column mounting plate, with the notch over the steering column with the column supporting the beam. Now place blocks under the bar at both ends of the scuttle until the bar is perfectly level, and just 1/16" or so clear of the steering column. Refer to figures 6.2 and 6.6 for positioning the beam.

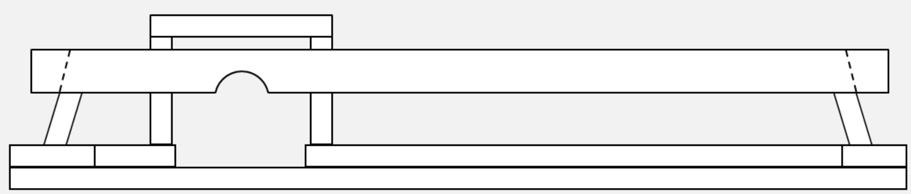

Figure 6.6

This is more or less the final position of the beam, the less part being somewhat optional, which is to lay the beam back 17 degrees to match the angle of the steering column. We did it, and we think you can too, but it does make fitting and welding the short support tubes at either end a little trickier. So it's up to you, and everything will still work if the beam and its supports are vertical.

Whichever way you position the beam, make sure it isn't any farther back than necessary to clear the aft steering column mounting plate. This beam will make life difficult later on when it comes time to fit switches and gauges in the dashboard, and the farther forward it is, the better. You can't go any farther forward than the steering column mounting plate, but it should be right up against it.

Cut and fit the short support tubes at either end of the beam, and tack them to the scuttle arms on the bottom and beam on top. When you're done, go ahead and fully weld all the joints on the scuttle frame. Finally, trim off the ends of your steering column support beam to match the sides of the support tubes, as shown by the dashed lines in figure 6.6.

The only remaining task at this point is to fill in the ends of all your open tubes with small squares or rectangles of 16 gauge steel. This is a tedious job, cutting and fitting the pieces to fit, and getting them to stay in place at the end of each tube while you try to weld the edges. But it has to be done. Magnets can help. Make sure the filler pieces fit inside the tubes, and not on top, so we don't add any unnecessary length to any of the tubes.

c. Attaching the Scuttle to the Frame

Before we do anything else with the scuttle, we need to weld on tabs for attaching the scuttle to the Locost chassis. We'll need to make eight tabs out 1/8" thick steel, 1" wide by 2" long. Drill a 1/4" hole in each tab 1/2" from one end. Again, the finish of the drilled end of the tab is up to you. We may have mentioned this before, but we like rounded ends.

The scuttle will be bolted to the P and J tubes, using a fascinating and universally despised fastener known as the rivet nut, or rivnut for short. We don't like them much ourselves, but when you need to bolt something to a tube, and you can't get a nut for the bolt inside the tube, then a rivnut is about your only choice. And real automobile manufacturers use them, so how bad could they be?

The only significant problem with rivnuts is that they don't have a super positive mechanism for resisting torque. Which is kind of antithetical for a nut. To keep from spinning inside the tube, they usually have serrations on the shank that dig into the base metal when they're pressed in. This works okay so long as you don't drill the initial hole too big—the rivnut has to be a press fit—and you don't apply too much torque to the bolts. Since our scuttle bolts are primarily loaded in shear, we're okay with this limitation.

So the first thing we need to do is install our 1/4" rivnuts in the P and J tubes. We'll install a total of eight, spaced on the tubes as shown in figure 6.7. Holes for 1/4" rivnuts are generally 3/8", but it wouldn't be a bad idea to first test drill and fit one on a scrap of 16 gauge sheet. On the scuttle tubes, try to center the holes vertically. The exact positions along the lengths of the tubes aren't critical, but don't get too close to any of the inside corners or it'll be difficult to weld your attachment tabs to the scuttle.

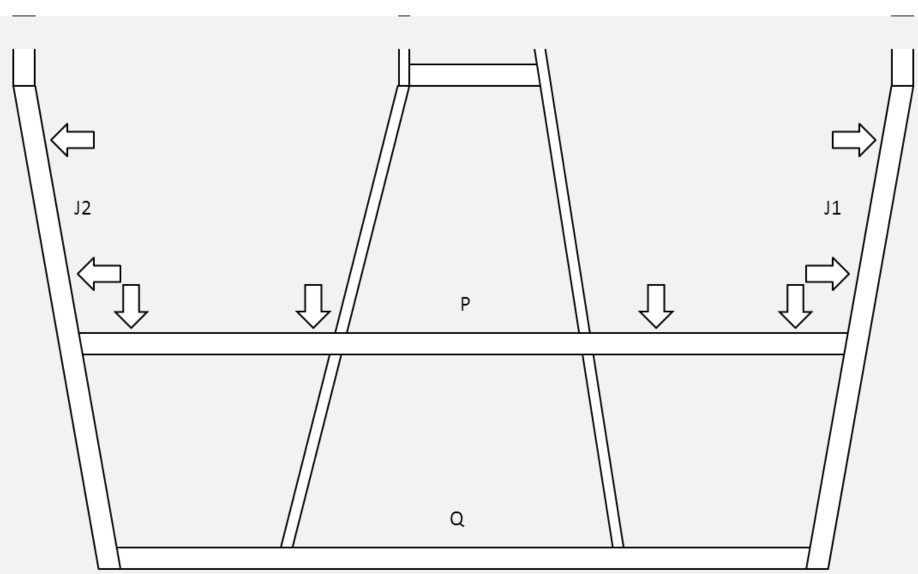

Figure 6.7

To install rivnuts, you need either a special rivnut tool, or a cheap rivnut tool. The only downside of the cheap tool is that it uses a screw to draw up the rivet, and turning the screw can apply torque to the rivnut, which stresses the serrations before the rivnut is really seated. Still, thousands if not millions of rivnuts have been installed with the cheap tool, and we don't know how many rivnuts have been ruined by cheap rivnut tools, if any, so we like those odds.

When all your rivnuts have been successfully installed, bolt a scuttle attachment tab to each one, with the tabs sticking up above the P and J tubes. Clamp your engine bay shelf in place, place some 1/16" spacers on the J tubes, and set the scuttle in place, snug against the attachment tabs. Clamp the scuttle in place, and then tack weld each attachment tab to the scuttle. Unbolt the scuttle and remove it from the frame, and then fully weld each of the attachment tabs.

d. Steering Column Mount

This next part is going to be a little difficult to follow, especially the way we've described it. So pay attention and maybe look for some pictures online. I'm sure you'll be fine. First thing to do, when the scuttle has cooled, is to install the steering column through the engine bay shelf. Bolt it loosely to the bracket welded to the Q tube. Next set the scuttle back on the frame and clamp the steering column into the recess on the support beam. Secure the scuttle with three or four bolts so it can't move around.

We can now build the rear steering column mount using the column as a jig. But first we need to cut out a few pieces of metal. The three bolt holes in the aft steering column mount are not in the same plane. The two holes closest to the steering wheel are about an inch lower than the forward hole. Or exactly an inch. If we're going to bolt this mount to a flat sheet of steel, and we are, we're going to need spacers.

To make the spacers, cut two 1-1/2" lengths of 1-1/2" square 1/8" wall tubing, and cut off one side of each piece to form a U-shape 1" tall, as shown in figure 6.8. Once again, if we're cutting off one side of an ERW tube, we like to remove the side with the ERW seam. But it's up to you. Once the spacers have been cut, drill a 3/8" hole in the exact center of each spacer, and weld a 3/8" nut on the inside edge of each hole.

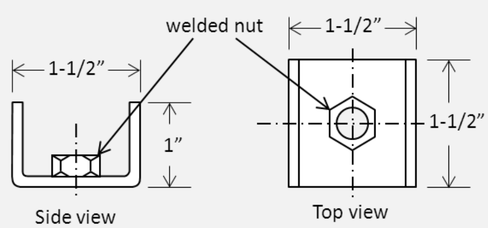

Figure 6.8

When the spacers have cooled, bolt them to the two rear holes in the steering column mount with the ends of the U facing up, as shown in figure 6.9. A flat metal sheet laid on top of the mount should now be able to make contact with the forward bolt hole and both sides of each spacer. Small gaps less than 1/16" are okay.

We next need to cut, fit, and weld two lengths of 1" 16 gauge square tubing between the steering column support beam and the vertical tubes on the temporary bridge. These tubes will start out about 6-3/4" long. One end of each will be square, and the other end will be angled 17 degrees.

Trim the square end of these tubes until they fit parallel to the steering column, with the tops even with the tops of the bolted-on spacers, as shown in figure 6.9. The tubes should be flush with the bottom of the 2" steering support beam. When both tubes are in the correct position, tack weld them to the bridge verticals and the steering column support beam.

Unbolt the scuttle and remove it from the chassis, and then fully weld these tubes. You can now chop off the top of the bridge, and grind the tops of the vertical tubes until they're flush with the tubes you just welded, as shown in figure 6.9. When everything has cooled, reattach the scuttle frame to the chassis.

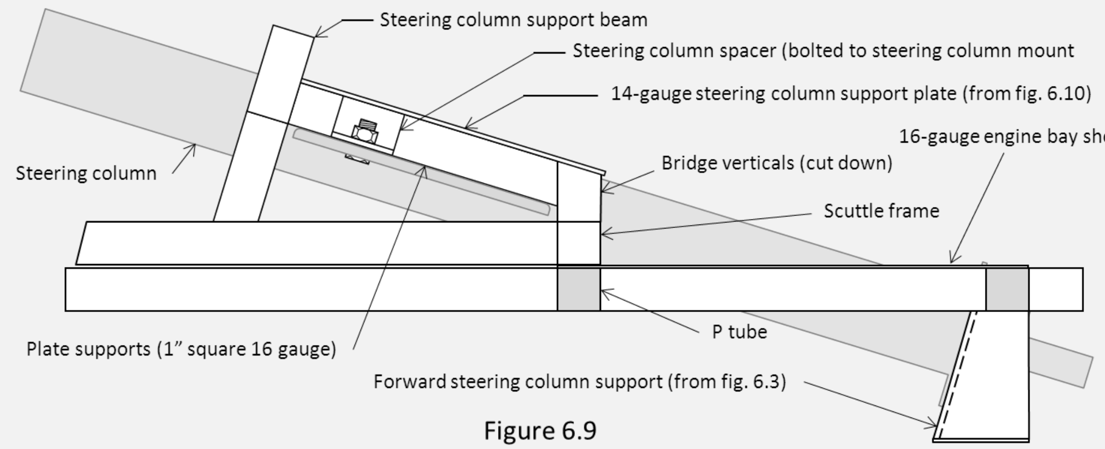

Figure 6.9

Next cut a 14-gauge steel mounting plate to the size and shape shown in figure 6.10. This plate should fit squarely over the tubes you just welded, with the aft end butted up against the column support beam, and the forward end even with the front of the bridge verticals and front of the scuttle. You may need to grind away some weld beads on the steering support beam to get a flush fit. A little overhang is okay, but it can't come up short of the front of the scuttle. Better to leave it a little short of the steering column support beam.

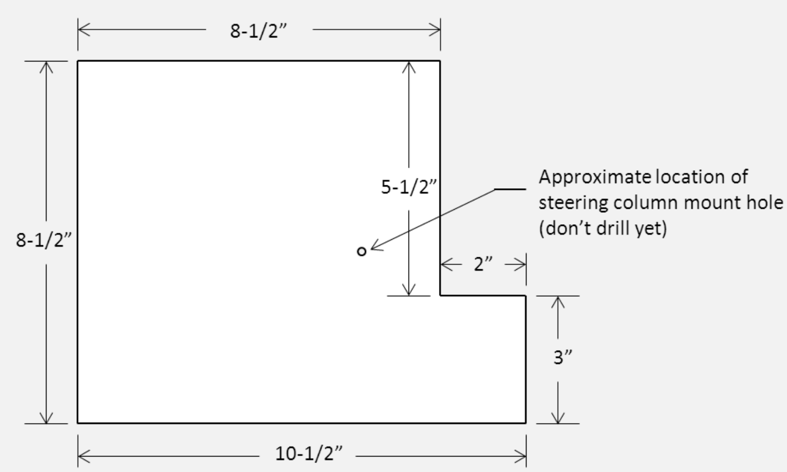

Figure 6.10

The sides of the plate should reach the edges of the two support tubes, with the tab extending over the left tube in front. This tab will be used later as the floor of the master cylinder recess in the firewall. When the plate has been centered and aligned, clamp it to the support tubes. From underneath, mark the location of the forward steering column mounting hole on the plate. It should be somewhere in the vicinity of the hole shown in figure 6.19.

Now unclamp the plate and drill a 3/8" hole at the marked location. Replace the plate and verify the hole is correctly positioned over the hole in the steering column mount, then remove it and weld a 3/8" nut over the hole on top of the plate. Be sure you know which side is the top.

When the plate has cooled, remove the scuttle from the chassis and remove the steering column from the car. Bolt the plate to the steering column mount through the one hole with the welded nut on top, using a 3/8" bolt. Rotate the plate until it's perfectly square with the column, and tighten the bolt. Flip the plate and steering column over, and tack weld the U-shaped spacers to the plate. Unbolt the column from the plate and spacers, and fully weld the spacers to the plate along both sides of each spacer.

When the plate has cooled, set the steering column and scuttle back on the chassis. Bolt the forward end of the steering column to the bracket welded to the Q tube. Set the aft mounting plate back on the scuttle, and from underneath bolt it to the steering column mount using 3 3/8" bolts.

Now line up the column with the car. Once the mounting plate is welded to the scuttle, you won't be able to adjust the steering column again. Ever. So get it right. When you're happy with the alignment, tack weld the plate to the scuttle. You can now unbolt the steering column and remove the scuttle, then weld the plate to the scuttle frame. It doesn't have to be fully welded, stitch welding is enough.

e. Firewall

Next task is the upper engine bay firewall. It shouldn't take too long to cut out, but we'll need to drill quite a few holes in it before we weld it to the front of the scuttle, and then build a recessed box for the clutch and brake master cylinders. So it's a big job but I think by now we can handle it.

We're going to cut the firewall from 16 gauge sheet according to the plan in figure 6.11. In a little while we're going to need to cut the dashboard frame (figure 6.14) from the same material. The dashboard frame will fit neatly around the outside of the firewall, so it would be fiscally prudent to plan ahead and cut them both from the same sheet of 12"x48" steel.

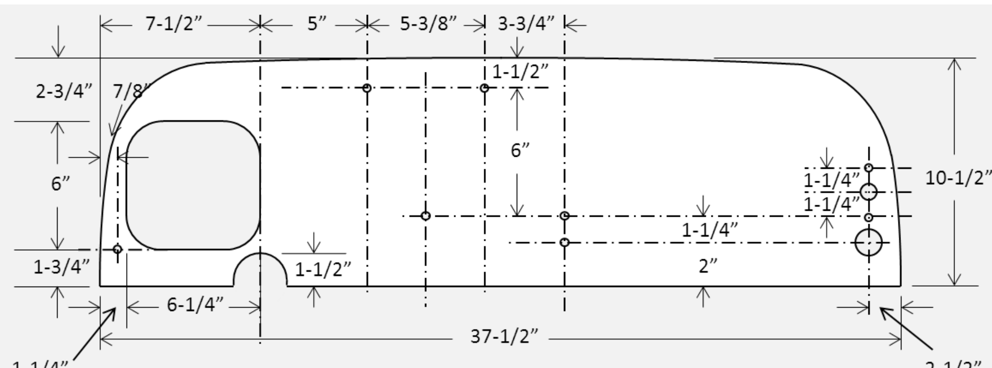

Figure 6.11

When cutting the firewall, use the 37-1/2"width of the base in the plans only as a guide. It's more important that the base is exactly as wide as the front of your scuttle frame. Which should also be 37-1/2" wide, but it's your frame, and it's not a showstopper if it's off a sixteenth of an inch or two. Make the firewall 10-1/2" tall to get the proper hood slope. A little taller is okay, but more than 11" and it'll start to reduce the sleekness index of your finished Locost.

The shape of the firewall is in part a matter of taste, but you would do well to stay close to the pattern shown here. Some builders like the sides leaning in a bit, but in our opinion vertical sides not only look better, they provide more protection in the cockpit from roadside debris kicked up by the front tires. You might also choose to make the top of the firewall flatter, but the slight curved shape will make the sheeting over the scuttle more rigid.

