

Building a PVC Bed Cover Support

by Penni L. Smith

My neuropathy has made my feet very sensitive to any sort of pressure. My feet are barely tolerant of socks, and the pressure of sheets, blankets, and other bed coverings is much too painful. There are some commercial products available to address this concern. It is easy, however, to build a suitable support with inexpensive PVC pipe, which is available at any hardware or home improvement store. Such a support will be superior to any commercial product because it can be customized to your exact needs, and is likely to be both more sturdy and less expensive. These instructions will explain in detail how to build such a support. This may sound complicated, especially with the options I am going to explain, but it's really a pretty straightforward process. If it seems too complex, chances are a friend or neighbor can help you understand.

I am going to cover two types of designs. First is an upside-down U-shaped design that goes across the bed, and the other is a C-shaped design that fits around the foot. Be sure to read the background on the designs and carefully consider which one best suits your needs.

Whichever design you choose, this is an inexpensive solution. The material for a large support should come to less than \$10, exclusive of the cutter. I've listed prices throughout this article based on those I found on line in January 2008 for a well-known home improvement retailer. These are all based on 1/2 inch material, which is quite sufficient for a U-shaped design. If you are using the basic C-shaped design, you may prefer 3/4 inch material instead, which should cost just a bit more.

A Little Background on the Designs

I'm probably part of a dwindling minority, but I sleep in a waterbed (and have for almost 35 years). When I first decided to build a support, I needed one that would work with a waterbed, and I created one that looks like an upside-side down U, and that rests on the base that the mattress itself rests on, fitting between the mattress and the frame. When I needed to adapt this design for travel, creating a support that would work on standard hotel mattresses, I simply modified that concept. This upside-down U design can work on any mattress by resting on top of it, resting between it and a frame, or totally surrounding it. I have used it all three ways on standard mattresses of all sizes, portable air mattresses such as those typically sold to be guest beds, bunk beds, trundle beds, and more.

Another NCCNA board member, Sandra Vinson, brought in a commercial support she had purchased. It was quite flimsy, but she did like that it slipped under the mattress from the bottom of the bed. I can certainly see where that could be desirable, and I've developed an alternative design, which in itself has two forms, that works that way.

FIRST STEP: CHOOSING A DESIGN

The Upside-Down U-Shape Design

The upside-down U design resembles an elongated U turned upside down, or perhaps a rectangle with no bottom. The support consists of two of the U frames joined with crossbars about twelve inches long. The support can either rest on top of a mattress, fit between a mattress and a frame, or surround a mattress and rest on the floor. If it rests on top, it can extend partially or totally across the width of the mattress. It's very sturdy and versatile. It can also be positioned as close or far from the bottom of the bed as suits your purpose. Though I can see the appeal of the C-shaped design, I think the upside-down U is superior overall.

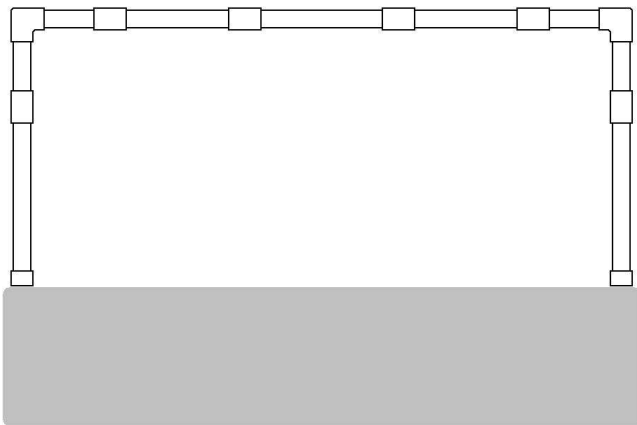


Figure 1 One version of the Upside-Down U-Shaped design can sit on top of a mattress.

Figure 2 An alternative is to have it go alongside the mattress in a frame.

