

# Andrew Tu Hofheimer Eagle Project



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# Materials List



## Cutting the Pieces

The following gives instructions as to how each component need to be cut and from which raw lumber it should come from. Please follow the directions as close as you can. See attached designs for more information. When cutting from the raw material, there is enough space given for 1/4" between each piece.

### Trailhead

#### Raw Materials

	Quantity				
	8'	10'	12'	16'	20'
1" X 2"	6				
2" X 4"				3	
2" X 6"					6
4" X 4"					
4" X 6"				1	
6" X 6"				2	

#### Component Pieces

	Quantity			
1"x2"x8'	6'	6'	3'11.75" x2	
1"x2"x8'	6'	6'	3'11.75" x2	
2"x4"x16'	3'7.5" x4	3'7.5" x4	9'9", 1'7.5"x2	
2"x6"x20'	9'6" x2	5'x2; 9'6"	9'6", 2'1/4" x4	
2"x6"x20'	2'1/4" x6	2'1/4" x6		
4"x6"x8'	6'4"	6'4"		
6"x6"x16'	14'3/4"; 5 1/2"	14'3/4"; 5 1/2"		

## Final Pieces List

Quantity				
Name	Quantity	Lumber	Length	Distinguishing Char.
Main Support Posts	2	6"x6"	14'3/4"	Longest pieces, 6"x6"
Horizontal Beam	2	4"x6"	6'4"	One beam will have groove down middle
Short Side Framers	4	1"x2"	3'11.75"	Trapazoids
Long Side Framers	4	1"x2"	6'3"	Trapazoids
Plywood	1			
Long Side (F.M.B.) Box Top	4	2"x6"	9'6"	
Short Side (L.R.) Box Top	2	2"x6"	5'	
Box Top Supports	16	2"x6"	2'1/4"	
Spacers	2	6"x6"	5 1/2"	Cube
Top Top Beam	1	2"x4"	9'9"	
Rafters	2	2"x4"	3' 7 1/2"	Il ogram w/bird mouth cuts
Vertical Support	2	2"x4"	1' 7 1/2"	
Plywood Top	1		??	

## Additional Materials List

<b>Forming Tube (12"x48")</b>	4		
<b>Concrete (80lb)</b>	24		
<b>Shingles (33 ft^2)</b>	3		
<b>Roofing Paper (216 ft^2)</b>	1		
<b>Drip Edge (120 in)</b>	6		
<b>Deck Screws (1lb) (1")</b>	0		
<b>Deck Screws (1lb) (1.5")</b>	1		
<b>Deck Screws #8 3" (1lb)</b>	3		
<b>Roofing Nails (1lb) (1")</b>	1		
<b>1/2"x6" Lag Bolt</b>	8		
<b>Carriage Bolt (1/2"x10" long)</b>	4		
<b>Nut/Washer 1/2" (4 set)</b>	1		
<b>4'x4' Plexi Glass</b>	1		
<b>H1Z Z-MAX Gal. 18 Gauge Hurricane Tie</b>	8		
<b>H2.5AZ Z-MAX Galvanized 18-Gauge Hurricane Tie</b>	8		
<b>ZMAX L - Angle</b>	8		

## Tables (For 1 Table — Double for 2)

### Raw Materials

	Quantity			
	8'	10'	12'	16'
1" X 2"				
2" X 4"	2	1		
2" X 6"	4	3		
4" X 4"				
4" X 6"				
6" X 6"				

### Component Pieces

	Quantity			
	28"x2	28"x2		
2"x4"x8'	28"x2	28"x2		
2"x4"x10'	60"x2			
2"x6"x8'	32 1/3"; 60"	32 1/3"; 60"	32 1/3"; 60"	32 1/3"; 60"
2"x6"x10'	60"x2	60"x2	60"x2	

### Additional Materials List

5/16" x 4" Galvanized Carriage Bolts	8		
5/16" Washers	8		
5/16" Nuts	8		
Deck Screws (2.5") (1lb)	1		

## Benches

### Raw Materials

	Quantity			
	8'	10'	12'	16'
1" X 2"				
2" X 4"				
2" X 6"				
4" X 4"	3			
4" X 6"				
6" X 6"				

### Component Pieces

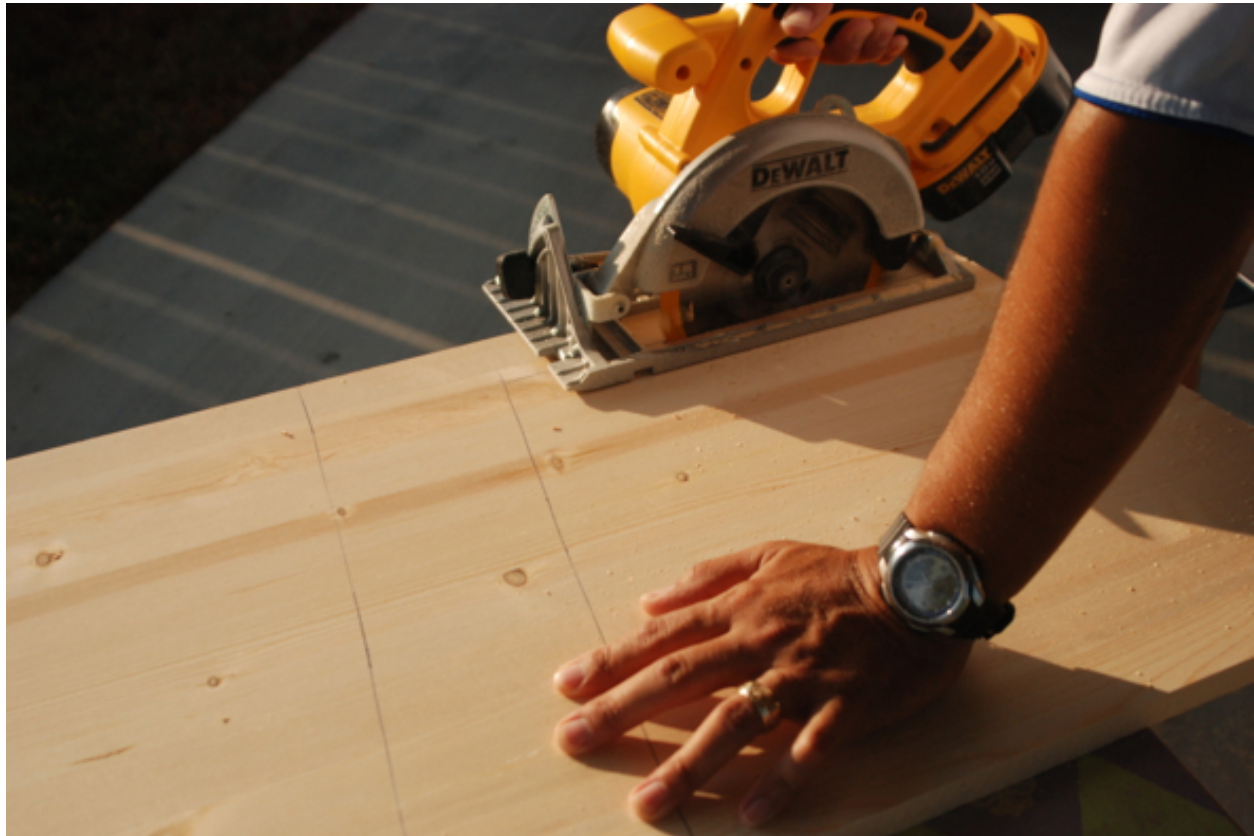
Quantity				
4"x4"x8'	36"x2	48"x2	36"; 10 3/4"x2	

### Additional Materials List

Screws (3") (1lb)	Use from Trailhead		
"L" Brackets	6		
Double "L" Brackets	4		



# Cutting the Wood



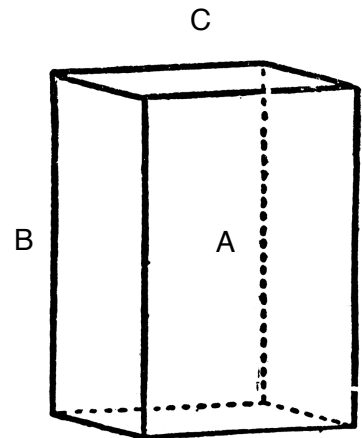
## General Guideline for wood cutters

1. **Measure Twice, Cut Once:** We only have a limited amount of wood. Lets try to conserve it.
2. **Avoid unnecessary work:** For pieces that repeat, cut ONE piece first to full specifications and then use as a template for cutting the remainder of the pieces. Note: The **SAME** piece should be used trace out every single piece! Make sure you check it against the annotated diagrams before using it as a template to verify it's accuracy as a model.
3. **Wear all necessary safety equipment:** Pretty self explanatory. Let's try to keep casualties to a minimum
4. **Follow the Specifications:** They are there for a reason! Use them!
5. **When in doubt, ASK:** I'd rather have a deluge of questions and cut everything right the first time than find out on build day that we messed up.
6. **If you have a suggestion, I'm all ears:** Let's be real here... I'm not an architect. Many of you probably have just as much, if not more experience with wood work as I do. If you see a discrepancy or have a suggestion to make, MAKE IT!
7. **Read through the section you're working on:** Make sure you know how each component interacts with the rest of the project. Understanding what your piece does allows you to preemptively avoid any potential issues with the building process and may also allow you to see a more efficient method of construction.
8. **Refer to the individual drawing diagrams:** I've done the best I can to spell out the specific cuts needed however, the individual diagrams of each of the pieces is the best way to see how the cuts need to be made

