

NAHB Playhouse Building Instructions

Introduction

The NAHB Playhouse was designed to be assembled by students in 5th through 8th grade using components that are prefabricated by adult volunteers or students enrolled in a high school carpentry program. The playhouse is 4' x 6' and designed for outdoor use. The design may be modified if it will remain indoors.

The information in this report is also available in three PowerPoint presentations: Project Overview, Component Fabrication and Playhouse Assembly. The drawings are assembled on seven, 11x17 PDF documents. When these figures are referred to, the sheet number is also given. Photographs of the construction process are included in this report and the PowerPoint presentations.

Due to the high cost of construction materials and the goal to minimize waste, the design was developed with the size of common materials in mind. Cutting plans were developed to use as much of each piece of material as possible.

All materials should be precut, marked and predrilled prior to engaging the students in the construction of the playhouse. These procedures were developed to introduce the participants to the carpentry tasks used in residential construction, while shielding the middle-school students from tasks that might be unsafe for young, inexperienced constructors. The structure will be nailed together by the students in the Assembly phase. They will place the nails in predrilled holes in the primary member, then drive them into the secondary members. Careful component fabrication will ensure that the resulting structure is accurately constructed with minimal errors and need for reworking.

Material List

21 - 2x3 x 8' Studs
2 - 2x4 x 8' Pressure Treated
1 - 2x4 x 12' Pressure Treated
2 - ¾" x 4' x 8' Moisture-Resistant Tongue and Groove Floor Panels
3 - 4'x8' LP® SmartSide® 3/8 Grooved 8 OC Panel Siding
2 - 1x2 x 8' PVC trim (5/8" x 1 1/2" actual)
3 - ¼" x 1 3/4" x 8' PVC trim
10 - 1 ¼" x 8' Vinyl Wall Panel Moulding (Outside Corner)
Nails
 5 lbs. 10d Common
 1 lb. each 10d, 8d, 6d Galvanized
6 - 1 ¼" screws
15 - 4x8x16 Concrete Blocks
Paint
Adhesive

Component Fabrication

Component fabrication can be accomplished by anyone with basic carpentry skills. Recommended tools are:

- Miter saw
- Circular saw
- Tape measure
- Carpenter pencil
- Speed square
- Drill
- Drill bits – 7/64, 1/8", 5/32"
- 4' ruler or straight edge
- Work gloves
- Masks

Component Lists

Figures 1 show a dimensioned sketch of all components and the required quantity. Each component is given a letter designation. The quantities are also summarized in Tables 1 through 4.

Figure 1a. Floor components (Sheet 1)

Figure 1b. Wall framing members (Sheet 2)

Figure 1c. Wall sheathing panels (Sheet 3)

Figure 1d. Outside corner trim components (Sheet 2)

Figure 1e. Other trim components (Sheet 1)

Table 1. Floor Components

| Designation | Description | Quantity |
|-------------|---------------------------------------|----------|
| A | 72" 2x4 PT | 2 |
| B | 45" 2x4 PT | 4 |
| C | 36" x 48" ¾" T&G Flooring | 2 |
| Dt | 60" x 42" ¾" T&G Flooring with tongue | 1 |
| Dg | 60" x 42" ¾" T&G Flooring with groove | 1 |

Table 2. Wall Framing Members

| Designation | Description | Quantity |
|-------------|-------------|----------|
| E | 72" 2x3 | 5 |
| F | 42 ½" 2x3 | 13 |
| G | 22 ½" 2x3 | 1 |
| H | 14 ½" 2x3 | 6 |
| I | 16" 2x3 | 6 |
| J | 11" 2x3 | 8 |
| K | 45 5/8" 2x3 | 6 |
| L | 43" 2x3 | 2 |
| M | 41 ½" 2x3 | 2 |
| N | 44 3/8" 2x3 | 2 |
| O | 46" 2x3 | 2 |
| P | 5 3/16" 2x3 | 2 |
| Q | 10 3/8" 2x3 | 2 |