When you have the basic shape cut out, file all of the edges smooth, then cut out the large 6" x 6-1/2" hole for the pedal box recess. Best way for cutting this hole is to drill 2" to 3" holes in the corners with a hole saw, and then trim the edges between the holes with a cutting wheel.

Next cut the opening for the steering column. If you lay your engine bay shelf (figure 6.1) and firewall end to end, the cutouts for the steering wheel in both pieces should line up. Note that your firewall is slightly narrower than the engine bay shelf, because it intersects the shelf about 1" forward of the end.

The rest of the holes can be cut with a drill, except for the wiring harness hole, which needs to be 1-1/4" in diameter, and the cutoff switch hole, which needs to be 3/4". Both will probably need a hole saw. The rest of the holes are 3/8".

The three holes in a triangle near the center of the firewall are intended for mounting a Moroso 1-1/2 quart coolant tank. If you plan to use a different tank, you'll probably need a different bolt pattern. Be sure your coolant tank is as high on the firewall as it'll go without the cap interfering with the hood. A quarter inch clearance is all you need.

The next step is to add a 1/2" lip to the firewall, 1/8" from the outer edge to support the bonnet, a.k.a. hood. But before you do that, while you've got the firewall nice and flat, put a mark at the top in front, exactly on center. Not just a scratch, take some metal out. You don't want to paint it away later on. Having a mark at the exact center of the car will be a big help on future tasks.

The lip is made from a 5-foot length of 1/2" wide, 1/8" thick steel. Bend it to the shape of the top of firewall, and then a little more so it fits on the firewall about 1/8" in from the edge. Don't worry if it's not exactly 1/8", we'll make sure it's exact when we weld it on. A five-foot strip is a little long and the ends of the strip will stick down a little from the firewall, but don't worry about that either.

Before you start welding, make sure you're welding the strip to the front of the firewall, i.e. the side facing the engine. The strip won't work as well in back. If you're not clear which side is the front, maybe it's time to take a break. Hint: if the firewall looks like it does in figure 6.11, flip it over.

We're only going to spot weld this lip to the firewall, because it doesn't have to be all that strong, and any more welding and we'll warp it. Fifteen evenly-spaced spots will do it, so about one every 4". Start at the top and work your way left and right until you reach the lower corners. Before you start a weld, clamp the strip exactly 1/8" from the edge of the firewall. It might be tempting to reduce this distance because you think might be able to get better fit with the hood, but trust us, you'll need all of that 1/8".

The spot welds should be little more than tacks, but move the torch just enough to ensure metal melts on both the strip and the firewall. Your welds will be mostly hidden by the strip when the car is done, so don't worry too much about how they look.

When the firewall has cooled, trim the edges of the strip flush with the bottom of the firewall, and deburr all the holes. On the scuttle frame, file or grind the forward edge of the steering column mount plate until it's flush with the front of the scuttle, as shown in figure 6.12. Also grind away any weld beads at the front of the scuttle, for example where the bridge verticals were welded to the bottom scuttle tube. Once that's all done, we're ready to weld the firewall to the scuttle.

Clamp the firewall flush with the bottom scuttle tube, and with a carpenter's square make sure the firewall is exactly perpendicular to the scuttle frame. If it doesn't end up exactly perpendicular we can bend it slightly, but we'd like to avoid that if at all possible. Weld the firewall to the bottom scuttle tube and the steering support plate using stitches no more than 1" long and spaced a couple of inches apart.

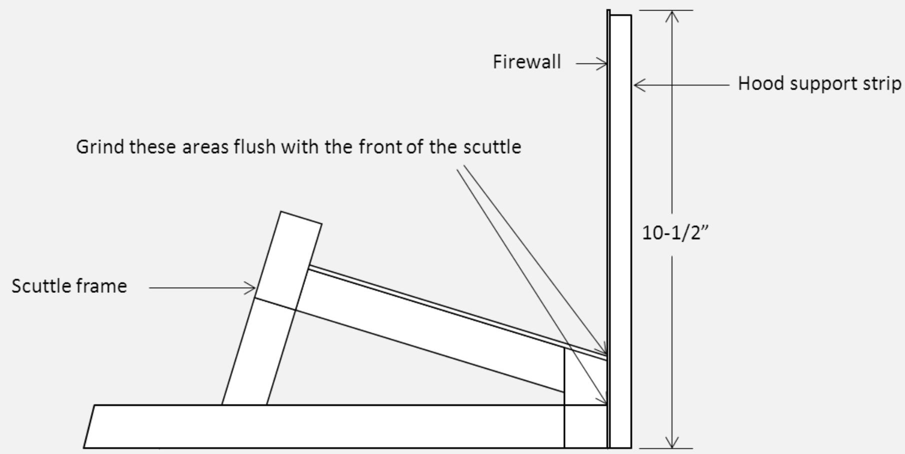

Figure 6.12

We can now build the pedal box recess. We'll make this from a 2-1/2" wide strip of 20 gauge steel, and a 6"x6-1/4" sheet of 18 gauge steel. The 20 gauge strip will start out about 18" long, and after it's bent in the shape of the recess, the ends need to be trimmed at an angle to rest flat on the steering column support plate, as shown in figure 6.13.

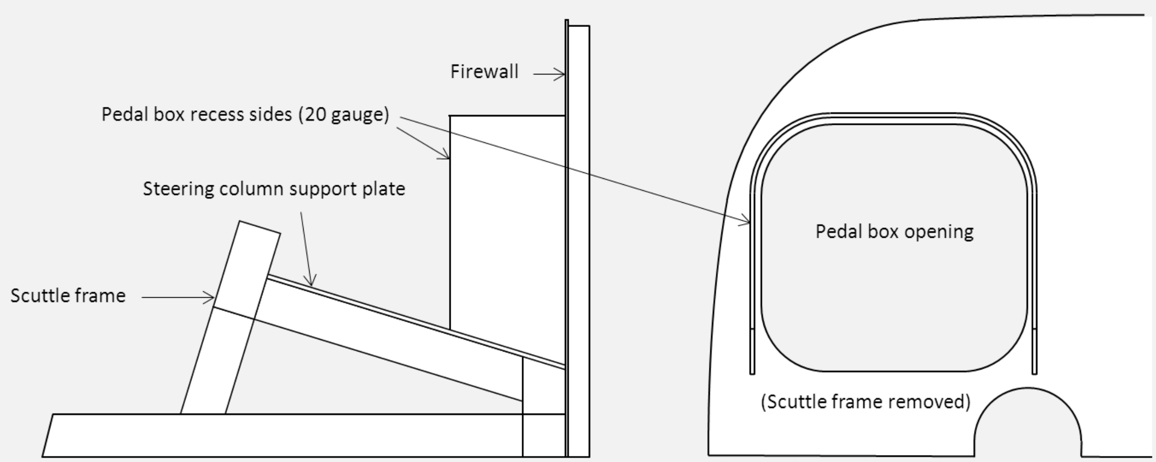

Figure 6.13

It's not necessary to have the 20-gauge strip perfectly flush with the edge of the pedal box opening, but get within an eighth of an inch or so. Tack the strip to the firewall in three or four places, and to and the steering support plate in a couple of places on each side.

Next, cut the back of the box out of 18 gauge sheet. It'll be easier to weld if you make it slightly larger than the opening in back, but don't make it too much larger. Tack the back to the sides and to the steering column support plate in three or four places. Finally, fully weld all of the seams. Take your time and do it in stages so the metal doesn't heat up too much.

If you want, when everything has cooled off you can file or grind the edges of the opening and the back plate flush with the sides. It'll look nicer and save a little weight. But we didn't do it and so far it hasn't been a problem. Except for the weight. And stuff may be building up in the crease between the steering support plate and the firewall. But how much harm could it do? Unless it's brake fluid. Okay, maybe some things to consider there.

f. Dash Mount

The dashboard mount is similar to the firewall, although possibly not as easy to make. You'll have to judge for yourself. The mount has only two parts, a five-foot long 1/2" wide strip of 1/8" steel, and a 16 gauge steel frame shown in figure 6.14. We hope you took our advice when cutting out the firewall and saved the remains from that sheet to make the dashboard mount frame.

Bend the 1/2" wide strip of 1/8" steel similar to the way you bent the bonnet support strip attached to the firewall. Get it close to the shape of the dashboard frame, and don't worry if it's not perfect right now because we'll get it perfect when we weld it to the frame.

Note that the shape of the dashboard frame is basically the same as firewall, although stretched vertically slightly because it's going to lean forward at a 17-degree angle. If you modified the firewall from the plans here, you'll probably want to make the same changes to the dashboard frame. Note also that the dash frame is the same height as the firewall, because it rests on the scuttle frame tubes, an inch higher than where the firewall sits. So it'll all work out. You'll see.

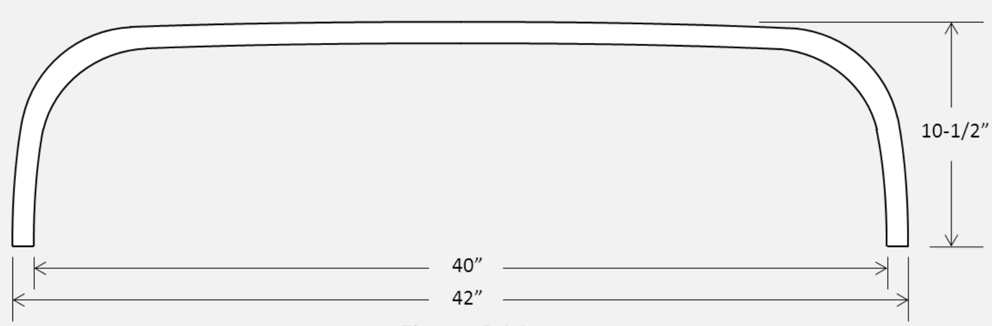

Figure 6.14

With the dashboard leaned forward 17 degrees, the top of the dash frame should be very close to 1/2" higher than the top of the firewall (0.4588" if you do the math). This will impart roughly equal slopes to the scuttle and the bonnet. This isn't critical and we're only talking about aesthetics, but you don't want your Locost to look odd, because people will comment.

Luckily we don't have to be terribly precise with the height of the dash frame right now, so long as we err on the side of making it taller than we need. We can always trim the feet later on if we need to make it lower. Making it higher will be more difficult.

Welding on the 1/2" strip will be similar to welding on the bonnet support lip, except for three things. First, we want this strip to be flush with the outer edge of the frame. Second, this strip will be buried under the completed scuttle and will never be seen by anyone. Ever. So we're going to worry even less what it looks like. Finally, unlike the firewall there is no front or back to the dashboard frame. So we won't worry at all about which side we weld it to. Like the bonnet support lip, your welds should be little more than tack welds, less than 1/2" long, spaced about 4" apart.

When the dash mount has cooled, grind away any overhanging bead flush with the 1/8" strip, so the scuttle sheeting will lie flat against the strip. Next trim the bottoms of the mount to the proper length and 17-degree angle, and we're ready to weld the dash mount to the scuttle. We're going to do this with the scuttle bolted to the chassis.

Clamp the dashboard mount in place on the scuttle. The feet should be square with the bottom scuttle frame tubes, 1/8" forward of the ends to provide for the thickness of the dashboard, and the frame should be leaning forward 17 degrees. Magnets may help keep the feet in place. To keep the dash mount leaning forward 17 degrees, clamp lengths of wood between the mount and the firewall.

Lay something flat across the top of the scuttle from the dash mount to the firewall. This is the slope of your scuttle. If you don't like it, this is your last chance to change it. If you want to see how your scuttle slope will match your hood slope, rest something 8-1/4" tall on the top of the upper nose tube, and then run a piece of string or tape between the fire wall and the top of this 8-1/4" object. That's the slope of your hood. Enjoy it.

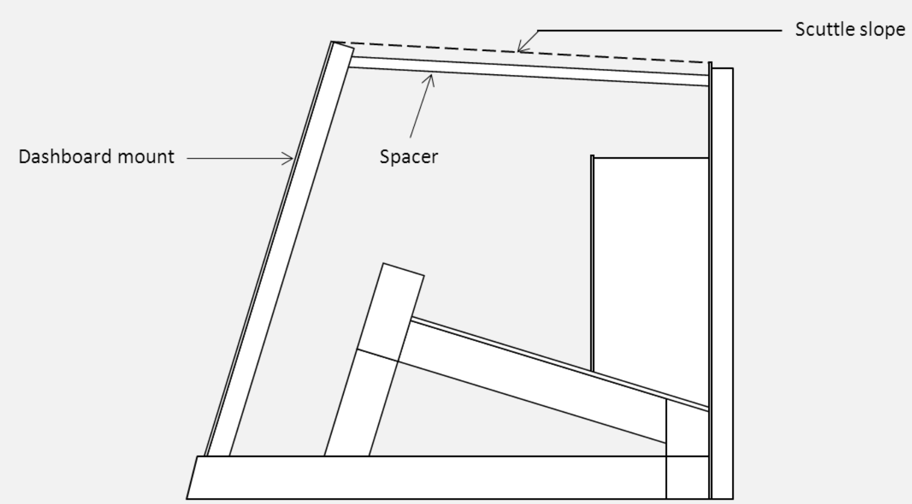

Figure 6.15

When you've got the slope of the scuttle matching the slope of the hood, or close enough, remembering what we said earlier about people and their disapproving comments, go ahead and tack the dash mount feet to the bottom scuttle tubes, and then fully weld them.

One more step before sheeting the scuttle, and that's to weld in spacers at the top of the scuttle. These will fix the angle of the dashboard at 17 degrees exactly, and will also provide some support when we bend sheet metal over the top of the scuttle.

Spacers can be made from just about anything long and thin, but we found the tops of 1" square 16 gauge steel tubing to work well. Cut the tops off so they're only about 1/4" thick or less. The number of spacers is up to you, but two is probably not enough and four is probably too many. But it's up to you. One note of caution though, don't place your spacers where they might interfere with the defroster vents. In fact, forget what we said about the number of spacers being up to you. Place one in the middle of the scuttle, and one 16" either side of the middle one.

Don't weld your spacers right at the top of the scuttle. In back, weld them just below the dash mount lip, and in front weld them about 1/4" down from the top of the firewall. Later you'll be able to hang zip ties from them, to help support the wiring harness.

On our Locost, we drilled a row of 1/2" holes in our spacers about 1-1/2" apart, to save weight. It also looks cool, but of course no one will ever see them. In addition, we welded a blind nut onto the top of each of our spacers, in case one day we ever wanted to bolt something to them. We've never used them.

g. Sheeting

We're going to sheet the scuttle with 20 gauge steel. Aluminum would be an option, but attaching it would mean using rivets, and the whole thing just wouldn't be strong enough for everything we want to do on the scuttle, at least in our estimation. So steel it is.

We could probably draw up a nice plan with the shape of the scuttle sheet and all the dimensions, and you could then scale up the plan and cut your sheet of 20 gauge from that, but the odds of that fitting your actual scuttle are somewhere between slim and none. So we're going to approach this from a different angle.

As it happens, just about everyone who ever built a Locost approached scuttle sheeting from the same angle. It starts with a 16"x60" sheet of construction paper. The odds of finding a sheet of construction paper that large aren't very good either, but it turns out you can tape smaller pieces together, and it'll work just the same.

Stretch the paper over the scuttle, or not stretch but, you know, keep it taught, and then tape the ends to the H and J tubes on the chassis. Next crease the paper slightly around the edges of the firewall, dashboard mount, and bottom scuttle tubes, and mark the creases with a felt pen. We like Sharpies, but any decent quality pen will work. It's just paper.

Now cut the paper along the lines. If this is difficult for you to do with scissors, you're not alone. Try a utility knife. Once the paper is cut out, lay it on your 20-gauge sheet and trace the edges of the paper onto the sheet with your felt pen. Then cut out the scuttle sheet along those lines. If you're anything like us, all of this transferring of lines will assure the sheet is marginally bigger than you need. Which may prove to be advantageous.

When you're done, your sheet should have a shape similar to figure 6.16. We caution you again to not use figure 6.16 as any sort of plan. It's just an example, and not a very good one.