## Trailhead

### Main Support Posts (6"x6"):

1. **Dado cut:** Side B', 2'- 6 3/4" from top, 3.5" tall (going down), 2" deep
2. **Dado cut:** Side B', 6'-11 1/4" from bottom, 3.5" tall (going up), 2" deep
3. **Pilot holes (2):** Side B', 5/16" through hole, 1" up and 1" to the right of the bottom left corner of each dado cut
4. **Pilot holes (2):** Side B', 5/16" through hole, 1" down and 1" to the left of the top right corner of each dado cut
5. **Pilot holes** (to be drilled during construction to ensure they line up): TENTATIVELY- Side A, 5/16" through hole, 1 1/2" from right edge, 1' 8 1/4" from top
6. **Pilot holes** (to be drilled during construction to ensure they line up): TENTATIVELY- Side A, 5/16" through hole, 1 1/2" from left edge, 2' 6 3/4" from top



Side opposite is: X'

### Horizontal beam w. Groove (4"x6")

1. **Dado cut:** Centered along C side, 3/4" wide, 1/4" deep, full length
2. **Pilot Holes:** Side B and B', 5/16" hole, 1" deep, 1" from top, 1" from left edge
3. **Pilot Holes:** Side B and B', 5/16" hole, 1" deep, 1" from bottom, 1" from right edge

### Horizontal Beam (4"x6")

1. **Pilot Holes:** Side B and B', 5/16" through hole, 1" deep, 1" from top, 1" from left edge
2. **Pilot Holes:** Side B and B', 5/16" through hole, 1" deep, 1" from bottom, 1" from right edge

### Short and Long Side Framers (1"x2")

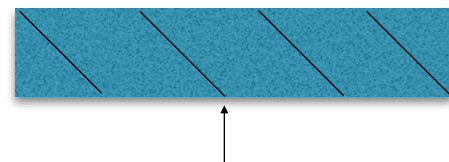
1. **Angled cut:** 45° cut from corners toward center, form a trapezoid

### Middle Box Top Beam (2"x6")

1. **Pilot Holes (2):** Wide side; 5/16" through hole 1' 7 1/2" from short side edges towards center, 1 1/2" towards center from top (long side edge)
2. **Pilot Holes (2):** Wide side; 5/16" through hole 1' 5" from short side edges towards center, 1 1/2" towards center from bottom (long side edge)

### Rafters (2"x4")

1. **Angled Cuts:** Two 56° cuts in the same direction creating a parallelogram. The cuts will be 3' 5 1/4" inches apart. The second angled cut of one rafter creates the first cut for the second
2. **Birds Mouth:** Make a mark 6 1/2" in from one of the pointed corners of the parallelogram and 3/4" deep. Make two more marks along the bottom edge (same corner on the lower left) at 6" and 7 3/4". Connect the dots forming a triangle and cut along the lines creating the "birds mouth"



The 2nd edge of one parallelogram will create the first edge of the next

## Tables

### Legs (2"x6")

1. **Angled Cuts:** Mark an angle with a speed square 23 degrees on one end of a 2x6 and cut it. Measure 30" from the long point of the previous cut and mark another 23 degree angle and cut it parallel to the first cut.

### Diagonal Braces (2"x4")

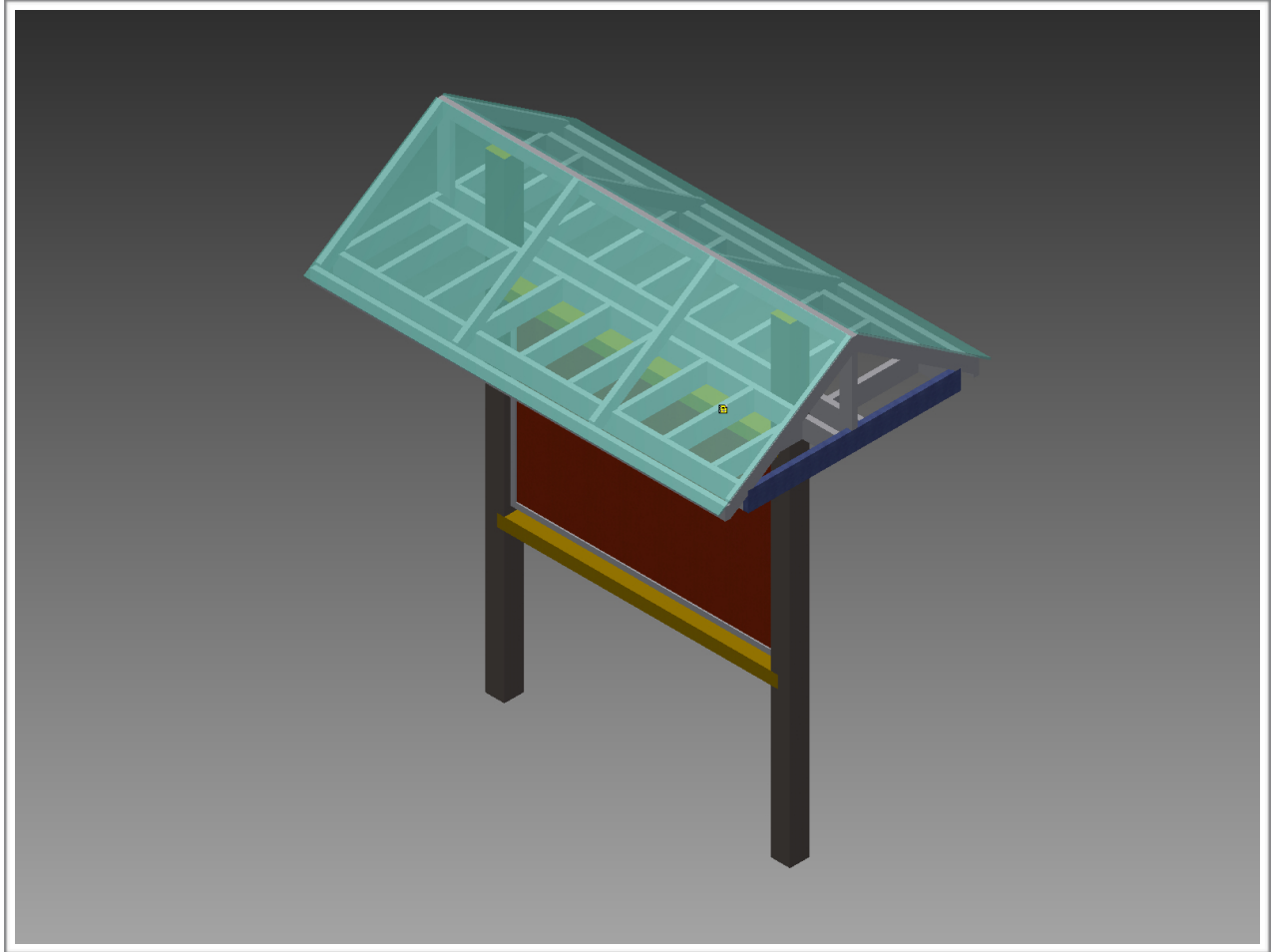
1. **Angled Cuts:** Cut two 24" pieces with a 45 degree bevel on each end. These will be used as braces.

## Benches

### Bench Supports (4"x4")

1. **Angled Cuts:** Make a 45 degree cut from each side of the lumber toward the center creating a trapezoid
2. **Pilot holes:** Drill a 5/16" through hole in the center of the flat side of the trapezoid.

# Trailhead Construction

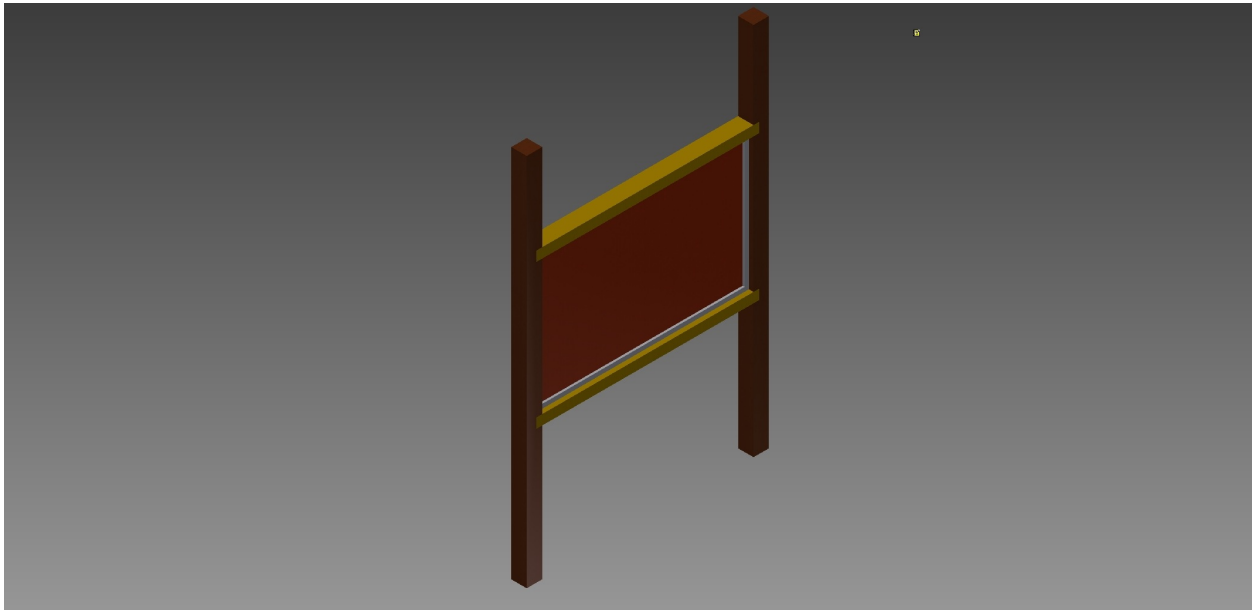


## Trailhead

The Trailhead can be broken down into 3 main components: the body, the box top, and the roof. The Roof and the box top should be constructed together while the body may be constructed independently of the others. While construction of both components can be begin simultaneously, the body needs to be *completed* before the box top and roof as to allow proper attachment to the box top.

