RoboCup 2011
ISTANBUL - TURKEY
THE JOURNEY STARTS HERE
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NIST
National Institute of Standards and Technology
U.S. Department of Commerce

RoboCupRescue
ARENA ASSEMBLY GUIDE

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NOTICE

The International System of Units (SI) is used throughout this document. Conversions from SI units to U.S. Customary units are made where possible but approximate equivalents are used to specify materials which are readily available in the domestic market or to avoid excessive fabrication costs of test apparatuses while maintaining repeatability and reproducibility of the test method results

Total lumber quantities can be calculated by adding the elements in a test method together. Below is a materials purchase and cut list. The first quantity is the total amount of raw lumber needed. The second quantity is how the lumber is to be cut.

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Solid wood posts cut to length (non pressure treated)

  [12] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [9] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (C)

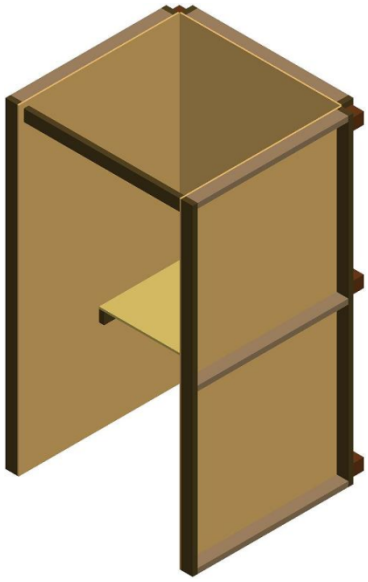
  [6] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plates (D)

  [1] 50 x 100 x 1200 mm (2 x 4 x 48 in) – Brace (E)

  [2] 50 x 100 x 600 mm (2 x 4 x 24 in) – Shelf support (F)

Please send all comments or suggestions to Ann Virts at robottestmethods@nist.gov

FIGURE A



Note: Picture shows an operation station on a pallet for ease of movement

OPERATOR STATION (2)

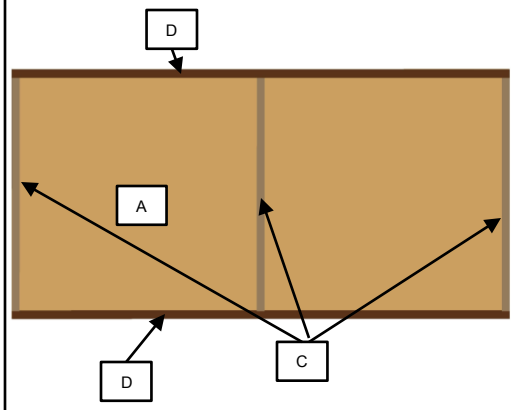
ELEMENTS

- ❑ [2] Operator Station

FABRICATION INSTRUCTIONS

- Place the operator station walls in position.
- Attach shelf in operator station

FIGURE B Wall Panel (2400 mm (96 in))
Front View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)
(D) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)

Operator Station

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [6] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

  [6] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall Panel (A)

  [2] 2400 x 1200 x 19 mm (96 x 48 x ¾ in)

  [2] 600 x 600 x 19 mm (24 x 24 x ¾ in) – Shelf (B)

- ❑ Solid wood posts cut to length (non pressure treated)

  [1] 100 x 100 x 2400 mm (4 x 4 x 96 in)

  [24] 100 x 100 x 90 mm (4 x 4 x 3.5 in) – Connect Blocks (G)

  [24] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [18] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (C)

  [12] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plates (D)

  [2] 50 x 100 x 1200 mm (2 x 4 x 48 in) – Brace (E)

  [4] 50 x 100 x 600 mm (2 x 4 x 24 in) – Shelf support (F)

- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 in)

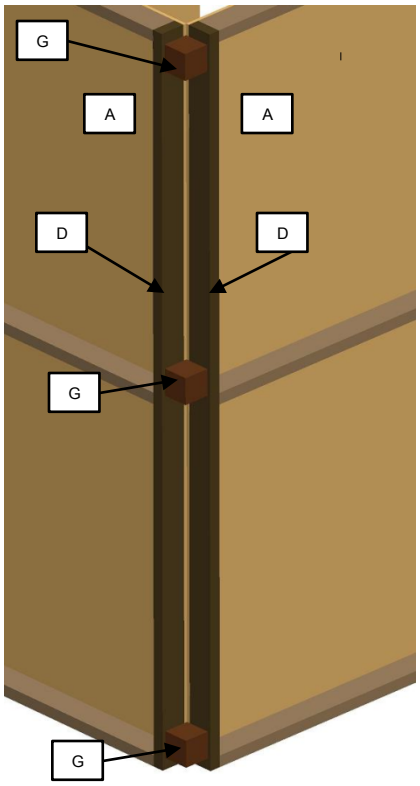
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Wall Panel Element

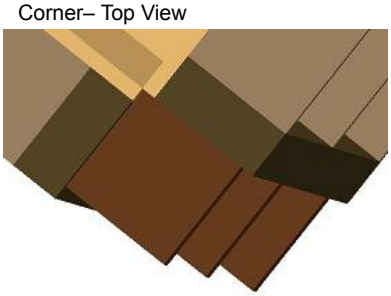
- Lay out two stud plates (D) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (C) to stud plates as shown in Figure B. Studs are 1200 mm (48 in) on center. Attach OSB wall panel (A) to stud frame. Repeat for three additional 2400 mm (96 in) panels.

NOTE: Only one sheet of OSB is used per wall panel.

FIGURE C Wall Panel – Corner View



Corner– Top View



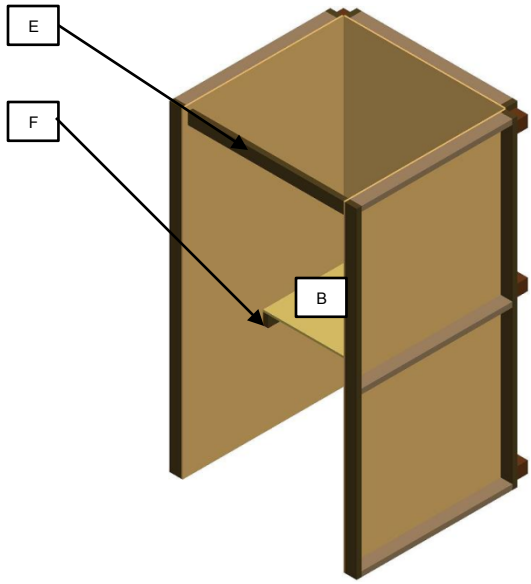
(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(D) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(G) Connection Block
100 x 100 x 90 mm (4 x 4 x 3.5 in)

CONTAINMENT UNIT

FABRICATION INSTRUCTIONS – Wall Panel Element

- Attach two full wall panel (A) elements together to form a corner. Use three connection blocks (G). Blocks are placed 40 mm (1.5 in) from top and bottom. Third block is centered. Attach blocks by screwing into adjacent stud plate (D). As shown in Figure C. Repeat for other side.
- Attach brace (E) to wall panel element as shown in Figure E.
- Attach shelf braces (F) and shelf (B) into operation station as shown in figure E

FIGURE E



(B) Shelf
600 x 600 x 19 mm (24 x 24 x ¾ in)
(E) Brace
50 x 100 x 1200 mm (2 x 4 x 48 in)
(F) Shelf Support
50 x 100 x 600 mm (2 x 4 x 24 in)

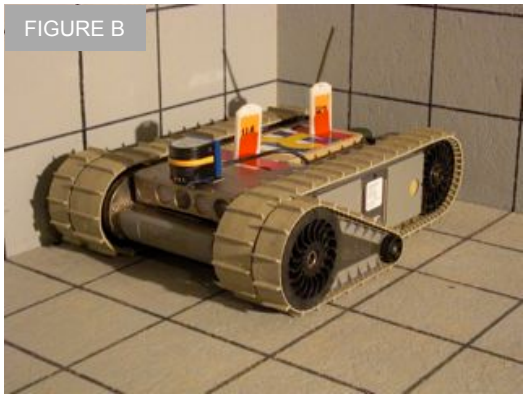
LOGISTICS: ROBOT TEST CONFIG AND CACHE PACKAGING

FIGURE A

ELEMENTS

- ❑ [1] Scale
- ❑ [1] Tape Measure
- ❑ [1] Photo Backdrop

FIGURE B



FABRICATION INSTRUCTIONS – Photo Backdrop

- Place the Wall Panels (A) in the position of the apparatus.
- Insert the Bottom Panels (B) shown in Figure C.
- Add extra bracing if necessary.