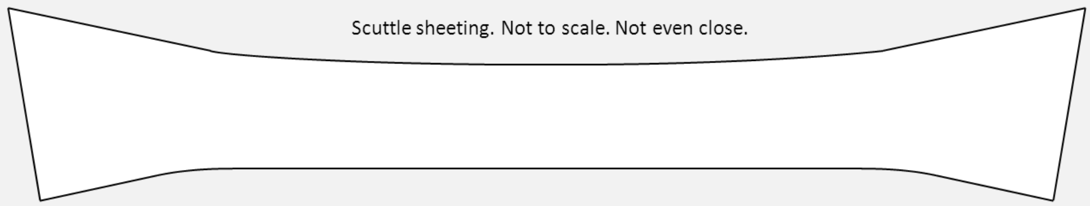

Figure 6.16

You can form the bends in your sheeting directly over the scuttle. It helps if the scuttle is bolted down to the chassis. Due to spring back in the metal, the most you'll be able to bend the sides is a little more than halfway. After that you can start using clamps. Don't clamp directly to the sheet. Use large strips of wood between the sheet and the clamp. The only place you really need to clamp the sheet is along the lower scuttle tubes.

With the sheet clamped in place, check the edges along the firewall and dashboard mount. You shouldn't have any gaps, and the sheet should extend to the firewall or slightly beyond all the way around. It should also extend to the dash mount all the way around, but you do have a wider surface to work with here with the additional 1/2" strip, although you'll note the strip isn't flat along the top of the scuttle, but angles down slightly.

When you're satisfied with the fit, which admittedly won't be easy, tack the sheet to the lower scuttle tubes at all four corners, and then remove your clamps. Remove the scuttle from the chassis and flip it over. Stitch weld the edges of the sheet to the lower scuttle tubes. Use welding clamps as necessary to keep the sheet tight against the tubes.

Finally, tack weld the sheeting to the firewall and dash mount frame. One tack every 4" or so will do it. More than that and your scuttle sheet will start to get wavy. It will anyway, but remember that this is going to be part of your bodywork, and a highly visible part at that. Take your time and don't make all of your tacks at once.

Clean up the edges of the sheeting with files or your grinder. Just so you know, files will take forever. You want the front of the sheeting flush with the firewall, and the back flush with the dashboard mount. On the lower edges, grind away any weld bead that sticks out or down. You'd like a nice square finish if at all possible. It'll look better.

This concludes the scuttle phase of your Locost build. We know it wasn't easy, and maybe didn't turn out quite as well as we hoped. But it'll do the job, and it'll look better with paint. Maybe.

You'll need to use the scuttle in the next chapter, and you'll have to drill a couple of 5/16" holes in the pedal box recess to fasten the pedal box in place. Down the road you'll also need to add defroster vents, and drill holes for the rear view mirror, the side mirrors, and the windshield frame. So the scuttle isn't "done" done, but it's close enough and it's time to move on.

7. Steering and Pedals

We're next going to install the steering mechanism, along with the brake, clutch, and accelerator pedals. These controls are already a tight fit in an MGB. In a Locost, they're on top of each other. Which means we're going to have to be very accurate with our measurements. If we get it right, all of the pedals will fit in the driver's foot well, the steering wheel will be centered on the driver's seat, and we'll be able to close the bonnet. Win-win.

We're not going to need a ton of metal for this part of the build, but we'll need a few parts that we don't currently have, including an additional MGB steering column universal joint:

5 feet of 1" x 1/2" rectangular 16-gauge mild steel tubing
1 foot of 3-1/2" square 1/8" wall mild steel tubing
1 foot of 1-3/4" square 1/8" wall mild steel tubing
2 feet of 1-1/2" x 2" rectangular 1/8"wall mild steel tubing
1 sheet of 14 gauge steel measuring 8-1/2" x 11"
1 foot of grade 5 9/16x18 threaded rod
2 9/16" thread 1-1/2" long forged steel lug nuts
1 MGB steering shaft universal joint
1 3/4" steering shaft support bearing
1 10" x 3/4" steering shaft extension, 48-spline at both ends

We're also going to need quite a few nuts and bolts of the 1/4x28 and 5/16x24 varieties, but we can pick these up as we go. We found it useful to buy a box of 50 at a time, but we also had a lot left over. So it's your call. Two specialty bolts we will need are the clamp bolts on the steering column universal joints.

a. Accelerator Pedal Box

In an MGB, the pedal box for the clutch and brake sits 15" above the floor of the driver's foot well. The frame of our Locost is only 13" tall, so to get the pedals in the right place we're going to have to build a mount on the engine bay shelf for the pedal box, to raise the pedals another two inches.

This clutch and brake pedal box mount will be supported on the outboard end by a slice of 3-1/2" steel tubing, and on the inboard end by the accelerator pedal box, which from now on we're going to call the gas or throttle pedal box because it's easier to type and we're never quite sure how to spell accelerator. We'll make the gas pedal box out of the same material we used for the steering column support beam, 1"x2" rectangular 16-gauge tubing. It should be 8" long, but don't worry if it's slightly shorter than that.

Start by cutting 1/4" off one of the 1" sides of the tube. The remaining piece should be exactly 1-3/4" wide. On the side opposite the side you cut off, drill two 5/16" holes along the centerline. Drill these holes 7" apart, 1/2" from each end. Positioning isn't critical, but get it close. Now weld two 5/16x24 blind nuts on the inside of the tube, behind these holes. It won't be easy to weld all around the nuts, or even possible, but weld as much as you can.

Next drill three holes for the throttle cable stop in the top of the box, along the centerline. The middle hole should be 2-1/2" from the aft end of the box, as shown in figure 7.1. As always, rather than trust our crude drawings, use your own throttle stop bracket to align the holes correctly.

It will be a big help later on if you could now weld some #10-32 blind nuts underneath the outer two holes. It will be even more difficult to reach these nuts with a MIG torch, however you can buy #10-32 weld nuts that have flanges on either side, and it will just be possible to reach in there and tack the ends of these flanges to the inside of the box. If you can't do it, don't worry about it. Attaching the throttle stop later on will be difficult, frustrating, and mind-numbing, but still possible.

When that's cooled, cut out two 1" x 1-3/4" pieces of 16 gauge steel and weld them to the ends of the tubes. You should have something that's starting to look like figure 7.1, minus the flange.

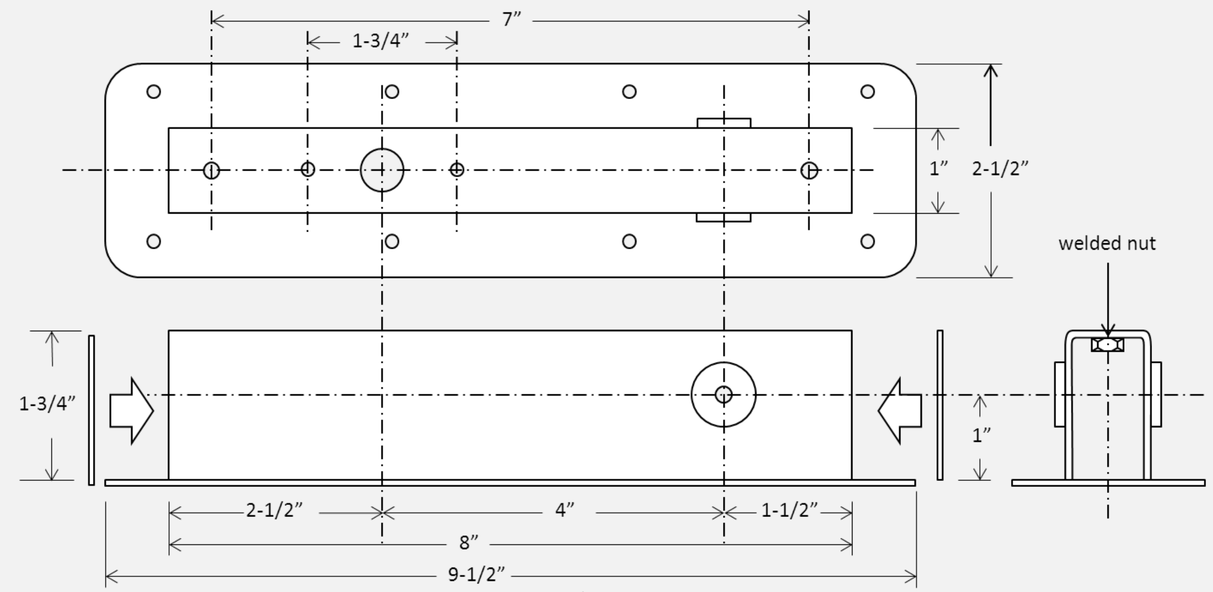

Figure 7.1

Next drill a 3/8" hole for the throttle pedal shaft 1" from the bottom and exactly 4" forward of the center of the middle hole for the throttle stop. Reinforce this hole on both sides of the box by welding on 1/8" thick collars made from 3/4" tubing with a 3/8" hole in the middle. Alternately you could make these out of 1/8" sheet with a 3/4" hole saw, if you have a 3/4" hole saw.

Last thing to do is weld a flange made from 16-gauge sheet to the bottom of the gas pedal box. The dimensions of the flange are 2-1/2" by 9-1/2", which provides a 3/4" mounting surface. Round the corners for that extra special factory look, and make sure there's a 1" wide slot in the middle so we don't close off the bottom of the box. That would be bad. Stitch weld the flange to the box slowly and carefully so the flange stays relatively flat.

You may be tempted to drill the mounting holes in the flange before you weld it on. We recommend you wait until after you weld, and drill the holes through both the flange and the engine bay shelf at the same time. The reason for this will be clear in a minute.

Clamp the engine bay shelf to the chassis exactly where you want it to go when it's welded on. Look underneath the shelf, or possibly through the slot for the gas pedal, and note the location of the nearby 1" x 1/2" transmission tunnel tube. With a felt pen or maybe masking tape, mark the location of the edges of this tube on top of the engine bay shelf. Be conservative and make your marks a little wider than 1/2" apart. Next, draw a dashed line down the middle between the two edge marks.

Now clamp the gas pedal box to the engine bay shelf directly over the slot for the gas pedal. Line it up square with the shelf. Note that the transmission tunnel tube runs below part of the flange. Note also that figure 7.1 shows eight flange holes. Most of the eight holes will clear the transmission tunnel tube, but not all of them, and it's now up to you to determine which of the eight holes you can actually use.

Mark the location of the holes on the flange with a felt pen, close to where they're shown on the plans. If a potential hole clears the transmission tunnel tube easily, you can use it. If it lines up with the exact center of the tube, you can also use it. If it lines up near an edge of the tube, you can't. To use a hole you need at least 1/8" clearance between the hole and the edge of the transmission tube.

On our Locost we ended up using seven holes. We'd have been okay with six. One of the holes did line up with the center of the transmission tunnel tube, and that hole now goes all the way through the tube. You can't tell by looking at it. Unless you look underneath.

You may be asking yourself, isn't this kind of a poor design? Couldn't we move the transmission tunnel, or use a different pedal box? The answer is yes and no. Yes it's a poor design, and no we can't move anything. Things fit where they fit. Remember, we're trying to stuff as many M.G. parts as we can in this thing, so there are going to be compromises. If it's any consolation, this is probably the worst of it.

Go ahead and drill 3/16" holes through the flange and engine bay shelf at your marked locations. You may at this point want to weld #10-32 nuts underneath the shelf over these holes, to make it easier later on to attach the flange. If you do this, the shelf will warp. It won't warp a lot, and you'll be able to eliminate just about all of it when we weld the shelf to the chassis.

b. Brake Pedal Box

The brake and clutch pedals in the M.G. Locost will use the stock MGB pedal box. Installing the pedal box will be a challenge as we will need to squeeze all of the brake, clutch, and steering components into the same space on the rear engine bay shelf. So long as we're careful with our measurements, it'll all fit.

As we noted earlier, the pedal box will be mounted on a platform raised 2" over the engine bay shelf. The right side of this platform will be supported by the gas pedal box, and the left side will be supported by the part we're going to make next, which we're calling the pedal box platform support, in a possibly misguided attempt to be a little less confusing.

Our starting point for this piece will be the 3-1/4" square hole in the engine bay shelf. The size of this hole is not coincidentally the same as the inside dimensions of our 3-1/2" square 1/8" wall steel tubing, so we first need to cut a 1-3/4" slice from this tube. Make sure both ends of the tube are cut, ground, and filed perfectly flat and square. A milling machine is ideal for this, or so we've been told.

Next cut four lengths of 1-3/4" square tubing, two 3-1/4" long and two 1-1/4" long. Cut off one side of each to form U-shaped brackets 1" tall as shown in figure 7.2. Round the ends so they look nice, and then drill 1/4" holes in the locations shown in figure 7.2.

Weld these pieces to the 3-1/2" square tube as shown. It'll be easy to weld the tops and bottoms, not so much the middle, but do the best you can. These won't be high-stress welds so it's not critical, but that doesn't mean it's okay to be sloppy. Show some pride.

We'd like the 3-1/2" tube to be nice and flat on both sides, in fact that's kind of important, so grind all of the weld beads flush with the top and bottom of the 3-1/2" tube. Mark one side of the support piece as the top, and the other side as the bottom.

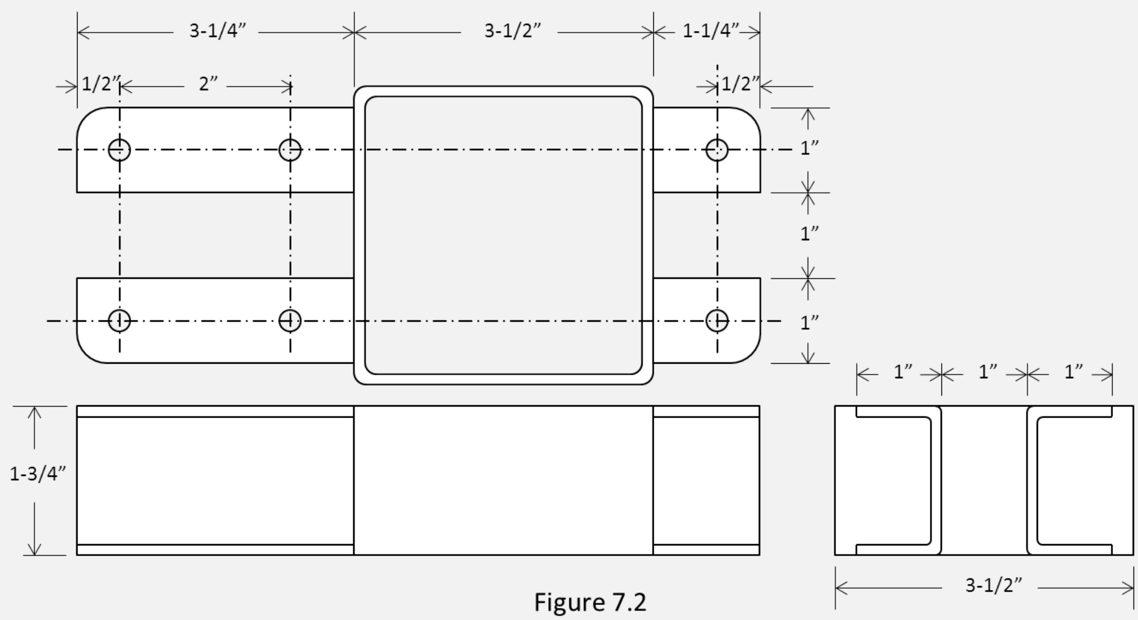

Figure 7.2

We now want to clamp this piece to the engine bay shelf, directly over the pedal opening, with the square holes nicely lined up and the longer arms pointing toward the rear of the shelf. Make sure the bottom of the support is in contact with the shelf. Using the 1/4" holes in the support piece as a guide, drill six holes through the engine bay shelf.

The next piece we need to make is the pedal box platform. This is cut from 14-gauge steel to the dimensions shown in figure 7.3. One corner needs to be rounded to clear the bonnet, but that corner also has to support the pedal box cover, so don't trim it any more than shown.