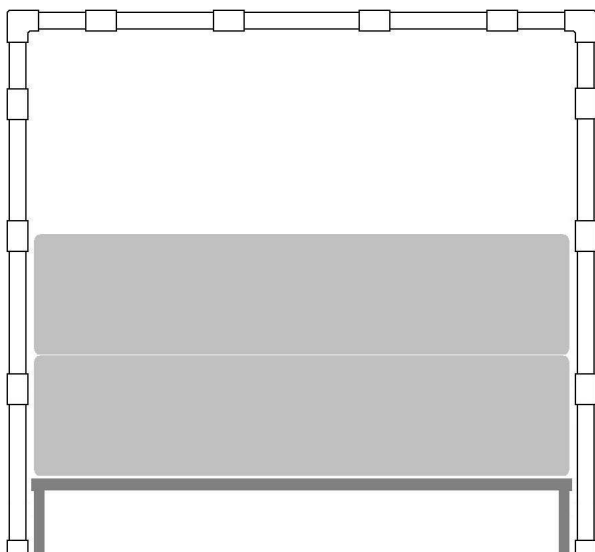
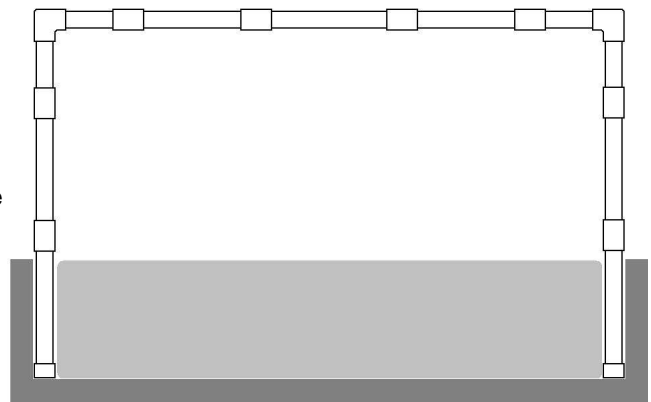


Figure 3 It can also go completely around the bed and rest on the floor.

No matter whether the support will rest on top of the mattress, between it and a frame, or around it on the floor, the design of the upside-down U-shape support is the same. The only variations are in the height and width. The only design question really is the number of crossbars desired.

The C-Shape Designs

The C-shaped design slides under a mattress from the foot of the bed. The basic design consists of two C-shaped frames joined by crossbars that can be as wide as desired. For very long widths, one or two additional C frames can be added in the middle. In the basic design, there are no posts to interfere with your feet or legs, which might make it a better choice for a restless sleeper. The alternative design has supports that come down from the portion that extends out from the foot of the bed and rest on top of the mattress. This would be at least on the end Cs, and could be on additional Cs if they exist. Unless you choose the alternate design with the supplemental supports, this support is flimsier, which may make it ill-suited if you use heavy bed coverings. This drawback, however, can perhaps be compensated for by using larger (3/4 inch) material.

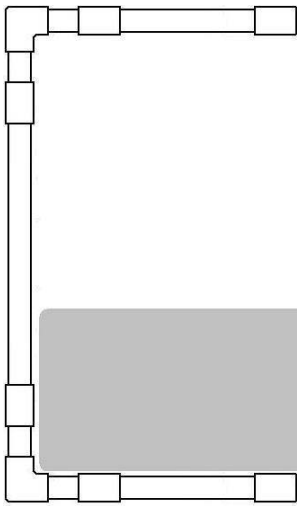


Figure 4 The basic C-shaped design fits under the mattress at the foot of the bed. For a support that isn't too wide, the frames can go at either end. For wider ones, additional "Cs" can be added in the middle.

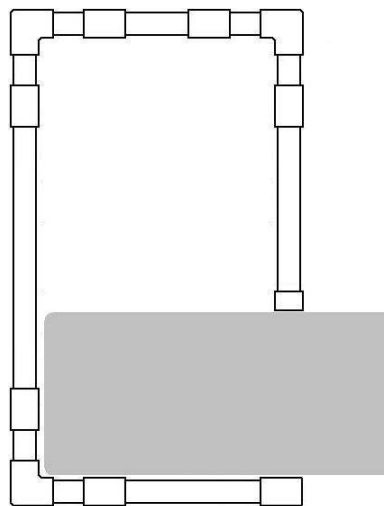


Figure 5 For additional support, the C-shaped design can be modified to add support posts that come down and rest on the mattress. This would be especially helpful for heavier bed coverings.

Unlike the upside-down U-shape design, the design variations possible with the C-shape support are extensive. For this article, I'll explain one possibility, but as long as the parts go together and the support functions, it can be made any way you like.

Study the illustrations and make your basic design decision, as that will dictate the measurements you make and the particular pieces you buy. Photos of frame cross-sections and fully-assembled supports are later in this article, which you may also want to look at for help making your decision.

DETERMINING THE MATERIAL NEEDED

Before heading to the hardware store, you will need to figure out how much material to purchase. The process of calculating this involves a couple decisions and a little math. This may end up sounding a little complicated, but it really isn't.

How Wide?

First, how wide do you want the support to be? This may not be the width of the bed. For example, if you sleep with someone else, that person may not want the support extending the full width and lifting the covers off everyone's feet. On the other hand, it might annoy the person more to have it end midway across where it might be kicked and bumped.