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### Body

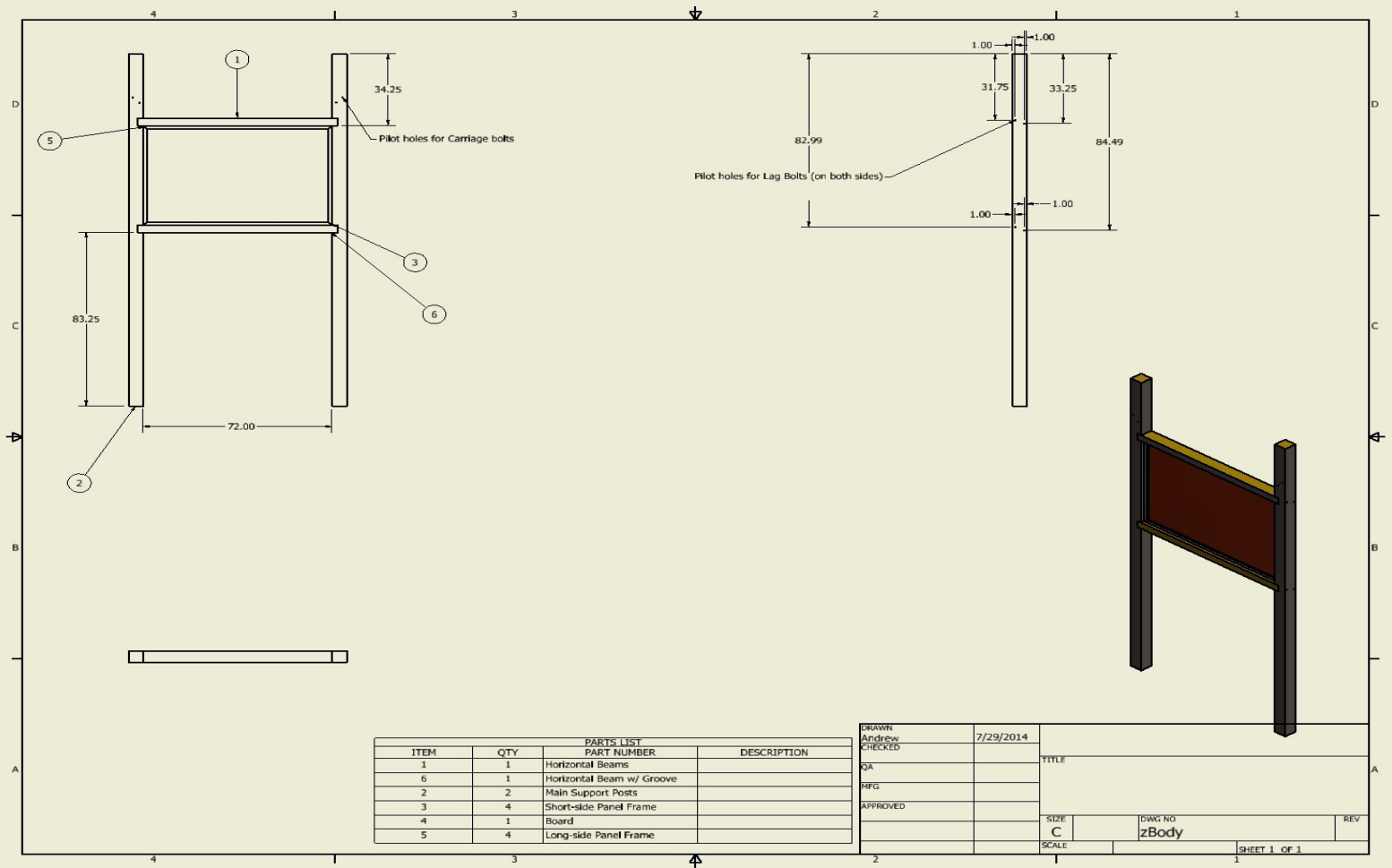


### Components for Body

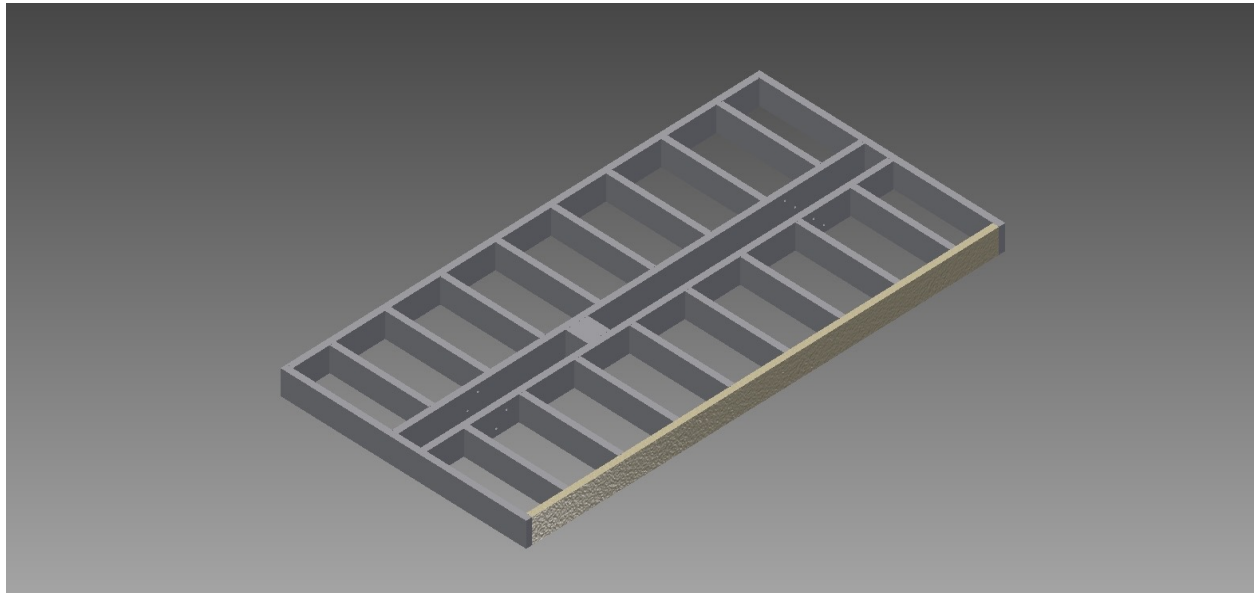
Name	Quantity	Lumber	Length	Distinguishing characteristics
Main Support Posts	2	6"x6"	14'3/4"	Longest pieces, 6"x6"
Horizontal Beam	2	4"x6"	6'7"	One beam will have groove down middle
Short Side Framers	4	1"x2"	3'11.75"	Angled ends
Long Side Framers	4	1"x2"	6'	Angled ends
Plywood	1	4'x6'		

## Assembly

1. Lay two main support posts down parallel approximately 6ft apart with indented cuts facing in towards center
2. Insert bottom horizontal beam (4"x6" with groove down middle) face up
3. Secure with 2 (6)" lag screws per side as shown in the diagram. Ensure the bolts line up with the pilot holes.
4. Insert plywood wood board into bottom groove. This will be secured in place later by the border pieces.
5. Insert Top horizontal beam and secure the same way as the bottom beam with 2 lag screws.
6. Place border pieces around edge of Plywood and screw in with 1.5" decks screws — one approximately every foot (alternating sides — front and back)
7. Using L brackets, secure the boards/border to the Main Support Posts and Middle beams. The screws that go into the border should be 1.5" screws while the screws that go into the posts/middle beams can be 3" nails. One bracket should be used every foot.