FIGURE C

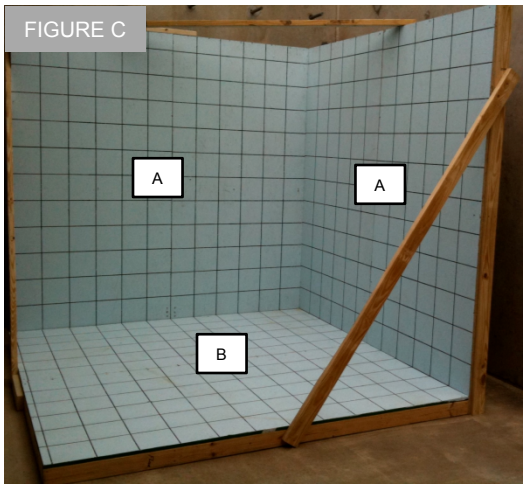
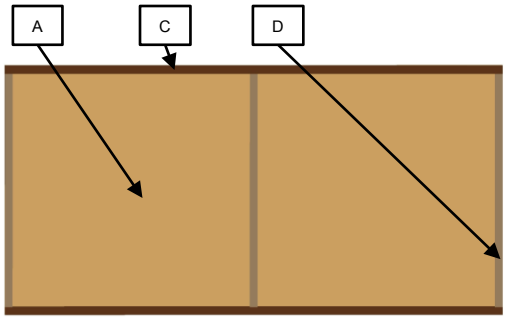
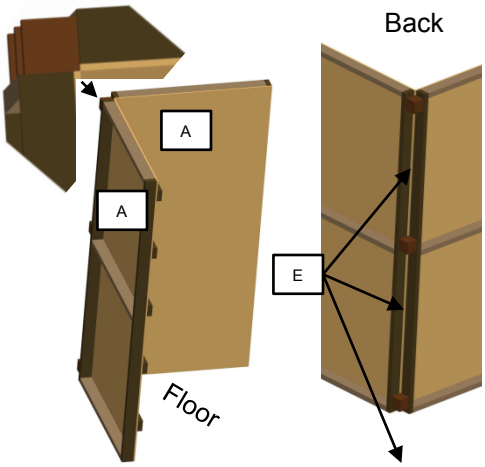


FIGURE A Wall Panel – Back View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(B) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(C) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

FIGURE B **Corner**



LOGISTICS: PHOTO BACK DROP

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [4] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
  [4] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall Panel (A)

- ❑ Solid wood posts cut to length (non pressure treated)
  [14] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [8] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plate (C)
  [12] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (D)
  [1] 100 x 100 x 1200 mm (4 x 4 x 48 in)
  [3] 100 x 100 x 90 mm (4 x 4 x 3.5 in) – Connection Blocks (E)

- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

- ❑ [1] Gray Paint
- ❑ [5] Large Black permanent markers

FABRICATION INSTRUCTIONS – Wall Panels

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (D) to stud plates as shown in Figure B. Studs are 1200 mm (48 in) on center. Attach OSB wall panel (A) to stud frame. Repeat for four additional 2400 mm (96 in) panels as shown in Figure A.
- Paint wall panels (A) gray
- Layout a 20cm (8 in) grid pattern on Wall Panel (A) using permanent makers. Start pattern in the corner and work toward the edge
- Attach wall panels (A) together as shown in Figure B. (Note start with corner and add the additional wall panels to end.

NOTE: Only one sheet of OSB is used per wall panel.

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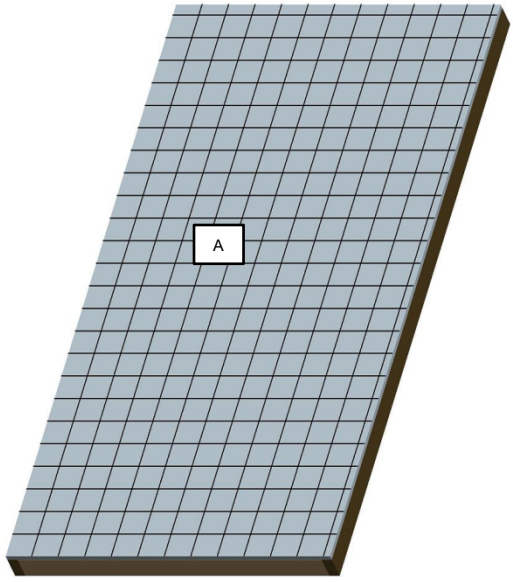
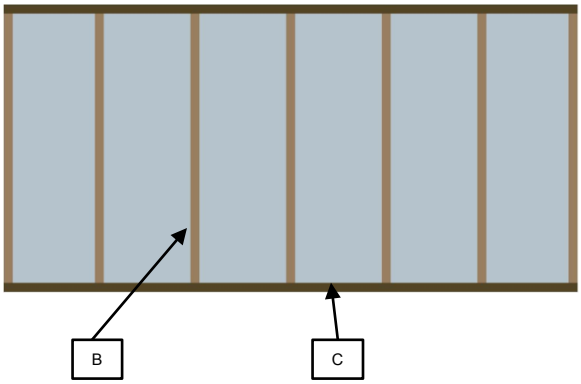
ARENA ASSEMBLY GUIDE

FIGURE A

Top ISO View



Bottom View (OSB is not painted)



(A) Floor Panel - 2400 x 1200 x 19 mm (96 x 48 x 3/4 in)
(B) Support Stud - 50 x 100 x 1100 mm (2 x 4 x 45 in)
(C) Stud Plate - 50 x 100 x 2400 mm (2 x 4 x 96 in)

LOGISTICS: PHOTO BACKDROP SUB FLOOR ELEMENT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [2] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)

  [2] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in) – Subfloor (A)

- ❑ Solid wood posts cut to length (non pressure treated)

  [12] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [14] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)

  [4] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plates (C)

- ❑ **Torx wood screws**

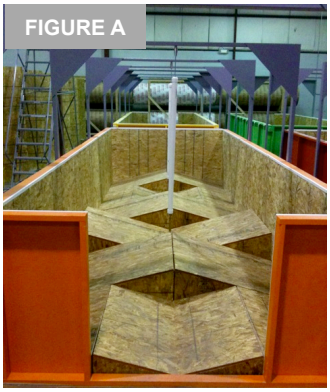
  M5 x 40 mm (#10 x 1-1/2 in)

  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Sub Floor Element

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 400 mm (16 in) on center. Attach OSB wall panel (A) to stud frame as shown in Figure A. Repeat for additional 2400 mm (96 in) panel as shown in Figure A.