Even if you don't share the bed, you might want it shorter than full width. If you are using the upside-down U design and setting it on top of the mattress (see below for making that decision), you should plan on making it at least a foot shorter than the full width (six inches shorter on each side) so that it isn't prone to falling off. If you are having that same design set on the floor (again, see below), you will need it to be a couple of inches wider than the mattress, at least. The width of the C-shaped designs can be exactly how wide you want the support, though it should be at least six-twelve inches less than the width of the mattress on each side, if you are going for full width. If you don't need a lot of space, you may wish to keep whichever support you are using narrow to minimize the change to how the coverings lie.

Whichever design you are using, determine the width you need, in inches, and make a note of the measurement. This is the width number.

How High?

Before you can figure out how high you need the support, you need to determine where it will rest. If you chose the C-shaped design in either form, the support will be resting beneath the top mattress. If you chose the upside-down U design, you might have the support rest on top of the mattress, on a frame that might be just a few inches below the mattress top or near the floor, or on the floor itself.

Some examples might help. For the support I use for travel, the frame rests right on top of the bottom sheet (essentially, then, on the mattress), and thus only needs to be as tall as the amount I want it above the mattress. My main support, the one in the waterbed, runs between the mattress and the frame, and rests on the board that supports the mattress, so the total height is the height of the mattress and the height of the amount of rise above it. Once I slept in a glorified cot, which was rather narrow, and I had the support resting on the ground so I didn't have to sacrifice any bed space or worry about knocking it off. This would

probably be the better arrangement for someone who moves a lot while sleeping but still wants the upside-down U design. Figure out where you want it to rest. If you aren't sure, plan on the floor. Things can be shortened and really, if you don't glue the support together, it can be lengthened too, but it's generally better always to have more than less.

Again, if you are using the C-shaped design, the base resting spot is underneath the top mattress.

Once you have determined where the support will be based, measure the inches from the base resting point to the top of the mattress. If you are resting it on top of the mattress, this figure will be zero. If you have one of those highly elevated mattresses and are basing it on the floor, this could be a large figure. Note this figure as height number one.

Also, you need to know how much above the mattress you want the support to rise. The simplest way to figure this is to measure the length of your foot in inches and add two to three inches for clearance. This would let you lie with your feet straight up and have plenty of room. If you are sharing a bed and going across the entire mattress, be sure to measure the longest feet. This is the second height number.

The total height is height number one, the base to the top of the mattress, plus height number two, the amount above the mattress.

For example, my waterbed has eight inches from the board on which the mattress rests to the mattress top, and I have the support rise to twelve inches above it, for a total of twenty inches. My travel support rests on top of the mattress, so it just needs to be the twelve inches that it rises above it.

Make a note of both height figures, as well as the total height.

How Deep?

For the upside-down U-shaped design, I like the two U frames to be about a foot apart, though anywhere from ten to fourteen inches would probably work. Decide what you prefer.

For the C-shaped designs, this is a critical number, as this determines how far from the foot of the bed the frame extends. You'll want to make sure this is long enough to lift the covers fully off your feet in your usual sleeping position. Of course, you will have some lift as the covers rise to reach the top of the frame. Not having used this design, I would guess that this would be 18-24 inches, but it is clearly a matter of individual preference.

One Other Thing to Consider

To make my travel support easier to assemble, all the pipes are the same length except those connecting to the elbow joints and the risers. The crossbars and the pipes that make up the width are identical. This enables me to assemble the support without having to care much about which part I'm grabbing. This is not an issue for my permanent support, of course. You may want to make as many of your pieces of pipe as possible the same length.

Calculating the Pipe Length Needed

For the Upside-Down U-Shaped Design

Take the width you determined in inches, and multiply that by two. Take the total height in inches, and multiply that by four. Take the number of crossbars you decided on, and multiply that by twelve inches (unless you determined you wanted a different depth—if so, adjust accordingly). This will be the total length of pipe, in inches, you will need for the frame. Again, this sounds more complicated than it is

Figure Component Summary:

Height of support above bed in inches: ____.
(At least the length of your foot plus two or three inches.)

Length in inches of the base the support will rest on to the top of the mattress: ____.
(Zero if resting on the top of the mattress.)

Add those two amounts together for the Total Height: _____.

Calculation:

Total Height times four: _____.
Total width times two: _____.
Total number of crossbars times two: _____.

