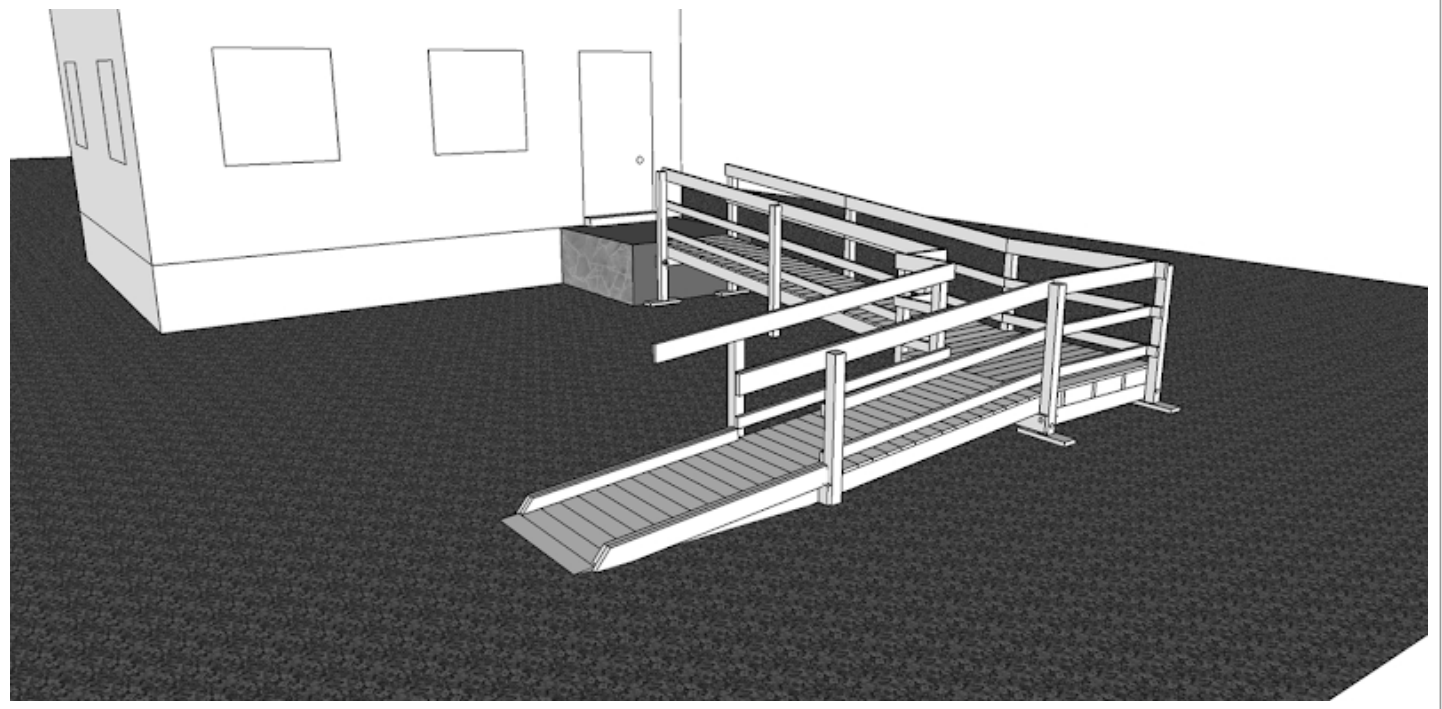


## XII. Wheelchair Ramps



### Common Materials

- 4x4 for posts
- 2x6 for joists and handrails
- 2x4 for handrails
- 5/4 x 6 decking
- Cap blocks for footers
- 1/2" carriage bolts
- 16d, 8d, Joist hanger nails

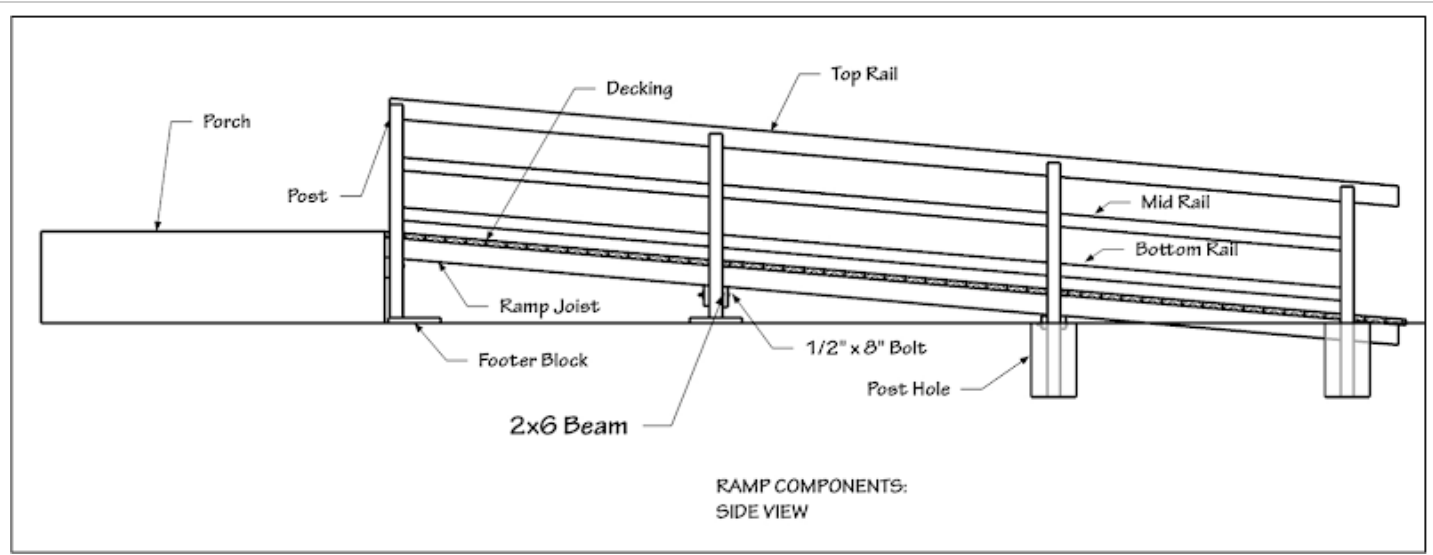
### Wheelchair Ramp Specific Tools

- Miter Saw (optional)
- Sandpaper
- Circular Saw
- Crescent Wrench
- 1/2" Drill Bit

### Common Measurements

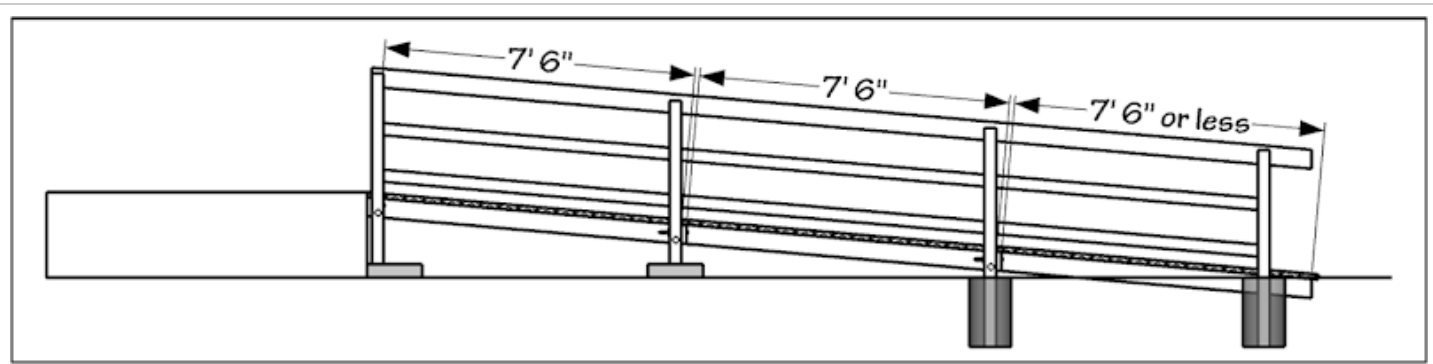
- Slope is 1 inch down to 12 inches out
- Each section is 7'6" long
- Width is 39" between posts for a 36" finished width
- Landings are 5'x5' for non switchbacks or 5'x9' for switchbacks
- See handrail section of manual for handrail specifics.
- Post holes should be 20" deep (12" minimum)

## A. Ramp Components



### Lengths of Ramp Sections: "The 7 Foot, 6 Inch Standard"

- Although ramps can be built of any length, CCC has developed a standard based on 7'6". This standard makes it easy to construct ramp sections, provides the necessary stability, allows you to use almost exclusively 8' long materials, and keeps cost & waste wood to a minimum.
- This guide will teach you how to build ramps in sections that are about 7'6" long (i.e. 7'6", 15', 22'6", 30').
- If for some reason you are making a ramp of a length other than one of these multiples of 7'6", make the last section of ramp (the section that dies into the ground) the shorter section.
- If you must make a section shorter than 7'6" to maintain the correct slope, do this on the last section.
- (A ramp section must not span more than 8' without additional posts, headers/beams, etc.)



061

### Joists

- Joists are the support members of the ramp: two on the sides, one in the middle.
- To abide by the 7'6" standard, plan to use treated 2x6x8' boards to make joists.
- A five degree angle must be cut at the end of each joist (except at the end of the last joists, which interface with the ground).
- EVERY outside joist must be either bolted to a post or sitting on a 2x6 beam.
- EVERY inside joist must be sitting on a beam on both ends or sitting on the ground.
- Joists should be attached "crowns up."
- The width from "outside-to-outside" of the joists should be 39", a distance which will allow for plenty of space for the wheelchair.

### Posts

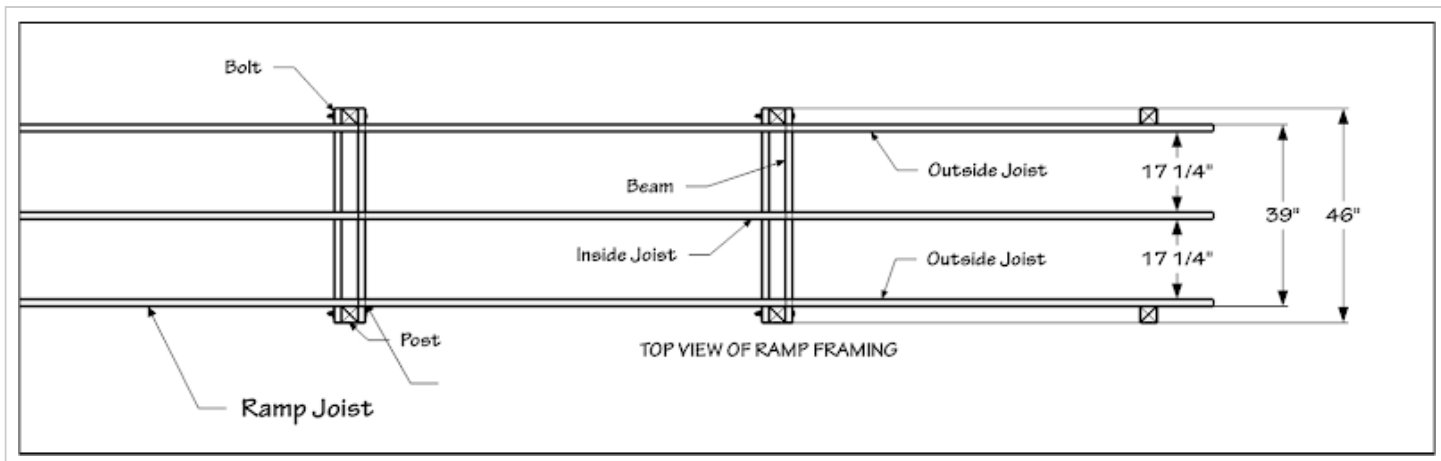
- The ramp will be anchored to the ground with treated 4x4 posts.
- Most of the time, 4x4x8' posts will provide enough length. If the porch is more than 3' off the ground, you will need longer posts at the top of the ramp...but if the porch is that high, the ramp is probably too difficult and/or costly to build.
- Posts can be a maximum of 8' feet apart, but the following "how-to" sections will help determine specific spacing.
- Allow posts to "run wild" until you are ready to begin attaching rails.
- Top of posts should be cut off 35.5" above framing, or about 34 1/2" above decking.
- Posts should interface with the ground using either cap blocks or postholes.

