Rubber Lumber Raised Bed

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Introduction

The 'Rubber Lumber Raised Garden Bed' represents our first attempt to incorporate the use of scrap tires in the design and construction of a permanent raised bed. The idea of using tire tread in bed construction came in the early 1990's, a time when the use of treated lumber was being questioned as a construction material in home gardens. To us, tire tread used as rubber lumber seemed to be a logical alternative to the use of arsenic treated lumber. We appreciated the fact that tire tread offered a longer service life compared to lumber. The biggest selling point, however, was the purchase price; there wasn't any! All of the scrap tires used in our demonstration projects were obtained from local tire stores at no cost. Three decades later scrap tires are still available at no cost. Your only cost will be the time and fuel required to pick up the tires.

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Introduction (cont'd)

These plans provide detailed instructions on constructing the latest version of our rubber lumber raised bed. Many years of trial and error, observation, modification and evaluation under field conditions have gone into the development of this bed. The bed has proven successful in producing a wide variety of vegetable, fruit and floral crops.

While material cost is minimum, a fair amount of time and labor is required to fabricate rubber lumber. If hired help is used for this task, the cost of advantage of using rubber lumber in bed construction is lost.

Now for the good news! Cost of material to construct a scrap tire rubber lumber bed, excluding soil, runs as low as 40 cents per square foot or about $1.20 per running foot.

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Tire Selection

The ideal tire for use in rubber lumber fabrication is a well worn, common passenger car, SUV or light truck tire. The lack of tread makes the tire more flexible and easier to work with. The majority of midsize car tires offer a combination of flexibility and acceptable tread length. Avoid high performance, low profile tires with narrow side walls as they are typically built sturdier thus requiring more energy to cut through. Also avoid self-sealing tires as the sealant is not compatible with gardening.

Low profile tire

On left: Avoid scrap tires with excessive tread remaining.
On right: Choose well worn tires with minimal tread remaining.

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Tire Selection (cont'd)

When fabricating rubber lumber to construct a raised bed it is important to select tires having the same (or close to the same) width. The sections of tread must overlap each other uniformly in order to fabricate a uniform piece of lumber.

A standard passenger car tire with sidewalls removed and the loop of tread severed produces a section of tread 6-7 feet in length. On average, one tire is required for every 3 running feet of bed.

The use of a matched set of scrap tires enables the fabrication of a uniform piece of rubber lumber.

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Rubber Lumber Fabrication

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Tool Requirement

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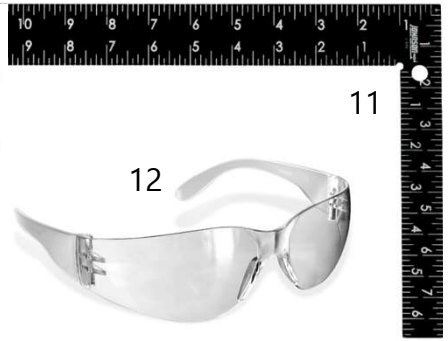

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No	Item
1	Jig saw equipped with hacksaw blades
2	Angle grinder
3	Impact driver (with appropriate bits)
4	Drill (with ¼-inch drill bit)
5	Plastic long tape
6	Retractable tape measure
7	Sharpie paint marker
8	Utility knife with standard and hook blades
9	Ratchet with appropriate size socket
10	Quick release bar clamps (two)
11	Carpenter's square (8-inch x 12-inch)
12	Eye protection
13	Welder's gloves

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Parts List (01/20)

Item	Quantity	Unit	Total
Scrap auto/light truck tires*	Variable	N/A	No cost
#9 x 1-½-inch hex-head self tapping roofing screws **	Variable	$0.09/screw	Variable
¼-inch x 1-1/2-inch hot dipped galvanized hex head bolts ***	Variable	$0.35/bolt	Variable
¼-inch galvanized nuts ****	Variable	$0.035/nut	Variable
¼-inch galvanized flat washers *****	Variable	$0.03/washer	Variable

*Number dependent on tire size and bed length. On average one tire is required for every 3 running feet of bed. Two additional tires are required to frame the ends of the bed.

** On average two screws required for each foot of rubber lumber (does not include end pieces). Six screws required for each end piece.

*** Four bolts required for each piece of tread used in rubber lumber fabrication.

**** One nut required for every bolt used.

***** Two washers required for every bolt used.

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Rubber Lumber Fabrication

You will need an elevated work surface to fabricate the lumber. For short pieces a large work bench will do. Protruding screw tips can damage your workbench surface, so it's a good idea to cover the surface with a piece of particle board. When fabricating extended lengths of lumber consider using 2-inch x 10-inch X 10-foot long boards supported by saw horses or concrete blocks. The work bench should measure at least two feet longer than the length of lumber you want to fabricate. Mark the boards every 18 inches as shown. The lines identify the location of the pockets that will be attached to the lumber later in the fabrication process.

A simple elevated work surface for fabricating rubber lumber is a back saver!

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Rubber Lumber Fabrication (cont'd)

With most tires it is difficult to determine where the side wall ends and the tread begins. This junction (where sidewall and tread meet) will vary slightly between makes of tires. Some tires come equipped with a raised or lowered area at this junction that can be used as a guide when cutting. When selecting tires look for this trait. A paint pen can be used to mark the cut line to assist you in making an accurate cut. Uniform cuts produce sections of tread with straight edges. Straight edges produce straight lumber.