## Box Head



## Components for Box Head

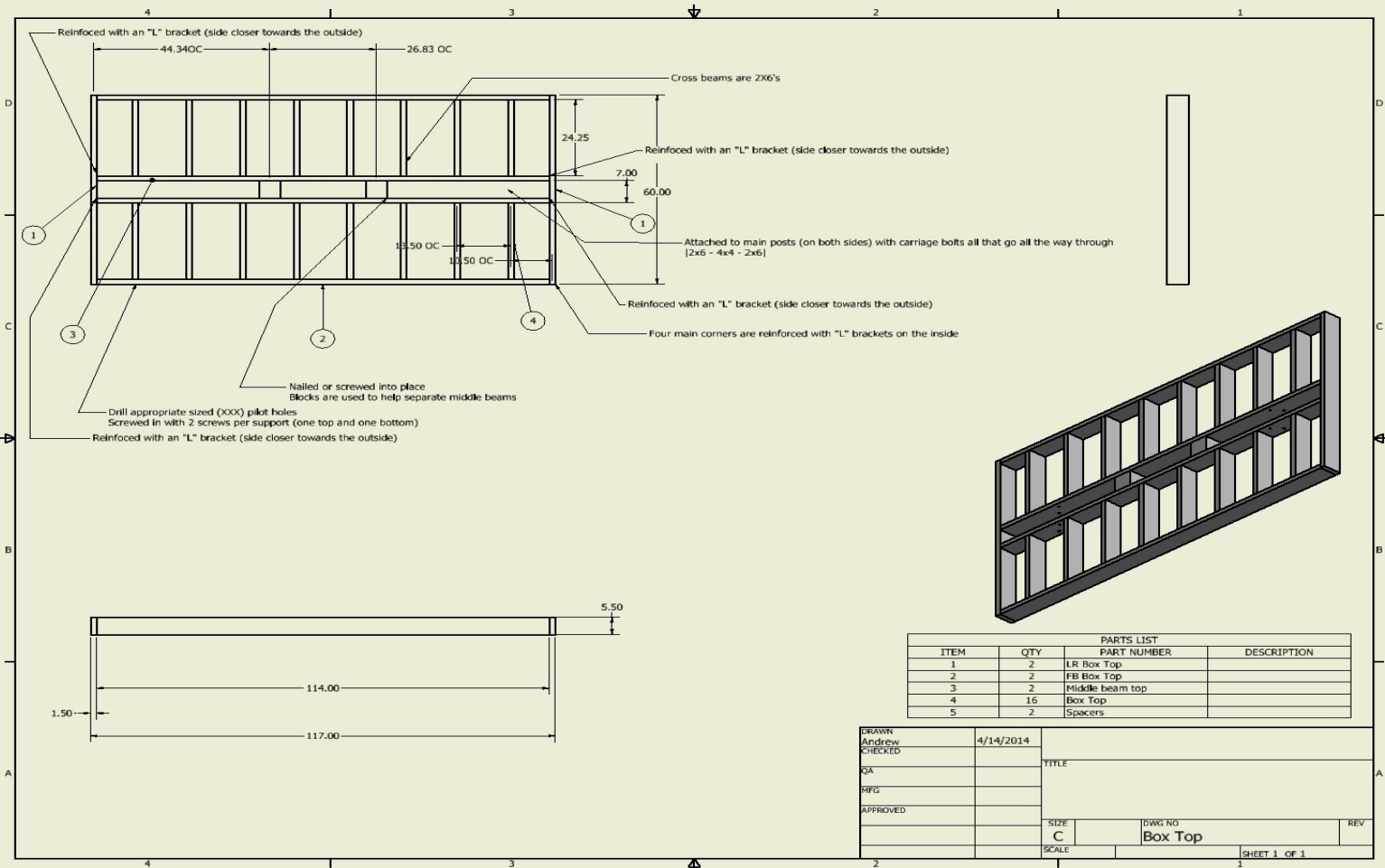
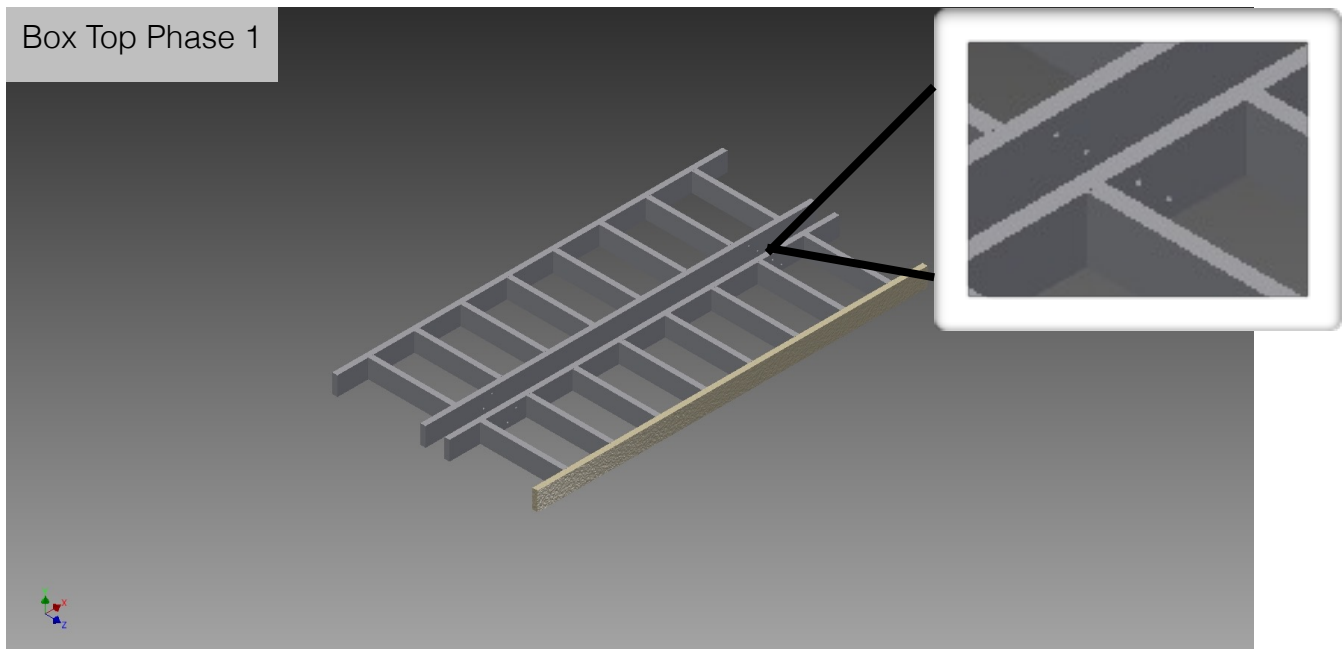
Name	Quantity	Lumber	Length	Distinguishing characterisitcs
Long Side (F.M.B.) Box Top	4	2"x6"	9'6"	
Short Side (L.R.) Box Top	2	2"x6"	5'	
Box Top Supports	16	2"x6"	2'1/4"	
Spacers	2	6"x6"	5 1/2"	Cube

## Assembly

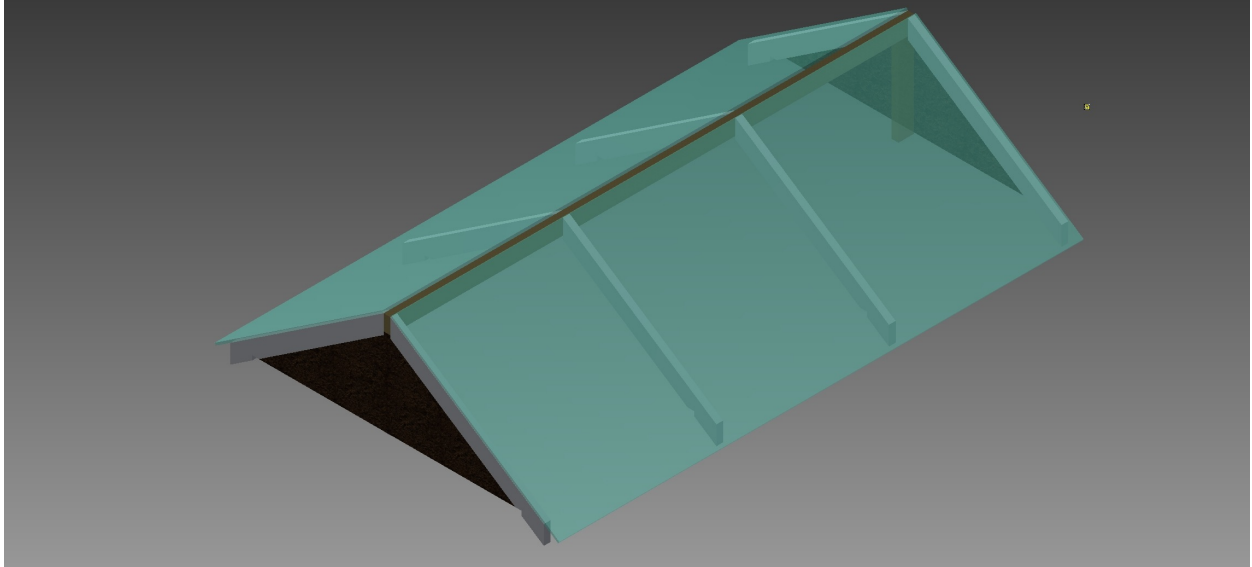
1. Lay out pieces as shown in "Box Top Phase 1". Ensure that the pilot holes are facing the correct directions and will match up with the holes drilled in the main support posts from the body
2. Using 2 screws per support per side, attach the F.M.B to the Box Top Supports to the F.M.B supports (as shown in "Box Top Phase 1")
3. Construct both sides individually before attaching them together with the L.R. Box Top.
4. Insert the spacers in-between the two sides according to the IDW drawing. Secure it in place with 5 3" nails per side, in the formation of a 5 on a die.
5. With the spacers in place, attache the L.R. Box Top pieces to either side of the Box top using "L" brackets on each of the inside corners of each respective side (8 total). See IDW for placement. Secure using 1" screws.