## Footers: Footer blocks or Cap Blocks or Postholes

- Cap Blocks: Use 4"x8"x16" masonry cap blocks. The ground should be leveled beneath each cap block. Posts sit directly on cap blocks and do not necessarily need additional anchoring. The last two posts at the end of the ramp cannot sit on cap blocks; instead you must dig...
- Footer blocks: These are used exactly like cap blocks but are 2x6 scrap about 18" long.
- Postholes: The last two sets of posts at the bottom of the ramp should rest in postholes, rather than on cap blocks. Postholes should 20" deep if possible and resting on solid footing (e.g. brick, rocks, gravel). 12" deep minimum! Postholes should be backfilled with water, then sacrete (approximately 40 lbs per hole). If sacrete is not available, use water, then dirt. If possible, it's good for posts to be sitting on rocks in the bottom of the hole (just make sure the post is at least 12" beneath the ground). Do not backfill posthole with rocks.

## Beams

- Each section of joists must begin and end with a beam.
- Headers should be 46" long; therefore, one treated 2x6x8' will yield two header boards.
- A header is bolted to the posts below the joists so that the joists sit on top of the beam.
- You may need a beam on both sides of the posts if you are transitioning between the landing and ramp or if you're continuing the ramp beyond that section.
- You do not need a beam at the very bottom of the ramp where joists die into the ground.
- "Entry" joists are joists that "enter" into the beam.



OSB

## Decking Boards

- Treated 2x6 boards are best. Treated 5/4 decking boards also work very well and are cheaper.
- Decking boards will ultimately be 39" long, however, it's a good idea to overestimate by an inch or so to allow for some "wobble room".
- DO NOT SPACE DECKING BOARDS! They should be as tight together as possible, with very minimal gaps in between.
- Decking boards should be attached to all three joists using 8d or 10d galvanized nails. There should be two nails at each decking board/joist intersection.
- Attach cups down (unless there is bark showing).
- Do not use 1x4s, 1x6s, plywood, or OSB for ramp decking!

## Bolts

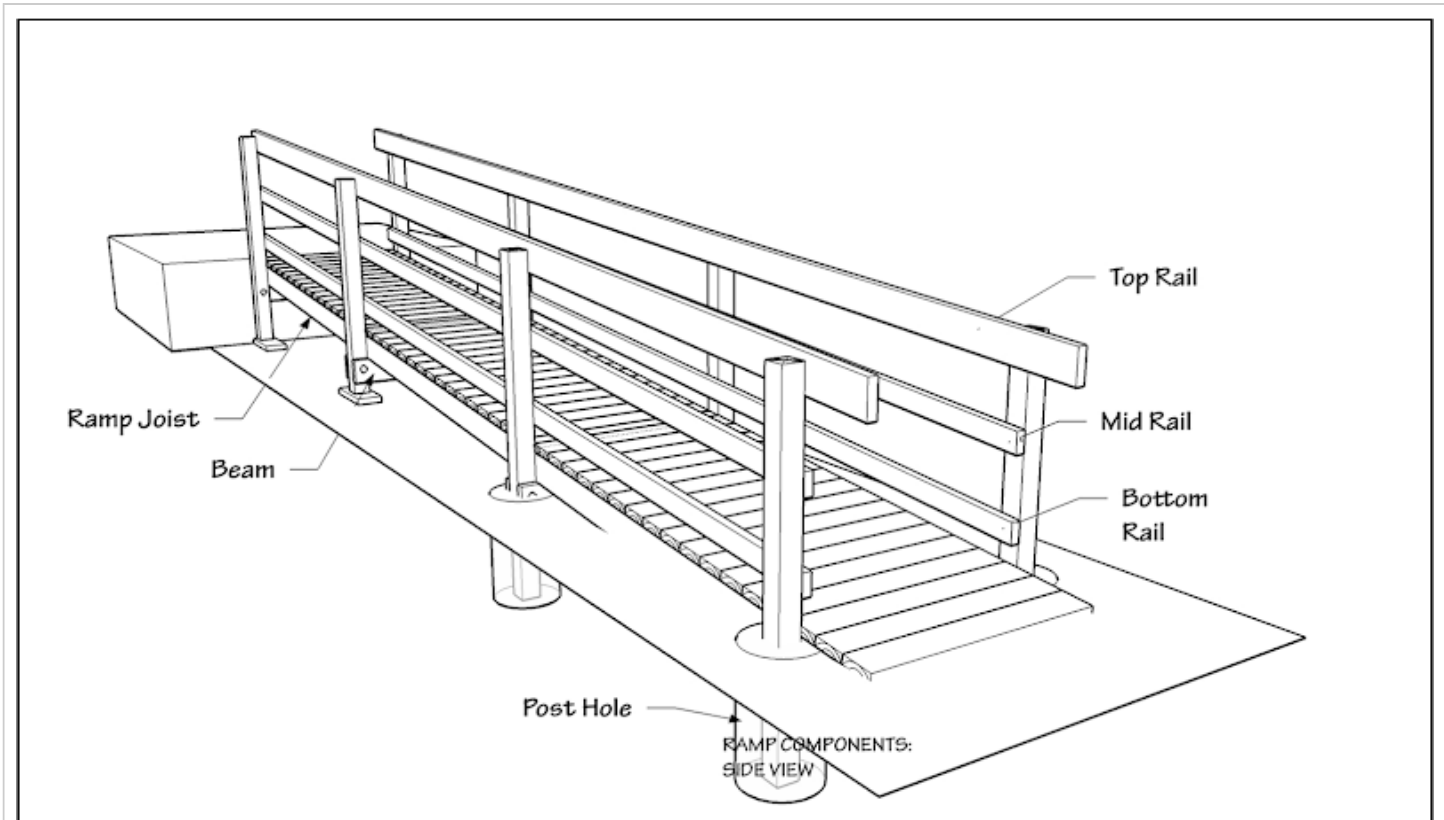
- Use 1/2" x 6" galvanized carriage bolts for attaching single 2x6 to a post or a 1/2" x 8' galvanized carriage bolt for two 2x6's attached to a post.
- When attaching bolts, make sure the head of the bolt is exposed and the nut side will be hidden underneath the ramp whenever possible. It's easier to catch clothing or flesh on the nut side.

## Rails

- Top Rails: Top rails should be treated 2x6s, fastened on edge on the inside of the posts. These tops of these rails should sanded thoroughly to prevent splinters! The top edge of top rails should be a minimum 1 1/2" and a maximum of 2" above the top of posts. Cups toward the post. Top rails should extend past the bottom posts by at least 1'.
- Mid Rails: Use treated 2x4 boards. There should be approximately 10" between the mid rail and bottom rail (inside-to-insider), and approximately 10" between mid rail and top rail (inside-to-inside).
- Bottom Rails: Use treated 2x4 boards. Should be at least 3 1/2" from the top of the decking to the bottom of the bottom rail. The best way to set the position of bottom rails is to use two 2x4 scrap pieces, set on their edges, one at each end of the rail. This will provide a gap of about 3 1/2".

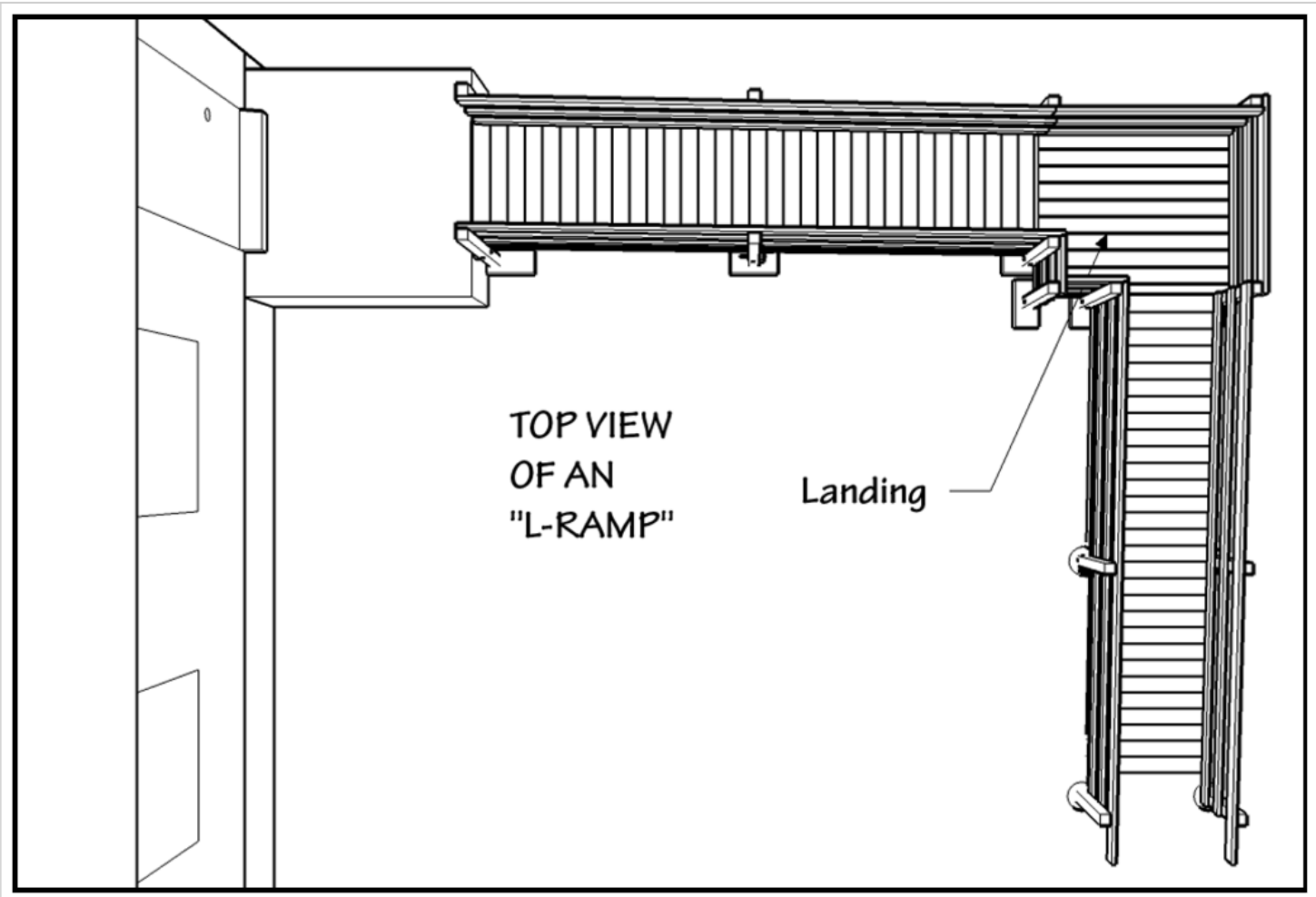
## Painting/Staining

- When you complete a ramp, do not paint, stain, or water seal it in the same summer! Treated lumber must go through a four-season cycle before it is painted or stained.
- Never paint a ramp unless the person you're working for wants it.
- If and when you paint the decking, use exterior flat paint, mixed with "No-Skid" to prevent the ramp from being too slick.



## B. Landing Components

Landings are flat, level structures that break up a ramp. Think of them as small porches. There must be a landing any time a ramp changes directions, and/or for any ramp that is longer than 30', so that the person using it can have a place to rest!



### Landing Dimensions

- If the ramp is an "L" (i.e. changes directions by 90 degrees), then the landing must be at least 5'x5'.
- If the ramp is a "switchback" (i.e. changes directions by 180 degrees), then the landing must be at least 5'x9'.
- If the ramp does not change directions, but is longer than 30', then the landing must be at least 5'x39". Note: 30' long ramps require many materials and will take 3 or more days for a CMG to complete.
- (These are "rough" dimensions. CCC staff will provide CMGs with more specific plans and diagrams.)

### Posts

- Each corner of the landing must be supported by a 4x4 post, resting on cap blocks or in postholes.
- You may design the ramp such that some of the posts of the landing also serve as posts for adjacent ramp sections.
- If you use posts to support both the landing and a ramp section, keep in mind that some bolts may need to pass through a porch band, post, and ramp joist. In these cases, you will need to use an 8" long bolt, instead of a 6" long bolt.
- If upper and lower spans of a switchback ramp are parallel (180 degree switchback), you can use one set of posts to in the middle to support both sections. Be careful of switchback ramps!! These require many materials and almost always take more than 2 days to complete.