Ready made cutting line

Rubber Lumber Fabrication (cont'd)

Start fabrication process by removing sidewalls from tires. Use a utility knife to cut a small slit in the tire sidewall as shown. The slit should be large enough to insert a jigsaw blade. On smaller tires having thin side walls it is possible to remove the side walls using only a utility knife. This technique is fine for cutting a few tires, however, for larger jobs plan on using a jigsaw. Your wrist and forearm will thank you for it! Cut as close to the tread as possible without cutting into the steel belts. Tread sections with even the smallest amount of sidewall remaining can prove difficult to use during lumber fabrication so be sure and cut close.

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Rubber Lumber Fabrication (cont'd)

For removing side walls using a jigsaw, fine-toothed blades are preferred. We have good results using blades with 17-24 teeth per inch (TPI). If you happen to cut into some of the steel belts by accident there is no need to panic. The steel wire exposed on the tread can be removed using an angle grinder. Plan on practicing on a few tires to get a feel for where the steel belting is located. Also practice making a uniform and consistent cut while removing the sidewalls. To reduce the amount of tension on the blade when cutting, insert a piece of tubing between the sidewall and tread as shown.

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Rubber Lumber Fabrication (cont'd)

Using a jigsaw, make a single cut through the tread at any point along the loop. We recommend a jigsaw equipped with blades having 11-14 TPI. The larger teeth enable easy cutting through steel belts.

Cutting through a loop of tread can be an awkward experience. To make this procedure easier and safer consider using a cutting jig. An inexpensive jig can be assembled from a few pieces of lumber.

Jig mounted to work table using bar clamps. Note the use of concrete block as a counterweight.

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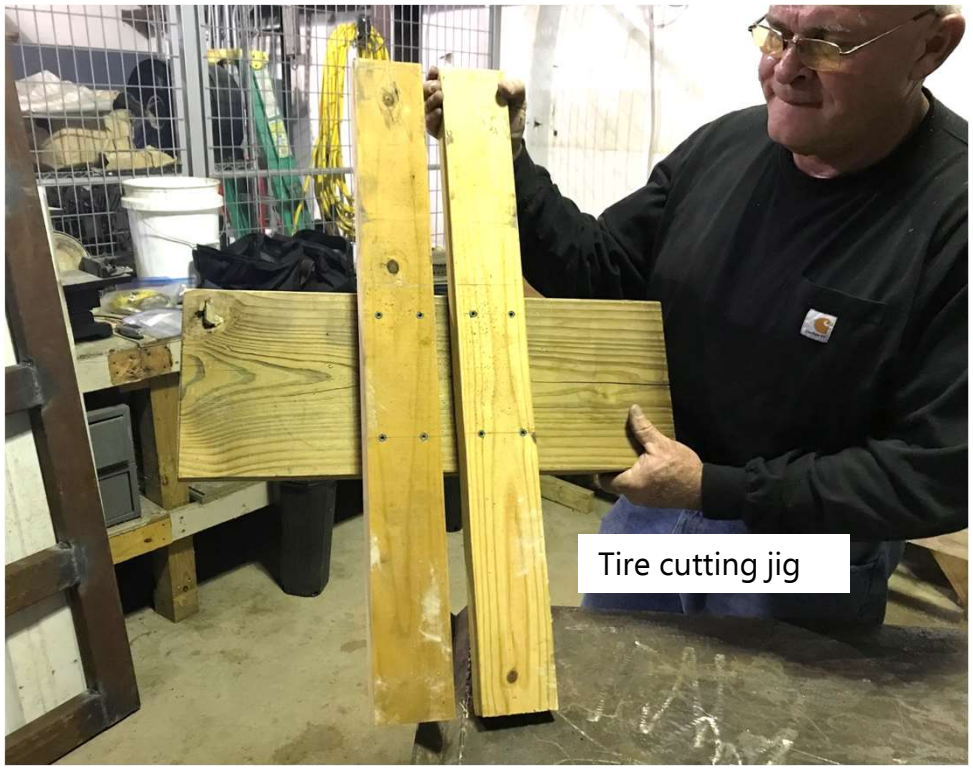
Tool Requirement



Note: Center 2 x 4's on base as shown. Leave 1-inch gap between boards to accommodate saw blade.

Parts List	
Item	**Quantity**
2-inch x 10-inch x 24-inch board	1
2-inch x 4-inch x 32-inch board	2
3-inch deck screws	8

Tool Requirement	
Item	**Quantity**
Quick release bar clamps	2
Spring clamps	2

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Rubber Lumber Fabrication (cont'd)

To facilitate cutting through tread in a straight line, use a paint pen and a square to mark the tread as shown.

Loop of tread secured to jig using spring clamps. Ready to cut.

Cutting through tread.

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Rubber Lumber Fabrication (cont'd)

After the loop of tread is severed, lay the section of tread on the floor and examine for cupping. In a perfect scenario the section of tread will lay flat on the floor. In reality most sections will exhibit some cupping but on occasion a section of tread will exhibit extreme cupping making it unsuitable for rubber lumber fabrication. In most cases these severely cupped sections can be cut up for pockets or used as end pieces in bed construction.

Section of tread exhibiting severe cupping.

The lower (flat) section of tread is preferred because it presents less issues during lumber fabrication.