FIGURE A



MOBILITY: TERRAINS: CROSSING PITCH/ROLL RAMPS (15°)

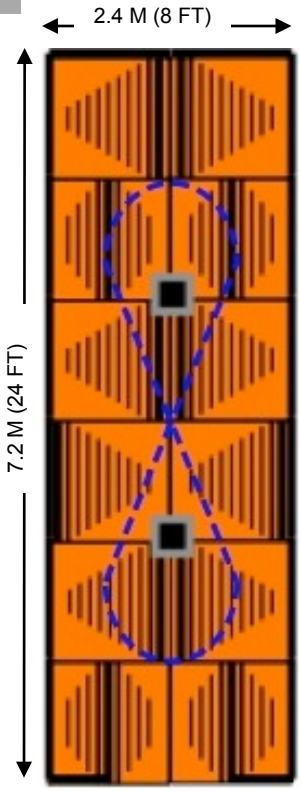
ELEMENTS

- ❑ [1] Endurance Bay Walls
- ❑ [8] Full Ramp Elements (with sides)
- ❑ [8] Half Ramp Elements (with sides)

FABRICATION INSTRUCTIONS

- Place the Endurance Bay Walls in the position of the apparatus.
- Insert the Full Ramp Elements and Half Ramp Elements as shown in Figure B.
- Insert PVC pylons as shown in Figure C.

FIGURE B



FULL RAMP TERRAIN ELEMENT

HALF RAMP TERRAIN ELEMENT

FIGURE C

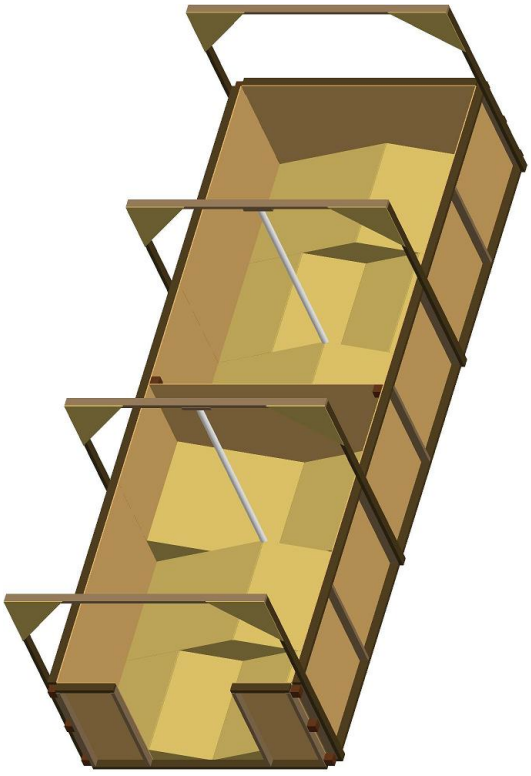
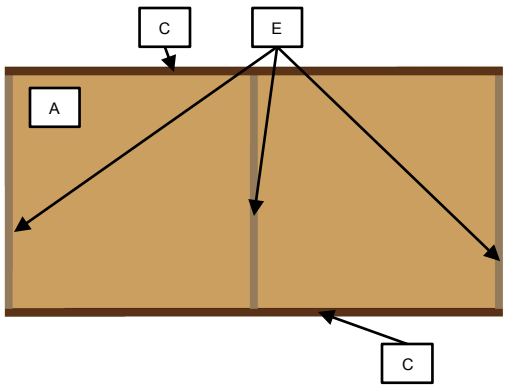


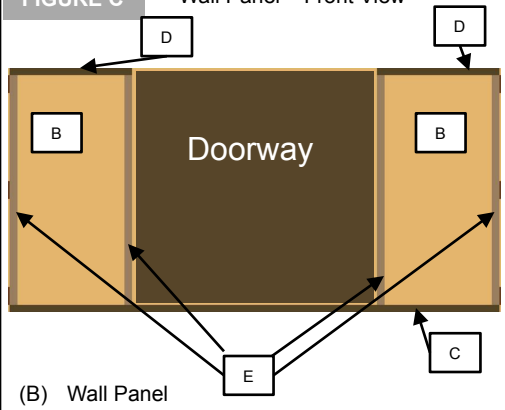
FIGURE A Foot Print– Top View

FIGURE B Wall Panel – Front View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(E) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

FIGURE C Wall Panel – Front View



(B) Wall Panel
600 x 1200 x 11 mm (24 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(D) Stud Plate
50 x 100 x 1200 mm (2 x 4 x 24 in)
(E) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

MOBILITY: TERRAINS: CROSSING PITCH/ ROLL RAMPS (15˚)
BAY WALLS

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [11] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

  [7] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall Panel (A)

  [1] 1200 x 1200 x 11 mm (48 x 48 x 7/16 in) – Door (I) (Not Used)

  [2] 600 x 1200 x 11 mm (48 x 24 x 7/16 in) – Front Wall Panel (B)

  [8] 600 x 600 x 11 mm (24 x 24 x 7/16 in) – Support Triangle (H)

- ❑ Solid wood posts cut to length (non pressure treated)

  [41] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [2] 50 x 100 x 600 mm (2 x 4 x 24 in) – Support Stud Front (D)

  [28] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (E)

  [2] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Side plate (K)

  [16] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plate (C)

  [8] 50 x 100 x 2400 mm (2 x 4 x 96 in) – Arch Support Stud (F)

  [1] 50 x 100 x 1200 mm (2 x 4 x 48 in) – End Cap (L)

  [4] 50 x 100 x 3000 mm (2 x 4 x 120 in)

  [4] 50 x 100 x 2622 mm (2 x 4 x 107 in) – Support Arch (G)

  [1] 100 x 100 x 1200 mm (4 x 4 x 48 in)

  [12] 100 x 100 x 90 mm (4 x 4 x 3.5 in) – Connection Blocks (J)

- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 in)

  M5 x 80 mm (#10 x 2-1/2 in)

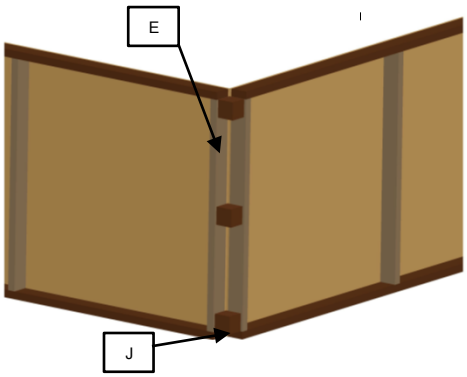
- ❑ **[2] 50 X 6600 mm (2 x 60 in) PCV pipe with caps**

FABRICATION INSTRUCTIONS – Wall Panels

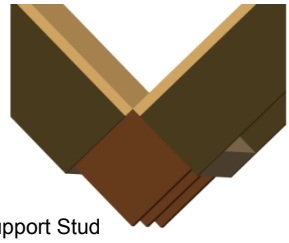
- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (E) to stud plates as shown in Figure B. Studs are 1200 mm (48 in) on center. Attach one sheet of OSB wall panel (A) to stud frame. Repeat for six additional 2400 mm (96 in) panels.
- Lay out one stud plates (C) and two stud plates (D) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (E) to stud plates as shown in Figure C. This will create the door opening. Attach OSB wall panel (B) to stud frame.

NOTE: Only one sheet of OSB is used per wall panel.

FIGURE D Wall Panel – Corner View



Corner– Top View



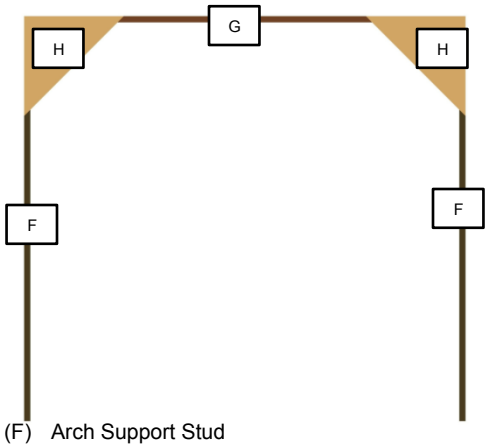
(B) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)
(J) Connection Block
100 x 100 x 90 mm (4 x 4 x 3.5 in)

MOBILITY: TERRAINS: CROSSING PITCH/ ROLL RAMPS (15°) BAY WALLS

FABRICATION INSTRUCTIONS (continued)

- Attach two wall panel (A) sections together to form a corner. Use three connection blocks (J). Blocks are placed 40 mm (1 ½ in) from top and bottom. Third block is centered. Attach blocks by screwing into adjacent stud support (E). As shown in Figure D.
- Attach additional wall panels (A) by screwing into adjacent stud support (E) to create 2.4 M x 7.2 M (8ft x 24 ft) foot print. As shown in Figure D.
- Attach support straps at 2.4 M and 3.6 M (8 ft and 16 ft). Straps will go underneath walls and ramps.
- Attach vertical support arch (F) to horizontal support arch (G) as shown in Figure E.
- Attach support triangles (H) arch frame as shown in Figure E.
- Attach the arch support frame to apparatus as shown in Figure F.