This platform has three sets of holes, in addition to the big square one for the pedals. The first set of six 1/4" holes will be used to bolt the platform to the support piece we just welded up. The two 1/4" holes at the other end will be used to bolt the platform to the throttle pedal box. The six 5/16" holes will be used to attach the brake and clutch pedal box to the platform. This will all become more clear eventually. We hope.

Cut the 3-1/4" square hole in the platform, but don't drill any of the other holes just yet. Clamp the platform to the top of the support piece—the side marked "top"—with the square holes lined up. Using the 1/4" holes in the support piece as a guide, drill six holes through the platform.

The next step is to weld a dozen 1/4"x28 nuts to the support piece. This won't be easy, but without those nuts, attaching the platform to the support and the support to the engine bay shelf will be all but impossible. You should be able to weld at least the eight corner nuts on two or three sides. The four middle nuts will test you a little, but get enough weld bead on there to hold the nuts in place up to about 15 ft.-lbs. of torque.

The next two holes we need to drill are for the gas pedal box. These will be tricky. Start by bolting both the gas pedal box and the platform support to the engine bay shelf. Then bolt the platform to the platform support, with the right hand side resting on the gas pedal box. If you're lucky or good, either one, the platform and gas pedal box will line up nicely. Ours didn't, but it was close enough and we're sure you can do better.

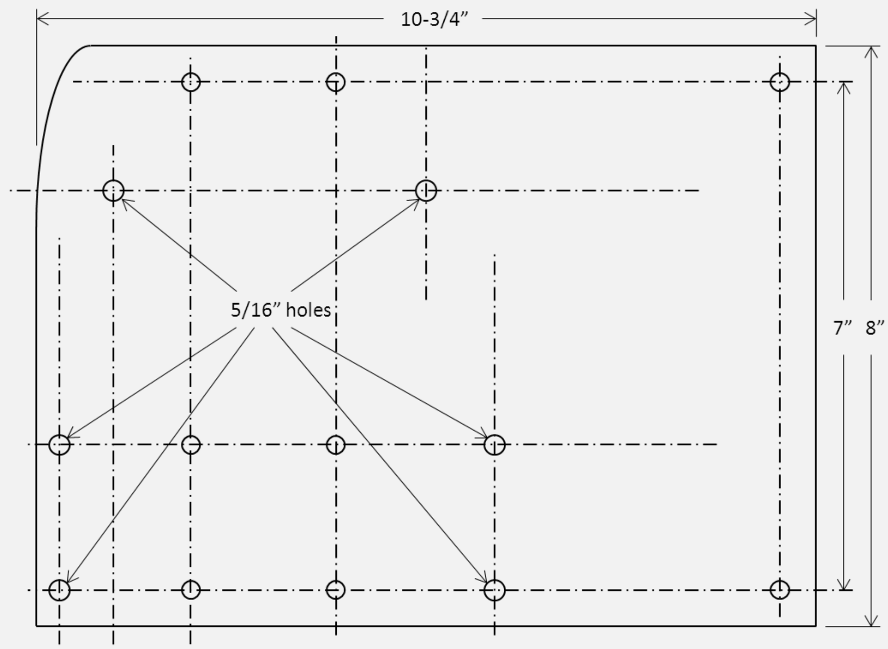

Figure 7.3

From underneath the engine bay shelf, mark the location of the holes in the gas pedal box on the underside of the platform, using a felt pen, or something else skinny enough to fit through the welded nuts and holes. Unbolt the platform from the support piece and drill 1/4" holes at these marks. Replace the platform to see how well your holes line up, and then enlarge the holes as necessary until you can get a 1/4" bolt through the platform and into the gas pedal box.

You also need to drill three holes in the platform for the throttle cable stop, duplicating the positions of these holes on top of the gas pedal box. Start with the 1/2" center hole, then mark and drill the outer two holes. Enlarge these as necessary, too.

To drill the last six holes in the platform, we're going to need to clamp the engine bay shelf to the chassis in very close proximity to the position it will eventually be welded. It wouldn't hurt, once you've got the shelf precisely aligned, to drill a couple of 1/8" holes through the shelf and J tubes. Using clecos or a couple of 1/8" thick rods, you'll be able to place the shelf in the exact same location every time. After the shelf has been clamped in place, bolt the scuttle onto the frame.

Bolt the platform support and gas pedal box to the shelf, then bolt the platform to both of those. Now set the MGB pedal box on the platform, as shown in figure 7.4. The two arms extending from the back of the pedal box will fit neatly into the pedal box recess on the firewall. Slide the box back until the arms contact the back of the recess, and align the box side to side over the 3-1/4" square pedal opening in the platform and support. Then clamp the pedal box in place.

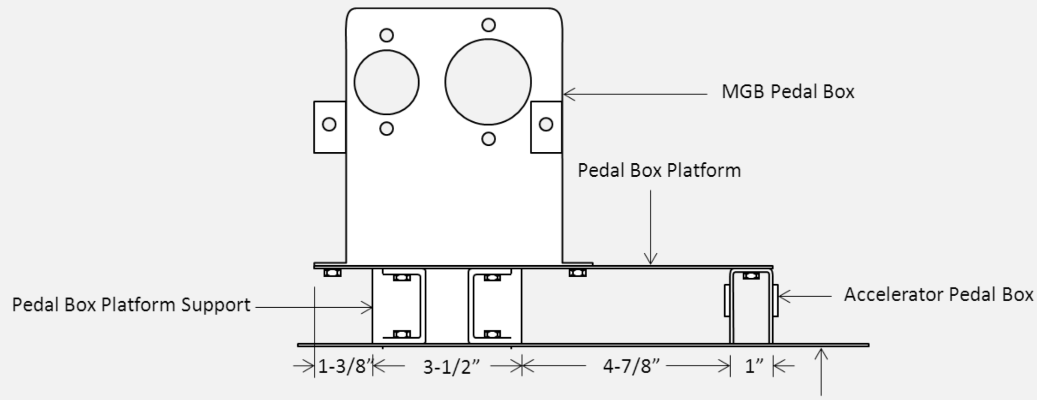

Figure 7.4

With the pedal box as far back into the pedal box recess as it can go, the pedal opening in the pedal box should line up with the pedal hole in the platform, within 1/4" or less, as in figure 7.5. If the pedal box is too far back, shims can be used between the pedal box and the pedal recess back plate. If it's too far forward, you may need to shorten the pedal box arms, or else pedal movement could be restricted.

Using the pedal box as a guide, mark the location of the six 5/16" holes on the platform. The pedal box holes are slotted, so give yourself a little installation tolerance by centering your holes in the slots.

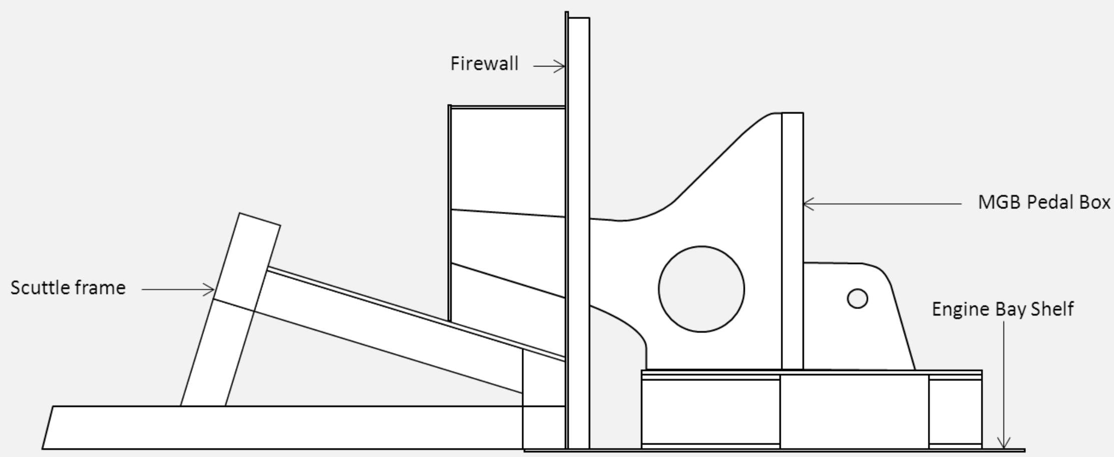

Figure 7.5

Remove the platform and drill the six holes. Flip the platform over and weld five 5/16x24 nuts over each of the holes, except the one closest to the 3-1/4" square hole. Whenever we install the pedal box, we'll have to use a nut and bolt in that hole, and depending on clearance, the nut may have to be shaved a little. Not a big deal because the hole is easily accessed, and we can worry about shaving nuts later.

Bolt the platform back onto the support piece, and bolt the pedal box to the platform, at least through the five holes with welded nuts. Make sure the pedal box is all the way up against the back of the recess. Now, using a suitably thin marking device, mark on the back of the recess the location of the two nuts on the end of the pedal box arms. Remove the pedal box and drill two 5/16" holes through the back of the pedal box. Refit the pedal box and make sure everything still lines up.

Our last step is to fit the pedal box cover. This wouldn't be such a big deal if it weren't for the fact that the brake light switch is attached to the cover and has to line up with the brake pedal. Clamp the pedal box cover tightly over the pedal box, and using the cover as a guide drill four 3/32" holes through the pedal box support platform. Remove the platform and flip it over, and then weld #10-32 nuts over the two rear holes. The front holes are too close to the support piece for welded nuts.

Fitting the pedal boxes to your Locost is one of the trickiest jobs of the whole build. We didn't like doing it. We didn't even like writing about doing it. Take your time, be as accurate as possible with the measurements, and it should all work out.

c. Steering Rack Mount

If you pay too much attention to the Locost forums on the Internet, you may find yourself overly concerned with a driving condition known as bump steer. The Locost book has probably the most accurate assessment of the causes and effects of this condition, so we won't repeat it here, but suffice it to say that our M.G. Locost will not suffer from bump steer because the book is right and we're going to do what the book says. This won't necessarily prevent arguments from self-proclaimed suspension gurus on the Internet, but you'll eventually learn to ignore them, at least when it comes to bump steer.

So to begin with, we're not going to molest our stock MGB steering rack. We'll use it in its standard length, and our steering rack mount will be that much stronger for it. To make the mount for the rack, we're going to need the following pieces of steel tubing:

6 feet of 1" x 1/2" rectangular 16-gauge mild steel tubing
1 foot of 1" square 16-gauge mild steel tubing
1 foot of 1" x 2" rectangular 1/8"wall mild steel tubing
4 feet of 16 gauge 3/4" DOM tubing

All of the steering rack tubes will be cut to fit. Start by cutting two 10" lengths of 1" x 1/2" 16-gauge tubing, and angle the ends so they fit between the LA and LB tubes in front, and FU1 and FU2 in back, as shown in figure 7.6. Orient the tubes so the 1/2" sides are vertical and the 1" sides are horizontal. The ends of the tubes will have to be angled in two planes, and it's probably best to grind and file the horizontal angles first, then grind the vertical angles until you can get the front and rear of the tubes to the correct height. Note that you'll probably have to grind the fronts of these tubes to fit around the weld beads for the lower wishbone pickup brackets. Don't be tempted to grind the bracket beads.

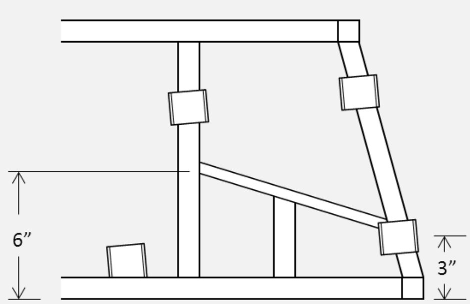

Figure 7.6

Clamp the tubes in place, double check your measurements, and sight across both tubes from the side to make sure they're at the same angle. If they look good, go ahead and tack weld the tubes to LA and LB in front, and FU1 and FU2 in back.

We next want to fit two crossbars between the tubes we just tack welded, using the dimensions in figure 7.7. Note that the ends of these tube have simple angles in one plane only, and you only need to keep trimming them until they're the proper distance from the FU tubes. The measurements shown aren't critical, and the tubes don't have to be perfectly straight or parallel, but try to make them look nice. When the tubes have been fitted and clamped in place, tack weld them to the outboard supports.

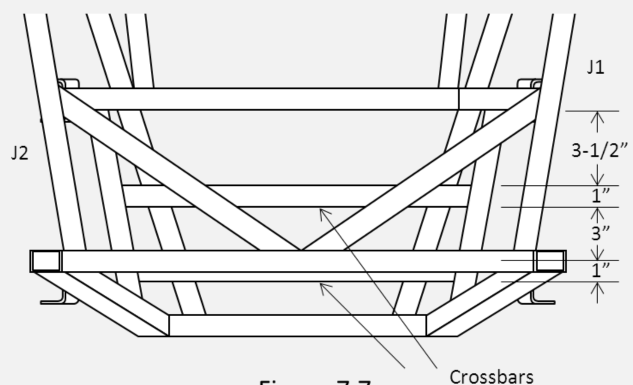

Figure 7.7

Next, cut two 4" lengths of 1" square tubing, and angle the tops to match the slope of the mount. Fit these tubes between the F tubes on the bottom and rear cross bar on top, as shown in figure 7.6. These tubes should be perfectly vertical from both the front and the sides. Fit them in place and tack weld them at the top and bottom.

You can now fully weld the tubes to the chassis and to each other. It'll be easier to do this if you can flip the chassis on its side and upside down. Make sure you don't have anything resting on the chassis when you do that. We've heard of incidents. Okay, we've had incidents.

To attach the steering rack to the mount, we're going to make two U-shaped channels like the ones in figure 7.8. Start with 5" lengths of 1" x 2" rectangular 1/8"wall tubing, and cut off one side to make them 1" tall.

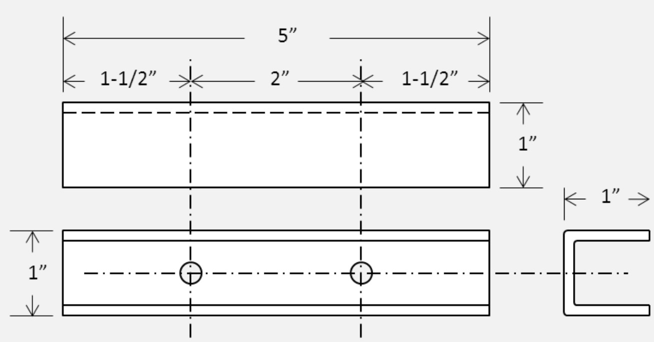

Figure 7.8

Rather than measure the holes off the plans, use the steering rack to make sure the holes in the channels are the correct distance apart, and then weld 5/16”x24 blind nuts inside the channels. Once again, the exact placement of these channels on the rack is not critical, but looks count for something.

When the channels have cooled, bolt them to the steering rack, and then set the whole assembly in the car, with the channels resting on the mount. You’ll notice that we have a lot of room to move the rack around, front to back and side to side. This is where we want to start being precise. We want the rack to be centered on the frame, and perpendicular to it. We want the bellows to clear the LA and LB tubes by just a quarter of an inch.

The steering column should now reach back into the engine bay, and the very top of the column should be right around the height of the bottom of the J tube. Don’t worry if it’s a quarter inch higher or lower, but if it’s off by much more than that, you may need to grind the bottoms of your mounting channels until the steering column is at a better angle. Don’t grind away too much, because we don’t want to lower the rack by any appreciable amount. We can always raise the rack slightly by moving it back on the support structure, but we don’t want the bellows more than 1/2" from the LA and LB tubes or it’ll adversely affect the Ackerman.

When you’ve got the steering rack clamped in place, tack the channels to the support structure. Then unbolt the steering column and fully weld the channels. This will be a challenge in some of the corners, or actually in all of them, but once you’re done, your steering rack can be bolted into place, although threading it through the maze of tubes may require a little trial and error.

d. Column Extension

Everything in an M.G. Locost is about 9” farther back than it is in an MGB. Well, not everything of course, but you’re definitely sitting farther back, only a few inches from the rear axle, and the engine, seats, pedals and other big pieces are set back 9” from the standard MGB wheelbase. This is what gives the Locost its better than 50/50 weight distribution and vastly superior handling. In theory.