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Rubber Lumber Fabrication (cont'd)

Designate a separate tire(s) to fabricate pockets for the rubber lumber. In order for the pockets to fit properly on the rubber lumber the tread used in making the pockets should never be wider than the tread used in making the rubber lumber. Prior to cutting, use a paint pen and a square to mark off 6-inch wide pieces of tread as shown.

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Rubber Lumber Fabrication (cont'd)

Using a jigsaw equipped with 11-14 TPI blades, cut pocket pieces from the previously marked sections of tread. The use of a pocket cutting jig makes this task much easier. Note: while more awkward, the tire cutting jig can also be used to cut out pockets.

Pocket cutting jig

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Rubber Lumber Fabrication (cont'd)

Pocket cutting jig construction using 2-inch x 4-inch and 2-inch x 10-inch boards.

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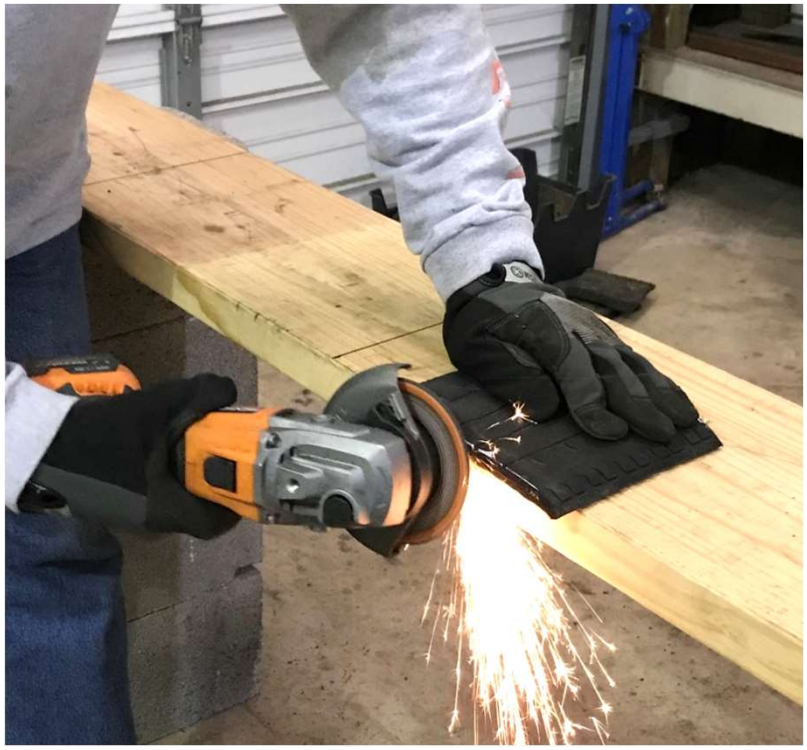
Rubber Lumber Fabrication (cont'd)

Use an angle grinder to remove any wire protruding from the ends and edges of each section of tread and the pocket pieces.



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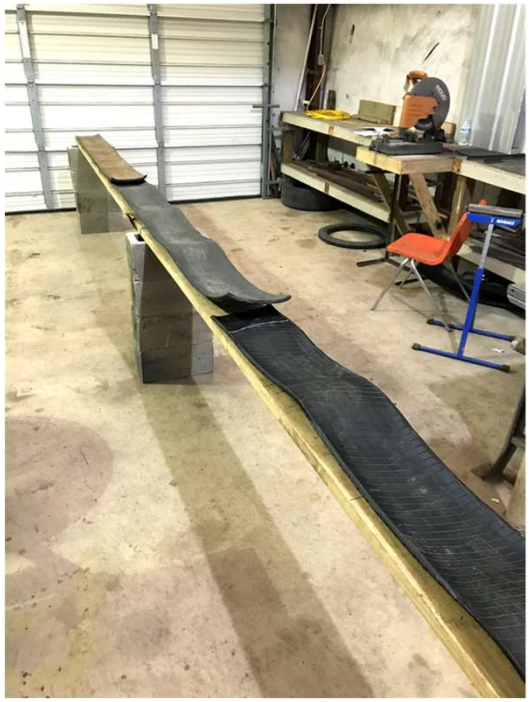
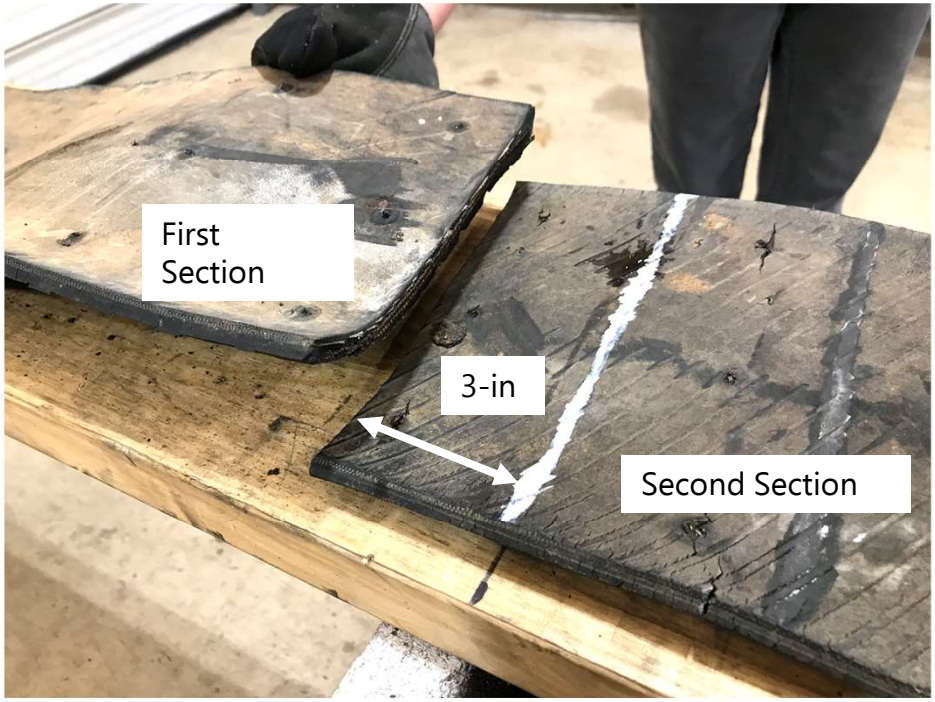
Rubber Lumber Fabrication (cont'd)