Box Top Phase 1



## Roof



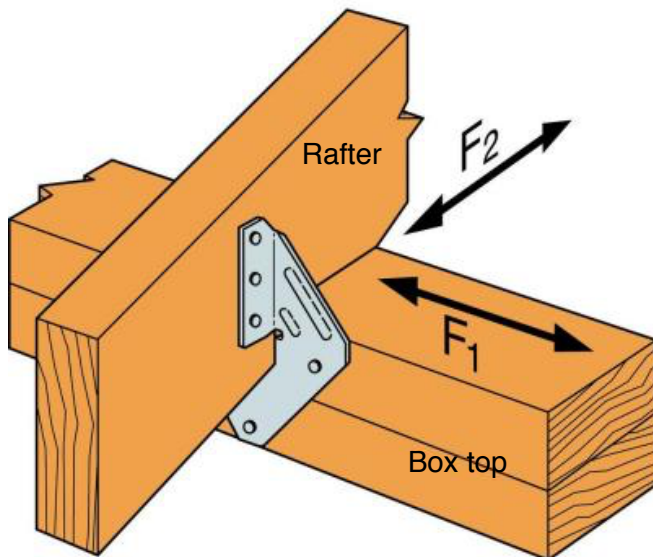
## Components for Roof

Name	Quantity	Lumber	Length	Distinguishing characteristics
Top Top Beam	1	2"x4"	9'9"	
Rafters	8	2"x4"	3' 7 1/2"	Parallelogram w/bird mouth cuts
Vertical Box Support	2	2"x4"	??	
Plywood Top	2	1/2"	12'x8x	

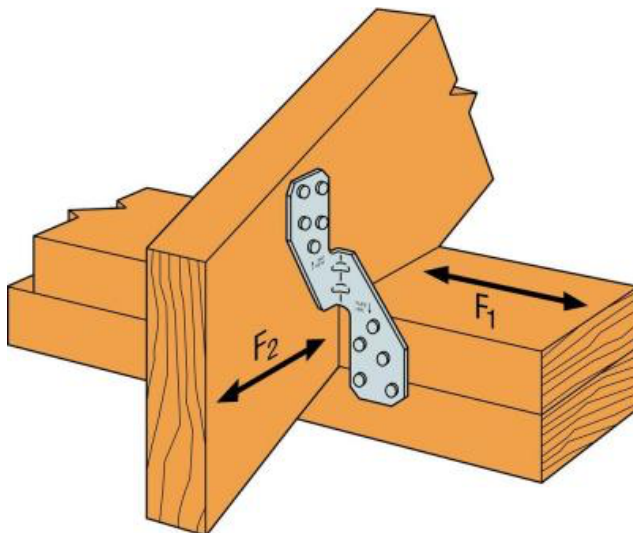
## Assembly

1. The roof MUST be constructed after the Box Top is constructed since it uses the box top as a base
2. Fit each birds mouth groove (on the Rafter pieces) into the Long Side (F.M.B.) Box Top according to diagram.
3. Secure EACH of the four center rafters using two H1Z Z-Max Hurricane Ties, one on each side of the Long Side Box Top — the bottom part of the tie should be screwed into the outside of the box top and surround the rafter. Use 1" screws. Be sure to slightly offset the ties so the screws don't hit one another. (See diagram below)
4. Secure each of the four edge rafters using two H2.5AZ Z-Max Hurricane ties, one on each side. Use 1" screws. Be sure to slightly offset the ties so the screws don't hit one another. (See diagram below)

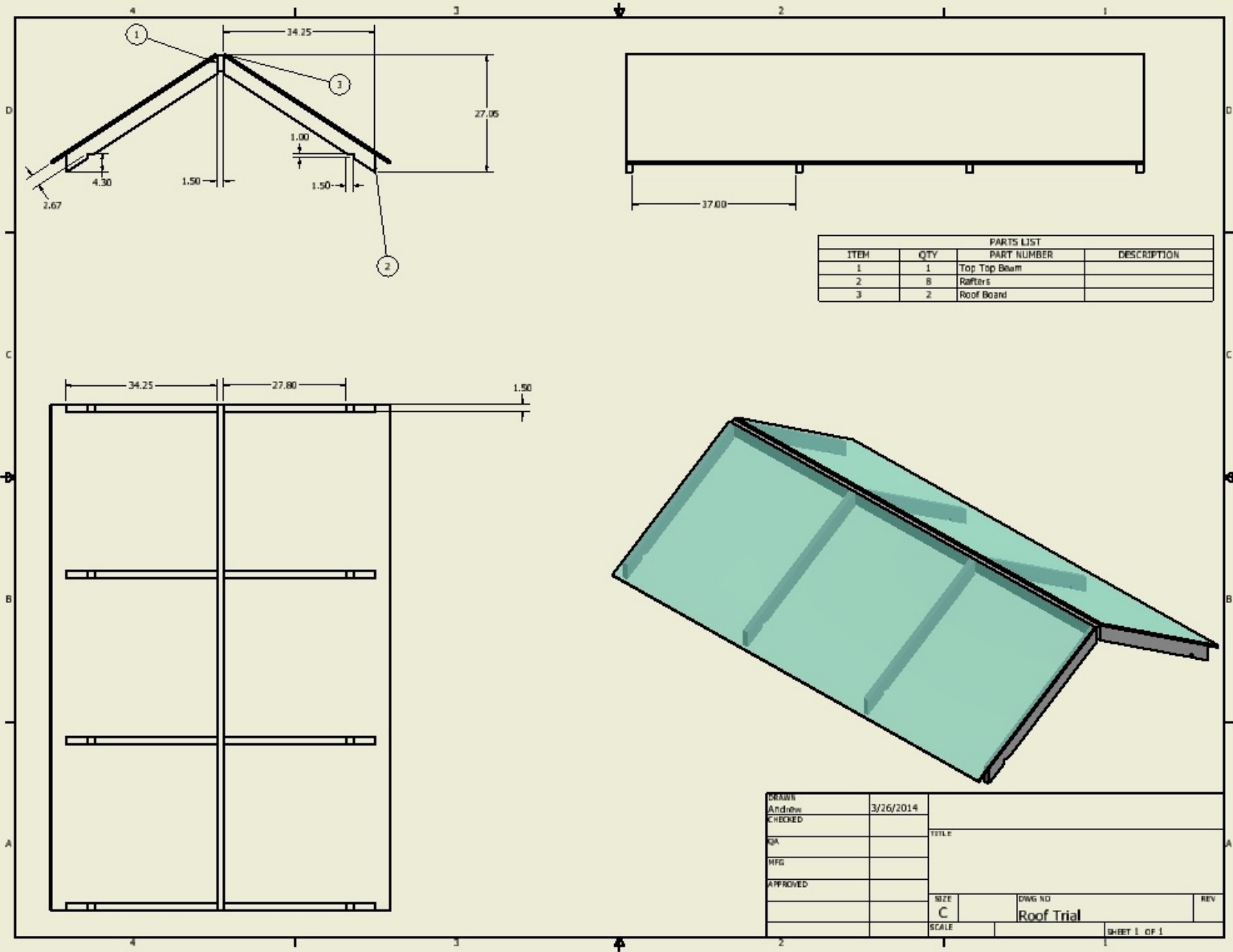
5. Align Top Top Beam in-between the two sides of the rafters — secure the rafters to the top top beam using “L” brackets and 1” screws. <— Maybe?
6. Insert the Vertical Supports between the Short Side (L.R.) Box Top and the Top Top Beam and secure with deck screws on both sides.
7. Attach plywood pieces across forming the “roof” over the rafters — ensure that the plywood lies flat against the edges. Screw the plywood into the rafters using 3” screw — one every 6”



H1Z Z-Max Hurricane Tie: bottom is secured to the outside of the boxtops while the top is secured to the rafter beam.