As a result of this shifting of major components, we need to extend the steering column by 9”. We can do this quite easily, if not cheaply, by purchasing a short length of splined tubing, an additional MGB steering column universal joint, and a 3/4" spherical bearing to support the short length of splined tubing. We’re also going to need a 2” length of 1-1/2” x 2” tubing to mount the spherical bearing.

You probably can’t buy a 9” length of splined tubing, but you can buy a 10” length and shorten it. The MGB steering column universal joints accept 3/4" shafts with 48 splines, so that’s what you need. You can buy a new universal joint from your favorite M.G. parts supplier for around $75, or pick one up on eBay for about a third of that. Plus shipping.

To fit the extension, set the steering column in place between the P and Q tubes, and bolt it to the forward bracket welded to the Q tube. Set the scuttle in place and bolt the back of the column to the scuttle mount. Then insert the steering rack up front, but don’t bolt it to its mount yet. You should have a good-sized gap now between the steering column and the shaft from the steering rack.

To fill this gap, slide the 3/4" spherical bearing over your 3/4" extension shaft, and then fit universal joints to each end. Make sure the universal joints are in the same alignment, or else your steering will be uncomfortably non-linear. Next fit one universal joint to the end of the steering column, and the other universal joint to the shaft from the steering rack. To do this, you'll probably need to move the steering rack around quite a bit

Once the universal joints are connected, bolt the steering rack to its mounts, sliding the extension in or out of the universal joints as needed to fit. With the rack housing in place, you should now be able to move the rack and tie rods back and forth by turning the steering wheel. Or if the steering wheel isn't attached, then by twisting the steering column.

So that's cool, but there's probably a little play in the steering. To eliminate this play we need to build a mount for the spherical bearing that's currently hanging from the extension shaft. Start by cutting a 2" length of 1-1/2" x 2" 1/8" wall tubing. Cut a 1" notch in the bracket so it fits neatly around J1 as shown in figure 7.9.

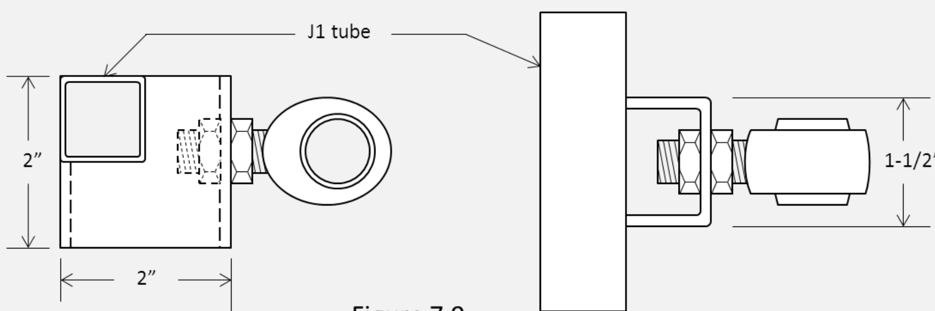

Figure 7.9

You may notice the lack of additional dimensions in figure 7.9, such as the location of the spherical bearing in the bracket, and the location of the bracket on the J1 tube. This is not an oversight. We don't know exactly how this bracket will fit in your Locost.

So we need to figure that out, and we'll start by swinging the spherical bearing up until it's perfectly horizontal, and then measuring the distance from the center of the bearing to the top of the J1 tube. Drill a 3/4" hole in the center of the bracket exactly this far from the notched end.

Screw a 3/4" jam nut onto the spherical bearing, then fit the bracket onto the bearing through the hole you just drilled. Now clamp the bracket along J1 somewhere near the forward end of the extension shaft, in a spot where the bearing shaft has enough threads protruding to fit another jam nut inside the bracket. Tighten the two jam nuts together, the shift the bracket back and forth on the J1 tube until the steering shaft turns freely in the bearing. When it all looks good, tack weld the bracket to the J1 tube. The steering should feel a lot better now, and if nothing binds, go ahead and take everything apart and fully weld the bracket to the J1 tube.

e. Tie Rod Extensions

With that out of the way, the steering column is completely done. All we need to do now, in order to be able to steer the car, is to connect the tie rod ends on the steering rack to the steering arms bolted to the front suspension swivel axles. If we do this, however, we'll have a considerable amount of toe in, because the front track on your Locost is nearly 3" wider than the track width of an MGB, and there is nowhere near that much toe in adjustment on a stock MGB steering rack.

So we need to extend each tie rod by an inch and a half, and the best way to do this is to buy a length of threaded rod, cut off two pieces, and connect each piece to the end of each tie rod with a long coupling nut. Because we want the steering to work flawlessly in every situation, we're going to make sure that we use the finest threaded rod and coupling nuts available, and we're going to tighten everything down with red Loctite, or one of its cheaper competitors, and as much torque as we can muster using big open-end spanners.

We're also going to be very precise with our measurements, because the threaded portion of an MGB tie rod is not very long, and so when we're done we're going to have a very small range of adjustment, and we want our actual tie rod length to end up within that narrow range.

You'll need a length of rod with 9/16x20 threads. Be sure to get these in at least grade strength 5, which is probably not the stuff sold at your local hardware store, unless you have a really awesome local hardware store. Cut two lengths exactly 2-1/2" long. File one end of each perfectly flat, and file the threads on the other end so that it accepts a 9/16" nut easily.

The next thing you'll need is two forged steel nuts, 9/16"x20, at least 1-1/2" long. We found shiny chrome lug nuts online that met this description, although they had closed ends that had to be sawed off. In any case you want the nuts to be exactly 1-1/2" long, and if they're longer than that they'll need to be trimmed.

Referring to figure 7.10, screw one of the forged nuts exactly half way (3/4") on to the flat end of one of the 2-1/2" threaded rods. Spin a jam nut on the other end to secure the forged nut in place. Apply red Loctite to the threads, and torque the jam nut to at least 80 ft.-lbs. Do the same thing with the other extension rod.

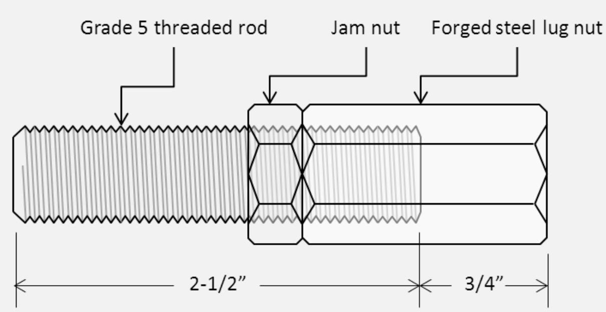

Figure 7.10

We next need to trim the ends of the tie rods. Referring to figure 7.11, remove the rod end (ball joints), then cut off all but the last 1-1/8" of the tie rod threads. That'll amount to about an inch of the tie rod.

File the severed end of the tie rod flat, then screw on a jam nut all the way to the end of the threads. Apply red Loctite to the tie rod threads, and screw on one of the extensions until the threads bottom out. Tighten the extension onto the tie rod as much as you can, then screw the jam nut on the tie rod toward the forged nut. Tighten the jam nut against the forged nut as close to 80 ft.-lbs. as you can get. That's one tie rod down. Repeat the process with the other tie rod and extension.

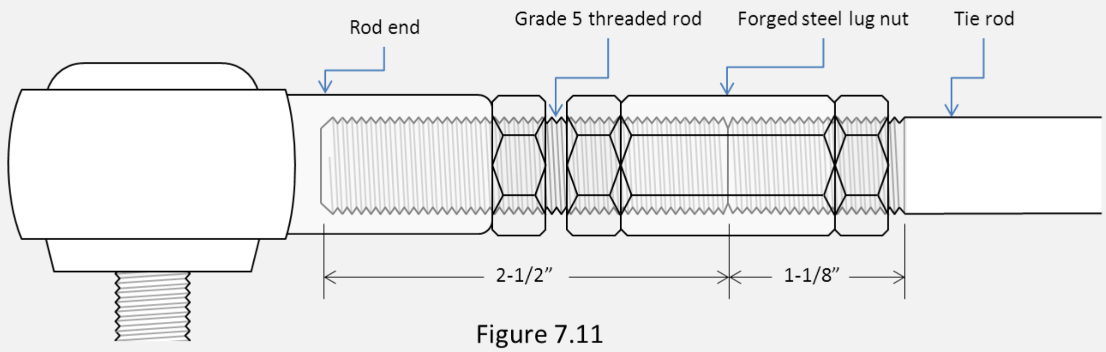

Figure 7.11

Screw jam nuts loosely on the extensions, and then reattach the rod ends. These last jam nuts will be used to lock the rod ends in place. We'll never tighten them to much more than around 40-50 ft.-lbs., and these will be the only nuts we ever loosen when it comes time to adjust toe in.

So that wraps up our steering and pedals, and in theory if we assembled everything we have so far we could push the car out into the street and even coast down hills, so long as we didn't have to stop. But we'll hold off on that for now because we could get into trouble, and also because we want to strip everything down to the bare frame next so we can start attaching more brackets.

8. Frame Details

I know it seemed like we were all done with the frame a long time ago, and we were, but it turns out there's a little more to a Locost frame than a bunch of tubes. From now on, just about every part we add to the car will need to be attached to the frame. We don't want to weld any of these parts to the frame, because we may want to remove some of them in the future, so we'll bolt everything on instead. However, we don't want to stick bolts directly through the frame tubes if we can help it, so that leaves us only one option, and that's to weld tabs and brackets to the frame so that we can bolt parts to the tabs and brackets.

The good news is, most of these tabs and brackets will be easy to make and easy to weld. The bad news is, there will be a ton of them. They'll add weight, use up a lot of metal, and we'll eventually get pretty tired of making them. Most of our tabs and brackets will be over-engineered, and could possibly be lightened, but that would involve even more work, so we'll expect you to build everything exactly as described here, even though, as always, it's up to you.

One thing to keep in mind whenever you're welding anything to a frame tube: the tube is hollow. This is obvious of course, but what it means is that all of the strength of a tubs is at the edges. The middle is comparatively weak. Any kind of bracket, tab, flange, or gusset therefore should be welded to the edges of a tube, and not the middle. A tab can also be welded so it overlaps the face of a tube, and it will still derive its strength from where it attaches to the edges of the tube.

Although there is actually no official distinction between a bracket and a tab, at least so far as we know, we will generally refer to flat pieces of metal as tabs, and bent pieces of metal as brackets. But not always. Don't hold us to it.

Many of our tabs and brackets will be made with 16 gauge sheet steel. We should have enough of this left over from our previous work with the scuttle, so we won't need to buy any more. Many other tabs and brackets will be made from 1/8" thick steel plate. We don't have nearly enough of that, so we'll order some. We've never been able to find this thickness of steel in anything wider than 6", but that's okay because none of our brackets or tabs are that big. If you can find cold rolled steel in wider sheets and it saves you money, go for it. Otherwise, get the following:

10 feet of 6"x1/8" mild steel bar or plate
6 feet 2"x1/8" mild steel bar
4 feet 1-1/2"x1/8" mild steel bar
10 feet of 1"x1/8" mild steel bar
1 foot of 1-1/2"x3/16" mild steel bar

We found it easiest to cut our brackets and tabs with an angle grinder and cutoff wheel. It takes a little effort to stay within the lines, but in most cases a misshapen bracket will function just as well as a shapen one. Although it won't look as good.

Whenever you're making several of the same tab, it's nice if you can make them all the same size. Sometimes you can clamp or bolt several of them together and file them as a group. This is not a requirement, however, and tabs are generally not placed so close together that anyone would notice. But you might.

a. Seat belt brackets

We'll start with something easy. We'll need a total of four seat belt brackets, and they will all be the same size. We won't try to lighten these particular brackets, because we may have to test their ultimate strength someday, and we'd rather not worry that they'll be up to the challenge

Cut your four seat belt brackets out of 1/8" thick steel using the plan in figure 8.1. You can start with a 6"x3" rectangle, and it'll be okay if the brackets end up slightly smaller after cutting and filing. But no more than 1/8" smaller.

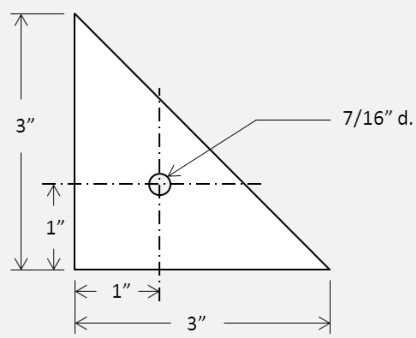

Figure 8.1

Drill a 7/16" hole in each bracket at the location shown in figure 8.1, and weld 7/16x20 nuts over each hole. Tack weld the brackets to the frame in the locations shown in figure 8.2, making sure that the brackets are flush with the inside edges of the frame tubes, and the nuts are on the outside.

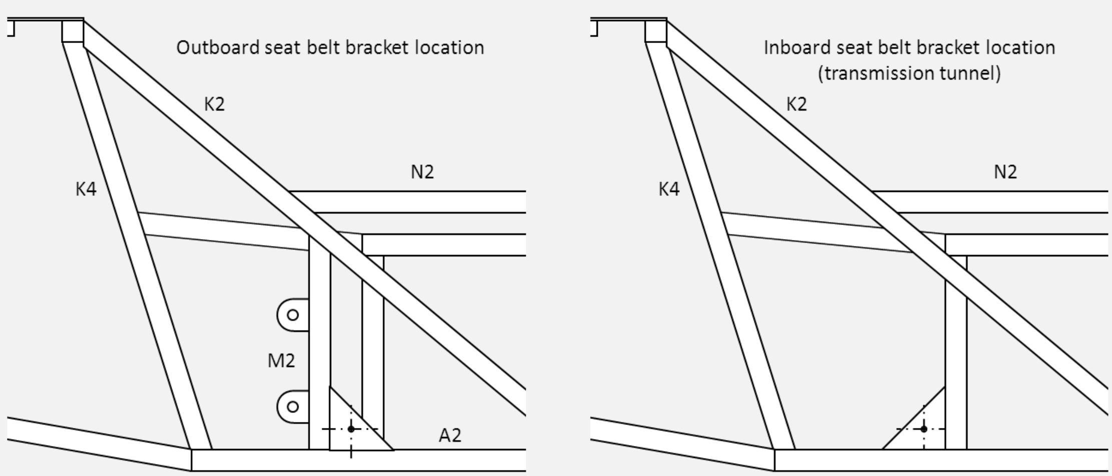

Figure 8.2

Double check your bracket arrangement, and if it looks like you'll be able to attach seat belts to the brackets when the car is done, go ahead and fully weld the brackets to the frame. Because you're welding 1/8" steel to 16 gauge, you're unlikely to get full penetration on the 1/8" brackets, unless you're really good. Even then, we think it's still a good idea to weld both sides of the brackets to the frame tubes, and even pad the beads on the inside (tee joints) if you're so inclined.

b. Rear Spring Gussets

The rear spring supports don't really fall into either of the tab or bracket categories, because we're not going to bolt anything to them later on. But we need them nonetheless, and we'll cut them out and weld them on just like all of the real tabs and brackets.

Cut two pieces out of 16 gauge steel using the plan in figure 8.3. Clamp them to the inner edges of the 1/8" spring mounting plates, with the bottom edges resting on the W1 and W2 tubes as shown. For maximum strength, the bottom edges of the gussets should sit directly over outer faces of the W tubes. It might be a good idea to clamp a backup sheet of metal or wood to the W tubes, and then clamp the gussets to the same backup sheet.

