

How To

Pro Street a Unibody Car

Installing a 4-Link Rear suspension & 10-Point Roll Cage

Cars with 4-link rear suspensions and full roll cages have long been common on drag strips. After all, the cages offer the greatest amount of protection for the occupants during mishaps, and the 4-link offers the greatest amount of adjustability for maximum traction under a wide variety of track conditions.

As can be seen in these "before" and "after" photos of a 1963 Nova, the installation of a 4-link rear subframe allows massive amounts of rubber to fit under a car.



In the foreground are the components that are included in our basic rear-subframe kit.



The first step in a project to upgrade the rear suspension of any car is to make sure that the axle centerline will end up back where it started. Here, a measurement is taken (and recorded) of the stock location, using the door opening as the point of reference.



Reference points are also critical under the car for fabricating the new subframe; in this instance, the front of the transmission crossmember-mount is the fixed point choice used for measuring back to the front of the axle housing.



The location of the front subframe crossmember is specified in relation to the axle centerline; in this kit, 25 inches forward. Keeping in mind that there is a 1-1/2-inch difference between the axle centerline and the front of the 3-inch-diameter axle tube, 23-1/2 inches is subtracted from the 73-inch reference distance; this distance is then measured back from the transmission crossmember and marked on the car's floor, which will be cut along this line.

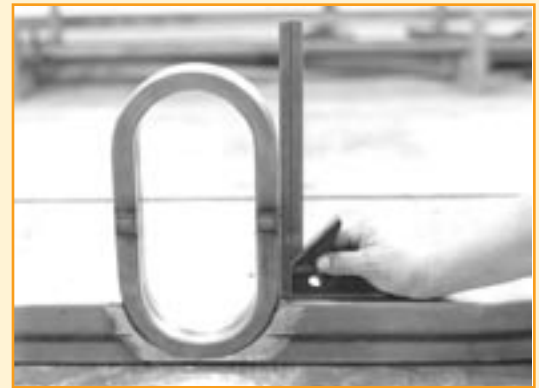


If a torch is used to cut the sheetmetal, be sure to have a water sprayer (visible under the wheel well) on hand to extinguish the flames that will probably result from the undercoating catching fire (water is much less messy than a fire extinguisher in this application).



The cut in the crossmember was cleaned up with a sanding drum, which helped achieve a perfect fit for the driveshaft loop.

Here are the exclusive Chassisworks dropped crossmember and 2x1-inch driveshaft-loop assembly. These let the crossmember sit lower in the car, with plenty of clearance for both the ground and the driveshaft.



After the loop is cut to size and the two halves welded together, it is tacked to the crossmember. Again, the use of a square helps in final positioning.



The crossmember will reside between the rocker panels of the unibody Nova, along the lower edge. When measuring for the proper width of the crossmember, be sure to note the location of the driveshaft centerline, which is rarely in the exact center of the car.



The completed crossmember is worked into position, with the bottom of the crossmember's ends flush with the bottom of the rocker panels, and tacked into place. If the crossmember has been cut to achieve a snug fit, the positioning and alignment of the crossmember is much easier.



The driveshaft centerline is marked on the crossmember (along with identifying the passenger and/or driver's side of the crossmember to assure its orientation); the bottom half of the driveshaft loop is centered on the crossmember at this point, with the bottom of the loop lined up just above the bottom of the crossmember, and the 3x2-inch tubing is marked for notching. The use of a square will ensure proper alignment.

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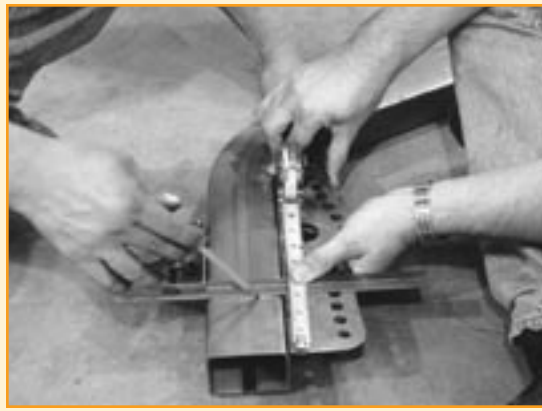
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The popularity of these automotive additions has been growing greater for a large segment of the street-machine crowd, as well. But merely putting race-car parts on street-driven cars is definitely not appropriate, for a variety of reasons that ranges from physical comfort and convenience of operation to potentially dangerous conditions for both car and passengers.

In response to the needs of our customers, we here at Chassisworks have continued to develop and refine products that can trace their lineage directly back to the drag-racing world, but that have been redesigned and built

specifically to handle the real-world rigors of the street. Our beefy link bars and ends require a bit more work to adjust, but cannot loosen by themselves; urethane bushings ride on steel sleeves in all critical locations to minimize the transmission of road imperfections to both the hardware and human software; swing-out and/or removable cage tubing eases the hassle of getting in and out of the car, while still providing full protection when all the pieces are back in place.