Add these three numbers for the Total Inches of pipe needed. _____

For the C-Shape Designs

Take the total width you determined in inches, and multiply that by 6. If you wanted additional crossbars, add the total width by the number of additional crossbars. Take the total height and multiply it by the number of C-frames (at least two). Take the total depth and multiply it by two and multiply that by the number of C-frames. If you are using the optional support posts of the alternate design, add the height in inches above the mattress times the number of support posts. This will be the total length of pipe, in inches, you will need for the frame.

Figure Component Summary:

Total number of C-frames: ____ (at least two).
Extra crossbars, if any: ____, plus 6, for total bars: ____.
Number of support posts, but only if using the alternate design: ____ (then at least two).

Total depth, in inches: _____.

Total width in inches: _____.

Height of support above bed in inches:____.
(At least the length of your foot plus two or three inches.)

Height in inches of the mattress the support will slide under: _____.

Add those two amounts together for the Total Height: _____.

Calculation:

Total width times total bars: _____.

Total depth times number of C-frames times 2: _____.

Total height times number of C-frames: _____.

Total height of support of the bed times number of support posts (alternate design only): _____.

Add these four numbers for the Total Inches of pipe needed: _____.

After You've Figured the Total Inches

Divide that amount by twelve to get total feet. PVC is sold in ten foot lengths, so round up to the nearest ten. Each ten foot length is less than \$2.

Calculation:

Divide the last number by 12: _____.

Round that number up to the nearest 10: _____.

This is the number of pipes to buy.

Additional Items Needed

In addition to pipe, you will need certain PVC pieces. Most of the pieces are available threaded and unthreaded. Be sure to get the unthreaded ones that just slip together. PVC is available in different sizes. For upside-down U support and the C-shaped support with the additional support posts, ½ inch material is sufficient. ½ material will probably be sufficient for the C-shaped support as well, but the additional strength of the ¾ inch material might be a good idea, especially if you are not using the alternate design with the support posts. Whatever you decide, be sure to get the pipe and pieces in the same size.

End Caps

For the upside-down U design, you will need four caps for the ends of the support that it rests on.

If you are using the basic C-shaped design, you will not need end caps.

If you are using the C-shaped design with the additional support posts, you will need one end cap for each post, minimum two.

Caps for ½ inch PVC run about 25¢ each.

Elbow Joints

You will also need ninety-degree elbow joints (also called L-joints, as they look like the letter L) for the corners. These should be about 20¢ in ½ inch material.

For the upside-down U design, you need four of these.

For the basic C-shaped design, you will need eight.

For the C-shaped design with the additional supports, you will need an additional elbow joint for every vertical post you have beyond two.

T-Joints

T-joints are so named because they resemble the letter T, joining two pipes straight and another perpendicular to them. T-joints are about 30¢ each for ½ inch material.

Figuring the number of T-joints you need is a little tricky, as it is entirely dependent on the particulars of your individual support and the basic design.

For the Upside-Down U-Shaped Design

You will need two T-joints everywhere you want a crossbar. I recommend a crossbar four to six inches on either side of the elbow joints, plus one every twelve to eighteen inches across the width. The height shouldn't need an additional crossbar, but if it is very high, one, or perhaps two, could be used. One way to figure out the number of crossbars needed for the width is to find the middle of the width, and plan to have a crossbar either right there, or six inches on either side of the midpoint. Then space them back to the ones near the joints. Don't worry too much about these—unless the support is glued, you can always add more, and it doesn't matter if they are twelve inches or sixteen and 2/3. It doesn't even matter if they are spaced equally. Just remember that the more crossbars you have, the more sturdy the support will be. Count the number of crossbars needed and note that number. Multiply it by two to get the number of T-joints.

For the Basic C-Shape Design

For the basic design, you will need eight T-joints. This will provide crossbar support on either side of the corners. If you want an additional crossbar in either the rise or the extenders, you will need two T-joints for each such crossbar. If you want more than the two supports, because you are extending with width, you will need two T-joints for each additional support.

For the C-Shape Design with Additional Support Posts

You will need the eight T-joints of the basic design, plus two for the support posts. If you have additional support frames, you will need four T-joints for each additional one. If you want an additional crossbar in either the rise or the extenders, you will need two T-joints for each such crossbar.

Cross-Joints

Shaped like a uniform cross or plus, these joints combine two pipes in each direction.

None are needed for the upside-down U-shaped design.

If you are doing either of the C-shaped designs, you only need cross joints if you are having more frames than the two on each end. If you have one or two in the middle, you need a cross joint for each one wherever a crossbar intersects it.

Couplers

Couplers are straight pieces that join two pipes together. None of the designs require couplers. These, however, can be handy if you need to extend a length that was cut too short, or if you need some flexibility in length or width, perhaps for a travel set of your own. For example, if you are using the C-shaped design and want to divide the long pipes into shorter pieces to better fit in a suitcase, you could use couplers. Just be aware that this part is available if you need it.