FIGURE E Support Arch– Front View



(F) Arch Support Stud
50 x 100 x 2400 mm (2 x 4 x 96 in)
(G) Support Arch
50 x 100 x 2622 mm (2 x 4 x 107 in)
(H) Support Triangle
600 x 600 x 11 mm (24 x 24 x 7/16 in)

FIGURE F Apparatus

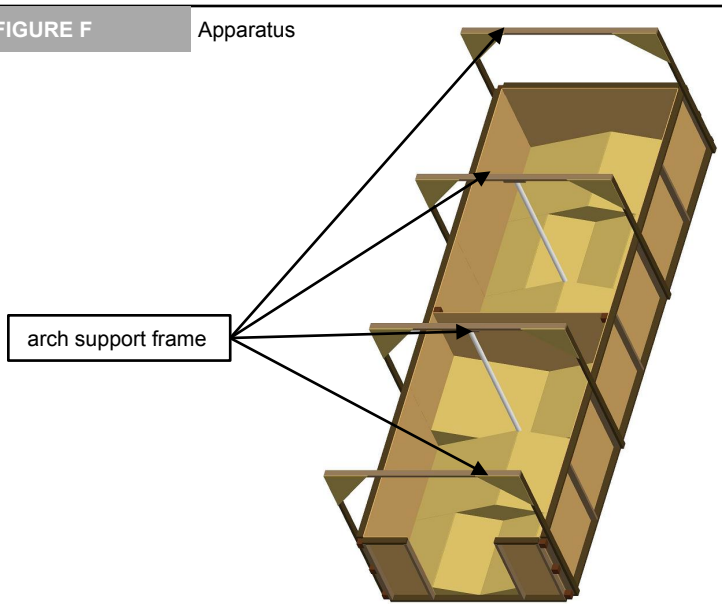


FIGURE A

FULL RAMP ELEMENT (with sides) (15 DEGREE)

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [10] 2400 x 1200 x 19 mm (96 x 48 x 3/4 in)

  [8] 1237 x 1200 x 19 mm (49 1/2 x 48 x 3/4 in)-Surface (A)

  [16] 1200 x 320 x 19 mm (48x12 13/16 x 3/4 in)-Support triangle(B)

- ❑ Solid wood posts cut to length with a 15° angle cut on one end (optional if clamping and gluing is possible)

  [5] 100 x 100 x 2400 mm (4 x 4 x 96 in)

  [24] 100 x 100 x 320 mm (4 x 4 x 12 13/16 in) – Top Post 15° cut (C)

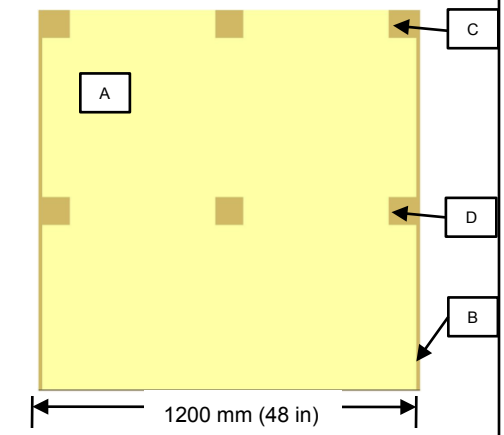
  [24] 100 x 100 x 160 mm (4x4x 6 3/8 in) – Middle Post 15° cut (D)

- ❑ **Torx wood screws** (optional if clamping and gluing is possible)

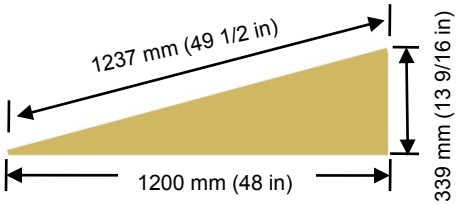
  M5 x 40 mm (#10 x 1-1/2 inch)

FIGURE B Support Triangle (B) Top Post (C) and Middle Post (D)

FIGURE C Bottom View



Side View

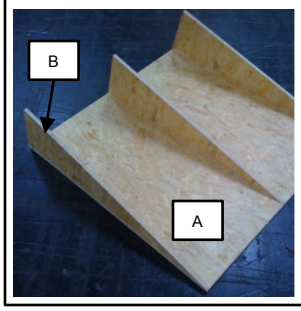


(A) Ramp Surface
1237 x 1200 x 19 mm (49 1/2 x 48 x 3/4 in)
(B) Support Triangle
1200 x 320 x 19 mm (48 x 12 13/16 x 3/4 in)
(C) Top Post 15° cut
100 x 100 x 320 mm (4 x 4 x 12 13/16 in)
(D) Middle Post 15° cut
100 x 100 x 160 mm (4 x 4 x 6 3/8 in)

FABRICATION INSTRUCTIONS

- Note that "Full Ramp" and "Half Ramp" elements have similar inclines but different cut dimensions as shown in Figure A .
- Place support triangles (A) flatly on the floor. Attach one top post (C) to support triangle (B). Attach one middle post (D) to support triangle (B) and repeat for additional side as shown in Figure B. Note: Posts will be flush with the top of support triangle (B).
- Attach ramp surface (A) to support triangles (B). Note: **Use rougher side up as the ramp surface if there is a difference in surface texture**.
- Add two additional top post (C) and middle post (D) to center of ramp shown in Figure C.
- The OSB support triangles may also be glued to the OSB ramp surface using available clamping tools to ensure a 90 degree joint as shown in Figure D. Gluing the OSB joints eliminates the need for posts in the assembly (purchasing, cutting, and screwing).

FIGURE D Bottom View – Alternative Method for Ramp Construction

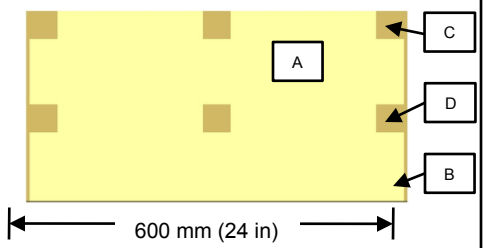


(A) Ramp Surface
1237 x 1200 x 19 mm (49 1/2 x 48 x 3/4 in)
(B) Support Triangle
1200 x 320 x 19 mm (48 x 12 13/16 x 3/4 in)

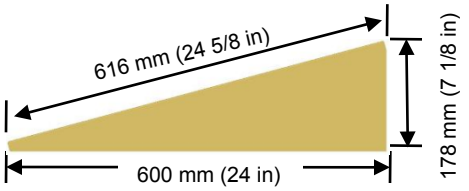
FIGURE A

FIGURE B Support Triangle (B) Top Post (C) and Middle Post (D)

FIGURE C Bottom View



Side View



(A) Ramp Surface
616 x 1200 x 19 mm (24 5/8 x 48 x 3/4 in)
(B) Support Triangle
600 x 160 x 19 mm (24 x 6 13/8 x 3/4 in
(C) Top Post 15° cut
100 x 100 x 160 mm (4 x 4 x 6 3/8 in)
(D) Middle Post 15° cut
100 x 100 x 80 mm (4 x 4 x 3 1/4 in)