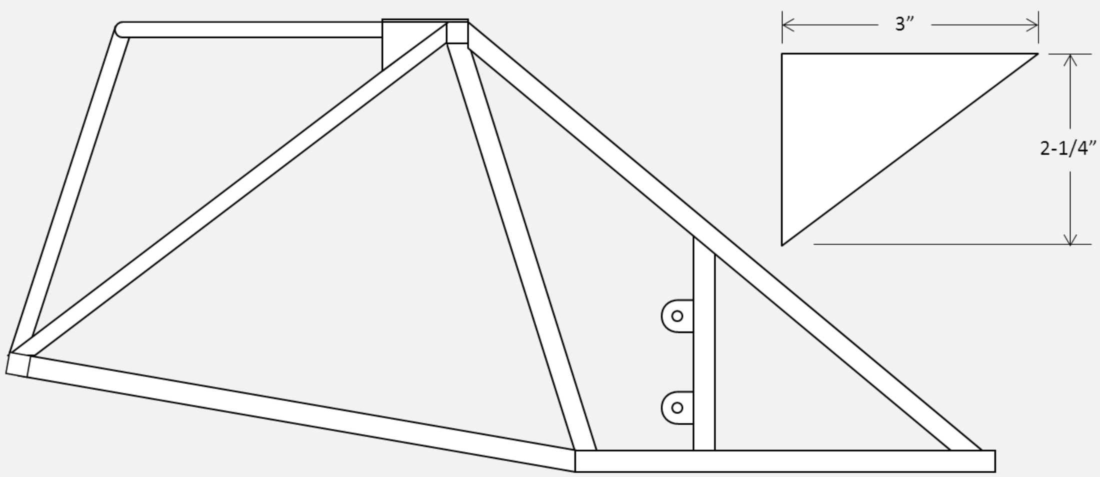

Figure 8.3

Make sure the bottom of the gusset matches the angle of the W tube, so you don't have any gaps bigger than about 1/32". The height of the gusset shown in the plan is 2-1/4", while the actual measurement, if all of your frame angles are correct, is 2.261". So it should be close. But file the gusset as necessary to make it fit. Note also that the forward point of the gusset may need to be filed down to clear any weld beads in that area.

When everything is lined up, tack weld the gussets to the spring mounting plates on top and the W tubes on the bottom. Remove any clamps and fully weld the gussets in place. Weld the gusset also to the end of the short 3/4" tube, at least along the rear and bottom edges, and as much of the forward edge as you can reach.

c. Fuel Tank Mount

The fuel tank will be supported by two 1-1/2" wide straps of 1/8" thick steel welded between the V and Y tubes at the rear of the frame. The fuel tank we'll be using is a Jaz 10-gallon Circle Track fuel cell. It measures 25" wide by 12" tall and 9" deep. More important than that is the location of the mounting strap recesses, which are exactly 12-1/2" apart on center. This is how far apart we want the straps on our frame.

Start by cutting two straps 11” long, as shown in figure 8.4. Drill 1/4" holes 1/2" from one end and 1” from the other end of each strap. The holes should be exactly 9-1/2” apart. Weld 1/4" nuts over each of the holes. When the straps have cooled, clamp them to the V and Y tubes exactly 12-1/2” apart as shown, with the nuts down. Note that the nut 1” from the end of the strap is to the rear, just clear of the V tube.

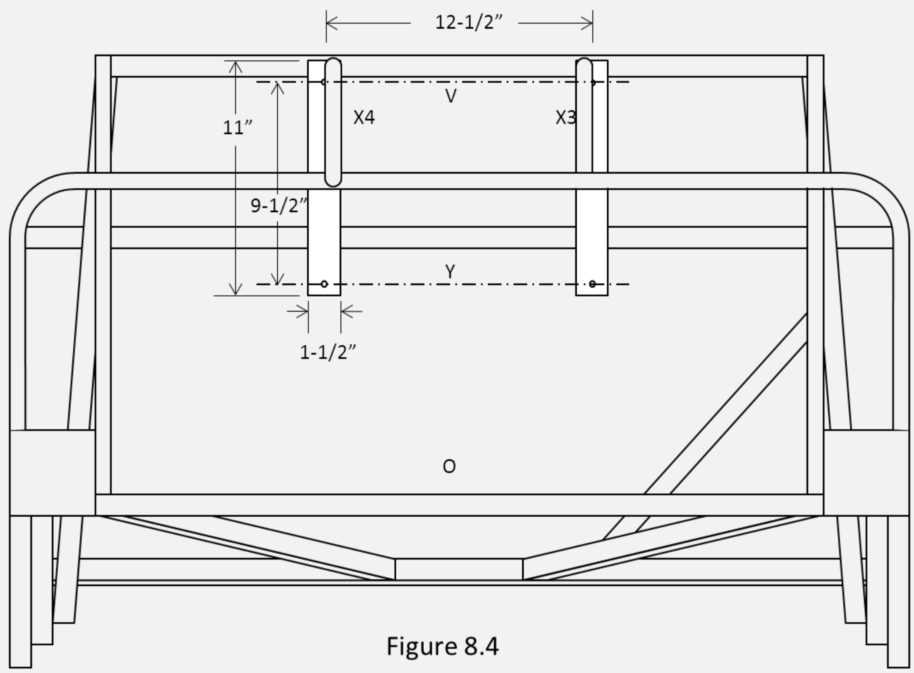

Figure 8.4

The straps should be positioned as far back as they can, with the rearmost welded nut up against the V tube. It’s okay to grind or file away some of the bead on these nuts to get the straps farther back. Note that you will probably have to grind away a little of the inboard rear corner of each strap to clear the X tubes and any weld bead at the base of the X tubes.

Once everything is clamped in place, go ahead and weld the straps to the V and Y tubes on top, then flip the frame over and weld the straps to the edges of the same tubes.

d. Fuel Pump Mount

We’re going to use the stock SU fuel pump from the MGB in our Locost, and we’re going to locate it just behind the passenger seat and in front of the rear axle. There isn’t a lot of room back there, but we’ll make it fit. If we have the proper year MGB, we can use the fuel pump mount that came with the car, but we’ll have to modify it to get the pump closer to the rear bulkhead.

The SU pump is clamped into a mount that looks something like the crude drawing on the left in figure 8.5. We need to cut a section out of the lower strap, and then weld the tab end back to the shortened strap, so it looks like the mount on the right in figure 8.5. The mount will then have to be cleaned and repainted, but before we do that we need to use it as a jig for our frame mount.

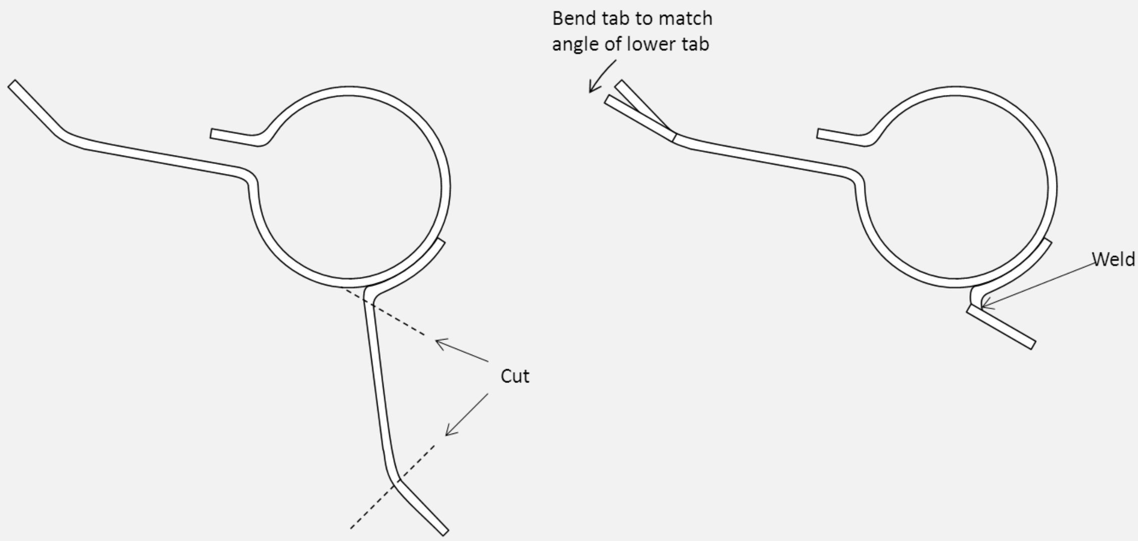

Figure 8.5

Cut an 11-1/4" strip of 1" by 1/8" thick steel. Drill a hole along the centerline 1" from one end as shown in figure 8.6. Bolt the clamp mount to this strip, and d rill a second hole in the strap through the second hole in the clamp. Unbolt the clamp mount and set it aside, then weld a 5/16" nut over each of the holes in the metal strip.

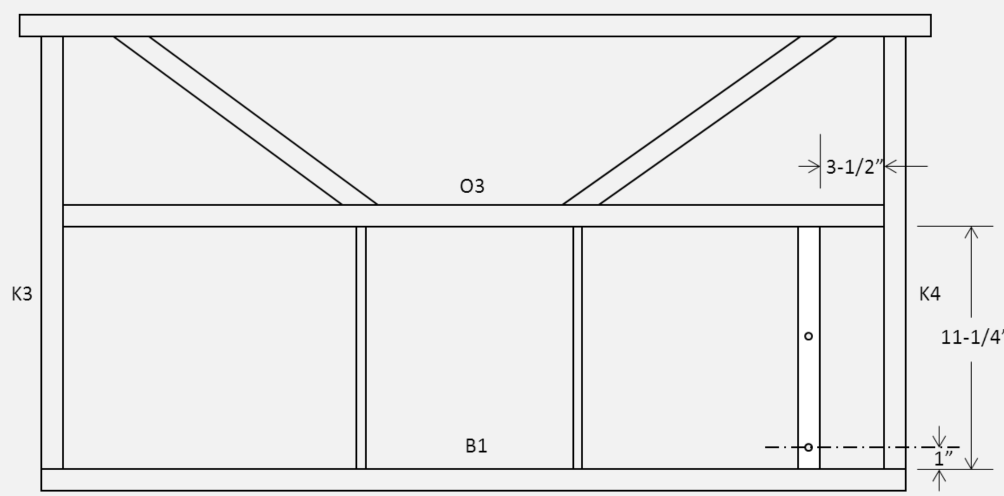

Figure 8.6

When the strip has cooled, trim it as needed to fit between O3 and B1, and then clamp it in place 3-1/2" inboard of K4 as shown in figure 8.6. Make sure the welded nuts are facing forward. We want the strip to be about 1/8" forward of the back of B1 and O3, to give the pump as much clearance from the rear axle as possible.

Tack weld the upper end of the strip to the O3 tube and the lower end to B1. When these welds have cooled, bolt the clamp mount to this strip, with the welded tab on the bottom. Slide the SU fuel pump with its rubber sleeve into the clamp, with the solenoid end inboard and the pump valves outboard.

Rotate the pump so that the fuel lines lead out from the bottom of the pump. The aft fuel line will run back to the fuel tank along the inside of the RU tube, so make sure the pump can be pushed into the clamp far enough that the fuel line clears the RU tube. If it looks like the RU tube will interfere with the fuel line, grind off your tack welds and move the mounting strip farther inboard. If the fuel pump looks good where it is, remove the fuel pump and fully weld the mounting strip to the O3 and B1 tubes.

e. Fuel Canister Mounts

MGBs after about 1967 came with a rudimentary emissions control system. This system included an expansion canister for the fuel tank and a charcoal canister in the engine bay. We want to install both of these canisters in our Locost, in part so we can claim we're helping to save the planet, and in part so we don't have noxious fumes wafting into the passenger compartment and smelling up the car.

The fuel expansion canister is a short cylindrical tank about 4" across and 2" deep. Two small steel tubes extend from the canister, one on the top and one on the bottom. The canister has a short flange around the perimeter with two holes sized for #10 screws.

Our mounting bracket for this canister will be a flat piece of 16 gauge steel in the same shape as the canister flange. Use the flange as a template to mark and cut out the mounting bracket. Drill two 3/16" holes in the bracket to match the holes in the flange, and then weld #10 nuts over each hole. Be sure the nuts are welded to the proper side, as the flange isn't symmetrical and the bracket only works one way.

When the bracket has cooled, clamp it to the inside of the W2 tube in the location shown in figure 8.7. The exact location isn't critical, but get it close, and make sure both welded nuts are above the W2 tube. Loosely bolt the canister to the mount and make sure the flange matches the shape of the mount, and also that both the inlet and outlet pipes are facing aft. If everything looks good, remove the canister and stitch weld the mount to the W2 tube. A pair of 1" stitches top and bottom will hold it in place.

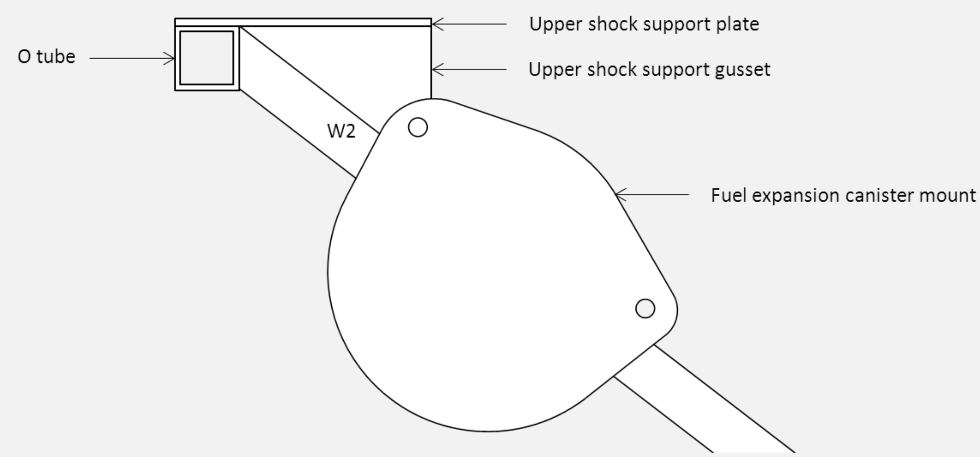

Figure 8.7

The mount for the charcoal canister will be located behind the driver, between the O3 tube and the angled O1 tube. Cut this piece as close as possible to the dimensions shown in figure 8.8, but matching the angle of the slope to the O1 tube on your own frame. The precise location of the canister and the mount aren't critical, but get them close to the plans and you won't have any issues.

This is a large and heavy bracket, which can be lightened considerably with one or more holes. The bracket is shown in figure 8.8 with a 2-1/2” hole in the middle, but you could replace this with a series of smaller holes if you have the time. The charcoal canister is not a heavy item.

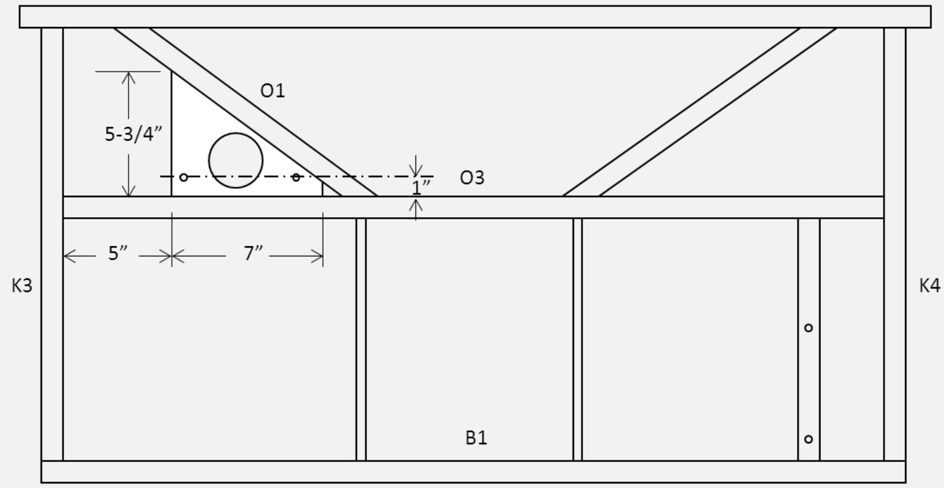

Figure 8.8

Use your charcoal canister mount to determine the position of the two 1/4"holes in the bracket. They should be about 5-1/8” apart. After drilling the holes, weld 1/4" nuts over each. Clamp the bracket flush with the back of O1 and O3, with the nuts forward. Stitch weld the bracket to these tubes with short 1/2" stitches spaced a few inches apart.