Table 3. Wall Sheathing Components

| Designation | Description | Quantity |
|-------------|---|----------|
| R | 16 3/8" x 48" Panel | 1 |
| Sb | 48 ¾" x 48" Panel – Back wall | 1 |
| Sr | 48 ¾" x 48" Panel – Right wall | 1 |
| Sl | 48 ¾" x 48" Panel – Left wall | 1 |
| T | 8 3/8" x 48" Panel | 1 |
| U | 40 3/8" x 48" Panel | 1 |
| V | 32 3/8" x 48" Panel | 1 |
| W | 40 3/8" x 13 5/16" Panel | 1 |
| X | 32 3/8" x 13 5/16" Panel | 1 |
| Y | 48 ¾" x 13 3/8" Triangular Panel – Right wall | 1 |
| Z | 48 ¾" x 13 3/8" Triangular Panel – Left wall | 1 |

Table 4. Trim Components

| Designation | Description | Quantity |
|-------------|--------------------------|----------|
| T1 | 6" PVC Outside Corner | 6 |
| T2 | 14 ½" PVC Outside Corner | 6 |
| T3 | 16" PVC Outside Corner | 6 |
| T4 | 21" PVC Outside Corner | 4 |
| T5 | 22 ½" PVC Outside Corner | 2 |
| T6 | 27" PVC Outside Corner | 2 |
| T7 | 44 ½" PVC Outside Corner | 2 |
| T8 | 75 ¾" PVC 1x2 | 1 |
| T9 | 52" PVC 1x2 | 2 |
| T10 | 72" PVC 1 ¾" x ¼" | 2 |
| T11 | 48" PVC 1 ¾" x ¼" | 2 |
| T12 | 50" PVC Outside Corner | 2 |
| T13 | 50" PVC Outside Corner | 2 |
| T14 | 62" PVC Outside Corner | 2 |
| T15 | 62" PVC Outside Corner | 2 |

Framing Lumber

The floor frame is constructed from 2x4 pressure-treated lumber. Be sure to follow all proper handling instructions when working with treated lumber. See, for example,

<https://www.southernpine.com/proper-handling-storage-pressure-treated-lumber/>

Figure 2 is the cutting plan for the 2x4s. Figure 3 shows how the 6' stringers should be marked to indicate the position of the joists. Two 5/32" holes should be drilled at each of these locations, ½" to ¾" from the top and bottom edges, as shown in Figure 3a. Figure 4 is a photograph of the completed floor framing members in position for assembly.

Figure 2. Cutting plan for Floor framing (Sheet 1)

Figure 3. Marking and drilling plan for Floor framing (Sheet 1)

Figure 3a. Drilling key (Sheet 1)



Figure 4. Photograph of Floor framing prepared for assembly

The framing for the four walls will be constructed with 2x3 stud lumber. These are frequently only available in 8-foot lengths so we assumed this in developing the cutting plan which is shown in Figure 5. Figures 6 show how the 2x3s should be marked to indicate the position of the adjoining members. Note that both the top and bottom sides of the top horizontal 2x3 in the front, right and left frames are shown in these figures. There is only one member in this position, not two. Two $\frac{5}{32}$ " holes should be drilled at each location marked with an X, $\frac{1}{2}$ " to $\frac{3}{4}$ " from the edges, as shown in Figure 6e. Toe nailing will be required in some places, as indicated. These holes are predrilled at a 45° angle approximately $\frac{3}{4}$ " from the end of the board. Figures 7 are photographs of the completed wall framing members in position for assembly. The framing for the left and right walls is identical so only one is shown.

Figure 5. Cutting plan for wall framing (Sheet 2)

Figure 6a. Marking and drilling plan for front wall framing (Sheet 5)

Figure 6b. Marking and drilling plan for back wall framing (Sheet 6)

Figure 6c. Marking and drilling plan for right wall framing (Sheet 6)

Figure 6d. Marking and drilling plan for left wall framing (Sheet 6)

Figure 6e. Drilling key (Sheet 6)