Other Items

There are two other items you may need.

If you don't have one, or have someone you can borrow one from, you will need a cutter for the PVC. You could make do with a hacksaw, but you will get far better results with much less effort with the PVC cutter, which runs \$10-20. There are also PVC saws. The cutter will likely cost more than all the material, and if you aren't building creative things or doing plumbing, you may not want to go to that expense. I'm not sure if you can get the store to cut the pipe for you. If so, you'll need good measurements going in.

If you want the support to be permanently assembled, you will need a PVC cement, such as Red Hot Blue Glue or something similar. A small can costs less than \$5. My travel support is not glued so that I can assemble and disassemble it at will. The one in my regular bed, however, is glued because I have three dogs that jump on the bed and can hit or jump on the support. If I didn't have it glued, I'd be reassembling it nightly.

Make your list and head to the hardware store.



Figure 6 Items to buy include elbow joints, t-joints, end caps, pipe, and a PVC cutter.

CUTTING AND ASSEMBLING THE PARTS

It is important, when cutting the pipe, to keep matching parts very close to the same length. The joints will cover up and handle minor variations (I cannot make my cut ends square except by luck), but cannot handle significant discrepancies. What I have found works best for me is to cut one piece by measuring, and the next ones by holding the first one against the uncut pipe and cutting with cutters right at the end. Also, remember that it is better to cut things long and shorten them if needed. You can use couplers to extend the pipe if you cut too short, but if you can avoid that, do so.



Figure 7 After cutting one pipe by measuring, it's easy to cut matching parts by using the first one as a guide.

Figure 8 This basic corner is used in all the designs. The elbow of the corner is joined with 4-6" lengths of pipe to t-joints that will have crossbars extending out from them.



Remember, this is rather like a big tinker-toy project.

For the Upside-Down U-Shaped Design

Begin by cutting the short pieces of pipe which will extend from the elbow joints to the crossbars on either side. For my small travel support, these are four inches; for my main support, they are six. Anything in that range will work.

Then cut your crossbars, the four on either side of the elbow joints, and any additional ones you planned for. I like them to be twelve inches long because I like the support wide for lots of room, but eight or ten inches will also work, as would fourteen. Use whatever amount you planned for, and just be sure they are all the same length.

Put the short length of pipe into each side of the elbow joint. On the other end of the pipe, put a T-joint, connecting it with the top of the T. Then put crossbars into the angled connection of each T-joint. Congratulations—you've finished the corners! See figure 8 above.

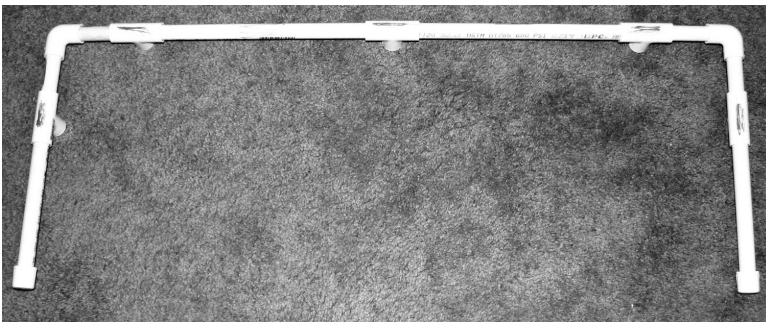


Figure 9 One side of the U-shape design. Crossbars will connect it with an identical frame on the other side.

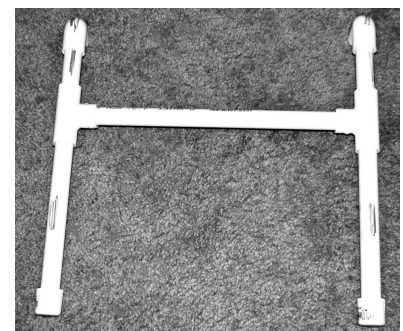


Figure 10 The end portion of the U-shape design.

Cut two long lengths of pipe for the total width of the support, minus the length of the pipe from the elbow joint to the first crossbar. Cut four long lengths of pipe for the total height of the support, again minus the length of the pipe from the elbow joint to the first crossbar.

Cut these lengths of pipe at whatever distance you planned for the crossbars.

Now you can finish your assembly. Put a length of pipe, a T-joint, and another length of pipe for the width until you are ready to join to the corner on the other end. Do the same for the other side, then add the crossbars. Add the lengths of pipe going down, putting in t-joints and crossbars if there are any. Add the caps on the end, and your support is ready.