Based on the length of the rubber board needed, arrange the appropriate number of tread sections on your work bench end-to-end, making sure tread is facing down. Align the end of the first section of tread with the end of the work bench. Slide the second section of tread under the first a distance of three inches. Continue process with each additional section. When staging the tread sections on the work bench, align the edges to the extent possible. The last section of tread should exceed the planned length of the rubber board by 16 inches. This extra tread is required to form a loop at both ends of the rubber board. Any additional tread should be removed.





Slide second section under first section up to the line.

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Rubber Lumber Fabrication (cont'd)

Secure each section of tread to the adjacent section using a combination of hex bolts and roofing screws. Using a paint pen, mark the location of the bolts as shown (one inch from the edge). To prevent the tread sections from slipping while drilling, insert two roofing screws as shown. To obtain a secure connection the screws will by necessity penetrate a short distance into the work bench.

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Rubber Lumber Fabrication (cont'd)

Using a ¼-inch drill bit, drill through both sections of tread at each paint mark. The drill bit will need to penetrate into the work bench at least ¼-inch to enable the bolts to pass completely through the rubber. Attach a washer to each hex bolt and insert into the rubber with the assist of an impact driver. When finished inserting the bolts, back out each screw and bolt just enough to detach from the workbench surface.

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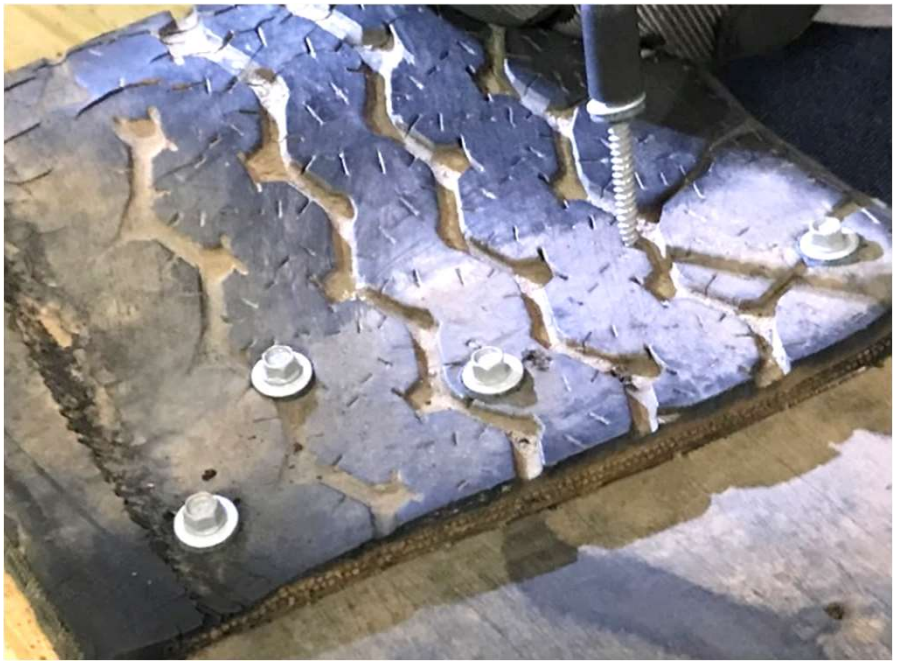
Rubber Lumber Fabrication (cont'd)

Return to the first section of tread and slide the new rubber board past the edge of the workbench about 8 inches. Bend the end over onto itself to form a loop and secure using five roofing screws as shown. When forming the loops keep them tight but not too tight as the opening needs to be wide enough to accept a 5/8-inch piece of rebar. Use bar clamps to obtain a tight bend. When finished, back out each screw just enough to detach from the workbench surface. Go to the other end of the workbench and repeat the loop making procedure.



