

# SHADE STRUCTURE WITH RAIN WATER COLLECTION

DIFFICULTY:  
**VERY COMPLEX**

 12 VOLUNTEERS

 8 HOURS

## MATERIALS

### PREP

- (1) 4x4x12ft board
- (4) 4x4x10ft boards
- (7) 2x6x8ft boards
- (4) 2x6x12ft boards
- (6) 26"x8' PVC roofing panels
- (1) 8' aluminum gutter

### BUILD

- (9) 80lb bags of concrete
- (4) 4x4x10ft boards
- (4) 4x4x36" trapezoids
- (4) 2x6x12ft boards
- (7) 2x6x8ft boards
- (4) 26"x48" PVC roof panel pieces
- (4) 26"x8' PVC roof panel pieces
- (1) 8' aluminum gutter
- (1) 8' aluminum downspout
- (8) .5"x8" galvanized carriage bolts
- (8) .5" galvanized nuts
- (8) .5" galvanized washers
- (4) LS30-R skewable angle braces
- 5lbs 2 .5" deck screws
- (8) H2.5A rafter ties
- 2lbs 1 .5" N8 nails
- 5lbs roofing screws
- (1) rain barrel
- (6) gutter hangers
- (1) left gutter end cap
- (1) right gutter end cap
- (1) downspout outlet

*Tools listed on page 2*

## PREP LIST

1. Sort materials into piles by like items to ensure you have materials needed to complete project.
2. Take the 4x4x12. Cut into (4) 4x4x36" pieces.
3. Take 2 of the 26"x8' PVC roofing panels. Cut down to (2) 26"x48", for a total of (4) 26"x48" PVC roof pieces.
4. Do NOT cut the following: (4) 4x4x10ft boards ; (7) 2x6x8ft boards ; (4) 2x6x12ft boards ; (4) 26"x8' PVC roofing panels.
5. Angle cuts: Take the (4) 4x4x36" pieces cut in step 2. Using the miter saw, cut 45° off bothsides, creating a 36" trapezoid.
6. Gutter cuts: Take the 8' aluminum gutter. You will cut the hole in the gutter for the downspout. This can be done by drilling a hole through the gutter and then using metal snips to cut a hole the size of the downspout outlet (the piece that attaches the downspout to the gutter). **IMPORTANT:** Make sure the hole is 6in away from the edge of the downspout and the hole is slightly smaller than needed. It is better if the outlet fits snugly into the hole as opposed to being loose, which will allow water to leak.

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## TOOLS

### PREP

Miter saw

Circular saw

Drill

.25" or larger drill bit

Metal snips

Tape measure

Carpenter's square

Pencil

### BUILD

Tape measure

Safety glasses

Pencil

Hack saw/hand saw

Hammer

Ladders

.5" long drill bit

Screwdriver bit

Drill

.75" open-ended wrench or .75" socket with ratchet

## BUILD LIST

1. Sort materials into piles by like items to ensure you have materials needed to complete project.
2. Sort all materials into piles by like items to ensure you have materials needed to complete project.
3. First, the 4x4x10s must be set in the ground as posts. Each post will be buried 2 feet in the ground with concrete. The footprint of the shade structure is 9ft long by 6ft wide. Holes need to be 24" deep with about an 8" diameter.
4. Posts need to be level side to side and front to back. They also need to be in straight line with proper alignment. A string-line can be helpful for this.
5. Let the concrete set for several hours before completing the shade structure.
6. The four 2x6x12ft boards will be the headers that sandwich the posts, as shown. Since the rain must run off the roof and into the gutter, the rafters need to be angled from front to back. The rafters should be 9.5" below the top of the back posts as shown in the picture below. Attach the posts using 2.5" deck screws to temporarily hold them in place, then drill a hole through both 2x6x12s and the 4x4x10. You'll place a carriage bolt, washer and nut through that drilled hole for extra stability.
7. Next you'll attach the 4x4x36" trapezoid braces. Make sure the 45° angle sits flush with the 4x4 post but also passes through the 2x6x12 header. You'll attach the lower end of the 4x4 trapezoid brace to the 4x4 post using the angled brackets and the 1.5" nails.
8. Cut the 9.5" off of the back two posts using the hand saw so that the tops of the posts are roughly flush with the rafters.

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## TOOLS

### PREP

- Miter saw
- Circular saw
- Drill
- .25" or larger drill bit
- Metal snips
- Tape measure
- Carpenter's square
- Pencil

### BUILD

- Tape measure
- Safety glasses
- Pencil
- Hack saw/hand saw
- Hammer
- Ladders
- .5" long drill bit
- Screwdriver bit
- Drill
- .75" open-ended wrench or .75" socket with ratchet

## BUILD LIST

9. Attach 2x6x8 rafters on top of headers you just installed. Start by attaching one rafter on both ends of the shade structure. Be sure to center (side-to-side) these rafters on the headers. You'll attach the rafters by using the H2.5A rafter ties.
10. Now install two rafters back-to-back 8ft from the front of the shade structure. The back edge of the first rafter should be at 8ft. This is where the roofing panels will meet and it is important to have two rafters together for additional support.
11. Attach remaining 3 rafters evenly spaced on the headers.
12. Start by laying four 26x96" panels at the front (higher end) of the shade structure. The panels will overlap each other (side-to-side) by about 2". The panels should be flush with the ends of the rafters on both sides and the end of the first rafter at the front. Use the roofing screws to attach the panels to the rafters. Don't screw the panels into the back rafter just yet -- you'll slide the 48" panels under the 96" panels first.
13. Now slide the 26x48" panels under the end of the 96x48" panels. Again attach the panels to the rafters using the roofing screws.
14. Next attach the gutter using the gutter hangers provided in your bucket. Make sure there is a slight slope to the gutter so that the rain water runs towards the downspout.
15. Next, attach the downspout to the gutter.
16. Lastly position rain barrel under downspout and cut downspout so it is at the proper height to fill the rain barrel.