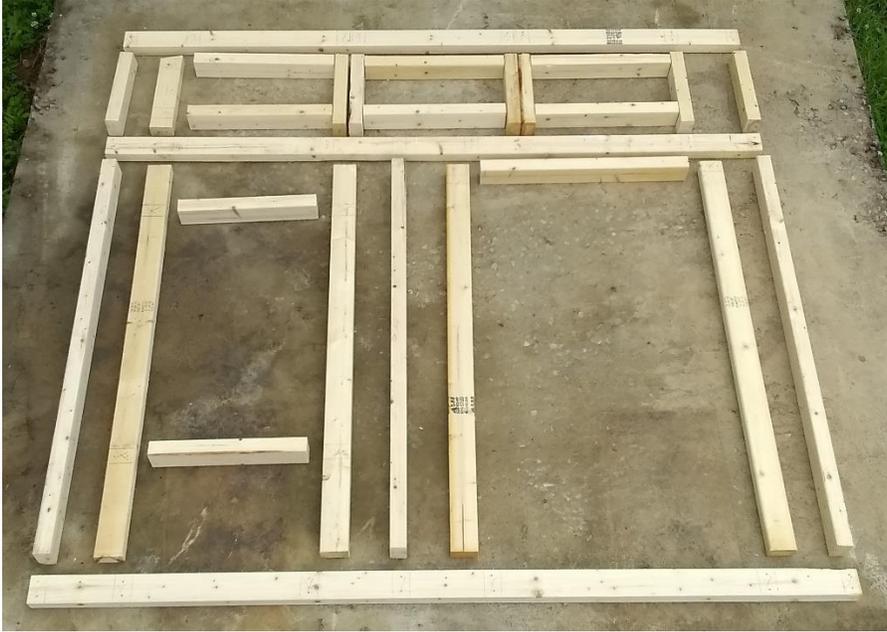


Figure 7a. Photograph of front wall framing prepared for assembly



Figure 7b. Photograph of back wall framing prepared for assembly



Figure 7c. Photograph of left wall framing prepared for assembly

Floor and Roof

The floor and roof are both fabricated from moisture-resistant, T&G floor panels. Two 4'x8' sheets will be cut as shown in Figure 8. Figure 9 is the drilling plan for the floor panels. Figure 10 is the drilling plan for the roof panels and PVC strip. The two pieces for the floor are identical. The roof will have a tongue and groove (T&G) joint, so one piece must retain the tongue and the other the groove. Cutting as shown in Figure 8 will allow two factory-cut edges to butt at the middle of the floor.

Figure 8. Floor and roof cutting plan (Sheet 1)

Figure 9. Floor drilling plan (Sheet 4)

Figure 10. Roof drilling plan (Sheet 4)

Siding

The 4' x 8' siding panels will all be cut into 4' x 4' pieces. The front and side walls will be sheathed with a 4' tall piece at the bottom with a smaller (rectangular or triangular) piece above. The siding will be aligned with the studs so that the center of the nails will be placed 3/8 in. from the edge of the vertical grooves in the panels. Rectangular holes will be cut during the Fabrication phase for the door and 6 windows.

The panels for the front and back walls were designed so that the shiplap joint in the front wall is full length and not interrupted by the window or door. Two partial, 4'-tall pieces are used for the front wall.

The remainder of these two pieces and another full 4' piece is used on the back wall. The cutting plan for these pieces is shown in Figure 11. Note that the groove lines were removed from the figure for clarity.

Each side wall will use the full width of one sheet which includes an extra $\frac{3}{4}$ " shiplap for a total 48- $\frac{3}{4}$ " width.

The top portions of the front and side walls will be cut from one 4' piece of siding as shown in Figure 12.

Figures 13 are the drilling plans for the four walls.

Figure 11. Cutting plan for the front and back wall sheathing (Sheet 3)

Figure 12. Cutting plan for the top portions of front, right and left wall sheathing (Sheet 3)

Figure 13a. Drilling plan for the front wall sheathing (Sheet 7)

Figure 13b. Drilling plan for the back wall sheathing (Sheet 7)

Figure 13c. Drilling plan for the right wall sheathing (Sheet 7)

Figure 13d. Drilling plan for the left wall sheathing (Sheet 7)

Trim

The outside edge of the door and window openings and the corners of the playhouse are trimmed with $1\frac{1}{4}$ " PVC Outside Corner. Figure 14a is the cutting plan for these trim components. Both ends of the door and window trim are miter cut at 45°. The dimension "A" given in the drawings is to the point that contacts the inside corner of the opening. Mark the inside surface at these points and carefully align the saw blade with the mark. Some custom trimming may be required to fit these components in place.