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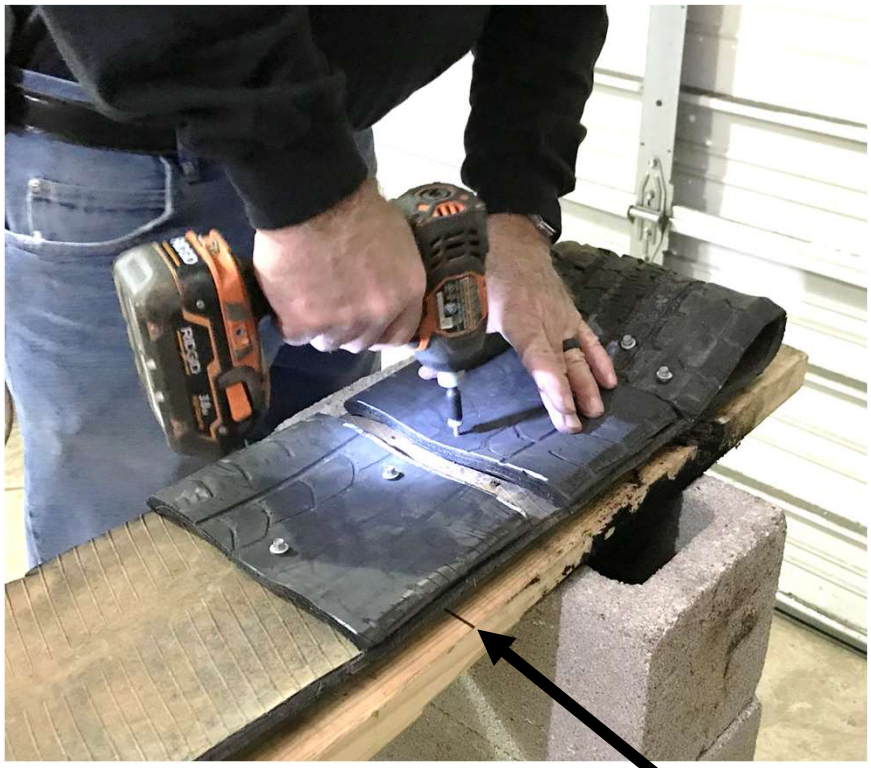
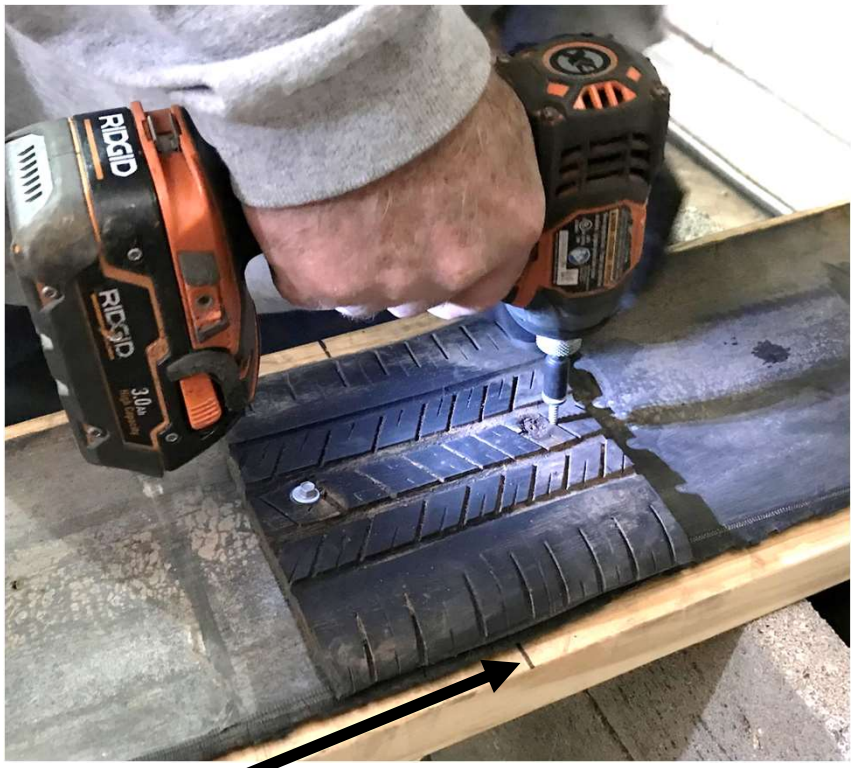
Rubber Lumber Fabrication (cont'd)

Return to the first section of tread and align the end of the new board with the end of the work bench. Using the marks on the work bench as a guide, center each pocket on a line and attach using two screws as shown. Also, plan on adding a pocket next to the loop at each end of the rubber board. In the event a bench mark is located where two sections of tread are joined, move the pocket to one side of the union and attach.





bench mark

Locate screws approximately ¾ inch from the edge of the pocket.

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Rubber Lumber Fabrication (cont'd)

Back off the pocket screws just enough to detach from the work bench. Starting at one end of the rubber board hold the board up off of the work bench and reinsert every screw and bolt (loop, joint and pocket) using the impact driver. This is the most dangerous task involved with fabricating rubber lumber. To keep from puncturing your fingers wear heavy leather (welder's) gloves and be careful where you place your fingers when lifting the board and reinserting hardware.

Holding board off of work bench while reinserting screws

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Rubber Lumber Fabrication (cont'd)

Flip the board over onto the other side.

Attach a washer and nut to each bolt and tighten using a ratchet and socket.

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Rubber Lumber Fabrication (cont'd)

Use an angle grinder to remove protruding screw tips. Protruding bolt ends do not pose an injury risk and do not need to be removed. If you do choose to remove the ends, grind them back flush with the nuts. Use eye protection when using grinder.

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Rubber Lumber Fabrication (cont'd)

The use of galvanized bolts will slow oxidation. To provide additional protection consider treating the bolt assembly (both sides of rubber lumber) with a rubber coating such as Flex Seal. You can treat the board while still on the workbench or after the lumber is installed prior to filling the bed. In each case allow time for the coating to dry.