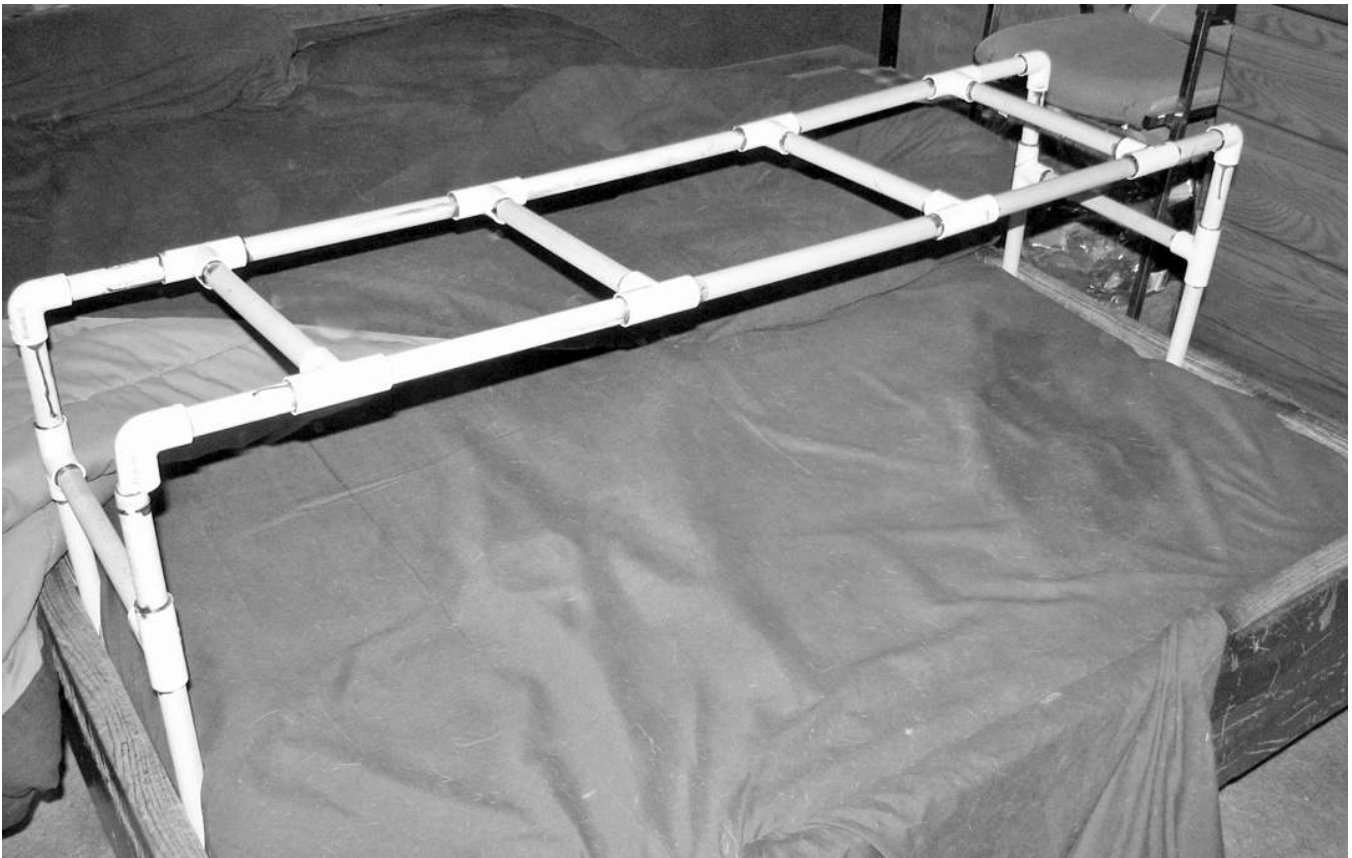


Figure 11 The fully-assembled U-shape support in use. This is my main rack, fitting between my waterbed mattress and its frame. Notice the marks around the joints, including the drips—this is my awful-looking but effective glue job.

For the C-Shape Designs

For the C-shape designs, begin by cutting six pipes the width between frames (whether two, three, or four). If you have additional crossbars, cut those as well.

Then cut the short pieces of pipe which will extend from the elbow joints to the crossbars on either side. I recommend that these be about four inches each. See the illustration of the basic corner above (figure 8).

Cut the additional pipes that will make up the height and the depth extension beyond the T-joints of the cross bars.

If you are using the alternate design with the supplemental support posts, cut those posts.