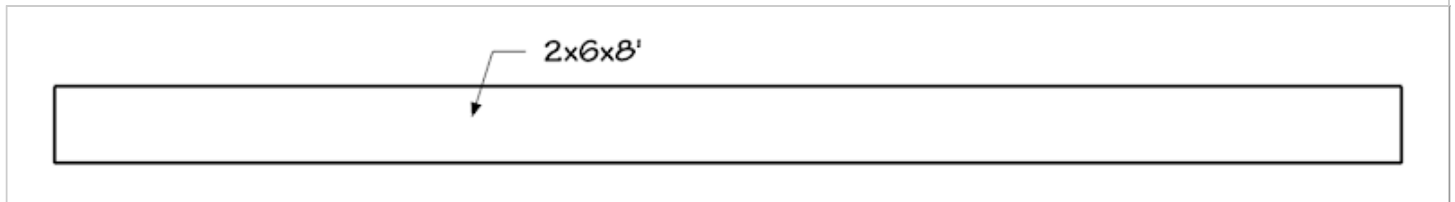
### Frame, Decking, and Rails

- The framing, decking, and rail systems for a landing should follow the same specifications of a porch.
- Beams: treated 2x6 boards, bolted to posts.
- Joists: treated 2x6 boards, attached to bands with joist hangers, at most 16" on center.
- Decking: treated 2x6 or 5/4 x 6 boards, attached with 8d or 10d nails.
- Rails: 2x6 boards for top rails, 2x4 boards for mid and bottom rails.

## D. Making a Ramp Joist

1. This example will show you how to make a ramp joist with the correct angle cuts for a 7'6" ramp section. You will use a 2x6x8' board for this purpose.

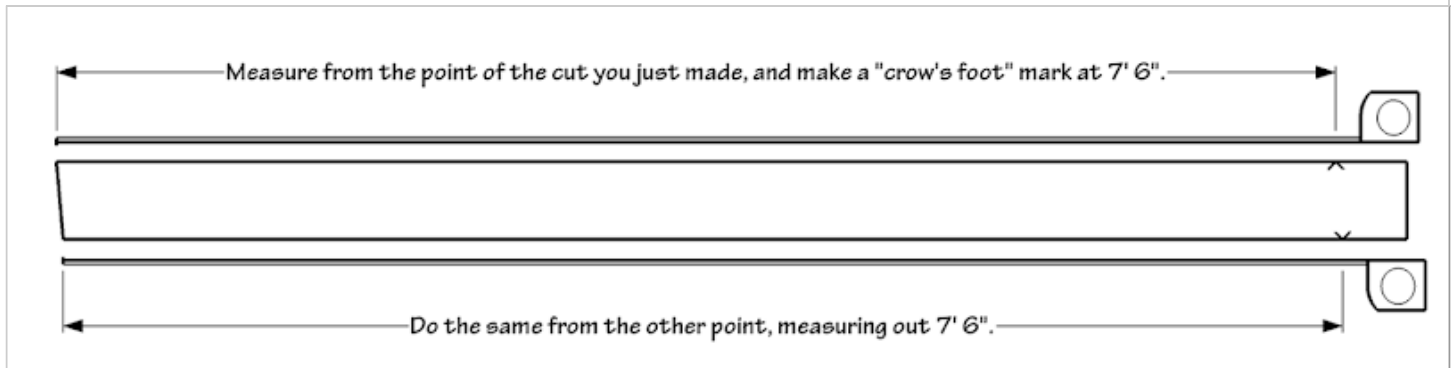




2. Measure about an inch in from the corner of the board, and place the point of a speed square on the edge of the board. Keeping the point of the square in this position, pivot the square so that the "5 degree mark" is in line with the edge of the 2x6. Draw a line on the board as shown, and cut along this line.

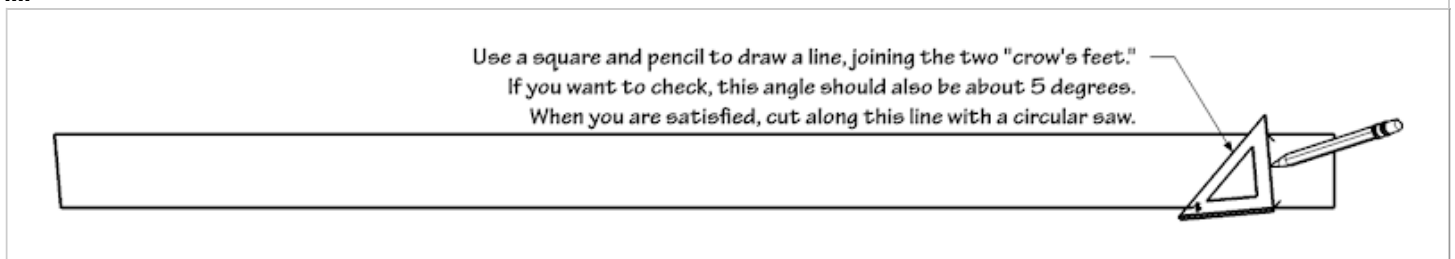
3. Measure from the "long point" of this cut you just made, and pull to a measure of 7'6", make a "crow's foot" mark on the board. Do the same from the "short point" of the cut you made, measuring out 7'6" along the opposite edge.





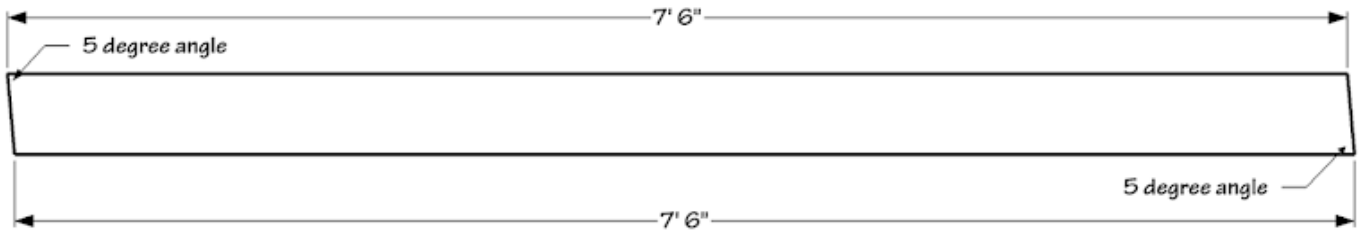
4. Use a square to draw a line that joins the two crow's feet marks. Use the speed square to check the angle that this new line forms (it should also be a 5 degree angle). Also ensure that the new line is PARALLEL to the first cut you made. When you are happy, cut on the second line with a circular saw. Try to keep the saw blade just to the "outside" of the line. If you cut exactly on the line, you will loose some of the overall length of the board.





5. If you have done everything correctly, you should have a board that looks something like the diagram below. You can follow the same method with all ramp joist boards, or use this first one as a template to trace the others. (Obviously, the ends of the last ramp joists the will be buried in the ground and do not need angled cut.)

The ramp joist should look like this when you are finished.

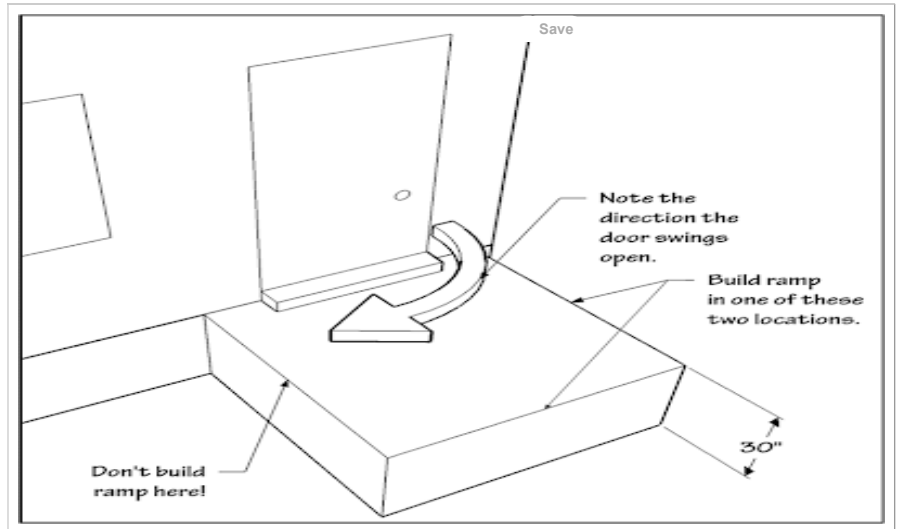


## E. Getting Started

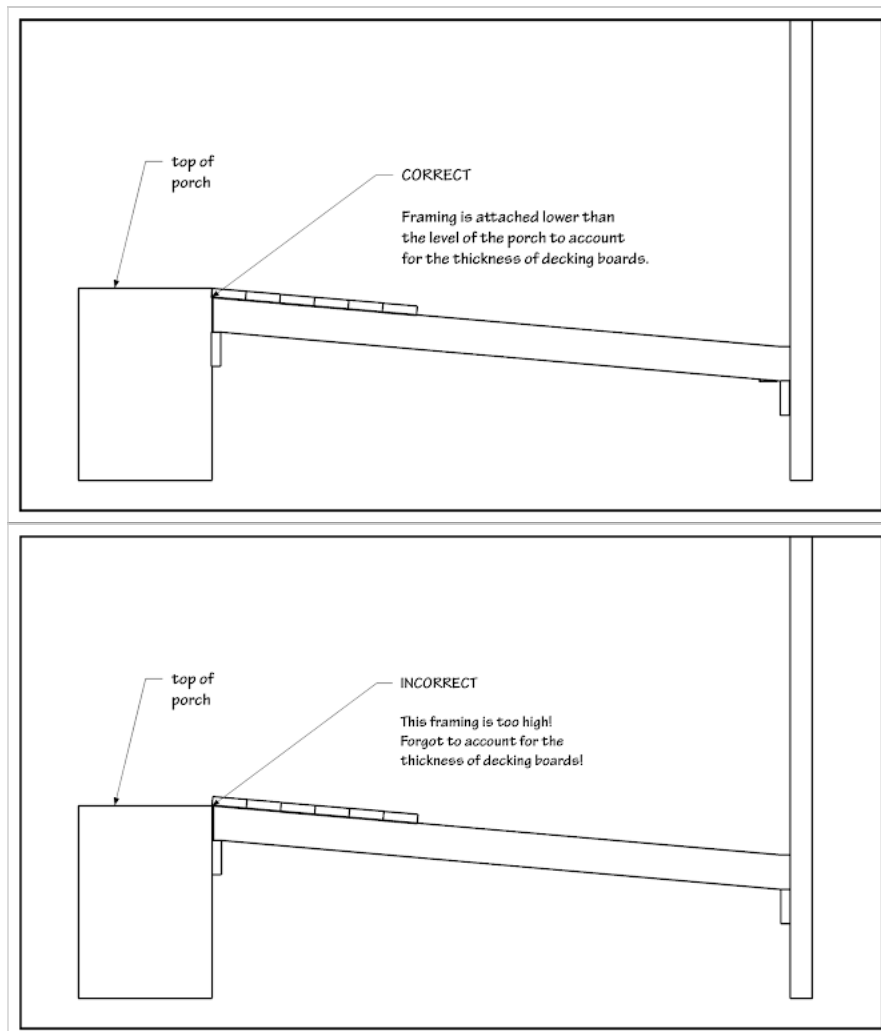
There are many variables in building a wheelchair ramp, and each ramp can be constructed slightly differently from another. This guide will give you a good starting point, but you may need to tweak these plans to accommodate the conditions you're working in.

1. Determine where the ramp will be built. This may depend on several factors, such as how the current porch and its railings are laid out, obstacles on the ground (trees, shrubs, etc.), the slope of the ground, and the wishes of the homeowner. Also keep in mind that if the porch is small, you don't want the ramp to be blocked by the door when it is swung open. For the sake of this example, we will assume...

- a. ...that the ramp will come off the front of the porch.
- b. ...that there is no slope to the ground.
- c. ...that the ramp will be free-standing (i.e. not attached to the porch)
- d. ...that the porch is 30" high. This example will walk through how to build a 30' long ramp comprised of two 7'6" ramp sections, a 5'x5' landing, and two more 7'6" sections. This will be an "L" ramp (i.e. direction will change by 90 degrees).