A 3/8” rubber tube will run from the expansion tank to the charcoal canister. This tube needs to be tied down in the vicinity of the O3 tube. We used a pair rivnuts installed in the middle of the O3 tube, but you can avoid that by welding a couple of 1” square tabs out of 16 gauge steel to the top of O3, just inboard of where O1 and O2 meet the O3 tube. You can even drill these tabs for #10 screws (3/16”) and weld nuts on the back.

f. Spare Tire Mount

The spare tire will be mounted on the back of the Locost, where it’ll look good, help with the weight distribution, and double as a rudimentary bumper. In addition, it can also be used as a spare tire, should one of the other four develop a leak. Many Locost builders elect to delete the spare tire, but we think that’s a mistake. A Locost without a spare tire looks incomplete. We think you’ll agree.

The spare tire is supported by two mounting brackets. The first is a cradle that extends from underneath the rear of the car to support the weight of the tire. The second is a bar that runs between the X tubes in back. The spare tire is bolted to this bar, which keeps it from flopping around in the cradle.

Our plans for the spare tire are based on a 14” Rostyle wheel wearing a 185/65-14 tire. The diameter of this wheel and tire is 23-1/5”, and it’s about 7.4” across at its widest spot. If the specifications of your own spare tire differ from this, your spare tire carrier may have to be modified from our plans. For the most part, this can be accomplished by lowering the bar the runs between the X tubes in back. Don’t worry if that doesn’t make sense, we’ll explain later.

We'll start by building the cradle, which will allow us to position the bar between the X tubes more accurately. Cut three 13-1/2" lengths of 16 gauge 3/4" DOM tubing. Cut one end of two of the tubes at a 45 degree angle, and cut both ends of the third tube at a 45 degree angle, with the angles opposed. Fit these tubes together as shown in figure 8.9. Make sure the angles between the tubes are perfectly square, then tack weld the tubes at the joints.

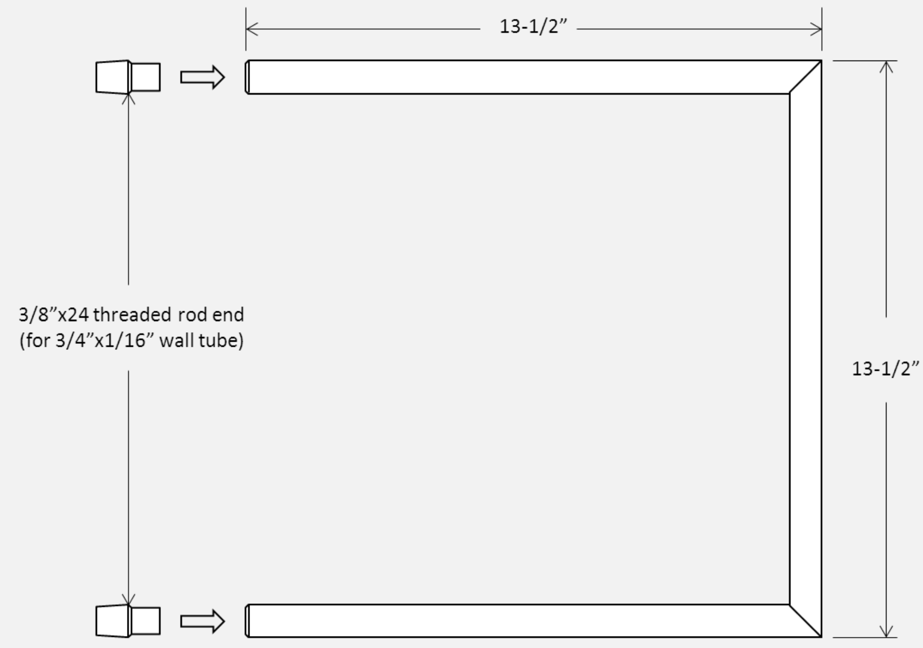

Figure 8.9

We next need to weld threaded rod ends into the ends of each open tube. As with the rod ends we welded to the rear suspension radius arms, you'll get a stronger weld if you chamfer the ends of the tubes first. When the welds have cooled, grind the weld beads flush with the tubes, so that the tubes are no more than 3/4" in diameter anywhere along their length.

Next we need to make a pair of brackets to attach the cradle to the car. There are two ways to make these brackets, an easy way and a hard way. Ordinarily this would seem like a simple choice, but on our Locost we did it the hard way, in a possibly misguided attempt to make the brackets a little more rust-resistant.

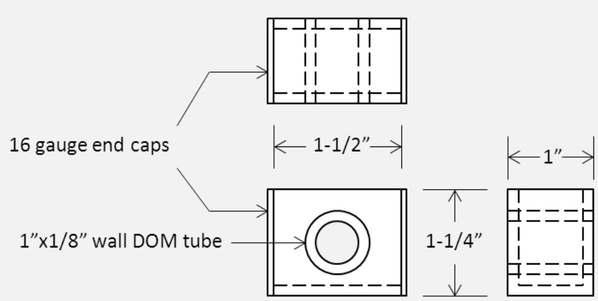

Figure 8.10

Both easy and hard brackets start out as 1-1/2” lengths of 1/8” wall rectangular 1” by 2” tubing, as shown in figure 8.10. Cut off the long end so the brackets are 1-1/4” tall. Now cut holes in the center of each face. If you’re keeping it simple, drill these holes to a diameter of 3/4”.

If you’d prefer to make a little more work for yourself, drill these holes to a 1” diameter, and then cut two 1” lengths of 1” round 1/8” wall DOM tubing. These tubes will be inserted into the brackets and welded in place, but before you do that, make sure the 3/4" tubes in your cradle assembly slide easily through the 1” DOM tubing. Ours didn’t, and we ended up spending a good hour with a file until they did.

Next thing to do is cut four 1” by 1-1/4” pieces of 16 gauge steel, and weld them to the open sides of the brackets. Clean up the welds after they cool so the brackets look nice, and then set them aside.

We now only need to cut two 2-1/2” strips of 1-1/2” wide by 1/8” thick steel, and drill a 3/8” hole in each strip 3/4" from one end. As always, you can leave the drilled ends of these strips square, or round them off in a semi-professional manner to both reduce weight and improve aerodynamics.

Next comes the tricky part. We’re going to assemble everything we’ve made so far, and clamp it all to the back of the car. Start by sliding the brackets over either end of the cradle assembly, then find a couple of long 3/8” bolts and stick them through the 3/8” holes in the 1/8” strips. Finally, thread the bolts into the cradle ends with the 1/8” strips hanging loosely from the bolts.

Figures 8.11 and 8.12 show how the various parts are attached to the frame. The 1/8” strips will be clamped to the forward face of the Y tube, and the brackets will be clamped to the bottom of the V tube, with the open ends up. The distance between the center of the brackets and the center of the 1/8” strips needs to be exactly the same, and they will be if your cradle is exactly square.

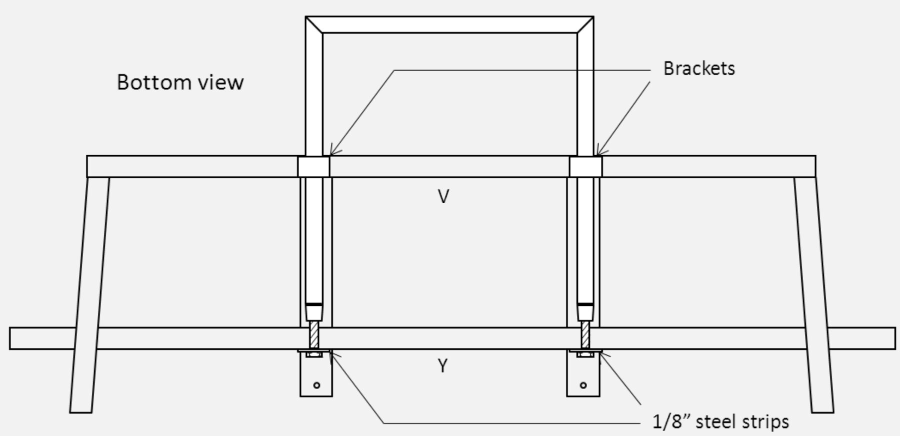

Figure 8.11

With everything clamped in place, and of course nicely centered on the chassis, remove the 3/8” bolts. The cradle should slide easily in and out of the brackets. If the cradle won’t slide easily, or at all, adjust the arms of the cradle and the distance between the hanging brackets until they do. This will force the sides of the cradle to be at least parallel, and hopefully square. To verify, measure the distance from the rear tube of the cradle to the V tube at both ends of the cradle. The distance should be the same.

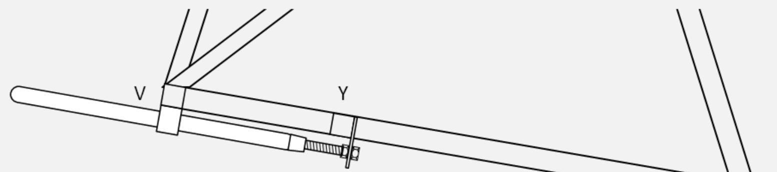

Figure 8.12

Once the distance between the brackets is correct and the cradle is square, slide the cradle all the way in until it contacts the 1/8" strips. Now move the strips back and forth on the Y tube until the 3/8" holes line up with the holes in the rod ends. Replace the 3/8" bolts and tighten them up against the 3/8" strips, clamping the cradle in place. Double check that the cradle is centered on the frame, and then go ahead and weld the 1/8" strips to the Y tube, and the brackets to the V tube.

Now we can make the upper mount, and this will be a lot easier if we have a spare tire we can use as a jig. The upper mount is a single strip of 2" wide 1/8" thick steel. The 12" length of this strip shown in figure 8.13 is an approximation. The actual length is the distance between the X3 and X4 tubes at the back of the frame. Which should be very close to 12".

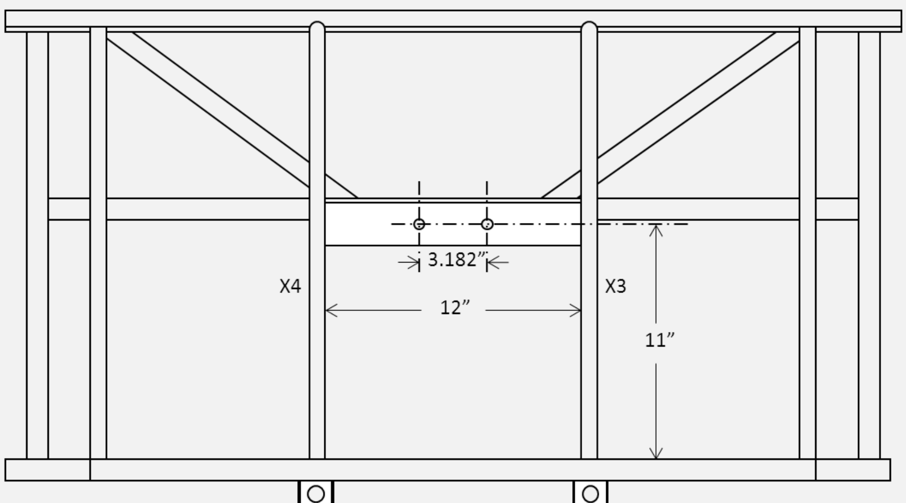

Figure 8.13

Cut the strip to fit, then drill two ½" holes in the center of the strip exactly 3.182" apart. This is about five thousandths of an inch less than 3-3/16", and exactly the distance between two adjacent holes in an MGB wheel. Clamp the strip in place between the X3 and X4 tubes at the height shown in the plans.

Next find two long 1/2" bolts with nuts, and attach them to two adjacent holes in an MGB wheel. The bolts should be long enough that they protrude past the back end of the tire. Set the tire in the cradle with the bolts forward, and then adjust the height of the 2" strip until the holes in the strip line up with the bolts. If the bolts actually fit through the holes, double bonus points. Tack weld the strip to the X tubes, then remove the tire and fully weld the strip.

The last thing we need to do is to weld a couple of tabs to the rear cradle bar that can be used to attach whatever license plate mount you plan to use. The license plate mount from the donor will work perfectly, in which case you can make your tabs like the ones shown in figure 8.14, using 1-1/2” wide strips of 1/8” thick steel. Holes are 1/4".

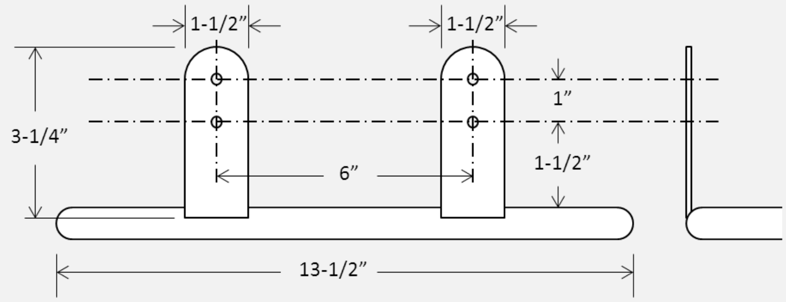

Figure 8.14

g. Wiring Tabs

The MGB wiring harness, or “loom” as our native English speakers are fond of calling it, can be used in a Locost without any modifications. Or very few modifications. The harness is, however, a little long for our purposes, and there are two options for dealing with this. The first is to put a loop in the rear harness behind the passenger bulkhead. That’s what we did. The second is to shorten the loom by about two feet, which isn’t as scary as it sounds, although it’s pretty scary if you’re like us. We left ours alone.

The loom is a two-part affair. The main part fits under the dash and runs into the engine bay. The smaller part is made up of only about a dozen wires that run to the rear of the car. The two parts connect at the head of the transmission tunnel using bullet connectors. If you’re good at crimping or soldering bullet connectors, or think you might be with a little practice, you can simply chop off the forward two feet of the rear wiring harness, unwrap a little of the covering, and attach new bullet connectors to each of the wires. This has the added benefit of providing you with some nice lengths of original wiring, which may be useful later on. It probably will be.

To keep the wiring from flopping around in the car, and possibly bursting into flames, which was our primary fear, we need to tie it down. The best way to do this is with something called P-clips, which surround the harness and bolt to the chassis. Many Locost builders wait until the last minute to install their wiring harnesses, and who can blame them, but this leaves little choice but to attach P-clips to frame tubes with sheet metal screws. Nothing wrong with sheet metal screws, they work great in washing machines, however in cars they seem to find a way to back themselves out at the worst possible moment. So we’re going to try to avoid them.

To do that, we’re going to make about a dozen tabs, and weld them to the chassis at strategic locations. We’ll weld five to the transmission tunnel offside, three to the curved round tube at the back of the car, and three more in the engine bay offside. We’ll also need one or two in the boot area.

The tabs are made from 16 gauge steel. They all look the same, and they’re easy enough to describe but we went ahead and made a drawing of them in figure 8.15 anyway, just to avoid any possible confusion. On our part.

Although we're only making tabs for the wiring at this point, you'll soon discover that we're also going to need tabs for routing the fuel and brake lines. Surprisingly, or maybe not surprisingly, these tabs will be eerily similar to the wiring tabs. Or actually identical, except for the six tabs shared by the brake and fuel pipes, which are a quarter inch longer. If you're so inclined, you could make about three dozen of these tabs right now. They won't go to waste.

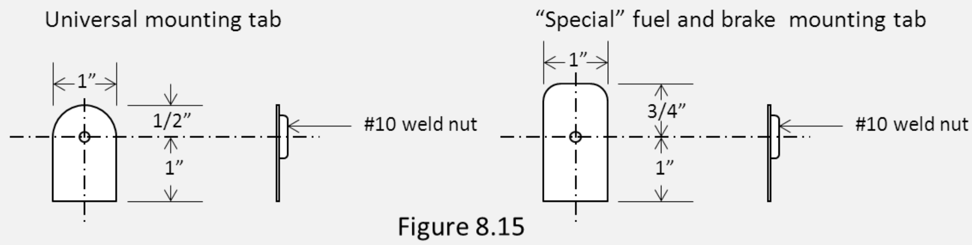

Figure 8.15

Locate and weld a dozen tabs in place according to the arrows in figure 8.16. All the tabs should be hanging from the indicated tubes. They don't have to be flush with the face of the tube—a 1/8" setback is about right. Make sure the welded nuts are on the correct side. Also, make sure the three tabs hanging off the round tubes in back are far enough forward that screws won't go through the bodywork.