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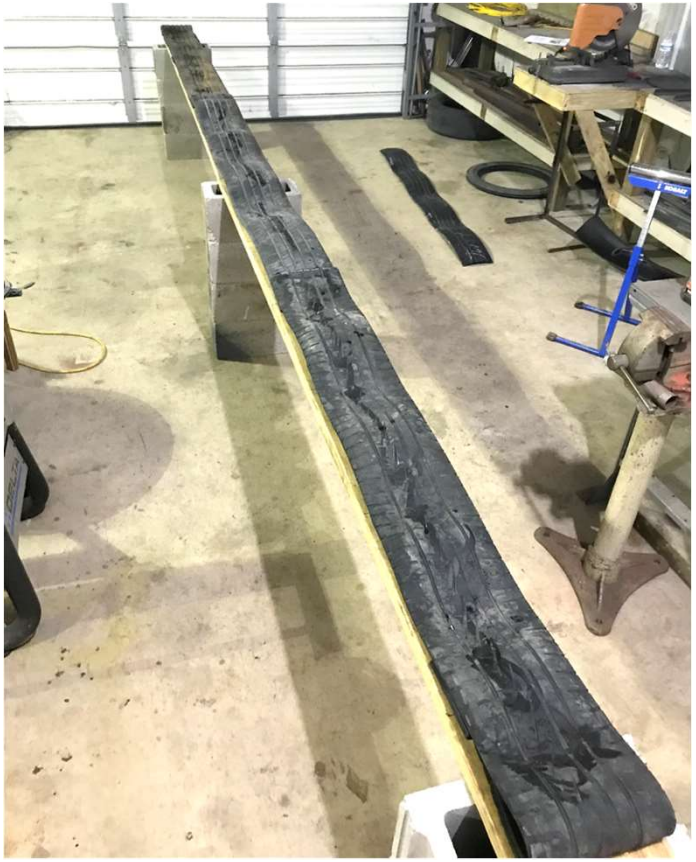
Rubber Lumber Fabrication (cont'd)

To transport rubber lumber roll it up and secure the loose end with a couple of roofing screws as shown.



Completed 20-foot piece of rubber lumber

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Rubber Lumber Fabrication (cont'd)

Prepare two end pieces using single pieces of tread. With the tread facing up on the workbench locate the center of the tread and mark a line as shown. Make two more lines 18 inches on either side of the center line. Center a pocket on each line and attach using sheet metal screws. Remember to remove protruding screw tips.

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Bed Installation

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Tool Requirement

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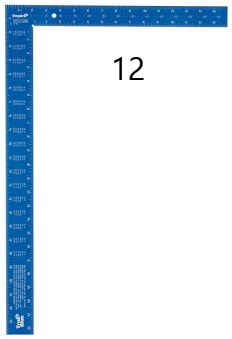
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No	Item
1	Come-Along hand winch
2	Chop saw
3	Impact driver
4	Sledge hammer (4-lb)
5	Plastic long tape
6	Retractable tape measure
7	Carpenter's level (4-foot)
8	Mason's string line
9	Garden rake
10	Shovel
11	Short piece of rope (minimum 3/8-inch diameter) or light duty chain/cable
12	Carpenter's square (16-inch x 24-inch)
13	Line level

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Parts List (01/20)

Item	Quantity	Unit	Total
3/8-inch x 20-foot rebar	Variable*	$4.25	?
5/8-inch x 10-foot rebar or oil field sucker rod	2	$9.75	$19.50
#9 x 1 ½-inch hex-head self tapping roofing screws	4 screws	$0.09	$0.36
2-inch x 4-inch x 8-foot treated lumber	1	$5.00	$5.00

* Number of joints needed varies with length of bed and length of stake required. Typically one, 20-foot joint is required for every ten running feet of bed (10-ft bed: 1 joint; 20 ft bed: 2 joints; etc.).

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Bed Installation (cont'd)

Using a chop saw prepare one, 3/8-inch x 18-inch rebar stake for every pocket on each piece of rubber lumber. The use of stakes on the end pieces is optional. Note: 18-inch stakes are long enough to provide required anchorage in most soil types. If beds will be installed on very coarse (sandy) soils the use of 24-inch long stakes is recommended to insure adequate anchorage. Also prepare two, 3/8-inch x 9-inch rebar 'corner' stakes.

Next prepare six, 5/8-inch x 30-inch rebar stakes. These stakes will be used in combination with string line to establish the location of the bed borders.

Using the treated 2-inch x 4-inch board prepare four, 18-inch long grade stakes. Taper the ends as shown.

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Bed Installation (cont'd)

Determine the location of the bed and level the site plus several feet around the periphery of the bed site. Initial leveling can be done by eye. You may need to till the site in order to move the soil around. If the soil is tilled, plan on packing it following leveling in order to limit the amount of settling. The recommended bed width is 40 inches, wide enough to insure plenty of growing area but not so wide as to make it difficult to reach the center of the bed without stepping into it.

Next determine the location of one side (border) of the bed and designate the corners using the 9-inch pieces of rebar. Drive stakes into the ground a couple of inches

Distance between corner stakes is equivalent to the length of the rubber boards.