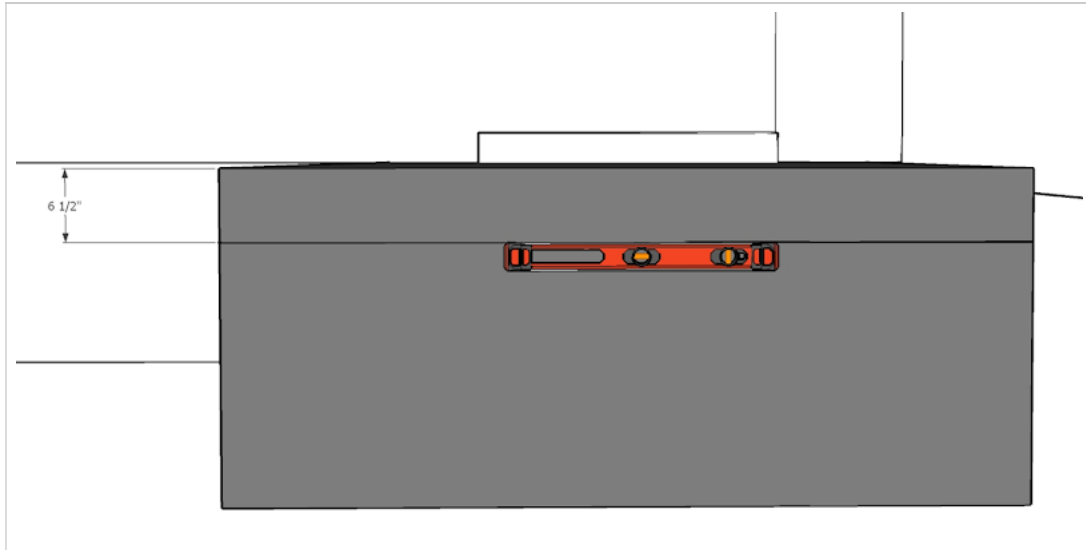
2. Next you want to establish the level of the top of the framing. This is an important step because a common mistake is attach the frame beginning at the level of the porch. If you do this, the decking you attach later on will be too high!



3. Measure down from the top of the porch 6 1/2". This is the height of the 1" decking board and the 5.5" joist. Hold up a carpenter's level (preferably 4') up to this mark, keep it level, and use a pencil to extend the mark so that it extends over and past both back cap blocks. This line establishes the level for



the first section of the ramp's framing system (beam).

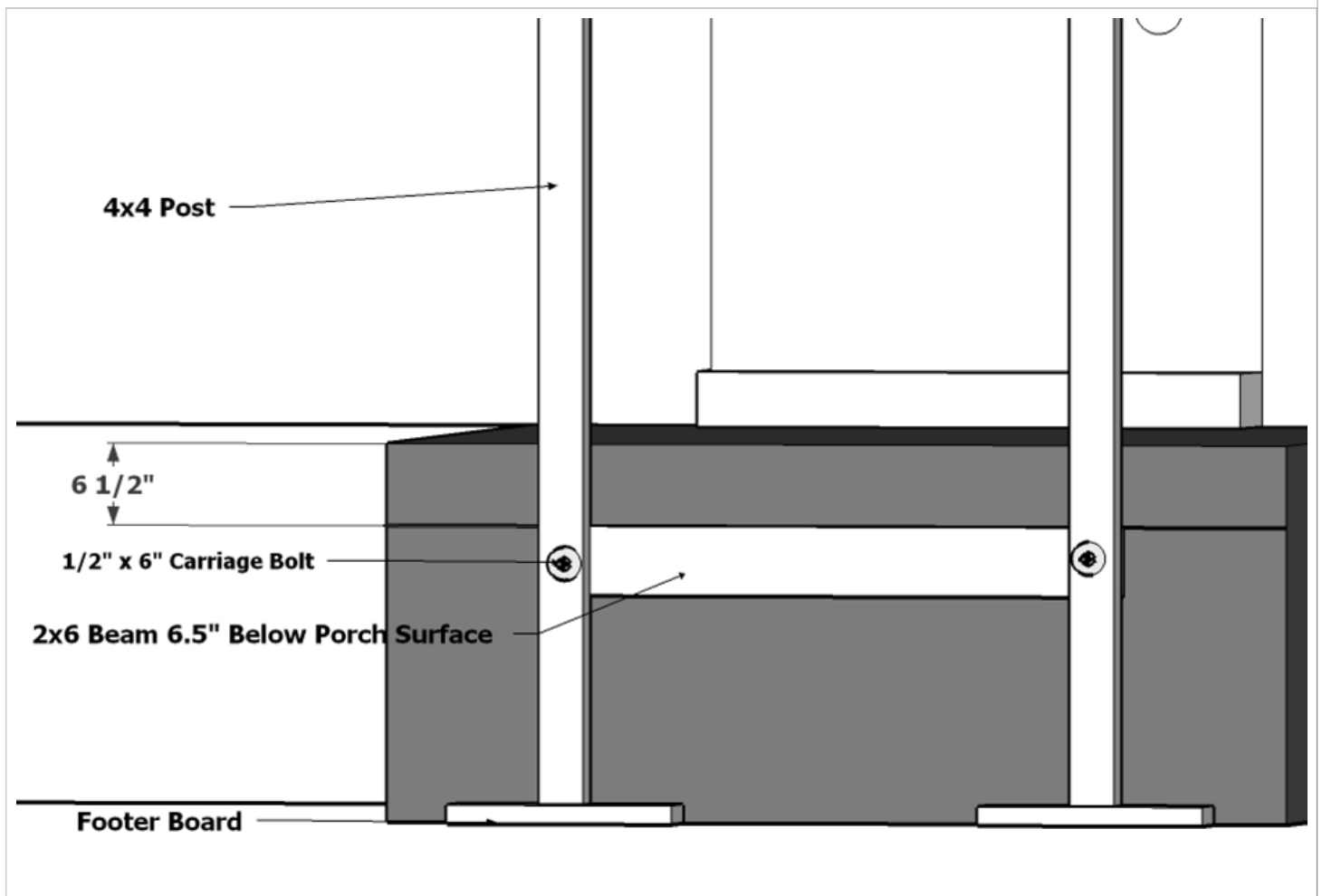


4. Place the left back post on the footer block, tight to the porch. Making sure the post is plumb on all sides, transfer the 6 1/2" mark to the post, using a speed square. Repeat the same process on the back right post. Do not cut any posts yet.

## F. The First "H"

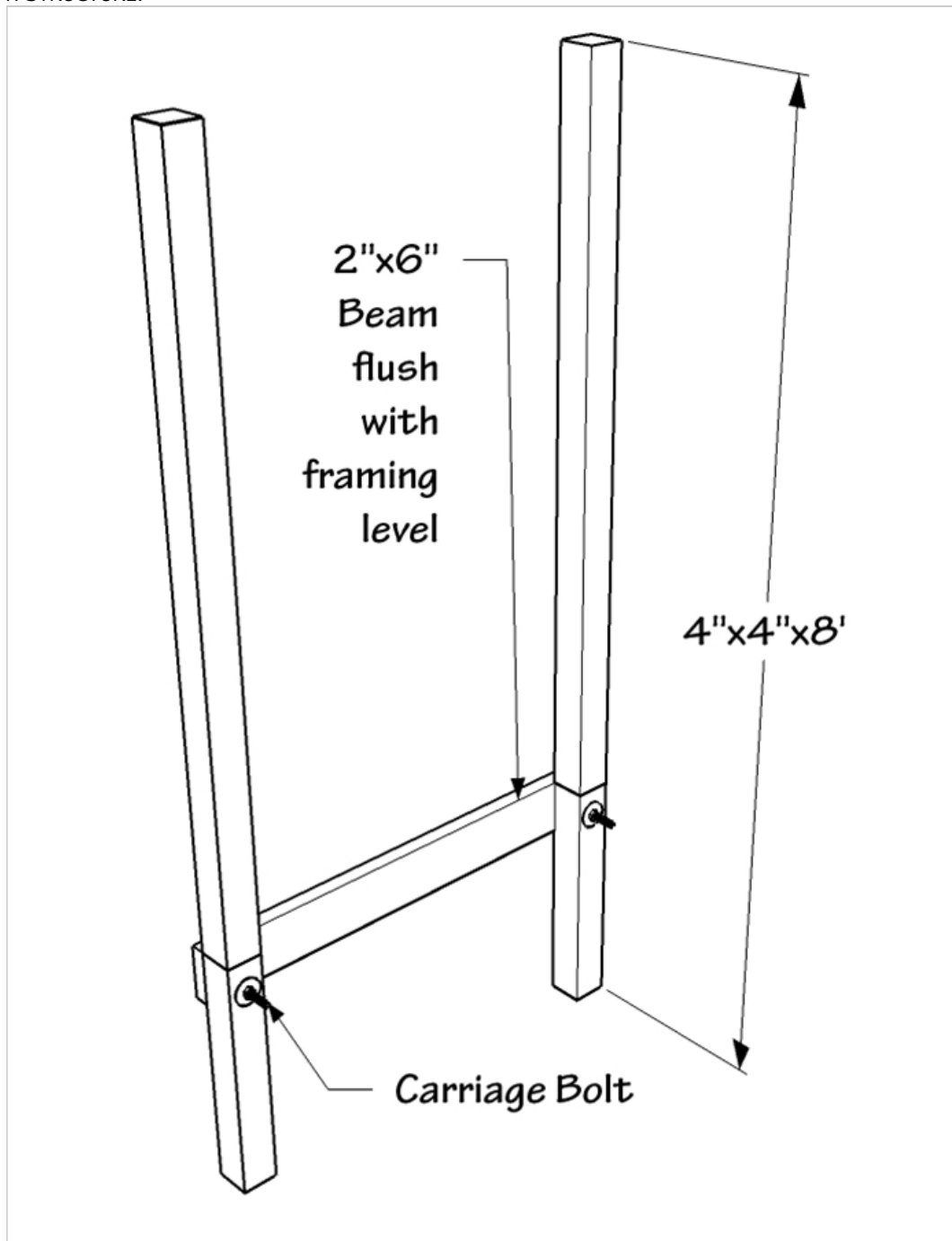
### How to Build a Wheelchair Ramp: The First "H"

1. The first part of your construction will be to build an "H" out of two posts (resting on footer blocks) and a beam. The H may not necessarily need to be attached to the porch itself, which would mean the ramp would be free-standing. If you are able to attach the beam to the porch, you may do so, using nails/screws and carriage bolts. If the porch is masonry, concrete, or brick, use or concrete porch, you can use Tapcons to attach the beam to the porch. If the porch is made of sturdy wood and you can nail and/or bolt the beam to the porch, all the better. For the sake of simplicity, this example will walk through building a free-standing ramp, thus, we begin with building an "H."
2. On a flat surface, lay down both of the marked 4x4 back posts.
3. Next, lay a beam board (2x6x46") on top of the posts. Line it up so that...
  - a. The top edge of the beam board is lined up with the transferred 6 1/2" framing level mark on each of the posts.
  - b. The ends of the beam is flush with the outside edges of each post.
  - c. The beam should create a 90° angle with both posts. Check with a speed square. Adjust if necessary.



4. Once they are in proper position, fasten the boards.
  - a. Drive two common 16 penny galvanized nails (the largest nails) in to the location shown.
  - b. Check to see if you still have a 90° angle with a speed square. Once the angle is square, bore between the 2 nails with the 1/2" or 5/8" drill bit.
  - c. Take one 1/2" or 5/8" galvanized carriage bolt and use a hammer to drive it through the hole so the head is on the beam side. Do not use a washer on the head side. Place the galvanized washer and nut on the thread side and tighten it flush to the board (or even very slightly indented) with a wrench.

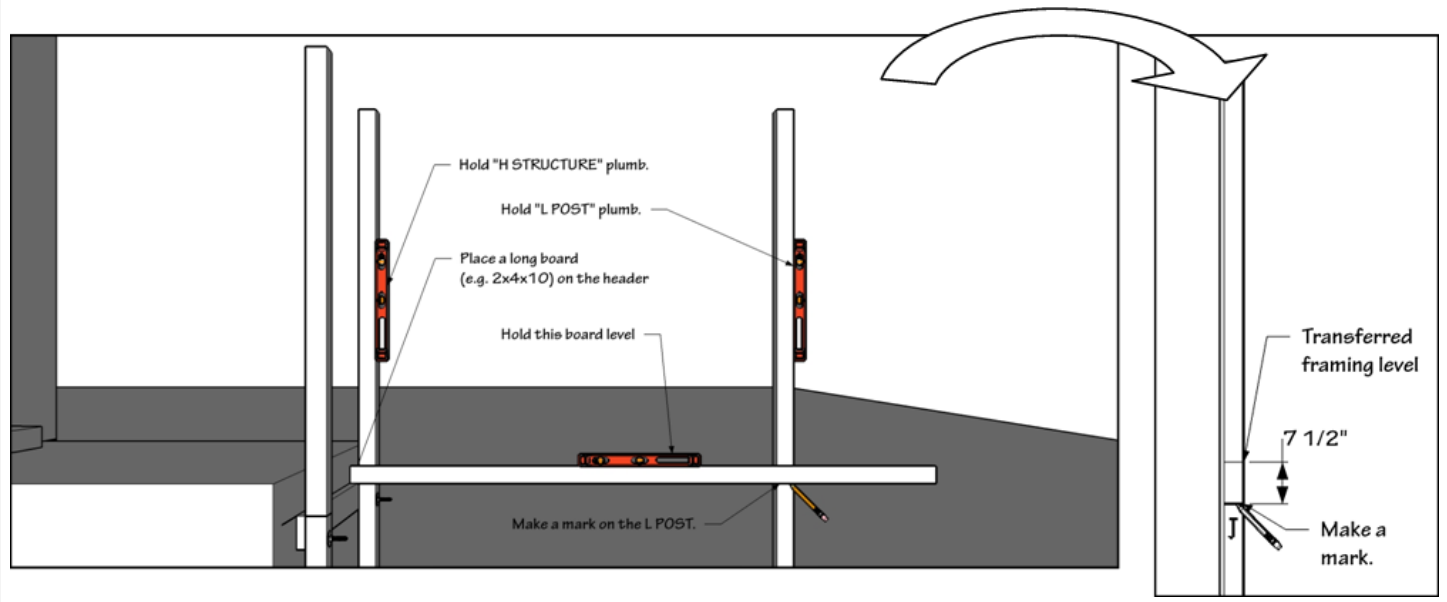
5. Once you are finished, you should have an "H" structure similar to the one shown in the diagram. Place this "H" back on the footer blocks, and check to make sure that the beam lines up with the framing level mark on the porch. For the rest of this example, we will call this our "H STRUCTURE."