All of these are found in this segment, as a backyard hulk of a 1963 Nova starts its transformation into a street/strip megaplayer. This project was pursued in conjunction with the editors of Super Chevy magazine, which published an expanded version of this build up in multiple issues under the heading of "Saturday Night Special."



The first step in preparing the new frame rails for installation is to cut the vertical section of the front of the rails to size. The 4-link brackets are designed to fit flush with the bottom of the front crossmember; the frame rail will be cut three inches up from the bottom of the 4-link bracket, which is designed to fit up snug in the frame rail's curve.



Next, the distance from the trailing edge of the crossmember to the inside of the rear of the car, in the trunk area, is determined. The rails will rest on the lip left behind when the trunk was cut out.



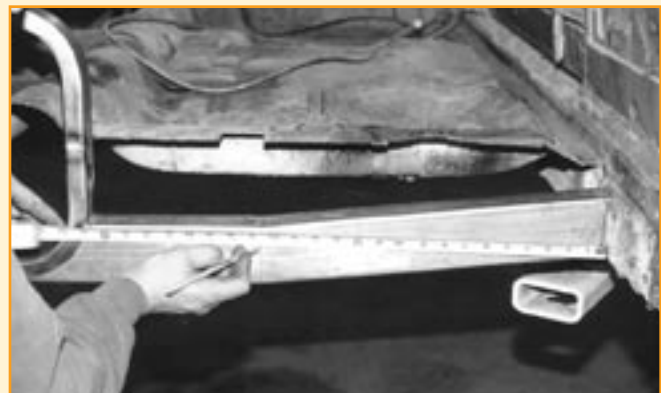
This measurement, taken from the inside of the vertical section of the rails, is transferred to the frame rails themselves, which are then cut to length.



Assuming the body is unwrinkled and the rear quarter panels are straight, a tape is used to measure across the back of the car to find the exact center of the rear area. It can't be assumed that the trunk-latch mechanism is in the middle of the car.



Once the midpoint of the car is established, the proper distance is measured out in both directions from this point, to mark the location of the frame rails (in this application, they will be 24 inches apart, as measured from the outside of the rails).



The front crossmember is then also marked for the frame-rail locations. The 24-inch frame width is subtracted from the length of the dropped crossmember, that number is divided by two, and this distance is measured in from the rocker panel on each side.



The frame rails are placed with their outside edges on the lines on both the crossmember and the inside of the trunk lip, tacked in place, and again measured to verify the proper width. Measuring across the tops of the frame rails should also be done to verify they are plumb and straight.



After the frame stub is removed, the 3x2-inch box tube to be used for the connector is held up in place and the trailing end marked for cutting. As always, a snug fit aids in the installation process.

A piece of tubing (included in the kit) is cut and mounted as far aft as possible. Although the frame rails will also be welded to the back-end body panel, this crossmember provides much more strength and stability for the assembly than the factory sheet metal.



Since the front-frame stub is narrower than the box tubing, the front of the connector tube was notched to provide the proper contour; the "flaps" will be hammered down and welded, with the welds then ground smooth.



The upper shock mount is fabricated as per the instructions, positioned as referenced from the dropped crossmember, and tacked to the frame rails. (The use of a level that attaches to the tubing magnetically is recommended, but you must make sure that there are no metal shavings between the level and the tubing.)



When welded up, ground down, and painted, the subframe connector will look like it has always been there.

With a unibody car, subframe connectors must be fabricated to tie the rear subframe into the front of the car. On this Nova, the front-frame stubs make natural forward mounting points for the connectors. The trailing part of the stubs were cut off at the transmission crossmember.



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This particular Nova, which ultimately received a supercharged small-block, was partially responsible for the development of our "NoFab" line of bolt-on front clips for various 1962-72 GM cars. As work progressed in our chassis shop, we became aware of Super Chevy's concerns about installing the new powerplant in this body. Coincidentally, our engineers

had been considering creation of an all-new front-suspension system for some time.

One thing led to another, and the results can be seen both in this installation section (“How To Install a ‘NoFab’ Subframe”) and on the catalog pages devoted to NoFab systems — which are now available for 1968-72 Novas and the 1967-69 Camaro-Firebird, as well as the first-generation Chevy II that gave birth to this exciting product line. ■



With the housing resting roughly in place and the pinion angle established with the help of a protractor and screw-type jackstand, it's time to install the link bars. The middle set of holes on each bracket is used for the initial set up, and all the bars are positioned with their threaded rod ends in the forward location, to facilitate later fine-tuning of the suspension.