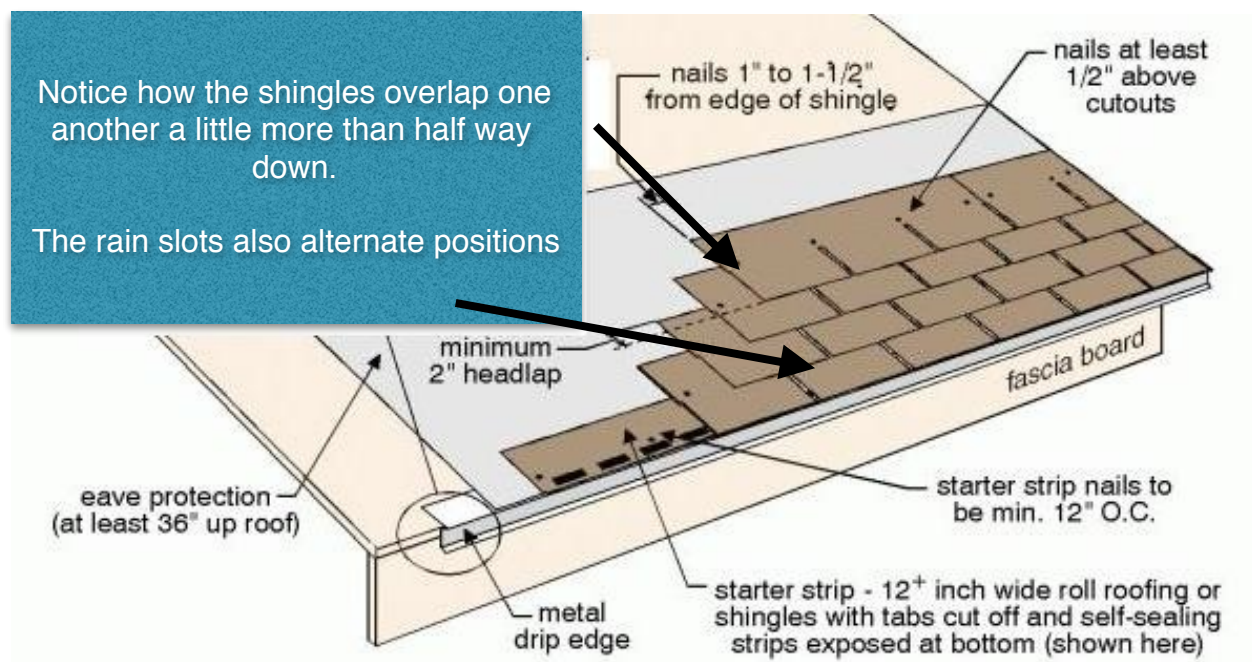
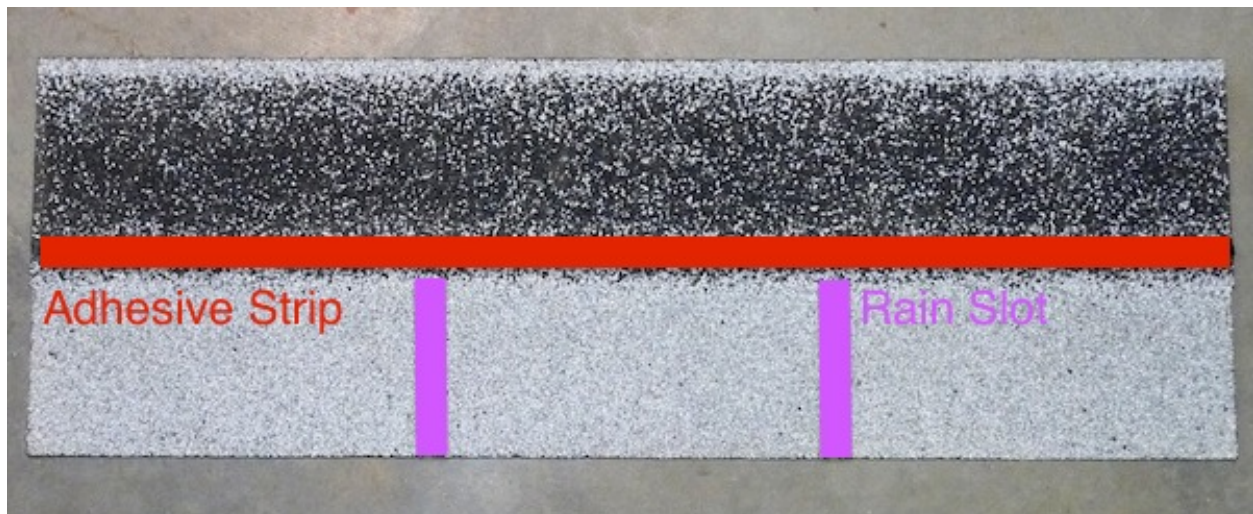
H2.5AZ Z-Max Hurricane ties: one goes on each side of the rafters. Be sure to attach one to each side and slightly offset them to prevent the nails from hitting each other.





## Roofing

1. Lay drip edge down along the bottom edge of the roof, nail it down using one nail every 24 inches
2. Cover plywood with roofing paper and nail it down to secure it (one every 24 inches left to right, one every 12 inches up and down).
3. Lay drip edge along the eaves edge of the roof (over the roofing paper), one nail every 12 inches
4. Attach the starter strip of shingles flush along the bottom of the two sides flush against the bottom edge and - nail them in
  1. To create a starter strip: take one strip of shingles and cut off the bottom half of the tabs (below the adhesive strips)
5. Place the first layer of shingles down offset by approximately 1/2 shingle length (horizontally) and approximately "XXX" inches below the adhesive strip of the shingles beneath it
6. Additional shingles are nailed in moving from bottom to top — be sure to alternate the strips locations to ensure that the rain slots alternate positions



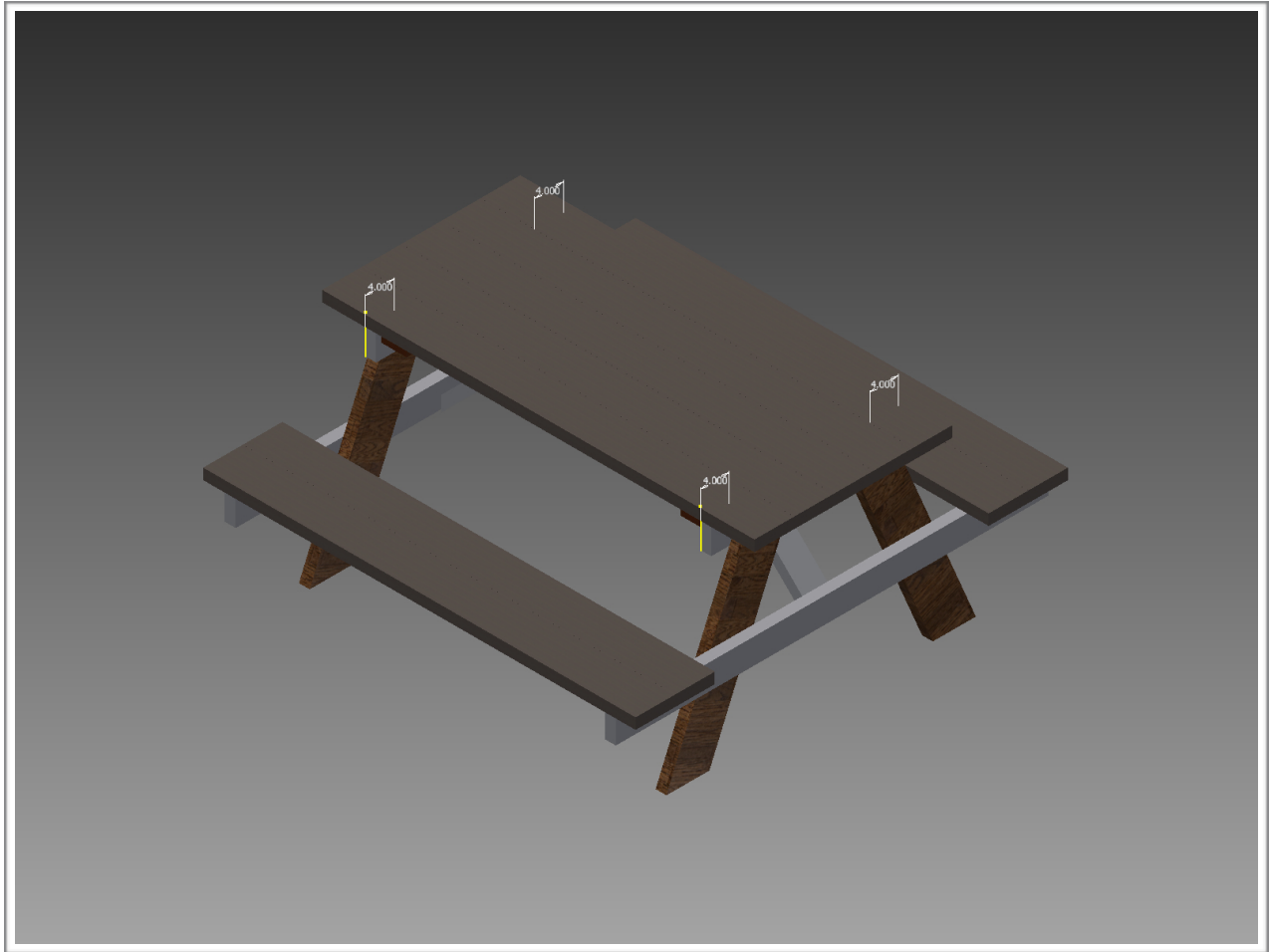
## Ridge Cap

1. Cut the shingles into thirds starting from the rain slot and moving backwards.
2. Lay the shingles down with the “nicer” side facing out bent long ways across the roof’s ridge
3. Nail the shingle in with 3 nails per side
4. Continue laying shingles down — work from the edges in to the center
5. Overlap the shingles with the sides covering a little more than half of the sheet

## Installation

1. Using a combination of post hole diggers and an iron ram rod, dig 2 [10 in] wide holes [36] inches down approximately 6 ft from each other.
2. Insert a forming tube into the hole making sure that its level
3. Separately, mix and prepare [5] bags of cement
4. Insert the post into each forming tube and ensure that it is level across all 3 axes
5. Pour cement into both forming tubes completely surrounding the posts
6. Secure the trailhead to prevent any movement using ropes and stakes — allow to set
7. Create a warning perimeter around the entire area to prevent any unsuspecting pedestrians to stumble into trailhead/trip over stakes

# Picnic Table Construction



## Picnic Tables

The Picnic Tables can be broken down into 2 main components: the Table Top and the Supports. The Table Top is very simple and very straightforward while the Supports require a little (but not much) more work in terms of alignments.

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### Raw Material

Material	Quantity	Purpose
2" x 6" @ 8'	4	Legs, bench, and table top
2" x 6" @ 10'	3	Legs, bench, and table top
2" x 4" @ 10'	1	Bench supports (free of knots)
2" x 4" @ 8'	2	Table top support (right and left) and misc.