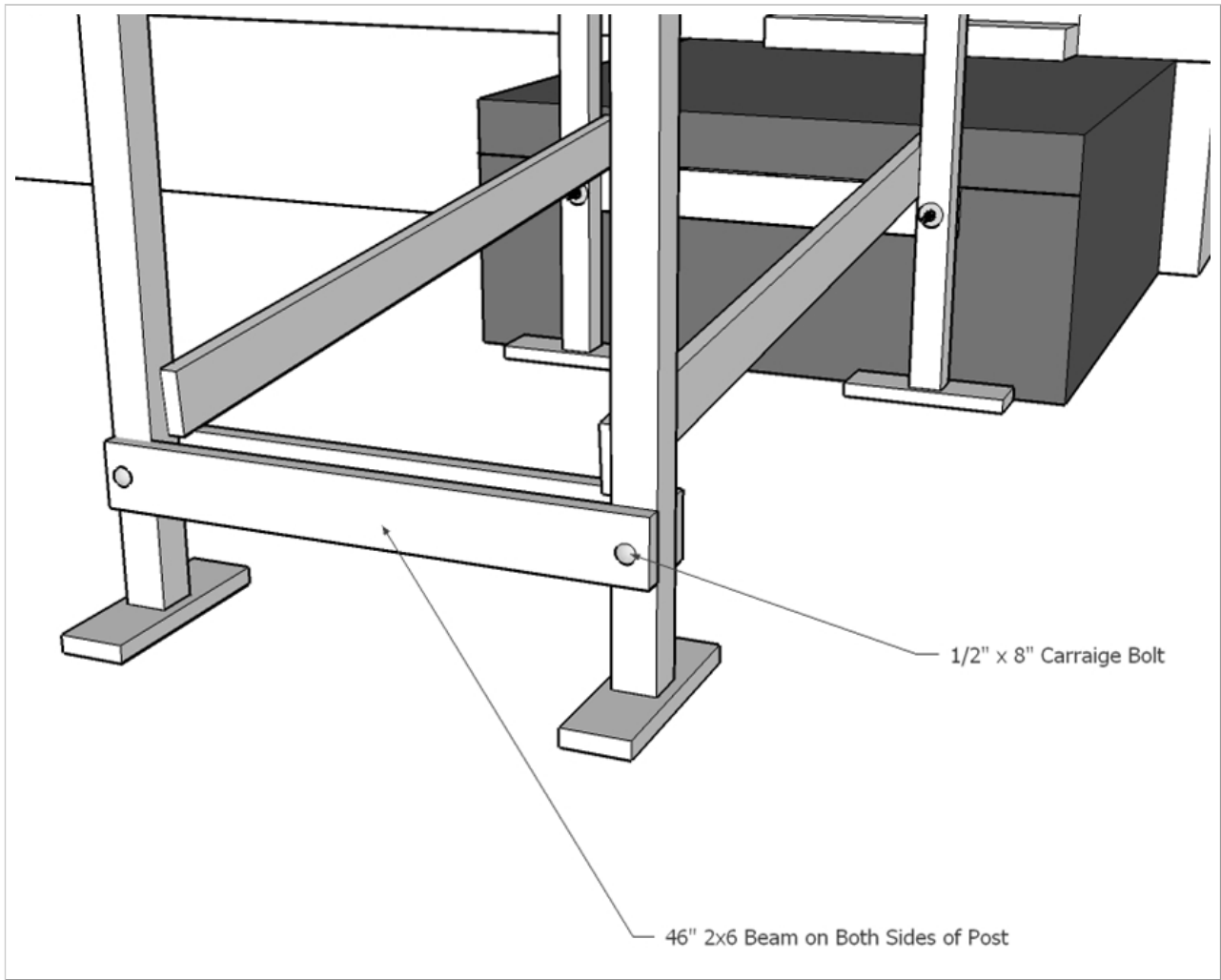
## G. Starting the First 7'6" Ramp Section

### How to Build a Wheelchair Ramp: Starting the First 7'6" Ramp Section

1. The first section is the hardest one to frame, and you will need several people for this task. Have one or two people holding up the H STRUCTURE (made earlier) on top of the footer blocks, up against the porch. It is helpful to hold it plumb, at least visually.
2. Now set another post on top of the next footer block. We'll call it the "L POST." You may want to set a 7'6" ramp joist on the ground, post-to-post, just to visually make sure that the joist does not extend too far past the L POST. If it does, you may need to reposition the footer block. Once you have the footer block and post in the proper position, use levels to hold both the L POST and the H STRUCTURE plumb.
3. Now set a long board, such as a 2x4x10', on top of the header board and extending past the L POST as shown. Use level to hold this board perfectly level. Make a mark on the post as shown. You can now remove the 2x4x10'.



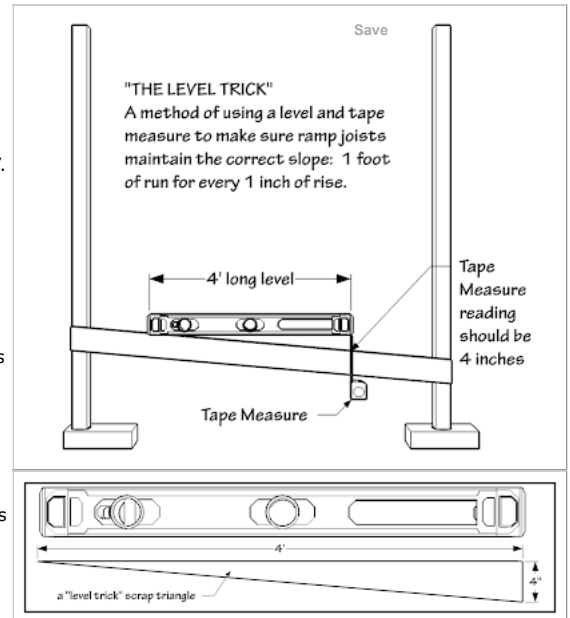
4. You have just transferred the framing level of the header to the L POST. But remember, you ramp needs to be sloped! In the next step, you will determine the correct slope of the first ramp joist, which is very important, as it will affect the slope of the rest of the ramp! (Note: Do NOT rely on the angled-cut of the joist to give you the correct slope!)
5. How do you determine the slope? Remember two important things: (1) the slope of the ramp is 12' of run for every 12" of rise, and (2) the length of the ramp joist you have made is 7'6", or 7 and a half feet. Therefore, measure down from the mark you made 7 1/2" and make a new mark on the post. This mark represents the level at which the ramp joists needs to sit on the L POST. It may be helpful to label this second mark "J" or "JOIST LEVEL MARK" to help you remember that this is the mark use. See diagram for help.
6. Now have another one or two people hold up a ramp joist, so that one end sits on the beam board and is held tight to the inside of the corner of the H STRUCTURE. Drive one nail only through the joist into the post. Continue to hold the H STRUCTURE and ramp joist in position.
7. Adjust the other end of the ramp joist so that its top edge is lined up with the JOIST LEVEL MARK on the L POST. You want the joist to end about mid-way of the post. Drive two nails through the joist into the L POST. Drive a second nail through the joist into the post of the H STRUCTURE.
8. Before you move on, it's a good idea to check the slope one more time. Continue to hold the H STRUCTURE and L POST plumb as you perform...The Level Trick!



## H. The Level Trick

### How to Build a Wheelchair Ramp: The Level Trick

1. Measure the length of your level (it's probably 2 or 4 feet long) and remember this length. Place this level on the ramp joist.
2. Pull some tape out and hold it as vertical as possible so that the end of the tape supports the "downhill" end of the level.
3. Push enough tape out until the level reads level. What is the distance between the top of the joist to the bottom corner of the level? If your level is 4' long, you want the tape to read 4". If the level is 2' long, you want the tape to read 2".
  - a. If the tape is exactly, or within  $\frac{1}{4}$ " of being correct, then you're good to go.
  - b. If the tape reads  $\frac{1}{4}$ " or more than the ideal measurement, the ramp joist is too steep, and you need readjust the slope of the joist.
  - c. If the tape reads less than the ideal measurement, the joist is too shallow. That's not necessarily a bad thing, but it could mean that your ramp will be much longer than it needs to be, and you may not have the time or materials! It's still a good idea to readjust if it looks like the slope is very shallow.
4. It's a good idea to use the Level Trick to check the slope of each ramp section you build, if not every joist.
5. Another handy way to accomplish "The Level Trick" is to create a triangle out of a scrap 2x6, as seen to the right. This eliminates having to use the tape measure and ensures that the slope is always correct.

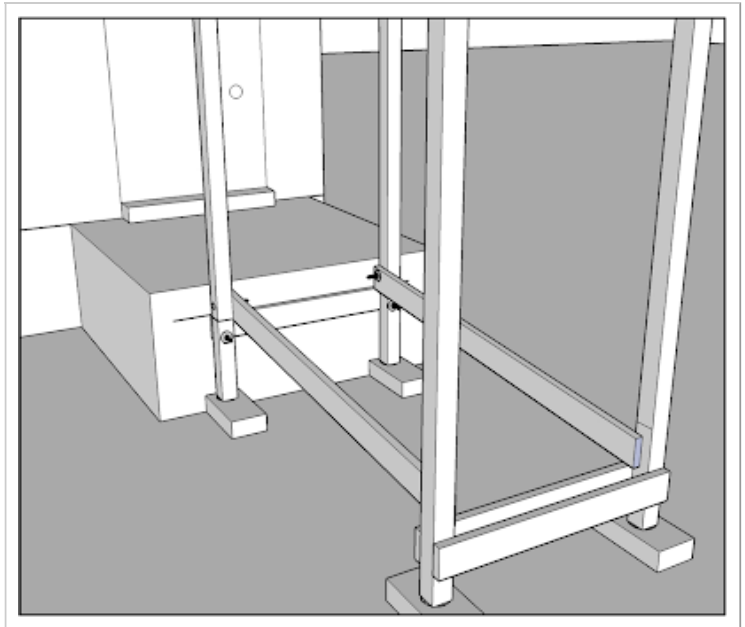


## I. Finishing the First 7'6" Ramp Section

### How to Build a Wheelchair Ramp: Finishing the First 7'6" Ramp Section

1. Follow the same sequence to attach the other outer ramp joist for this particular ramp section.

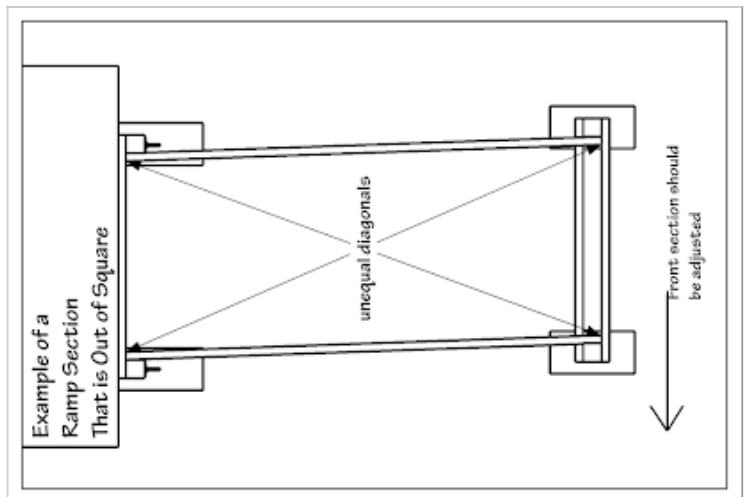
2. Now take a beam board (2x6x46"), and hold it up to the posts as shown. Readjust the posts' positions so that the ends of the beam are flush to the outsides of the posts. One beam should go underneath the attached joists on one side of the post. The second beam will need to be a bit lower than the first if you're continuing with a new ramp section (use a scrap piece of 2x6 joist to determine height). If you're transitioning to a landing you can have the second beam as the same height. Place a level on top of the header. You should now have a second "H STRUCTURE with a beam on each side. Don't attach bolts to the beam or joists yet.