HALF RAMP ELEMENT (with sides) (15 DEGREE)

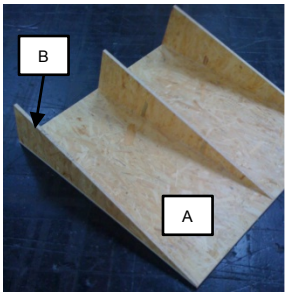
MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [8] 2400 x 1200 x 19 mm (2400 x 48 x 3/4 in)
  [8] 616 x 1200 x 19 mm (24 5/8 x 48 x 3/4 in) – Surface (A)
  [16] 600 x 160 x 19 mm (24 x 6 3/8 x 3/4 in) -Support triangle (B)
- ❑ Solid wood posts cut to length with a 15° angle cut on one end (optional if clamping and gluing is possible)
  [3] 100 x 100 x 2400 mm (4 x 4 x 96 in)
  [24] 100 x 100 x 160 mm (4 x 4 x 6 3/8 in) – Top Post 15° cut (C)
  [24] 100x 100 x 80 mm (4 x 4 x 3 1/4 in)– Middle Post 15° cut (D)
- ❑ **Torx wood screws**(optional if clamping and gluing is possible)
  M5 x 40 mm (#10 x 1-1/2 inch)

FABRICATION INSTRUCTIONS

- Note that “Full Ramp” and “Half Ramp” elements have similar inclines but different cut dimensions as shown in Figure A .
- Place support triangles (A) flatly on the floor. Attach one top post (C) to support triangle (B). Attach one middle post (D) to support triangle (B) and repeat for additional side as shown in Figure B. Note: Posts will be flush with the top of support triangle (B).
- Attach ramp surface (A) to support triangles (B). Note: **Use rougher side up as the ramp surface if there is a difference in surface texture**.
- Add two additional top post (C) and middle post (D) to center of ramp shown in Figure C.
- The OSB support triangles may also be glued to the OSB ramp surface using available clamping tools to ensure a 90 degree joint as shown in Figure D. Gluing the OSB joints eliminates the need for posts in the assembly (purchasing, cutting, and screwing).

FIGURE D Bottom View – Alternative Method for Ramp Construction (Full ramp element shown)

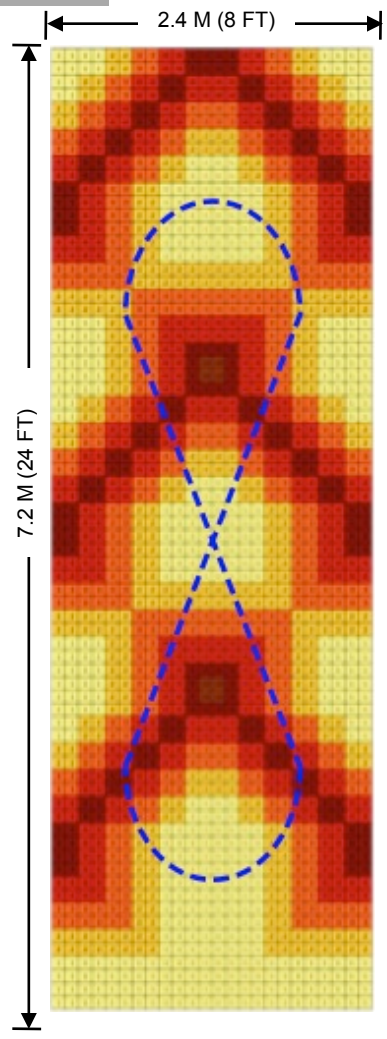


(A) Ramp Surface
1237 x 1200 x 19 mm (49 1/2 x 48 x 3/4 in)
(B) Support Triangle
1200 x 320 x 19 mm (48 x 12 13/16 x 3/4 in)

FIGURE A

(Image is of a prototype)

FIGURE B Step Field Placement



MOBILITY: TERRAINS: SYMMETRIC STEPFIELDS

ELEMENTS

- ❑ [1] Endurance Bay Walls
- ❑ Symmetric Stepfield Field consisting of
  - ❑ [1] Corner Peak Entrance Symmetric Stepfield Element
  - ❑ [2] Corner Peak (Double) Symmetric Stepfield Elements
  - ❑ [3] Diagonal Peak Symmetric Stepfield Elements

FABRICATION INSTRUCTIONS

- Place the Endurance Bay Walls in the position of the apparatus.
- Insert cut posts as shown Figure B. More detailed diagram given in Symmetric Stepfield section.

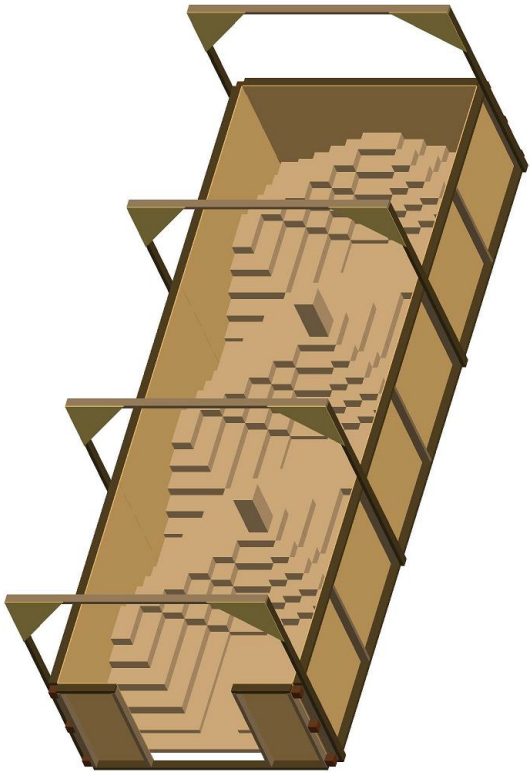
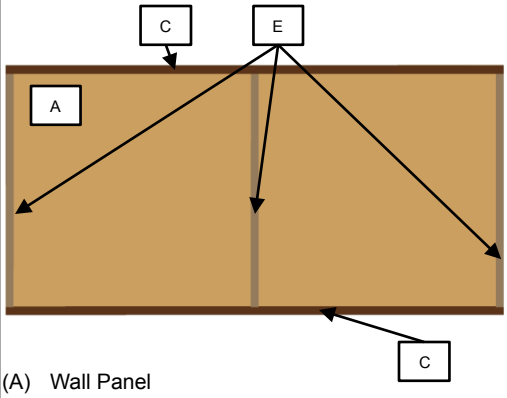


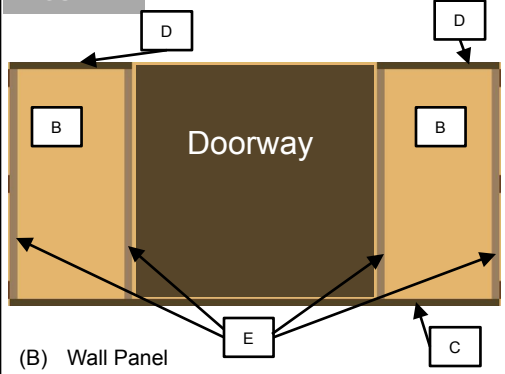
FIGURE A Foot Print– Top View

FIGURE B Wall Panel – Front View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(E) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

FIGURE C Wall Panel – Front View



(B) Wall Panel
600 x 1200 x 11 mm (24 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(D) Stud Plate
50 x 100 x 1200 mm (2 x 4 x 24 in)
(E) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

MOBILITY: TERRAINS: SYMMETRIC STEPFIELDS BAY WALLS

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

❑ Oriented strand board (OSB) plywood panels

[11] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

[7] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall Panel (A)