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### Table Top

#### Components

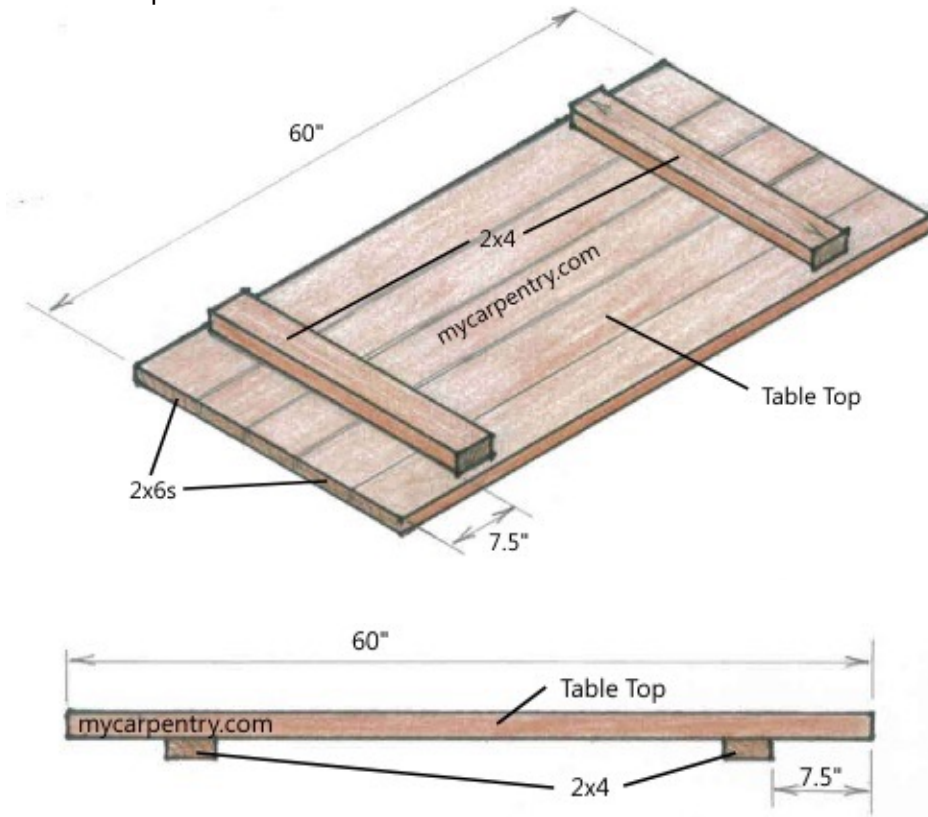
Name	Quantity	Lumber	Length	Distinguishing characteristics
Table Top Boards	5	2"x6"	60"	
Table Supports	2	2"x4"	28"	

#### Assembly

1. On a flat surface, lay out the 5 2x6s side by side, with the "prettiest" side facing down.
2. Position the two 2x4s on each end of the table top (as shown in the diagram) 7.5" from each end.



3. Attach the 2x4 braces to the table top boards using two 2.5" galvanized wood screws per side of the Table top board into the 2"x4".



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## Legs and Bench Supports

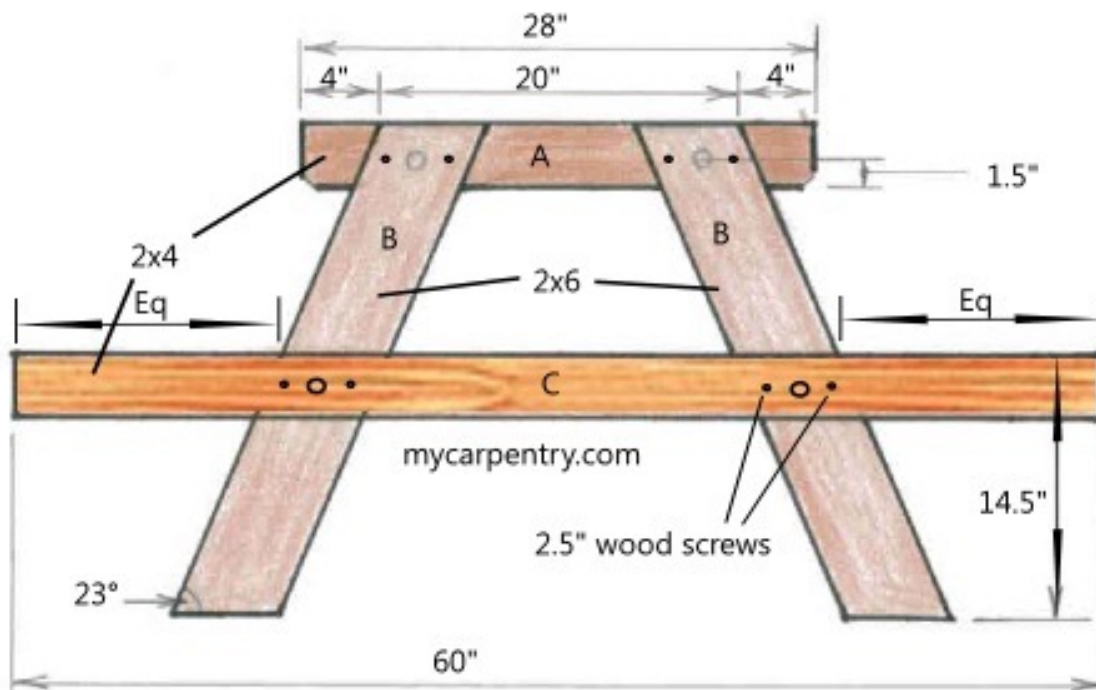
### Components

1. Mark an angle with a speed square 23 degrees on one end of a 2x6 and cut it.
2. Measure 30" from the long point of the previous cut and mark another 23 degree angle and cut it parallel to the first cut. (see diagram below)
3. From one of the 8' 2x4s, cut one piece 28" long.
4. On one edge of the 2x4 (A), make a mark 4" from each end. This will be the position of the top of the legs. (see diagram)
5. From the 10' 2x4, cut two pieces 60" long. These will be used for the bench supports.
6. Cut 4 2x6s 60"

Name	Quantity	Lumber	Length	Distinguishing characteristics
Legs	4	2"x6"	32.33"	Parallelograms
Table Edge (A)	2	2"x4"	28"	
Bench Supports	2	2"x4"	60"	
Seat Planks	4	2"x6"	60"	

## Assembly

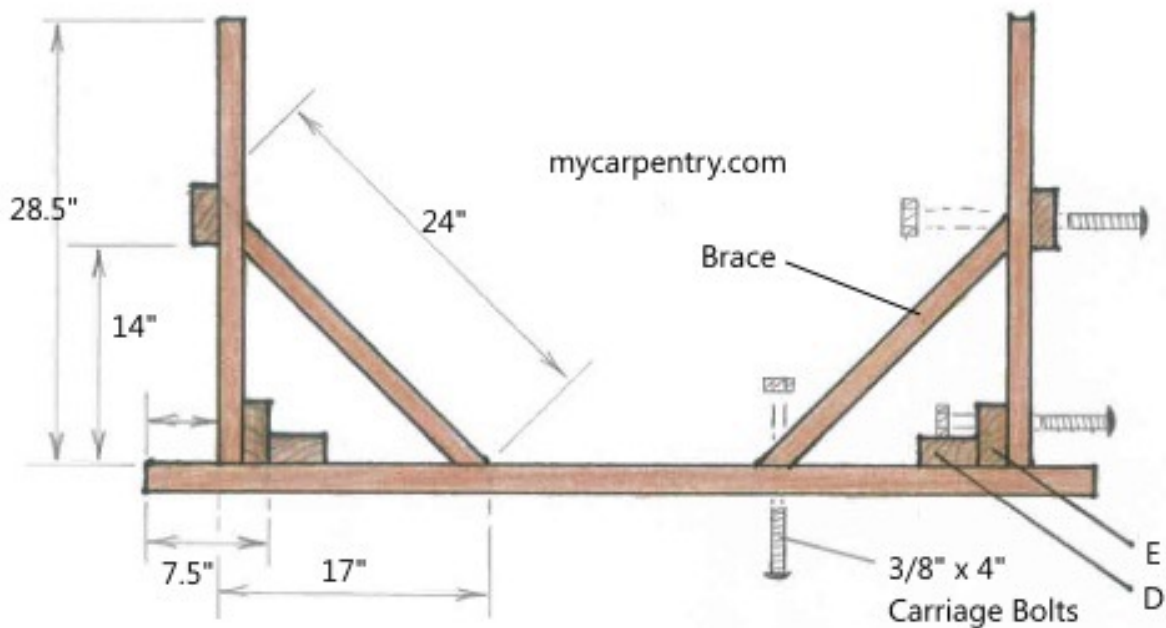
1. Place the legs (B) on the 2x4 (A) as shown in the diagram, and secure them with two 2.5" galvanized wood screws.
2. Measure up 14.5" from the other end of each leg and make a mark. This will be the height of the bench support.
3. Line up the top of the 60" bench support with the marks made from the previous step.
4. Center it between the legs so that an equal amount of 2x4 is extending from each side. (see the diagram below).
5. Secure the bench support (C) to the legs (B) with two 2.5" galvanized wood screws.
6. Drill a 3/8" hole through both boards where each piece connects, and secure the pieces together with four 3/8" x 4" carriage bolts. Note that the holes that secure the legs (B) to the upper support (A) should be drilled 2" from the top of the upper support (1.5" from the bottom). This is so that when you attach the leg assembly to the table top, the carriage bolts won't be in the way.
7. Repeat the steps above to assemble the remaining leg assembly.