3. Before you continue, you must check to see if this ramp section is square. Use these two methods to help accomplish this:

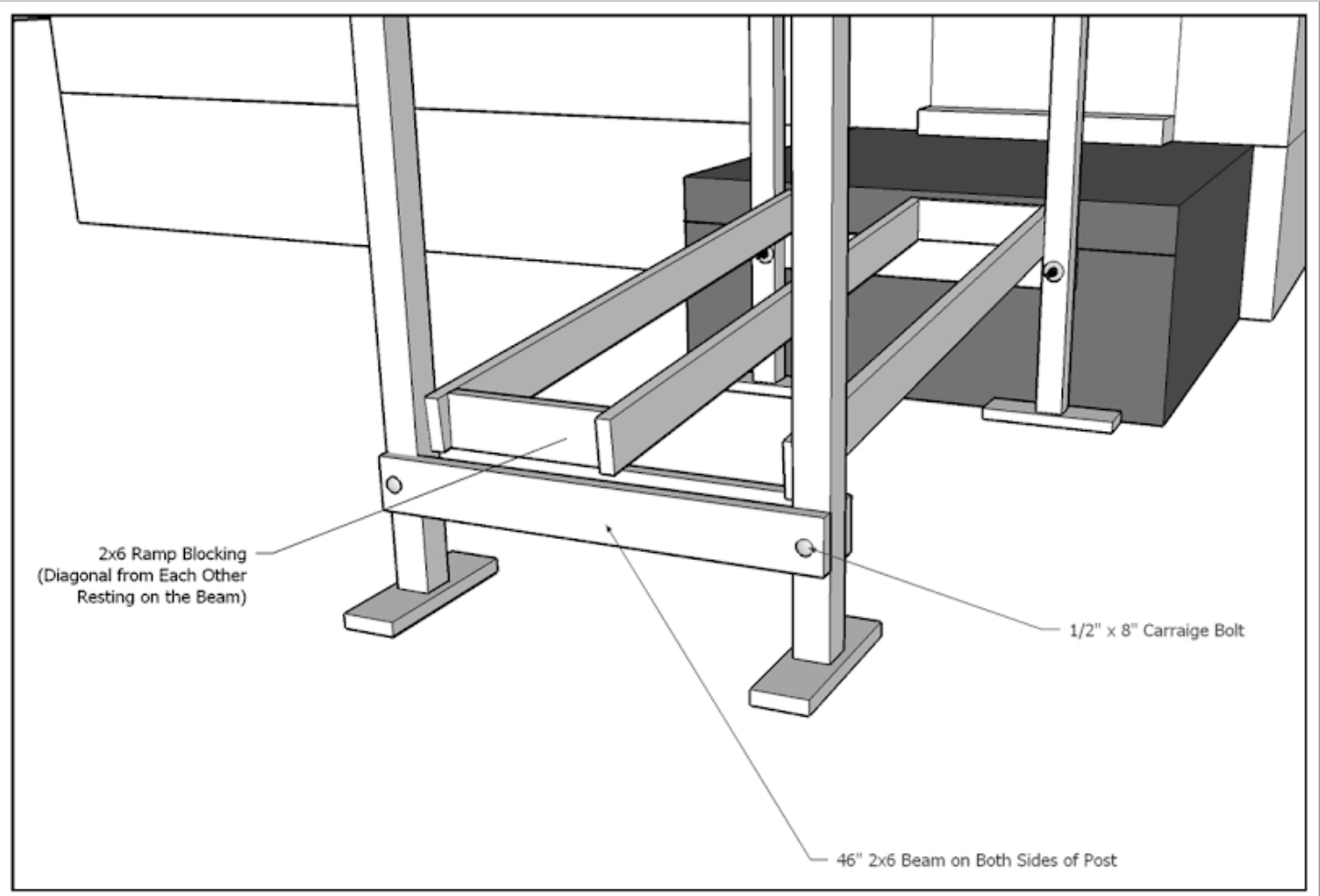
a. Hold up a framing square to the inside corner of the beams and joists. If the corners are not 90° angles, adjust the structure by moving the front two posts together left or right. Re-plumb the posts if need be and check the angles again.

b. If the imaginary diagonal lines of the "box" are equal, then the ramp section is square. Measure the distance between opposite corners of the box. Measure the INSIDE corners of the box (where the joists and headers intersect). If the diagonal line measurements are the same, the porch is square. If the diagonal line measurements are not the same, you are out of square, and you must adjust the structure by moving the front two posts together left or right. Re-plumb the posts if need be and pull diagonals again. The diagonal line measurements must have no more than a 1" difference.



4. Once the ramp section is square, bolt the beams to the posts. Maintain consistency for bolt positions throughout the entire ramp.

5. To finish framing this ramp section, you will install a middle joist. It should be about 18 ¾" o.c. with the outside joists, or 17 ¼" inside-to-inside (you do not have to be exact). Add in blocking to stabilize the center joist as shown in the picture on the next page.



6. You have completed the first ramp section! If you want, you can begin decking this section, or continue framing the rest of the ramp.



## J. Framing Subsequent 7'6" Sections

### **How to Build a Wheelchair Ramp: Framing Subsequent 7'6" Sections**

Build all subsequent sections in the same manner, keeping the following in mind:

- Follow a similar sequence as before: establish where footer blocks/postholes should be positioned, attach joists, set posts, attach beam, etc.
- Continue to check and maintain the slope of the ramp (1' run for each 1" rise).
- Make sure that each section is square, all posts are plumb, and all beams are level.
- It is also a good idea to step back and visually assess the ramp with each new section. Are the posts lining up with one another? Is the ramp truly running straight? It may be helpful to pull a string to make sure you stay in line.
- Outside ramp joists must be resting on a beam on both ends.
- Once you get to the last section, the joists will run straight into the ground. You will have to dig trenches out with a shovel and/or mattock. Make sure the joists ends are buried at the bottom. You do not want a step at the bottom of a wheelchair ramp! You also do not need a buried beam at the bottom section.
- Let all posts "run wild" until the entire ramp has been completed, or at least the entire frame.

## K. Installing Decking

### How to Build a Wheelchair Ramp: Installing Decking

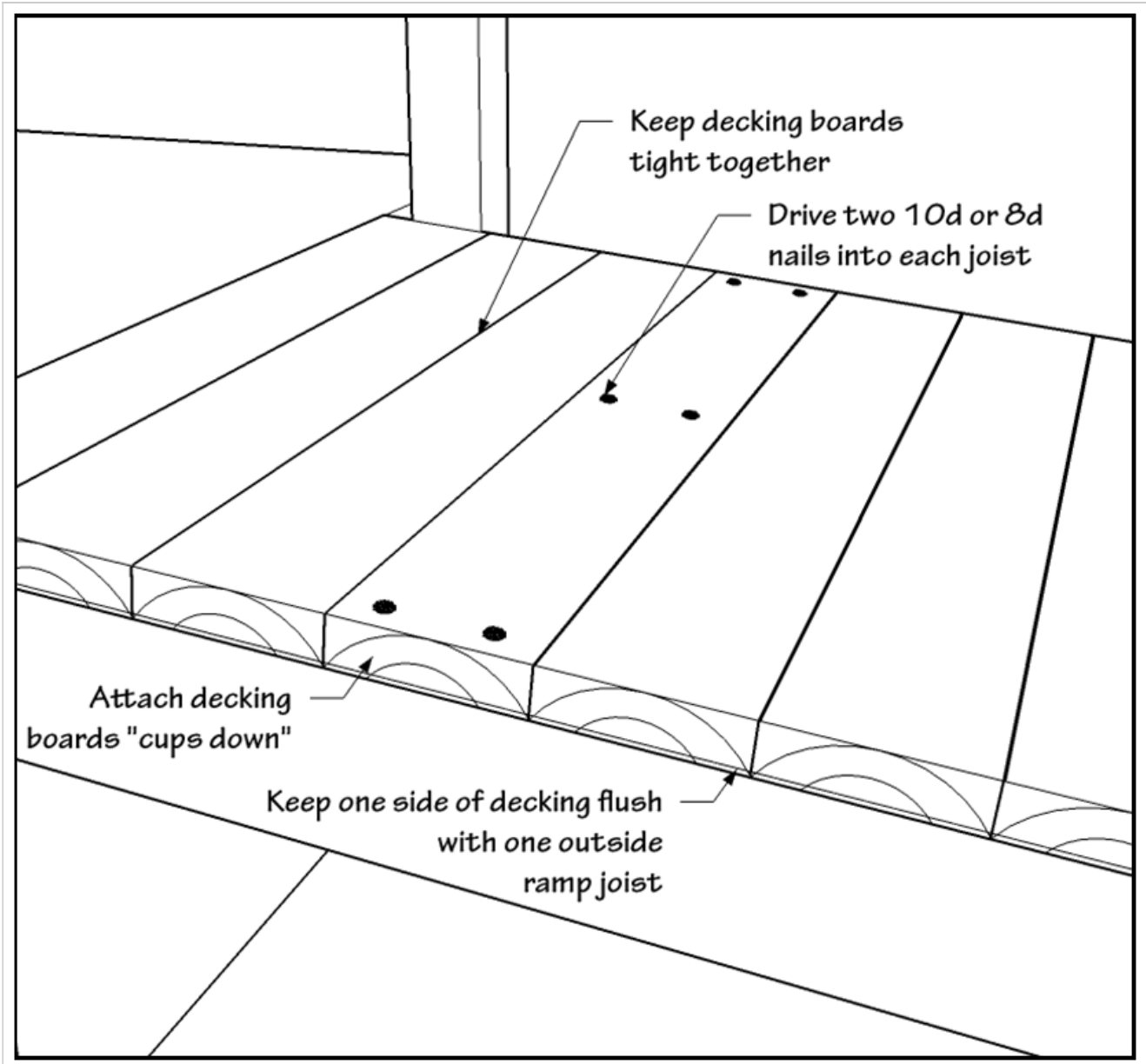
1. Begin decking at the top of the ramp, and work your way down.

2. To maintain consistency, pick one end (left or right) of the decking boards to always keep flush with the outside edge of that ramp joist (preferably the "more visible" of the joists). Every now and then, check to make sure that decking boards are more or less square to the ramp joists.

3. Do not leave any space between decking boards; they need to be as tight together as possible.

4. Attach decking boards "cups" down, unless bark is showing.

5. Use 10d nails to



attach  
decking  
boards to  
each of  
joists.

Each  
decking  
board  
should be  
held in  
place by  
six nails,  
two at each  
ramp joist.