The floor of the Nova needed only a few taps with a mallet to make room for the connectors, while some other cars will require the floor to be notched. Note that the connector fits under the “overhang” of the frame rail, and is lined up with its inside edge.



Here is the track-locator tube after being cut to size. The rear weld eye is next removed from the clevis and welded onto the tube. The forward, threaded rod end is screwed into place, with the locking nut set in about a half-dozen threads from the large end. After the assembly is back in place, the housing is checked to see if it is now centered from side to side. If not, one end of the locator is removed from its clevis and the rod end screwed in or out, as required (increasing the locator length will shift the housing towards the driver's side; making it shorter pulls it the other way).

After the contoured front 4-link brackets are assembled (using the steel sleeves from the urethane-bushed, billet link-bar weld eyes as spacers to establish the correct bracket-assembly width), the bottoms of the brackets are positioned flush with the bottom of the crossmember, then tacked in place.



Here is the Chassisworks FAB9 rearend housing, complete with 4-link brackets and back braces, that was used in the Nova. Installing the center section, axles, and brake-kit brackets before mounting the housing is recommended.



The billet, CNC-machined lower shock mounts are installed on the housing, again starting off by using the middle set of bracket holes.

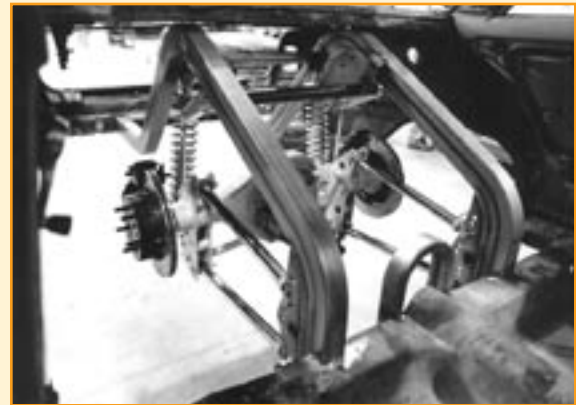


Before the final welding took place, wet rags were tied around the shocks and the housing was covered with a thick tarp to protect everything from welding sparks and debris.



Our exclusive antiroll bar was also installed in the Nova. This is the completed assembly after it was fabricated; the box-tube mounting brackets fit inside of, and are welded to, the new subframe rails, while the width of the arms exactly matches the outer width of the frame. Pieces of thin steel plate are included for capping off the cut-to-size mounting brackets.

This is how the 4130 antiroll bar itself fits inside the 1-5/8-inch mounting tube, with the bushing in between. It is critical that everything fits together snugly, with no allowable slop.



This is an overall view of the completed 4-link rear subframe and suspension system from the passenger compartment...

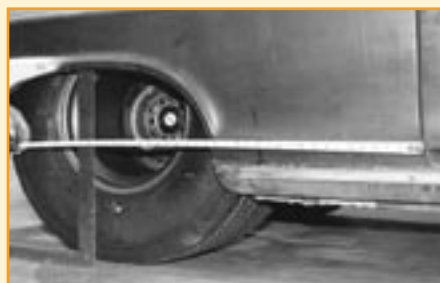


The front-to-back location of the antiroll bar, as spelled out in the installation instructions, is referenced between the bar centerline and the inner, vertical plane of the new frame rails, while the vertical placement of the bar is determined in relation to the center of the upper shock bolt. After attaining the proper placement of the antiroll-bar unit, its position was marked, the unit was removed from the car, and the mounting brackets cut to size and capped. The assembly was then clamped back in place, all dimensions verified, the adjuster links installed, and then everything was checked once again before being tacked in.



...while this shot from under the car shows the track locator in place, along with how the subframe connectors meet the crossmember.

The wheels and tires were installed, the car was set back on the ground, and the centerline of the rear axle checked to make sure it was back in the original location and that nothing was amiss.



With the subframe completed, it's time to go inside the Nova for the construction of the 10-point roll cage. Our cage kit includes material for the mounting plates, which must be cut and formed to follow the floor's contour. On the left is the final shape of the driver's-side plate for the main hoop; on the right is a plate segment that has not yet been introduced to a hammer.

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The main hoop was then brought inside the car and marked for trimming to length.



Both cage sides are in place, and the windshield brace is marked for cutting.



If the windshield-brace tubing is cut carefully and correctly, it should level out quite nicely. There is obviously not enough clearance for welding the top of this tube in place, but there is a way around that.



This is how the end of the main-hoop tubing was notched to fit the plate's contour. The weld will fill in any gap (within reason, of course) that exists between the pieces.



With the windshield brace positioned and tacked to the cage side, these corner gussets, included in the kit, are added to the structure.