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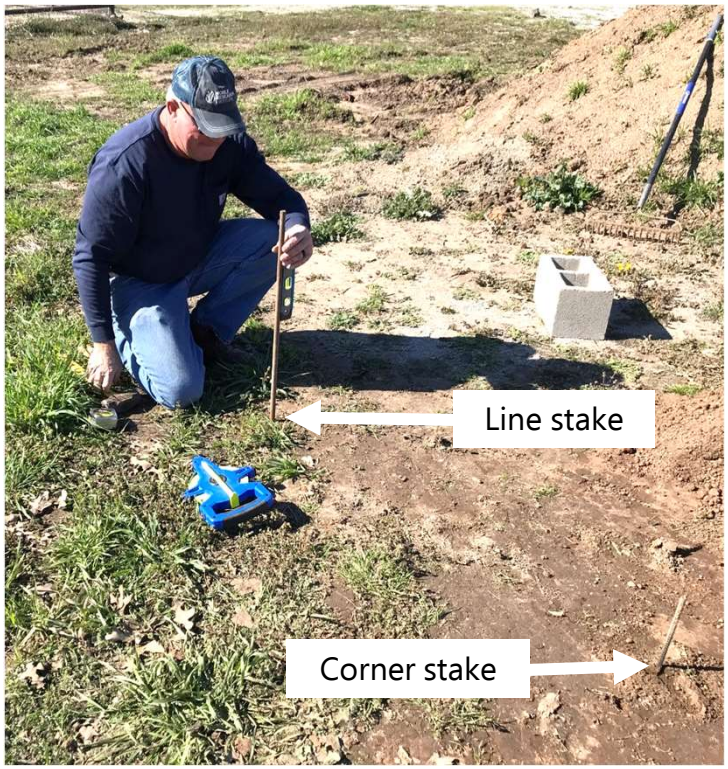
Bed Installation (cont'd)

Staying in line with the two corner stakes, move out four feet beyond the corner stakes and drive a pair of 5/8-inch stakes (one at each end) about a foot into the ground. Attach a string line between these outer stakes making sure the line is taut. If required, reposition the corner stakes so that they are directly beneath the string line. Use a torpedo level to ensure the corner stakes are installed plumb.



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Bed Installation (cont'd)

Designate the location of the opposite border. From each 5/8-inch line stake measure over 40 inches and drive another 5/8-inch x 30-inch stake into the ground. A square can be used to insure the line stakes are installed accurately.

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Bed Installation (cont'd)

Install grade stakes on the first border. Locate the grade stakes about a foot inside the line stakes. Center the stakes under the string line. Remove string from one of the line stakes and lay to the side. Drive grade stakes to depth. To make it easier to install the rubber lumber, the elevation of the grade stakes when driven into the soil should be ¼-inch to no more than ½-inch greater than the width of the lumber. If you are installing 8-inch wide lumber, drive the grade stakes to within 8-1/2 inches of the soil surface. It is easier to add soil to fill the gap than it is to remove soil when installing the lumber.

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Bed Installation (cont'd)

Reattach the line to the line stake and reposition on top of the grade stakes. Attach a line level between the grade stakes and check the level. Typically one stake is installed at the desired elevation and the second stake is installed to match the first using the line level as a guide. If a stake is driven too deep, pull it out, reposition and reinstall.

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Bed Installation (cont'd)

Using a Sharpie mark the location of the string line on both grade stakes as shown. Before marking make sure the string is located directly above the corner stakes. If you need to remove the line for whatever reason prior to completing lumber installation, align the string on the marks when reattaching the string and you are good to go.

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Bed Installation (cont'd)

Using the string line and tape measure check the soil level along the border. Remove soil or add where required in order to create a level site.

Target elevation: 8.5 inches.
Remove 1.5 inches of soil.

Target elevation: 8.5 inches.
Add 0.5 inches of soil.

Cut

Fill

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Bed Installation (cont'd)

Attach a long tape to one of the corner stakes and extend the length of the bed positioning the tape directly beneath the string line. Install a pair of 3/8-inch stakes every three feet along the tape as shown. The stakes form cradles that keep the rubber lumber upright during installation.

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Bed Installation (cont'd)

Remove the measuring tape and string line. Remove one of the corner stakes and replace with a 5/8-inch x 30-inch stake. Drive the stake into the soil to a depth of about 18 inches (one foot exposed above ground) and at a slight angle as shown. Installing the stake at an angle keeps movement to a minimum during the lumber stretching process.

Install stake at a slight angle with the top slanting away from the bed interior.

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Bed Installation (cont'd)

Unroll the rubber lumber and position along side the cradles. With the pockets facing out (toward the bed exterior), slide the end (loop) over the angled stake. Working toward the opposite end of the bed drop the lumber into the cradles.

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Bed Installation (cont'd)

Remove the corner stake and the grade stake located at the free end of the piece of rubber lumber. The corner stake is no longer needed. When removing the grade stake pull the stake straight up as it will need to be reinstalled.

Tie a loop in a 7-foot long piece of rope to form a sling. Run the sling through the loop on the lumber as shown.

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Bed Installation (cont'd)

Attach the fixed end of the Come-Along winch to the line stake and the cable end to the sling as shown. Note: to limit the amount of stake movement when using the winch you may need to drive the line stake deeper. Do not drive too deep or you will not be able to use it when reattaching the string line.

Use the winch to remove slack in the lumber. Be careful not to apply too much tension on the lumber as the sections of tread could separate. When sufficient tension is applied the lumber will stand on edge without assistance from the stake cradles. Your goal when stretching the lumber is to create a straight border by removing as much puckering as possible.

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Bed Installation (cont'd)

With the lumber under tension, remove the cradle stakes one at a time and insert into the pockets. Drive the stakes to within a couple of inches of the top of the lumber.