[1] 1200 x1200 x 11 mm (48 x 48 x 7/16 in) – Door (I) (**Not used**)

[2] 600 x 1200 x 11 mm (48 x 24 x 7/16 in) – Front Wall Panel (B)

[8] 600 x 600 x 11 mm (24 x 24 x 7/16 in) – Support Triangle (H)

❑ Solid wood posts cut to length (non pressure treated)

[41] 50 x 100 x 2400 mm (2 x 4 x 96 in)

[2] 50 x 100 x 600 mm (2 x 4 x 24 in) – Support Stud Front (D)

[28] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (E)

[2] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Side plate (K)

[16] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plate (C)

[8] 50 x 100 x 2400 mm (2 x 4 x 96 in) – Arch Support Stud (F)

[1] 50 x 100 x 1200 mm (2 x 4 x 48 in) – End Cap (L)

[4] 50 x 100 x 3000 mm (2 x 4 x 120 in)

[4] 50 x 100 x 2622 mm (2 x 4 x 107 in) – Support Arch (G)

[1] 100 x 100 x 1200 mm (4 x 4 x 48 in)

[12] 100 x 100 x 90 mm (4 x 4 x 3.5 in) – Connection Blocks (J)

❑ **Torx wood screws**

M5 x 40 mm (#10 x 1-1/2 in)

M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Wall Panel

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (E) to stud plates as shown in Figure B. Studs are 1200 mm (48 in) on center. Attach one sheet of OSB wall panel (A) to stud frame. Repeat for six additional 2400 mm (96 in) panels.
- Lay out one stud plates (C) and two stud plates (D) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (E) to stud plates as shown in Figure C. This will create the door opening. Attach OSB wall panel (B) to stud frame.

NOTE: Only one sheet of OSB is used per wall panel.

MOBILITY: TERRAINS: SYMMETRIC STEPFIELDS BAY WALLS

FABRICATION INSTRUCTIONS (continued)

- Attach two wall panel (A) sections together to form a corner. Use three connection blocks (J). Blocks are placed 40 mm (1 ½ in) from top and bottom. Third block is centered. Attach blocks by screwing into adjacent stud support (E). As shown in Figure D.
- Attach additional wall panels (A) by screwing into adjacent stud support (E) to create 2.4 M x 7.2 M (8ft x 24 ft) foot print. As shown in Figure D.
- Attach support straps at 2.4 M and 3.6 M (8 ft and 16 ft). Straps will go underneath walls and ramps.
- Attach vertical support arch (F) to horizontal support arch (G) as shown in Figure E.
- Attach support triangles (H) arch frame as shown in Figure E.
- Attach the arch support frame to apparatus as shown in Figure F.

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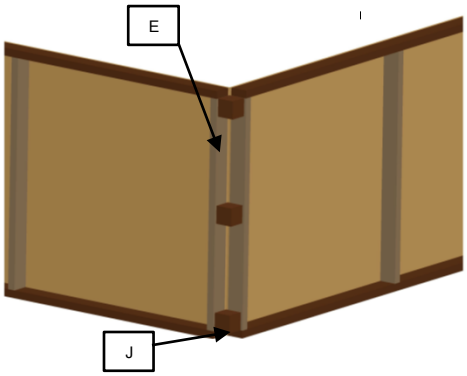
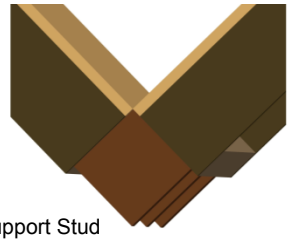
FIGURE D Wall Panel – Corner View

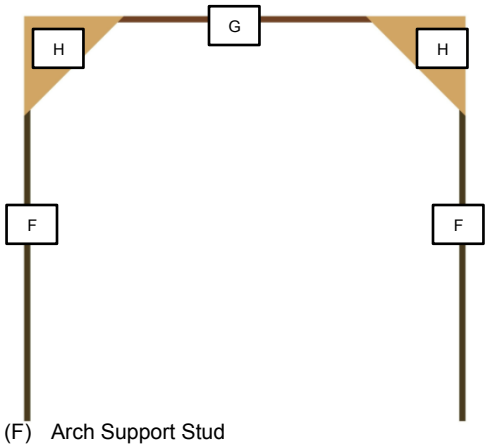


Corner– Top View



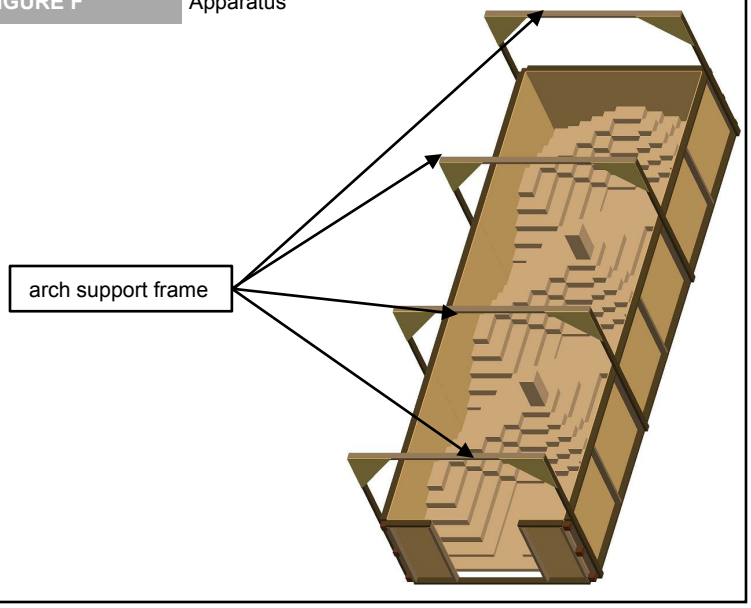
(B) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)
(J) Connection Block
100 x 100 x 90 mm (4 x 4 x 3.5 in)

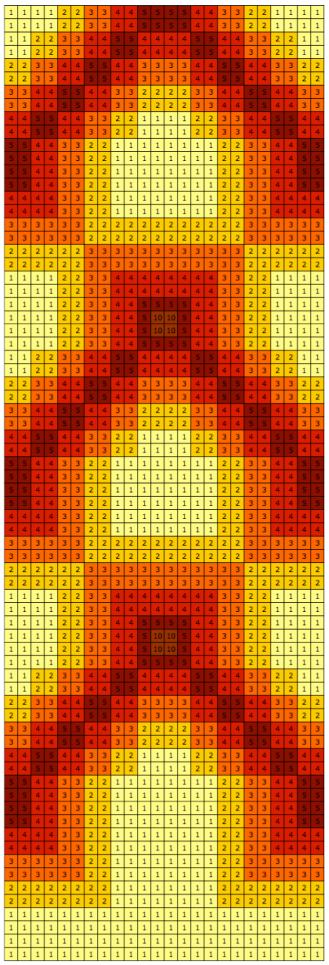
FIGURE E Support Arch– Front View



(F) Arch Support Stud
50 x 100 x 2400 mm (2 x 4 x 96 in)
(G) Support Arch
50 x 100 x 2622 mm (2 x 4 x 107 in)
(H) Support Triangle
600 x 600 x 11 mm (24 x 24 x 7/16 in)

FIGURE F Apparatus





MOBILITY: TERRAINS: SYMMETRIC STEPFIELDS

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Solid wood posts cut to length (non pressure treated)
  [196] 100 x 100 x 2400 mm (4 x 4 x 96 in)

[8] 100 x 100 x 1000 mm (or 4 x 4 x 39 in)	SIZE 10
[176] 100 x 100 x 500 mm (or 4 x 4 x 17-1/2 in)	SIZE 5
[360] 100 x 100 x 400 mm (or 4 x 4 x 14	SIZE 4
[392] 100 x 100 x 300 mm (or 4 x 4 x 10-1/2 in)	SIZE 3
[360] 100 x 100 x 200 mm (or 4 x 4 x 7 in)	SIZE 2
[432] 100 x 100 x 100 mm (or 4 x 4 x 3-1/2 in)	SIZE 1

FABRICATION INSTRUCTIONS – Wall Panels

- Arrange posts as shown in Figure A on next page.