After tacking both sides of the main hoop in place, it is checked to make sure it is level before moving on to the cage sides.



Here's the aforementioned method for welding the top of the windshield-brace joint. The tack welds holding the cage-side/windshield-brace assembly to the floor and to the main hoop are broken, the assembly is set down on the floor, and the welding can be easily done. (The tacks holding the main hoop to the floor will probably also have to come loose for this process.)



The cage side is cut to fit and positioned; the form-following shape of the tubing in the early Nova kit can be seen in relation to the windshield post. The horizontal bar should be higher than the door opening, but not so high that it would be impossible to weld a bead all the way around the tubing where it joins the main hoop.



The next chore is the fabrication of the X-braces. The area at the top of the antiroll-bar mount was designated as the spot to mount the rear of the brace, while the forward end will attach right in the middle of the main-hoop bend, in line with the cage-side tubing. After the first, continuous-length brace was cut, formed and tacked to the car, the second piece of X-brace tubing is marked to start its fitting procedure.

Another important point is to make sure that the cage-side tubing doesn't interfere with the operation of any of the controls for street cars. Here, the headlight switch was pulled out to check the clearance.





Ever wonder how the pros get those X-braces lined up so well? We use a notched piece of angle iron and a couple of clamps in our chassis shop to achieve the alignment.



The next order of business is to fabricate the struts from the main hoop back to the new subframe rails. With the lower end of the tubing roughly in place on the top of the subframe bend, the top of the tube is marked with the angle required to have it fit fairly snugly under the back-brace mount.



These clamps also come in very handy to keep the various pieces of tubing in place during the fitting process. Also visible is one of the gussets that are installed at the intersection of each cage side and the main hoop.



Because this Nova will be seeing considerable street time, swing-out side bars are being installed along with the removable back brace. Here, the swing-out clevis is welded to the lower end of the tube, bolted to the mounting tab, and, with the top end of the tube resting roughly in place, the tab is about to be tacked to the cage-side tubing.

The next tubing to be installed will be the struts that run from the back of the main hoop to the extreme rear of the new subframe. The tubing is marked to determine the center of the eventual fishmouth shape.



The rear of the strut will be installed on top of the extreme rear of the subframe rail, flush with the outer edge. Once the leading end of the strut is in place, a straightedge is clamped to the top of the rail at the midway point to help line it up.



The nut has to be located at the top in this case, or the bar will never be able to be removed. The angle and position of the lower mount must also allow the intended operation of the swing-out arm.



After welding the struts front and back, they were also raised part of the subframe rails since they line up so closely in this early Nova kit.

A removable back brace allows easy access to the back seat, an important factor if a car is not dedicated exclusively to racing purposes. With the driver's side of the brace installed, a helper holds onto the other end of the brace tubing as the mount and clevis are held in place and the tubing marked for cutting.



After cutting the side bar to length and installing the upper clevis, but before everything was welded up, the door was closed to make sure that the side bar didn't interfere with the operation of the door and window handles. As shown here, the handles are fine; however, the stock arm rests are history.



Once all the mounting tabs have been welded in place, the clevis is quick-pinned to the tab before it is welded to the side bar. A hole should be drilled in the tubing at this location, then welded up; this rosette weld will minimize the movement of the clevis within the tubing as the circumference of the clevis is welded.

It is not uncommon for the bracket-clevis fit to change slightly after final welding of all components. We recommend careful elongation of the bracket's hole to achieve the proper quick-pin fit, rather than just hogging out the hole with larger drill bits.



With the welding completed, the front seats are mocked up in place. The removable back brace will be the mounting location for the top straps of the intended 5-point safety harness.



The upper, rear mounting tab for the window net was welded right next to the gusset at the intersection of the main hoop and the cage side; the lower, rear tab was mounted to the main hoop, as shown. Here, the proper location for the clevis for the quick-release pin is determined.



This view into the Nova's passenger compartment shows all the tubing of the 10-point roll-cage kit in place at the completion of the project.



The installation of interior tin is covered elsewhere in this catalog, but this is what the interior of the Nova looked like when it was fully skinned. All panels are aluminum, and still covered with the protective plastic; the driveshaft tunnel is steel and welded to the floor. Cleco clips are being used to hold the panels in place, prior to the actual riveting.

Another angle shows the tin as it extends into the trunk, along with the package tray/rear firewall. Also visible are the rear main-hoop struts as they extend to the back of the car, not to mention a couple of our battery trays, welded in place.



With the Nova high on the lift of our in-house chassis shop, this snail's-eye view shows how the tin installation, the dropped crossmember, and the subframe connectors all tie in together to provide a sanitary package.



All of the pieces used in a typical tin-installation project are laid out here, including the detailed instruction sheets. Not shown is the steel driveshaft tunnel.