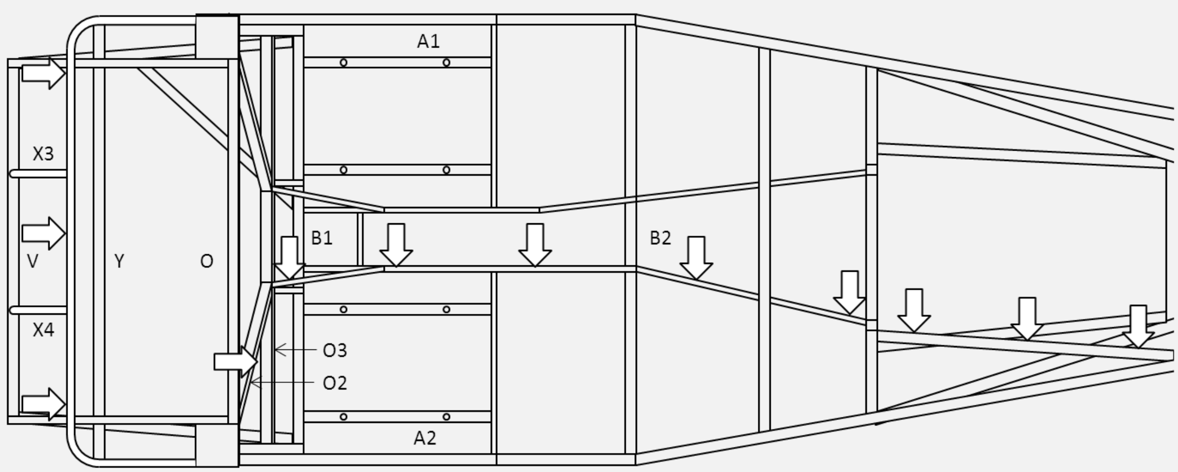

Figure 8.16

If you didn't shorten the rear loom, you'll need an additional tab behind the passenger bulkhead, hanging from the O2 tube right above the tab on the O3 tube.

When we actually get around to wiring up the car, we'll use a fair amount of tie-wraps (zip ties) on the individual loom branches, but these tabs are all we need to support the main wiring harness.

h. Fuel and Brake Pipe Tabs

The fuel and brake lines will run together through the transmission tunnel along the nearside. The idea here is to keep electricity and flammable liquids as far apart as practical. The locations of these tabs are shown in figure 8.17. All tabs except the O3 and RU tabs will hang down from the tubes. The O3 and RU tabs will be welded to the top of their respective tubes and will stick up.

Note that the five tabs in the tunnel and the one tab sticking up from the O3 tube will be of the "special" variety shown in figure 8.15. The rest will be the standard variety.

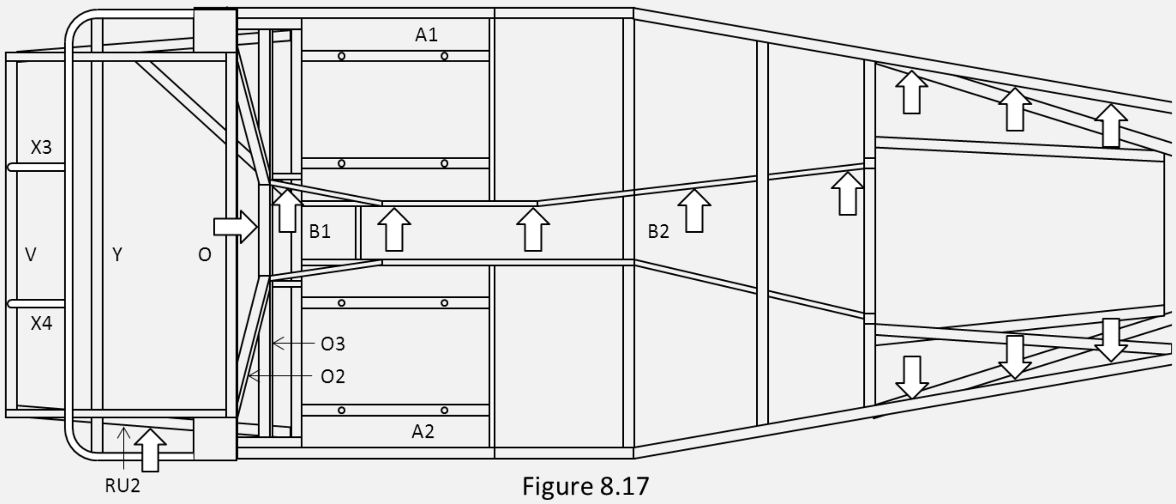

Figure 8.17

We also need three more tabs for the brake lines, where the pipes meet the flexible rubber lines. These tabs are rather more important than the regular routing tabs, and so we're going to make them from 1" wide 1/8" steel strips and fully weld them to the frame tubes. Two of the tabs will be 4" long and one will be 1-1/2" long. The holes will be 3/8" in diameter. No welded nuts will be needed.

The two longer tabs will be welded to the underside of the J tubes as shown in figure 8.18, with the ends flush with the inboard edge of the J tubes and the tabs sticking out from the frame about 3" . We angled the tabs forward 10 degrees so they'd be perpendicular to the J tubes, but if you don't like that look, straight out is okay too. Just be sure the holes are 5" aft of the back of the front shock absorber (damper) mounts.

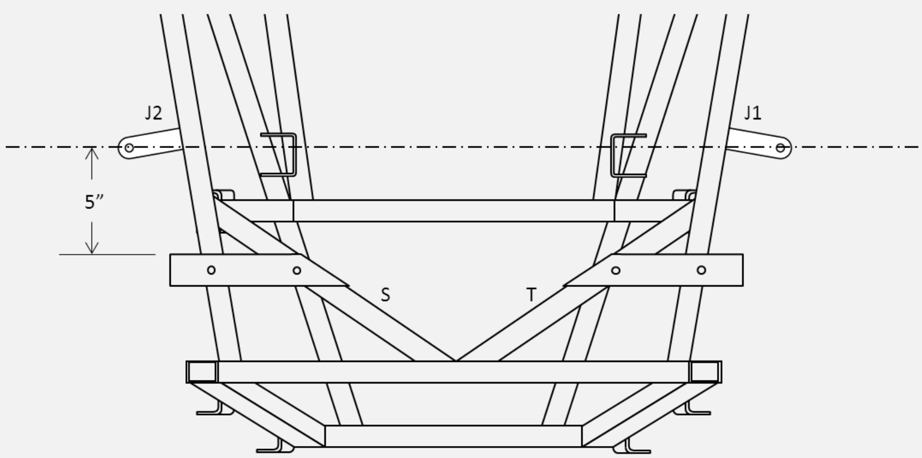

Figure 8.18

The third tab will be welded vertically to the rear face of the O3 tube and will stick back into the boot area, as shown in figure 8.19. The indicated location will place the tab directly across from the brake pipe junction box bolted to the rear axle. Weld this tab to the O3 tube on both sides.

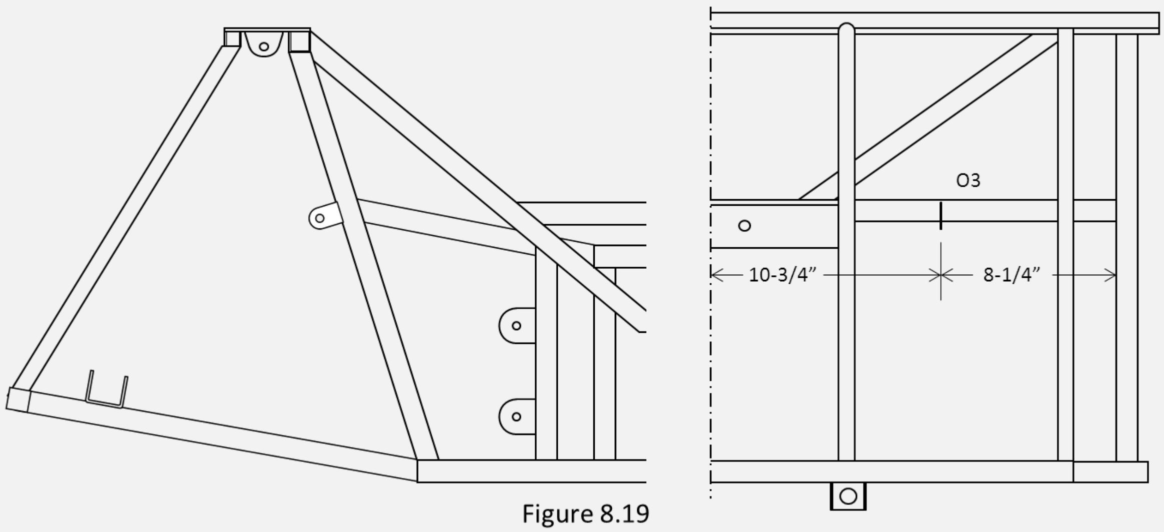

Figure 8.19

i. Console Mounting Tabs

The top of the transmission tunnel will be covered with two sheets of 0.10” 6061-T6 aluminum. Because they’re aluminum, we can’t weld them to the transmission tunnel, and we wouldn’t want to anyway or else we’d never be able to install the driveshaft (propshaft).

The panels will therefore be secured to the top of the transmission tunnel with 1/2" long #10 screws. To attach these screws, you can possibly use the same sort of 16 gauge tabs we used for the pipes and wiring, although they don’t need to be a full 1-1/2” long. One inch is plenty. You’ll need 8 of these.

We made our tabs out of 1” square tubing, with one side cut off as shown in figure 8.20. We felt this would help to keep the tabs from flexing, although in truth there isn’t any flexing stress on the tabs and that’s not actually why we did it. We did it because at the time we were all out of 16 gauge sheet metal. Completely. Not a scrap anywhere. So you can make the tabs like ours, or save yourself some time and make them flat.

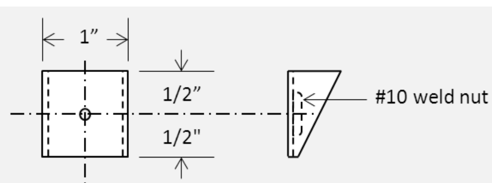

Figure 8.20

Attach eight tabs to the upper transmission tunnel tubes as shown in figure 8.21. Make sure they’re flush with the tops of the tunnel tubes, and weld them from underneath so you don’t have a giant weld bead on top.

Eight tabs is good, but we're actually going to attach the console panels with ten screws, six on the forward panel and four on the rear panel. So we still need two for the back of the rear panel, and if you want, you can simply weld on two more of the same tabs in back. However, that's not what we did, and it wasn't because we were out of sheet metal.

If you attach the rear console cover with tabs front and back, the rear of the panel will butt up against the O3 tube, but it won't fully seal off the noise and noxious fumes emanating from the transmission tunnel. This isn't the end of the world, but we thought it would be better if the rear of the panel rested on a flange. That way a foam strip could be inserted between the flange and the panel to seal off the tunnel.

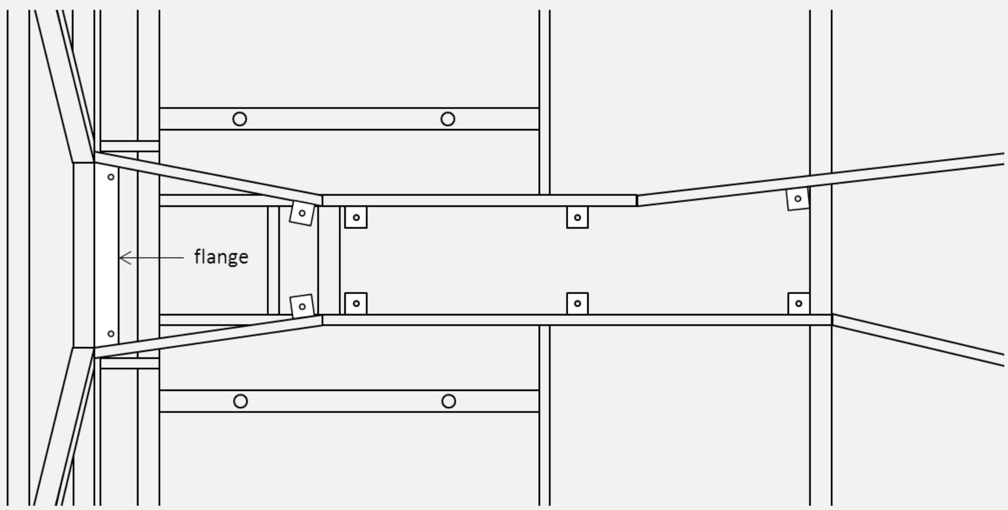

Figure 8.21

The shape and position of this 16 gauge flange is shown in figure 8.21. Cut it 1" wide, and angle the ends to fit between the upper transmission tunnel tubes. Drill the rear mounting holes into this flange and weld nuts underneath, then fully weld it to O3 and the tunnel tubes from underneath.

j. Bulkhead mounting flange

Another sealing problem we never liked on the original Locost book design is the rear bulkhead. The bulkhead is made from .050" 6061-T6 aluminum, and riveted to all of the tubes back there, including K1, K2, B1, O, O1, O2, and O3 tubes, as well as the two 1"x1/2" tubes that form the opening for the differential. Riveting the bulkhead to these tubes seals off almost the entire perimeter.

Except for the top of the transmission tunnel. There isn't anything there to rivet the bulkhead to. So we added another flange, as shown in figure 8.22. The flange is 16 gauge steel, and it doesn't need any holes drilled in it at this time.

k. Dashboard mounting flange

The dashboard in our M.G. Locost includes a center panel that drops down and joins up with the center console. We think it adds some style and flair to the interior. You may disagree, and you're certainly free to cut your dashboard straight across the bottom, but good luck hiding all the wiring under there.

If you like the look of a continuous center console, and we think you will, you'll need a way to attach the bottom of the dashboard to transmission tunnel. Another simple flange like the one shown in figure 8.23 will do the trick.

Note that the flange has three attachment holes, and that's the arrangement we used, however you could argue that the center hole will be directly ahead of the gearshift lever, and it will therefore be difficult to get a screwdriver in there. If that's your position, we wouldn't disagree with you.

As far as we can determine, attaching the dashboard with just two screws at the bottom instead of the full complement of three will work just as well as our arrangement. We can be fairly certain of this, because we've driven many miles with the center screw removed because we couldn't get a screwdriver in there to attach it. Fortunately we've found other tools that make this operation possible.

l. Tube Caps

Although not technically brackets, tabs, or even flanges, we need to weld flat pieces of 16 gauge steel to the ends of all open chassis tubes. Fortunately these do fall under the broader category of frame details, and so we can include them in this chapter.

You will need a total of 18 tube caps, and they'll mostly be 7/8" square, except for the two that cap the 3/4" tubes supporting the rear shock absorber (damper) mounts, which will be 5/8" square, and the two that cap the ends of the LC tube in the nose, which will be 7/8"x1-1/2" rectangles. We hope a diagram is not necessary for you to imagine how these caps will look.

The caps should be welded flush with the tube ends, which means the caps should fit just inside the tube, flush with the end, and welded around the perimeter. You may have to file the corners a bit to get them to fit. Also, it's a very good idea to have a magnetic probe on hand to fish out end caps when they fall inside the tube. Welding magnets can also be useful for holding the caps in position while you tack weld the corners.

After you've welded 14 caps in place, you'll find that you've run out of open ends to cap. Not to worry. We're about to cut open a couple of frame tubes. The first will be the center of B1, between the lower transmission tunnel tubes. This will provide clearance for the differential flange. You don't need to trim the B1 tube all the way to the edge of the tunnel tube, but don't have more than a quarter inch or so sticking out, leaving around 4-1/2" of clearance for the flange.

The other tube we need to sever is the C tube at the head of the transmission tunnel. Cut out the center section between the two inboard H tubes. Later on we'll reinforce this area with the transmission mount and the floor, so no need to concern yourself about any loss of chassis stiffness.

Weld your last four caps to the exposed ends of the B1 and C tubes. After all the caps are in place, clean up the welds with a file or angle grinder. This is mostly for looks, but the two caps on the ends of the 4" extensions of the Y tube need to be squared up nicely in order to fit the bodywork later.

m. Roll Bar

Truth be told, the roll bar on a Locost is optional. You can build yours without one and it'll work just fine. The car will even be 40 lbs. lighter. But it won't look nearly as good, and arguably will be less safe.