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Bed Installation (cont'd)

Release tension on the winch and remove the sling. Insert a 5/8-inch x 30-inch stake into the loop. With the stake resting against the back of the loop drive the stake into the ground a few inches. Continue driving the stake pulling back on it while it is being driven into the ground. Using the stake as a lever keeps tension on the lumber. To avoid skinning your hands when driving the stake be sure and wear gloves. Drive the stake to within a couple of inches of the top of the lumber.

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Bed Installation (cont'd)

Reinstall the grade stake as close to its original position as possible.

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Bed Installation (cont'd)

Reattach the string line to the line stakes. When attached you will notice the string runs directly above the lumber. The location of the string will need to be adjusted so as not to interfere with the final leveling process. To offset the string line, insert a screw into the top of each grade stake as shown and reposition the line. The line may be offset to either side of the grade stake.

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Bed Installation (cont'd)

Reattach line level to the string line. Use the level to insure the reinstalled grade stake is at the proper elevation. If not, make the needed adjustment.

Finish driving stakes using the string line as a gauge.

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Bed Installation (cont'd)

If the lumber is not resting on the soil surface it will tend to move downward with the stake when being driven. You can place your hand under the lumber to prevent this movement or use a pry bar to reposition the lumber on the stakes following insertion.

Pry bar used to reposition lumber on stake.

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Bed Installation (cont'd)

Fill in gaps along the base of the lumber.

Properly installed rubber lumber. Notice the lumber is level with the string line and there are no stakes protruding above the pockets. The lumber has been installed in a straight line with no indication of puckering or wrinkling.

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Bed Installation (cont'd)

Move to the other side and install the second border. Start by attaching a string to the line stakes and installing the grade stakes. Use a carpenter's level as shown to set the elevation of the second set of grade stakes.

At one end of the bed install a 30-inch corner stake directly opposite the adjacent corner stake. For greater accuracy employ the use of a square and carpenter's level when locating the corner stake.

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Bed Installation (cont'd)

Continue with the installation of the second border using the same procedure as outlined for the first border. Once installation of the second border is complete check the accuracy of your work using a carpenter's level as shown.

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Bed Installation (cont'd)

Install the end pieces. Typically, it is not necessary to attach the end pieces to the bed sides. Once the bed is filled the weight of the soil will prevent the end pieces from moving. To hold the end pieces in position prior to filling, insert two stakes into the soil at the corners of the bed as shown. Once the bed is filled, the stakes can be removed. Not attaching the end pieces to the sides enables easy removal and access to the bed when using a tiller.

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Bed Installation (cont'd)

Bed length can be increased slightly by adjusting the overlap of the end pieces with the bed sides.

Squared off configuration with significant side overlap.

Bowed out configuration with minimal side overlap.

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Bed Installation (cont'd)

Before filling the bed use a broadfork or spading fork to breakup any soil compaction that can occur during bed construction.

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Filling the Bed

The preferred soil type for use in a rubber lumber bed is sandy loam. Amending the soil with compost will improve the water and nutrient holding capacity of the soil. The compost will also serve as a slow release nutrient source.

If you plan on applying plastic mulch film/fabric to the bed surface add sufficient fill to form a crown on the bed. A crowned bed is essential to insuring a tight fit of the film to the soil surface. Soil warming is more pronounced using mulch film when there is continuous film to soil contact.

Crowned bed

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Plastic Mulch Application

Standard plastic mulch film or woven weed barrier fabric can be used successfully on a rubber lumber bed. To cover a 40-inch wide bed, we recommend using five foot wide material.

Measure off the required length of film and anchor one end temporarily to the ground using weights (concrete blocks, pavers, bricks, etc.). Cut the other end making sure the film extends a couple of feet beyond the end of the bed.

Stretch the film length wise and temporarily anchor to the ground with weights.

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Plastic Mulch Application (cont'd)

Pick a side and beginning with the first pocket, wrap the edge of the film immediately above the pocket several times around a 6-inch wide piece of treated wood lath. As you wrap the film around the lath, pull the film to the side of the bed. Pull back the top of the pocket and insert the lath. Proceed to the next pocket and continue the process. When finished, switch to the other side and continue the process. When you have finished with lath installation, all of the slack (wrinkles in the film) should be removed. If not, restretch the film where wrinkles exist, wrap and reinsert the lath.

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Plastic Mulch Application (cont'd)

Conclude mulch application by stretching the film towards each end of the bed, wrapping and installing the lath in the end wall pockets.

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Plastic Mulch Application (cont'd)

In most cases the pocket creates a tight fit sufficient to keep the lath from rotating or popping out. If this happens, secure the flap using sheet metal screws as shown.

A final note on using plastic mulch film. Standard mulch film isn't permeable to water. As such, drip irrigation emitter line must be installed in the bed prior to film application. If this presents a problem consider installing weed barrier fabric. It is permeable to water permitting the use of dripper line on top of the fabric.

Mulch film (water impermeable)

Woven weed barrier fabric (water permeable)

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Mini Tunnel Bed Cover

Rubber lumber beds can be easily outfitted with greenhouse poly film and floating crop covers. An inexpensive hoop frame to support the covers can be erected using 3/8-inch x 18-inch rebar stakes and ½-inch (125psi) x 7-foot long poly pipe hoops. The cover is attached to the hoop frame at the base using 2-inch binder clips.

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