Note that only a couple of dimensions are given in the cutting plan (Figure 14a) for clarity. Leave 2" between the marks on adjacent pieces. The 22" and 24" dimensions given indicate this. The 2 inches allows room for the miter cuts with minimal waste.

Approximate lengths are given for the four corner trim pieces. The 14° angle should be cut near the end of the trim piece after the other pieces are cut. These are labeled "Back Corner Trim" and "Front Corner Trim" in Figure 14a. Note that the orientation of the trim piece in the miter saw is different for each of these. After the playhouse is assembled, mark the square (bottom) end of these pieces in place and make the final cut to length.

Figure 14a. Outside corner trim cutting plan (Sheet 2)

The joint at the top of the 4-foot-tall siding panel on the front and side walls is covered with $1\frac{1}{4}$ " x $\frac{1}{4}$ " PVC. The same material is used to cover the exposed 2x3 at the top of the back wall. The top of the front and side walls are trimmed with 1x2 PVC. The front edge of the roof is covered with $1\frac{1}{4}$ " PVC outside corner. The cutting plan for these pieces is given in Figure 14b. The lengths shown in Figure 1e

are slightly longer than will be required. After the playhouse is assembled, mark the actual length on these pieces and make the final cut to length.

Figure 14b. Other trim components cutting plan (Sheet 1)

Playhouse Assembly

The playhouse should be assembled by the students with minimal adult intervention. Adults should orient the students to the requirements for each task, explain the drawing and procedures, and then let the students figure out how to proceed. If the students are making mistakes, reorient them through questions and suggestions. Avoid physically assisting them if at all possible. Adults should always be present to observe and ensure safe practices.

Recommended tools include:

- Hammers
- Tape measure
- Shovel
- Minimum 4' level
- Hand saw
- Step Ladder

The assembly primarily involves nailing the components together. The floor and walls should be framed individually on a flat surface. These could be fabricated inside and carried outside for final assembly.

Site Preparation

The playhouse should be placed on a fairly level site. The area under the foundation blocks should be completely leveled before placing the blocks. We chose to build our playhouse on an existing, level concrete slab, so no preparation was required.

Foundation

Because even treated lumber can deteriorate when exposed to soil for long periods of time, a concrete block foundation is called for. The concrete blocks will also support the ends of the joists eliminating the need for structural joist hangers. The 4x8x16 concrete blocks should be arranged as shown in Figure 15 on the leveled site. Check the squaring dimension across both diagonals. The actual dimension will probably be slightly longer, but both diagonals should be the same length. Figure 16 shows the foundation.

Figure 15. Concrete block foundation (Sheet 4)

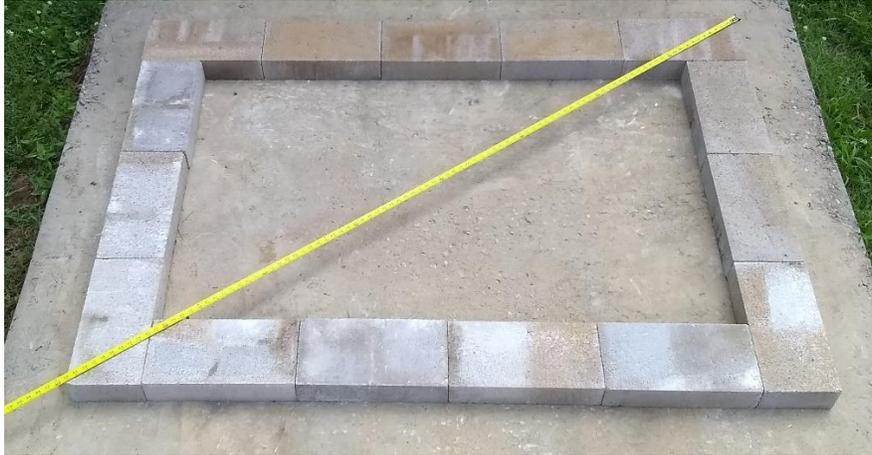


Figure 16. Photograph of concrete block foundation

Floor

The floor will be constructed with moisture-resistant, T&G floor panels supported by the 2x4 pressure-treated frame. We used a product with a 500-day, no-sand guarantee. Gloves should be worn by anyone handling treated lumber. Assemble the floor framing as shown in Figure 17, referring to Figure 3. Two 10d nails that are rated for use in treated lumber should be driven through the predrilled holes at each joint into the end of the joists. Ensure that the frame is square by checking the length of both diagonals. They should be the same and equal to the dimension given.