MOBILITY: TERRAINS:SYMMETRIC STEPFIELDS

BACK

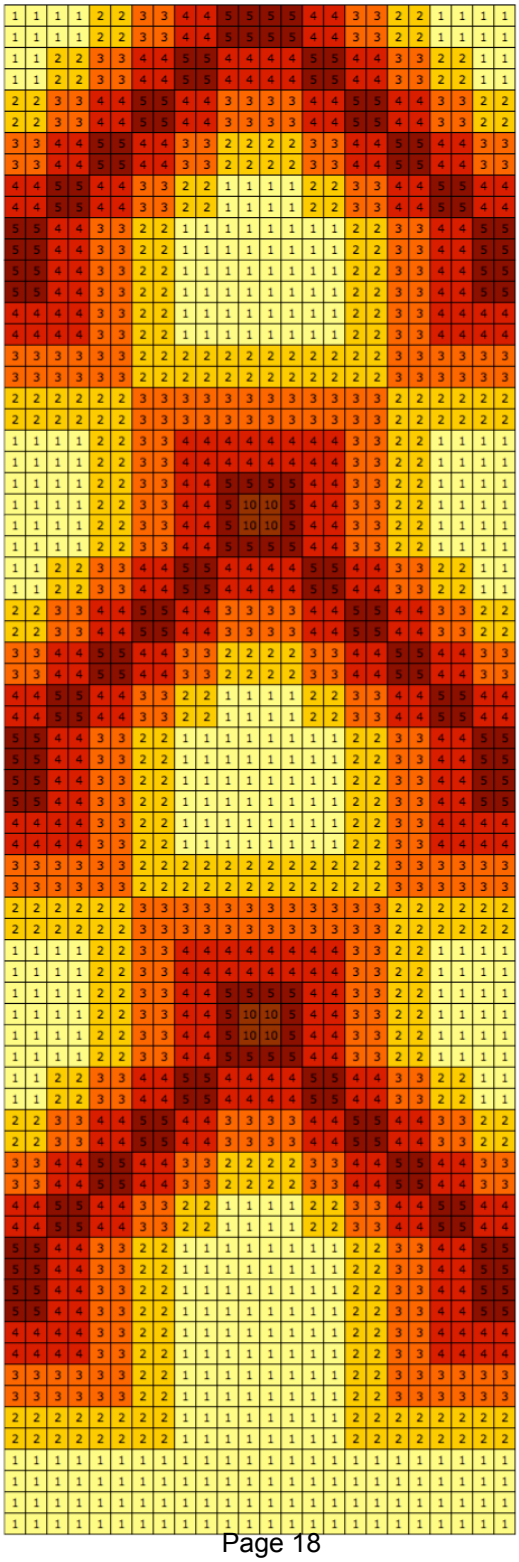
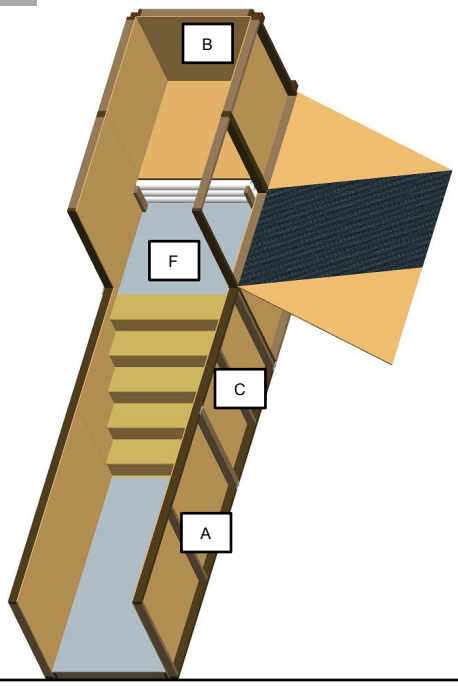


FIGURE A ISO View Stair 35 Degree



MOBILITY: OBSTACLES: STAIRS - 35°

ELEMENTS

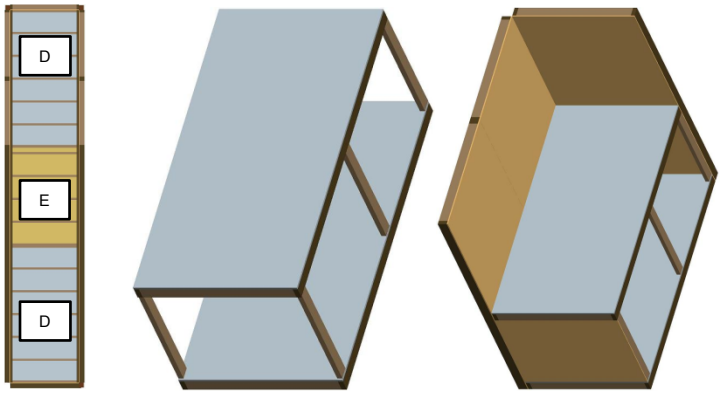
- ❑ [1] Containment Unit – Start Unit (A)
- ❑ [1] Containment Unit – End Landing (B)
- ❑ [1] Stair Unit (C)
- ❑ [2] Sub floor element 2400 mm (96 in) (D)
- ❑ [1] Sub floor element 1780 mm (70 in) (E)
- ❑ [1] Deck Unit (F)

FABRICATION INSTRUCTIONS

Note: This design uses the same start/end unit. The stair unit changes for the different degrees.

- Place subfloor element (D) and (E) in the position of the apparatus as shown in Figure B.
- Place deck unit (F) on sub floor (D)
- Place containment unit-end landing (B) around deck unit (F)
- Place stair unit (C) as shown in Figure B.
- Place start unit (A) as shown in Figure B.

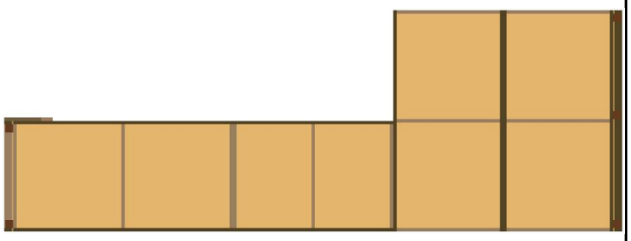
FIGURE B



Sub Floor element Bottom View

Deck element on Sub Floor

Wall around Deck element on Sub Floor



Containment Unit Side view

Containment Unit internal Side view

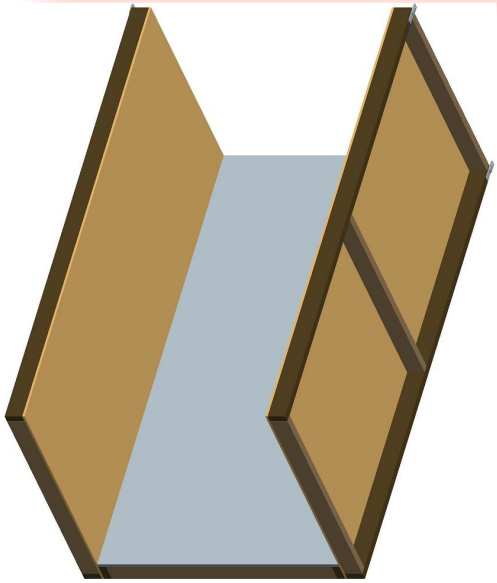
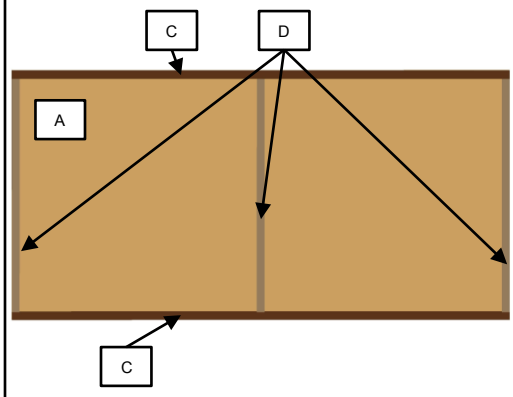