## Finishing

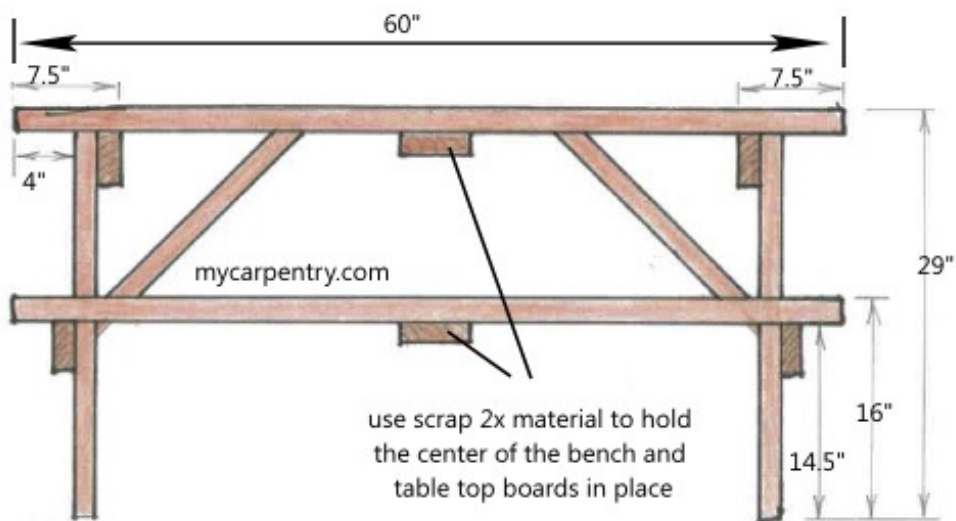
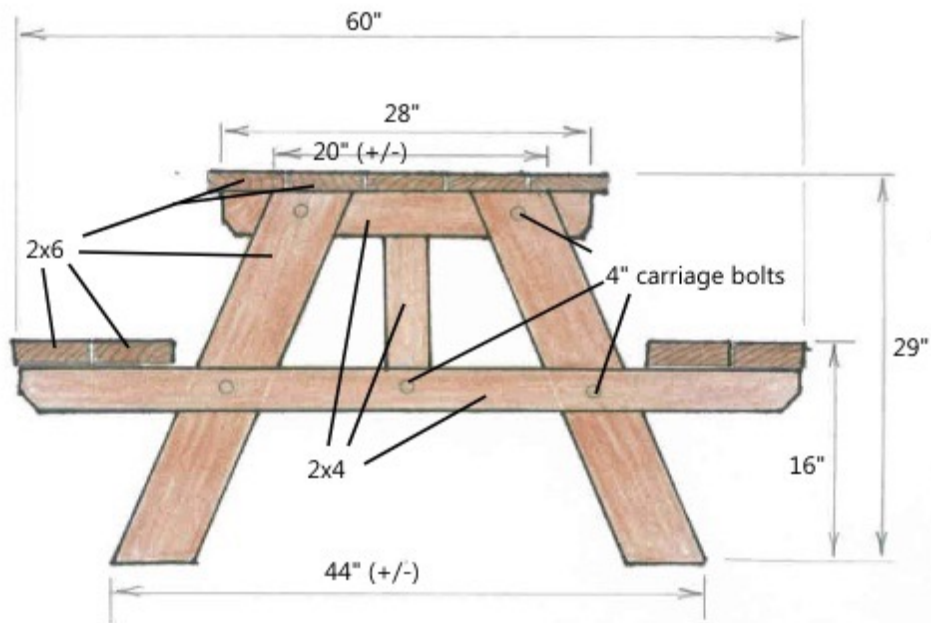
### Attach the Leg Sections to the Table Top

1. Flip the table top upside down and attach the legs to each side of the table top braces. Use four 2.5" galvanized wood screws to secure each leg section. (see diagram)
2. From the remaining 8' 2x4, cut two 24" pieces with a 45 degree bevel on each end. These will be used as braces.
3. From the bottom of the table top to the bench support, make a mark at 17" on the middle of the bench support.
4. Make another mark on the underside of the table from the inside plane of the bench support to the center board on the underside of the table (see diagram). The 24" brace, when attached, should line up with these two marks. If they don't, pull the leg assembly over until the marks line up. This is required so that the legs and table top will be a perfect 90 degrees.
5. Secure the braces with 2.5" galvanized wood screws and finally, with carriage bolts.

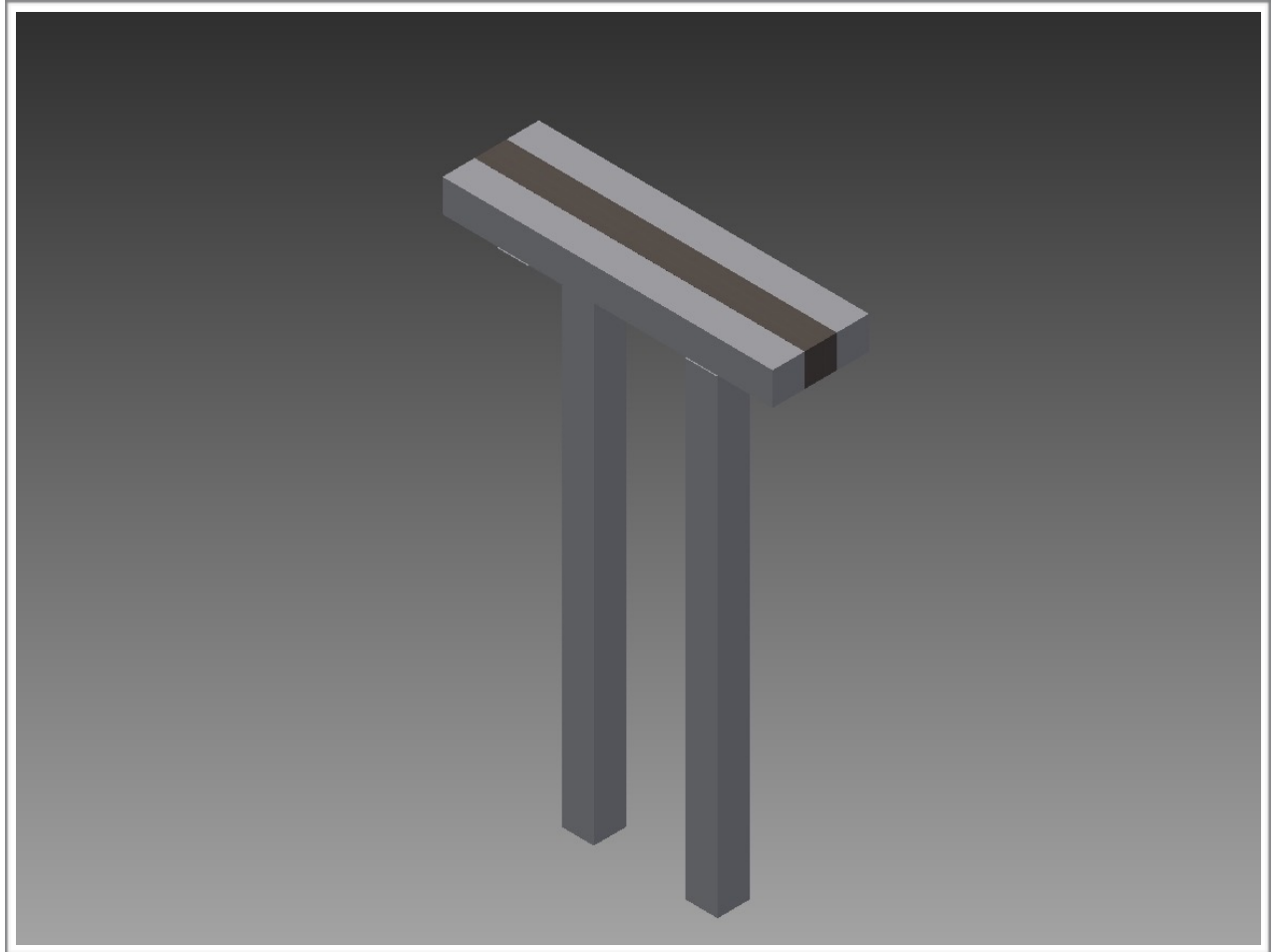


### Finishing Up

With the diagonal braces in place and secured, flip the table upright and add the 60" 2x6 bench seats. (see diagrams) Using the remaining scrap 2x material, add supports to the middle of the table top and middle of the bench seats to keep the lined up. (see the Picnic Table Side View) Cut these braces so that they are about 1" from either edge of the table top or bench seat. Secure them with 2.5" galvanized wood screws.



# Bench Construction



## Bench

The bench is very simple and can be constructed with just 4x4 lumber.

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### Raw Material

Material	Quantity	Purpose
4"x4"@8'	4	

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### Benches

### Components

Name	Quantity	Lumber	Length	Distinguishing characteristics
Bench Top	3	4"x4"	36"	
Bench Supports	2	4"x4"	10.75"	Trapezoid
Legs	2	4"x4"	48"	

### Assembly

1. Align the three Bench Top boards parallel to one another and lay the bench supports across them (perpendicular) 6" from the ends of the Bench Top Boards
2. Drill 2 pilot holes in the bench supports on the two diagonal faces of the trapezoid —
3. Drill 2 small bore holes slightly larger than a screw 2" deep in the center face, center a pilot hole halfway above and below the lag screw pilot hole and the edges — this will allow you to put another screw all the way through and connect the bench supports to the bench top.
4. Using 3" screws, screw in the bench support posts to the bench top using the drilled pilot holes as guides
5. With the bench supports secure, place the two legs on the insides of each bench support and screw in the carriage bolt — attach washer then nuts.
6. Use Double "L" brackets to screw in the front and back of the legs to the bottom side of the bench top boards using as many screws as necessary to eliminate any wobble.
7. For extra support, place use an L bracket on each bench top beam to secure it to the bench support.