If the floor was not constructed in place, place it on top of the foundation. Ensure that the floor is centered as shown in Figure 18. Figure 19 shows a photograph of the floor framing placed on the foundation.

Figure 17. Floor framing assembly (Sheet 4)

Figure 18. Floor frame placement on foundation (Sheet 4)



Figure 19. Photograph of floor framing placed on foundation.

Place the two pieces of floor sheathing on top of the framing. Butt the two factory-cut edges at the center. Carefully align the grooved edge with the front of the floor framing and drive 8d nails, rated for treated lumber, into each hole along the front edge. Adjust the back of the framing by tapping with a hammer until it is square and aligned with the sheathing. Drive nails in the remaining holes. The floor is shown in Figure 20.



Figure 20. Floor

Walls

Assemble each wall frame as shown in Figures 21, referring to Figures 6. Figure 22 shows the front wall framing. For the front and side walls, first assemble the framing around the windows and door (Figure 23). Second, attach all studs to the top and bottom horizontal members in the lower, 4-foot section (Figure 24). Next, attach the upper portion to each of these three walls, toenailing as required (Figure 25). We recommend cutting a piece of scrap 2x3 to use as blocking to prevent the stud from “travelling” when toenailing (Figure 26). Two 10d nails should be driven through the predrilled holes at each joint.

Figures 27 and 28 are photographs of the assembled framing for the back and right walls. The left wall is not shown as it is a mirror image of the right wall.

Figure 21a. Front wall framing assembly (Sheet 5)

Figure 21b. Back wall framing assembly (Sheet 5)

Figure 21c. Right wall framing assembly (Sheet 5)

Figure 21d. Left wall framing assembly (Sheet 5)

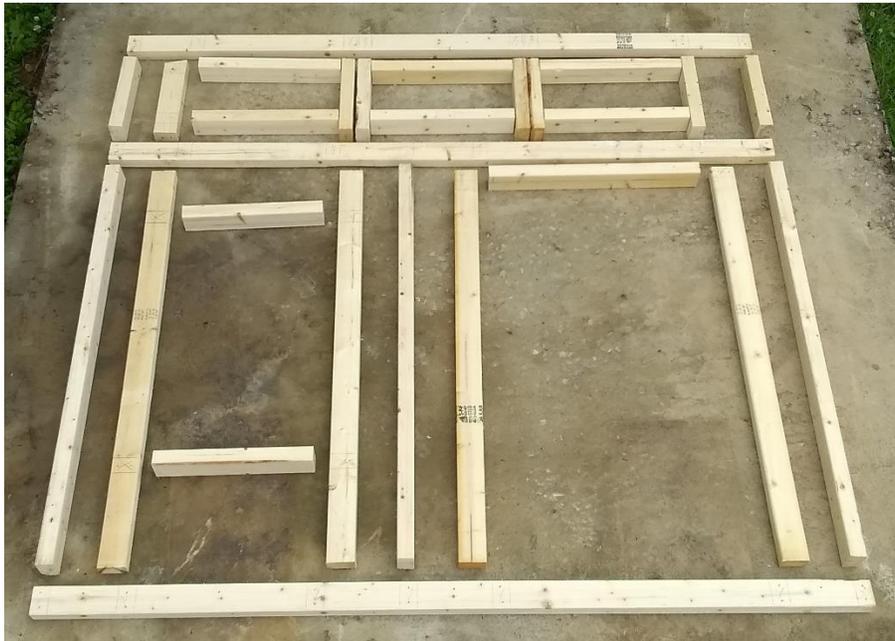


Figure 22. Front wall framing assembly photograph (Outside down, door on right)



Figure 23. Assemble the door and windows first



Figure 24. Complete the bottom 4-foot frame



Figure 25. Toenailing is required in places



Figure 26. Use blocking (with shims) while toenailing



Note that top plate is aligned
with inside of stud

Figure 27. Back wall framing assembly photograph



Figure 28. Right wall framing assembly photograph

After painting, place the wall sheathing on top of the framing for each wall. The sheathing should extend $1\frac{1}{4}$ " inches below the framing on all walls. The sheathing will extend $2\frac{7}{8}$ inches beyond the framing on both sides of the right and left walls.