## L. Cutting the Posts

### How to Build a Wheelchair Ramp: Cutting the Posts

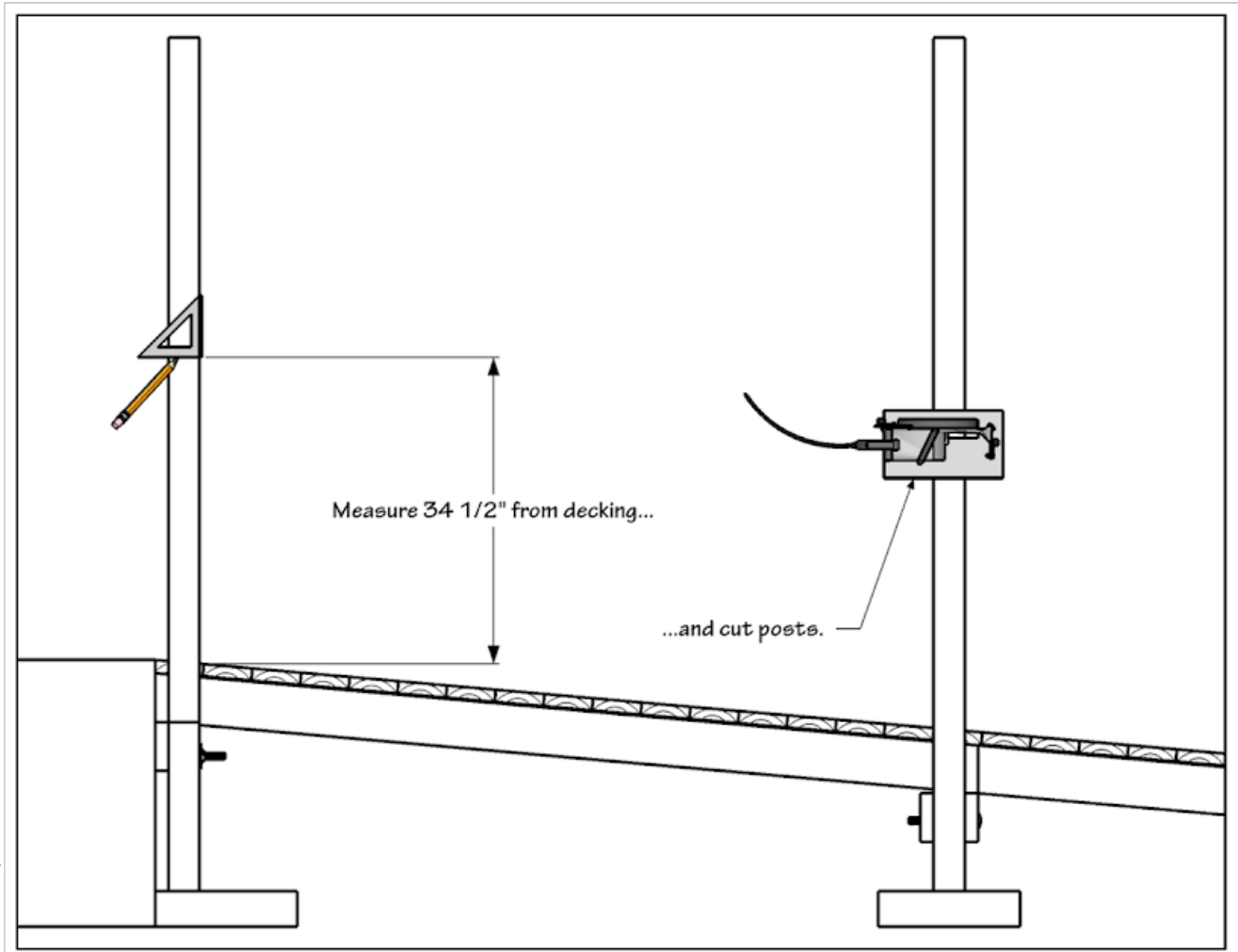
1. When the ramp is complete, you may cut the posts that have been running wild.

2. Measure 34 1/2" from the surface of the decking boards (or 36" from the top of the frame) and mark a post. Use a speed square to transfer the line to all four sides of the post.

3. CAREFULLY cut on this mark with a

circular saw (the blade will not go all the way through the post).

4. Use a hand saw to finish the cut. Do not finish it with a circular saw — this is very dangerous and can send the waste piece flying!

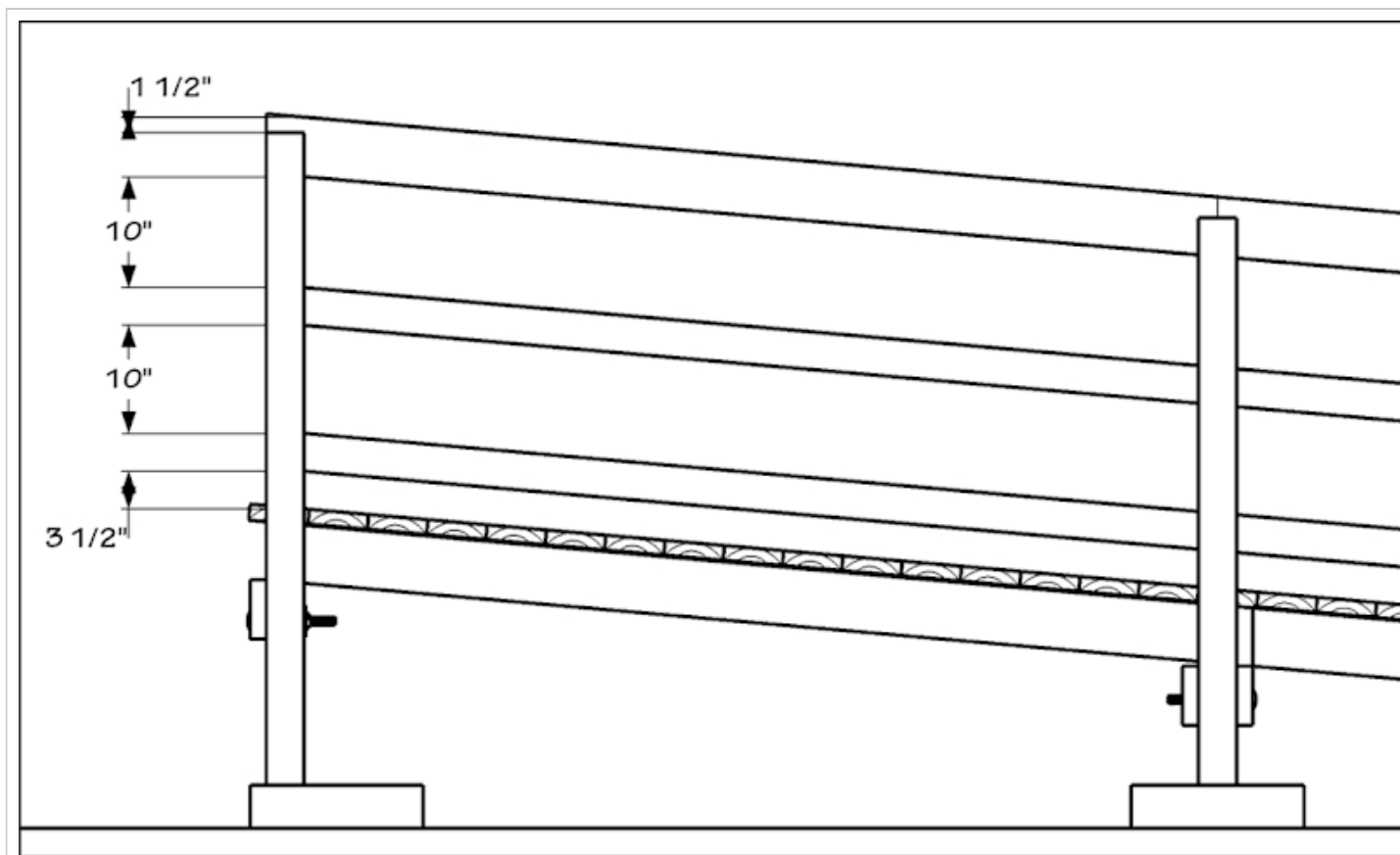




## M. Installing Handrails

### How to Build a Wheelchair Ramp: Installing Handrails

1. Install all "level" rails (i.e. handrails for porches and landings) before you install any slanted rails. This makes it much easier to make the rails continuous. The best sequence is to install bottom rails first, then top rails, then mid rails.
2. Bottom rails should be about 3 1/2" from the decking of the ramp. To achieve this, simply use 2x4 blocks on edge to get the correct spacing.
3. Top rails should be approximately 1 1/2" to 2" above the top of posts. Mid rails should be about 10" between top & mid rails (mostly, you just want them to look visually appealing).
4. The top, mid, and bottom rails at the top of the ramp should be cut so that they are flush with the posts. Mid & bottom rails should also be cut flush with the bottom two posts. The top rail should extend about 1' beyond the bottom set of posts, so that people have something to grab onto.
5. Sand all top rails thoroughly so they are splinter-free.

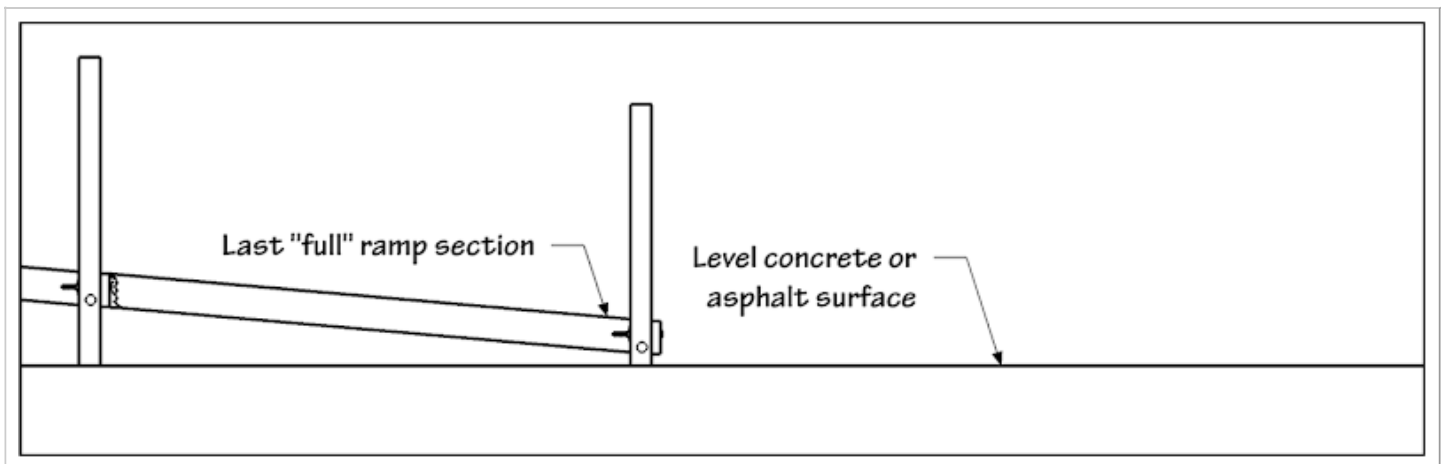


## N. Building a Ramp Over Hard Surfaces

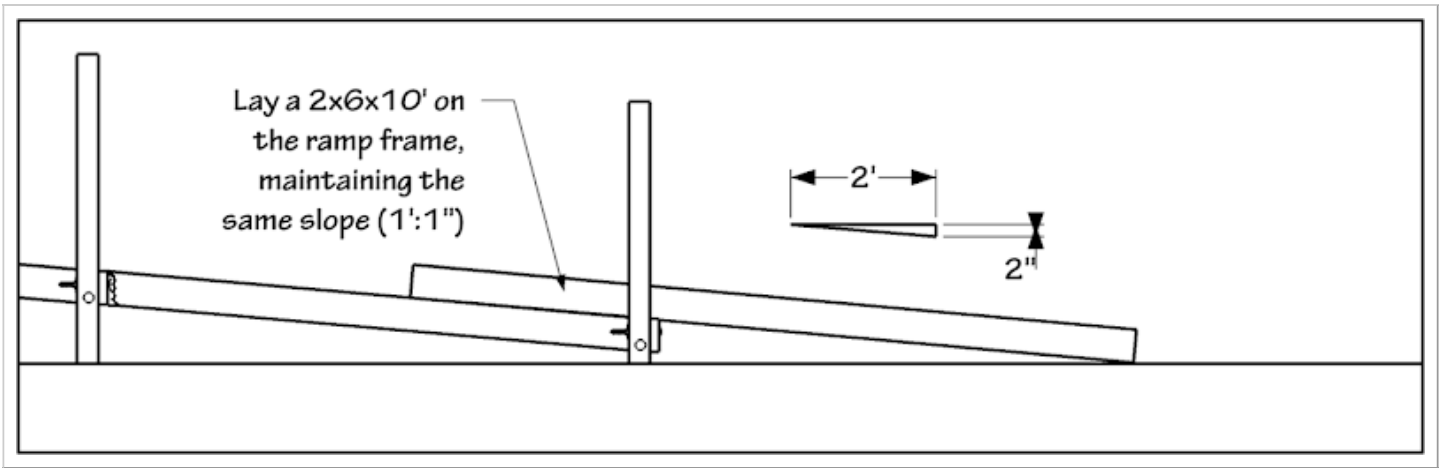
### Building a Ramp Over Hard Surfaces

Building a ramp over concrete or asphalt can be done, though some parts of the process can be tricky. One of the benefits of building over one of these hard surfaces is that you may not need to use footer blocks or dig postholes; the concrete/asphalt can serve as a sufficient foundation for posts. The tricky part is figuring out how to interface the last section of ramp with the hard surface. Another added difficulty may be the slope of the hard surface. Sloped concrete walks or asphalt driveways are more difficult to interface your ramp with than level walks and driveways. With all these factors in mind, here are some possible solutions.