Construct one of the end C frames. Put the short pieces of pipe into each side of the elbow joint. On the other end of each short piece, put a T-joint, connecting it with the top of the T. Repeat this, then join the two corners with one of the pipes that make up the height. On the free ends, connect the T-joints to the pipes that extend the depth of the frame. Use an elbow joint on the end. Make another frame for the other side. Add the long pipes that are the width crossbars into each T-joint and the ending elbow joints.

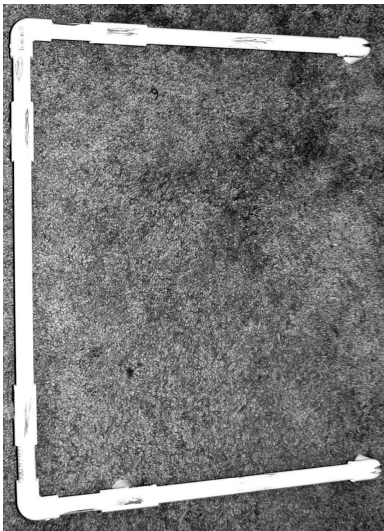


Figure 12 The basic C frame. This will join with crossbars to one or more additional C frames to make the complete support.

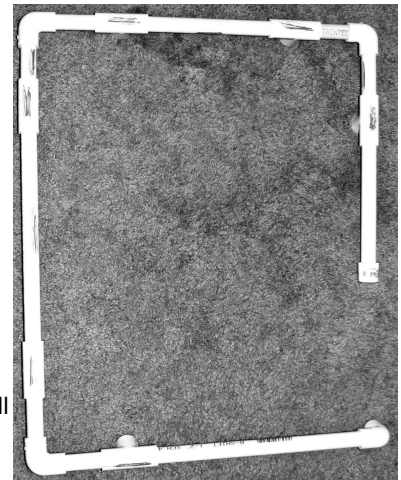


Figure 13 The C frame with the supplemental posts that will rest on top the mattress for additional support.

If you have additional crossbars, you'll need to insert them appropriately. If you have additional C frames, you'll be using cross joints and T-joints to connect them in.



Figure 14 The basic C-shape support assembled. Additional Cs could be added if a wider support is needed.

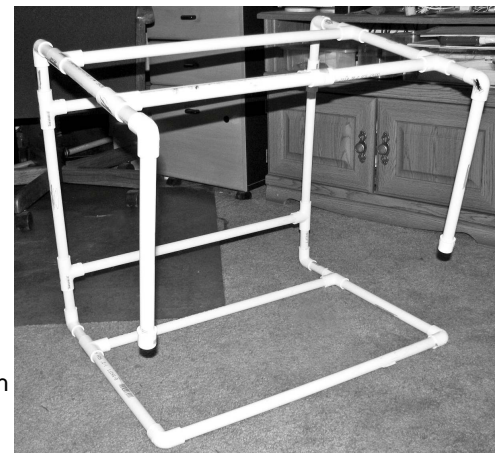


Figure 15 The alternate C-shape with the posts that rest on the mattress for additional support.

If you are using the supplemental posts, position the T-joints and elbow joints appropriately to incorporate those supports.

FINAL NOTES

If you are planning to glue your support, don't. You'll want to test it for a little bit to make sure you are happy with it before gluing.

Bed coverings are not designed to cover a support in bed, so realize that the coverings probably won't tuck in any more. Loosen or remove the covers and insert the support so that it is above the fitted bottom sheet and below the top one. Add any additional covers and arrange them as best you can.

Test your support. If it sits on top of the mattress, you may find it falling off if it is too wide, and you may need to shorten it a little. If it's too tall, you might want to lower it.

When you are happy with the support, you may glue it if you want. This can be messy (especially if I'm doing it), so be sure to do it someplace where you won't mind if it drips (or where you have put down protection). Do it in a well-ventilated area. I also wear old clothes, as I usually will get it on me and it does not come out with anything short of scissors.

PVC cement actually uses a chemical process to bond the parts together, and once glued the joints will actually be stronger than the plain pipe. This is how it can be used even on wet pipe. It sets very fast, so you will need to apply the glue and join it together, never to separate it again. Errors are not correctable. Therefore, I recommend assembling the whole support beforehand, and then pulling one joint apart, applying the glue, and putting it back together. Wait a couple seconds (literally) for the bond to form and move on to the next one.