For the side walls, adjust the sheathing so that it extends $1\frac{1}{4}$ " below the bottom plate and is centered on the bottom plate, $2\frac{7}{8}$ " from each side (Figure 29). Drive a 6d, exterior nails into each hole on the bottom plate. Adjust the frame by tapping the frame with a hammer until the sheathing overlaps the framing $2\frac{7}{8}$ " over the full length and the window and door frames are aligned with the holes in the sheathing. Drive 6d nails in the remaining holes over the side wall framing. Note that the nails near the edges of the sheathing will be driven in to the front and back frames later.



Figure 29. Align siding with the required overhang

After placing the sheathing on the framing for the front and back walls, check that the shiplap joints are properly aligned. The sheathing should be flush with the framing on the sides. Adjust the sheathing to extend $1\frac{1}{2}$ " below the frame and drive the bottom row of nails. Adjust the frame by tapping with a hammer to ensure that it is square and aligned with the door and window openings (front wall). Drive the remaining 6d nails.

Starting with the back and left wall, place the two wall panels on the floor, check that they are properly aligned and engaged, and attach by driving a 10d common nail through the top hole in the back stud of the left wall as shown in Figure 30. It may be helpful to clamp the top of the walls together while nailing.



Figure 30. Photograph of attachment of back and left walls

Place the right wall then the front wall, nailing the top hole in the framing. After ensuring that the bottom of the wall sheathing fits tight against the floor, drive 10d exterior nails through the holes in the bottom plates of all walls into the floor (Figure 31). It may be helpful to draw lines 2 ½" from the four sides of the floor before erecting the walls to ensure that the walls are properly positioned.



Figure 31. Nail walls to floor

Drive 10d common nails into the remaining holes in the wall-to-wall framing connections (Figure 32), and drive 6d exterior nails through the side wall sheathing into the front and back wall framing (Figure 33).



Figure 32. Finish driving nails to secure walls



Figure 33. Attach side wall sheathing to front wall frame

Roof

The roof is constructed from two 5' x 3 1/2' pieces of T&G Floor Panel. Paint the top and edges of the roof panels and a 9" border around the underside (eaves). Preassemble the two pieces with the underside up and attach the 1x2 PVC trim piece using 1 1/4" screws as shown in Figure 34. Also see Figure 35. Remove the trim piece and set each piece in place on the roof after placing a bead of exterior glue in the groove. Reattach the trim to the existing holes and use it to align the roof panel on the assembled wall framing. After ensuring that the trim piece is bearing on the siding at the top of the front wall, that the roof is centered on the playhouse and that that tongue and groove joint is uniformly engaged along the length, drive 8d exterior nails through all holes in the roof into the wall framing (Figure 36).



Figure 34. Trim attached to underside of roof

Figure 35. Roof assembly (Sheet 4)



Figure 36. Nail roof to walls

Trim

Using a hand saw, cut the section of 2x3 framing across the door opening from the bottom plate of the front wall (see Figure 21a, Sheet 5). After painting the trim, glue all pieces in place using an exterior, instant grab adhesive as shown in Figure 37 and 38. Touch up paint, as required.

Figure 37. Front trim placement (Sheet 5)

Figure 38. Side trim placement (Sheet 5)

Customization

If the playhouse will be used indoors

- Omit the concrete block foundation
- Use kiln-dried framing lumber instead of pressure treated for the floor frame
- Consider a lower cost T&G product for the floor and roof

If the interior walls are to be “finished,” add a stud to each end of the front and back walls for nailing the sheathing.

Pieces cut for door and window openings can be used to create operable doors/windows or shutters.