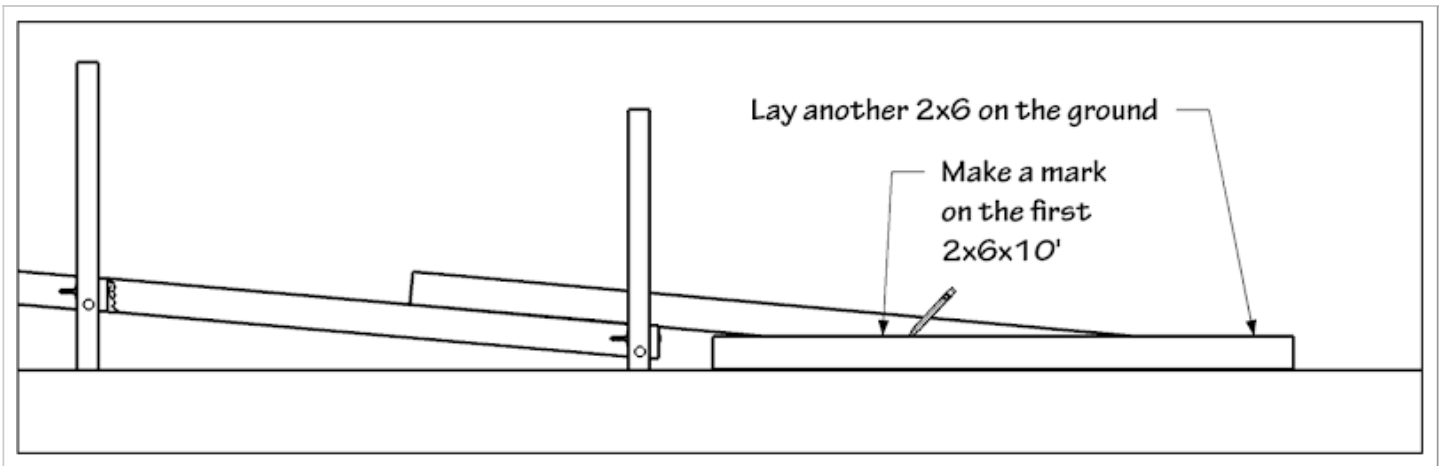
1. The easiest solution may be to simply build the ramp in a different location, over soft ground. This is especially recommended if the concrete/asphalt surface is sloped. You may save yourself a lot of time and head-scratching by simple relocating the ramp.
2. Another option is to build the ramp in the originally planned position, but add a landing at some point to change directions, so that the last section of ramp dies into the ground.
3. If you must build over the hard surface, another solution may be to build the wheelchair ramp as far as you can, then finish the last section with a simple wedge ramp (see Wedge Ramp section of this manual).
4. A fourth option is to build the wheelchair ramp as you normally would, but instead of burying the last set of ramp joists in the ground, you will cut these to fit, resting on the concrete/asphalt, maintaining the correct slope, and smoothly transitioning the ramp to the walkway. This is only recommended for surfaces that are level, or only slightly sloped! This is a trial-and-error process, but here are some tips on how to do it.
  - a. Build the ramp as you normally would, as far as you can go with ramp sections.



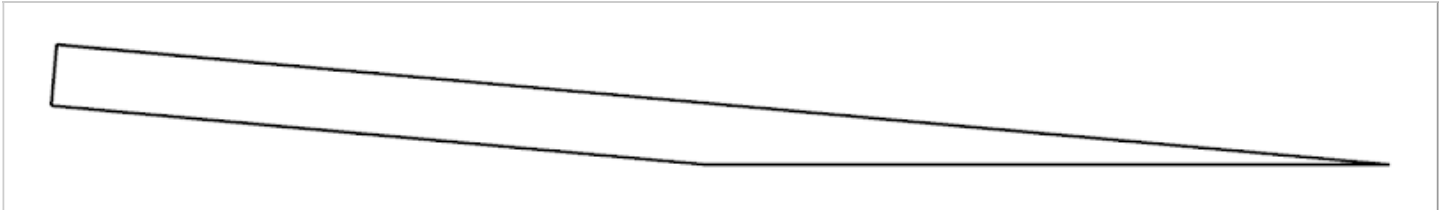
- b. When you get to point you cannot build anymore without altering joists, take a FULL, new 2x6x10' (i.e. don't make any 5 degree angle cuts on it yet), and lay it on the ramp as shown. Make sure the board maintains the same slope as the ramp.



c. Continue to hold the 2x6x10', and have someone else lay another, very straight 2x6 on the ground as shown. Use a pencil to mark the 2x6 as shown.

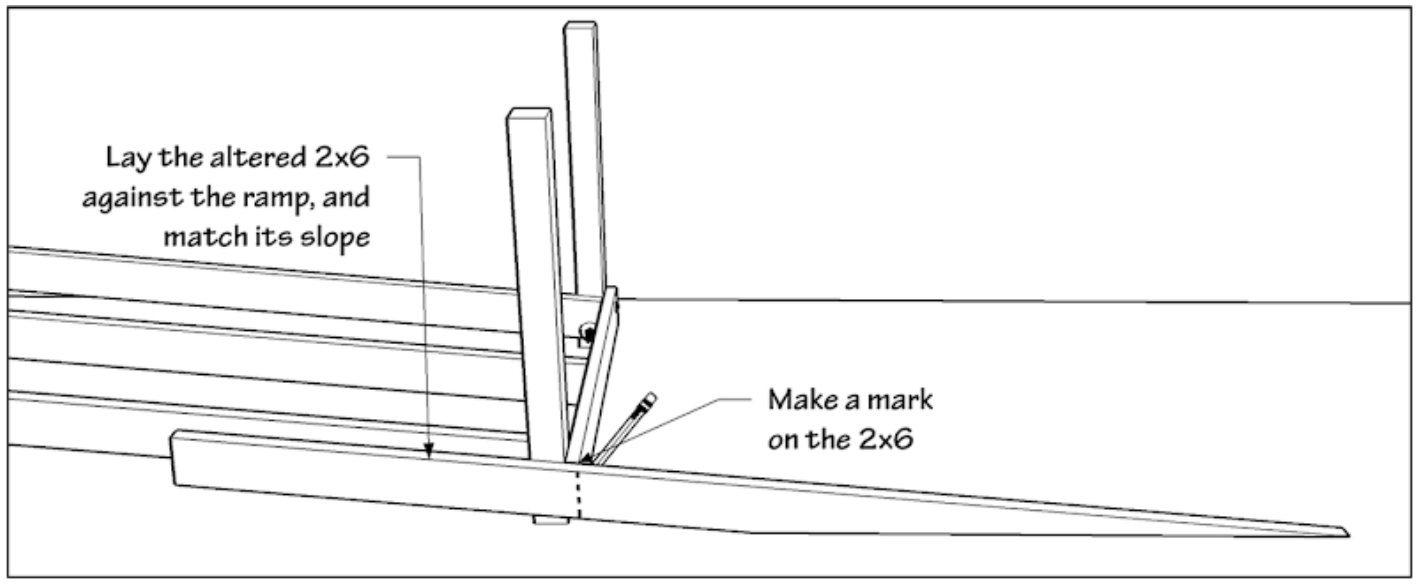


d. Place the 2x6 on a set of saw bucks, and cut carefully on this mark. You should end up with a board that looks something like this:

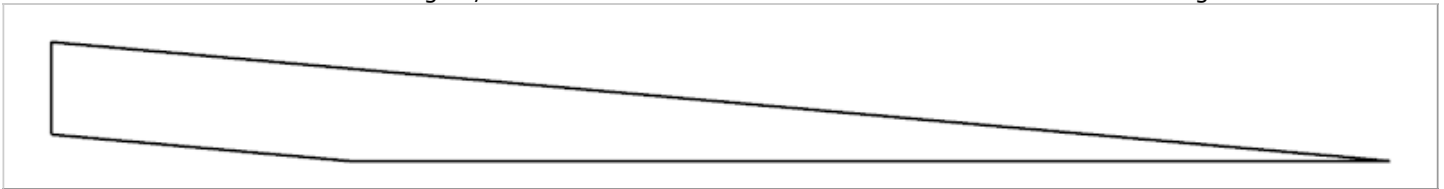


e. Place the altered 2x6 AGAINST the side of the ramp as shown, so that it is in-line with an already-installed ramp joist and matches its slope. Use "The Level Trick" to make sure the slope is correct. Use a pencil to mark the 2x6 as shown.





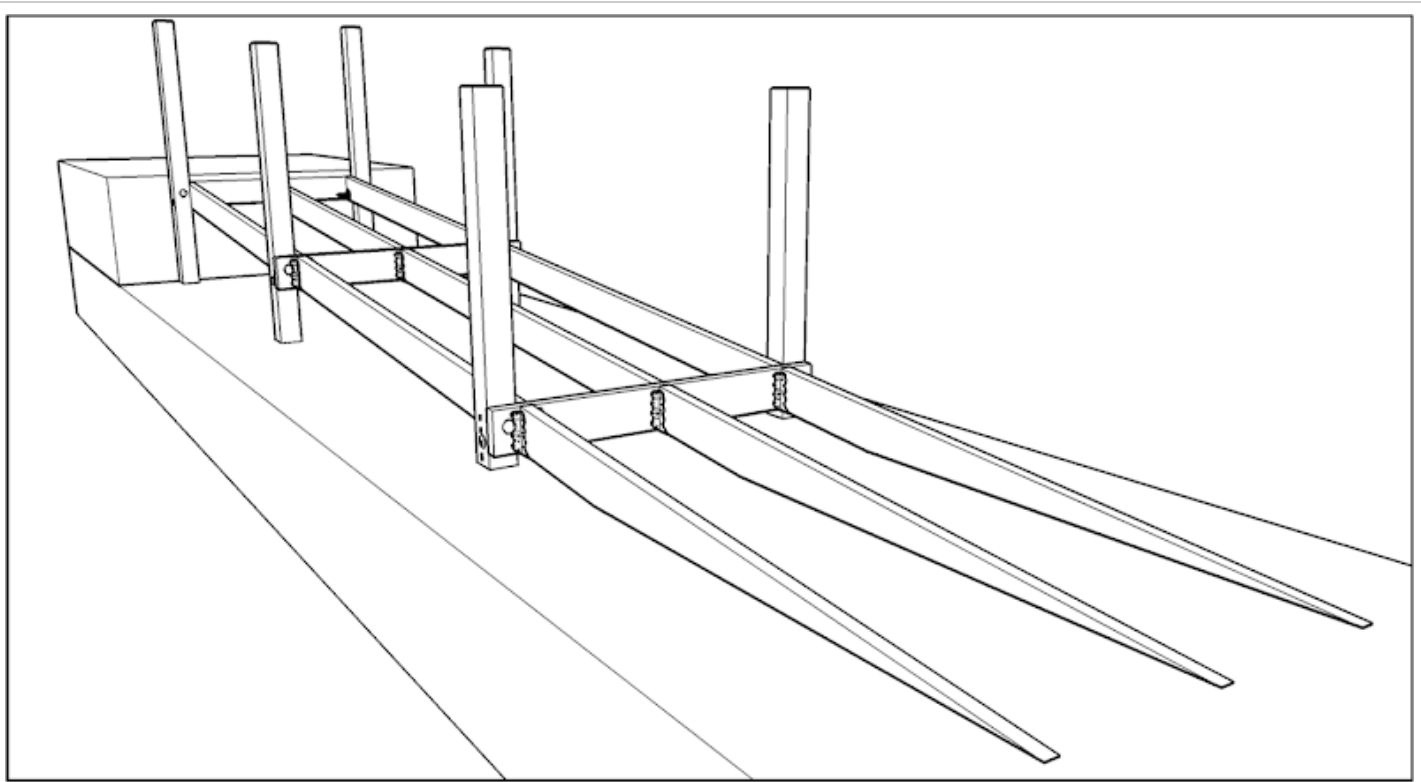
f. Place the 2x6 on saw bucks again, and cut on this mark. The board should now look something like this:



g.

Use this board as a template to trace and cut out two more ramp joists out of 2x6x8' boards. Make sure that they all fit correctly and make adjustments to each board if need be.

h. Now you should be able to install the joists using joist hangers or bolts.



i. The last thing to consider is the very last decking board. You may find that is too wide and/or creates too drastic of a "ridge" so that the walkway doesn't transition smoothly to the ramp. If this is the case, you may

need to change the angle of the circular saw blade and rip the last decking board to fit and create a smooth transition. See the Basic Construction Skills section of this manual for more info.

## **Building a Ramp Over Concrete Steps**

Some folks may wish to have a ramp built over concrete porch steps. If so, do not cut “notches” in ramp joists to fit over these steps. This is difficult, time-consuming, and can weaken joists. Instead, build a small landing over the steps first, so that ramp joists do not need to be notched to fit.

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