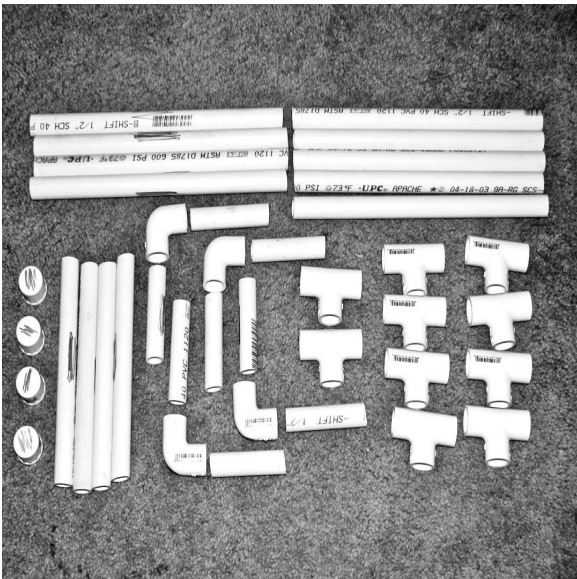


Figure 16 These is the complete set of parts that makes up my travel support. This U-shape design generally rests on top of the mattress, though I occasionally grab additional parts if I need it to sit on the floor. If I'm flying, I just take all these parts along in my luggage.

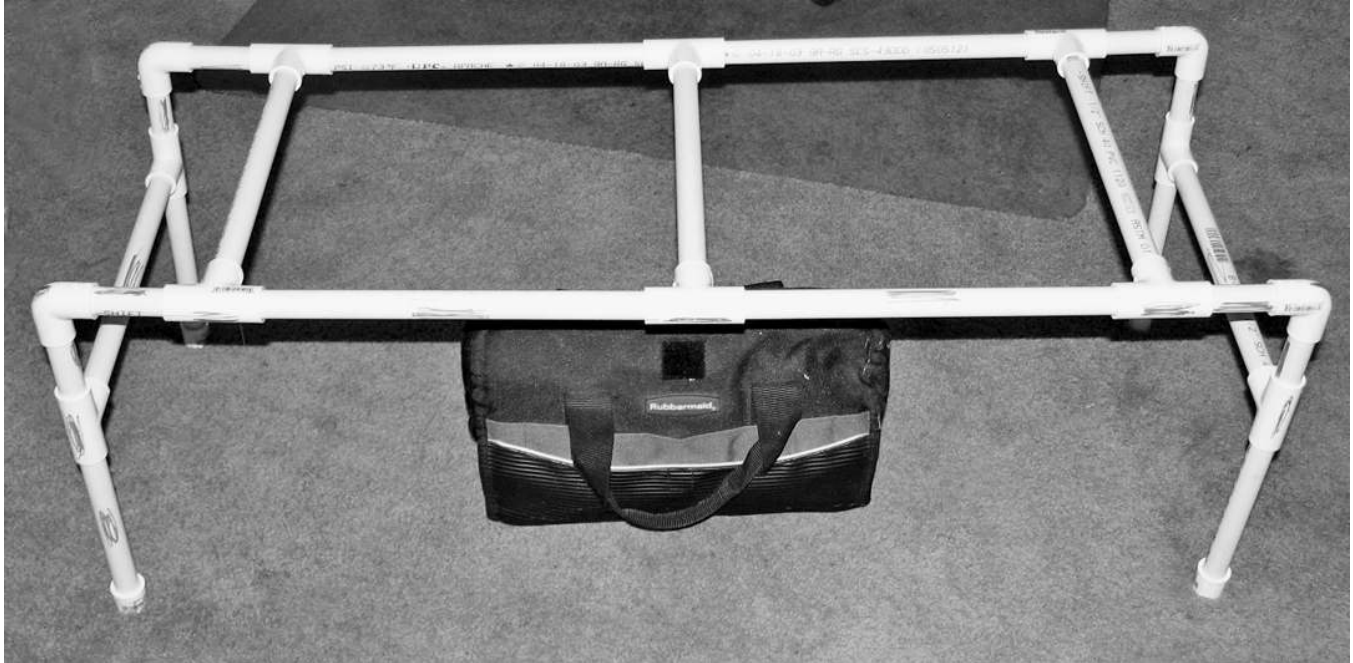


Figure 17 My travel support fully assembled, with the bag that I carry the parts in sitting underneath. I can put this support together in just a couple minutes. I can also take additional pipe and joints along if I might face an unusual situation.

MORE INFORMATION AVAILABLE

These instructions with color photos and some additional information about how the support can benefit others, please visit our website at www.pnhelp.org. Select Resources, Practical Help, from the menu, or go to <http://www.pnhelp.org/resources/bedsupport.html>. If you have questions or need additional help, you may e-mail me at plsmith@pnhelp.org, or call the NCCNA toll-free number, (877) 622-6298, to learn how to reach me by phone. I will be happy to help.