FIGURE A Wall Panel (2400 mm (96 in)) Front View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(D) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

MOBILITY: OBSTACLES: STAIRS 35° START UNIT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [2] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
  [2] 2400x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall Panel (A)

- ❑ Solid wood posts cut to length (non pressure treated)
  [11] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [4] 50 x 100 x 2400 mm (2 x 4 x 96 in) – Stud Plate (C)
  [6] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Stud Support (D)

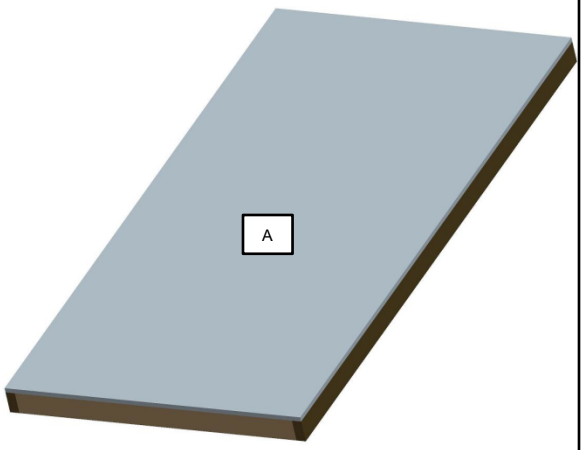
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS

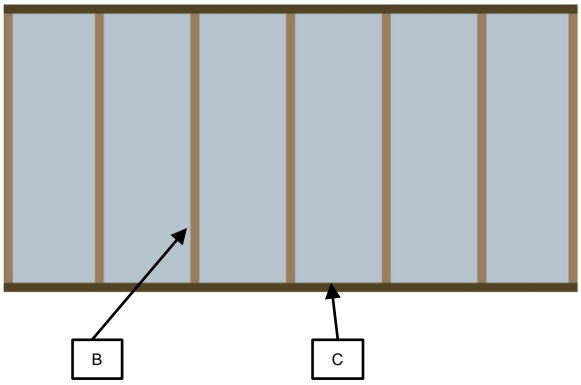
Wall Panels (Note: Wall panel uses one sheet of OSB)

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (D) to stud plates as shown in Figure A. Studs are 1200 mm (48 in) on center. Attach one sheet of OSB wall panel (A) to stud frame. Repeat for additional 2400 mm (96 in) panel.

FIGURE A Top ISO View



Bottom View



(A) Floor Panel - 2400 x 1200 x 19 mm (96 x 48 x 3/4 in)
(B) Support Stud - 50 x 100 x 1100 mm (2 x 4 x 45 in)
(C) Stud Plate - 50 x 100 x 2400 mm (2 x 4 x 96 in)

MOBILITY: OBSTACLES: STAIRS SUB FLOOR ELEMENT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [2] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)
  [2] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in) – Subfloor (A)
- ❑ Solid wood posts cut to length (non pressure treated)
  [12] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [14] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)
  [4] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plates (C)
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Sub Floor Element

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 400 mm (16 in) on center. Attach OSB wall panel (A) to stud frame. Repeat for additional sub floor element.

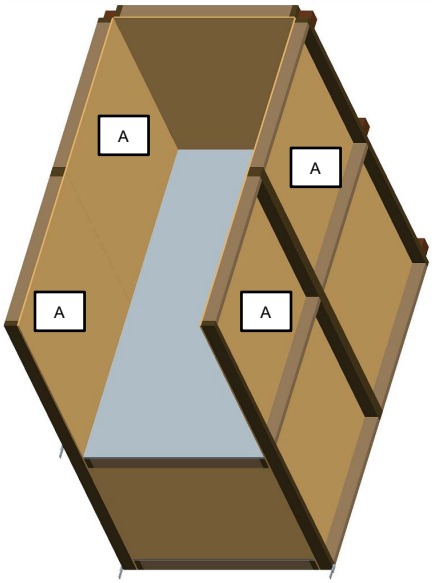
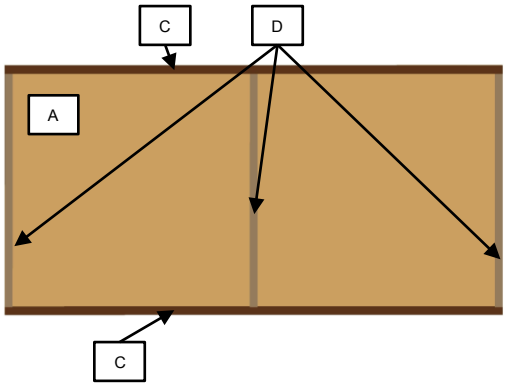


FIGURE A Wall Panel (2400 mm (96 in)) Front View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(D) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

MOBILITY: OBSTACLES: STAIRS- 35° LANDING UNIT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [6] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

  [5] 2400x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall Panel (A)

- ❑ Solid wood posts cut to length (non pressure treated)

  [18] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [10] 50 x 100 x 2400 mm (2 x 4 x 96 in) – Stud Plate (C)

  [15] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Stud Support (D)

  [1] 100 x 100 x 2400 mm (4 x 4 x 96 in)

  [6] 100 x 100 x 90 mm (4 x 4 x 3.5 in) – Blocks (F)

- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 in)

  M5 x 80 mm (#10 x 2-1/2 in)

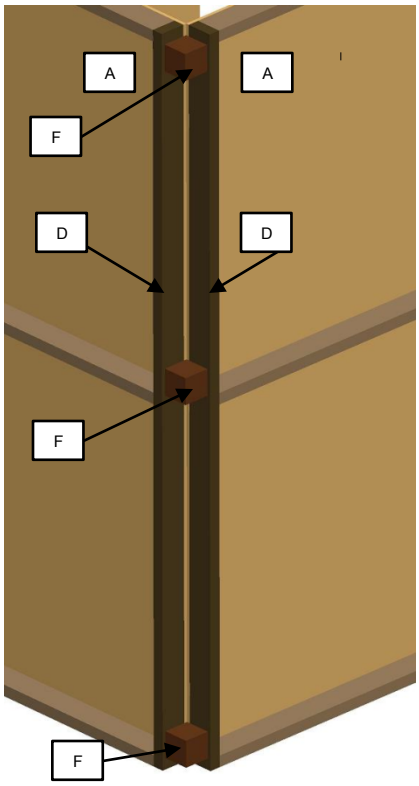
NOTE: For the configuration used in RoboCup no divider is used.

FABRICATION INSTRUCTIONS

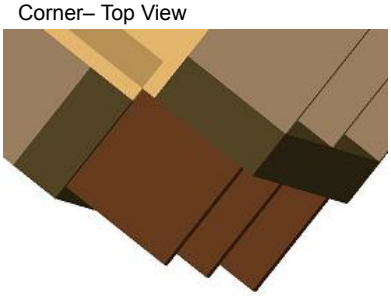
Wall Panels (Note: Wall panel uses one sheet of OSB)

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (D) to stud plates as shown in Figure A. Studs are 1200 mm (48 in) on center. Attach one sheet of OSB wall panel (A) to stud frame. Repeat for additional four 2400 mm (96 in) panels.

FIGURE B Wall Panel – Corner View



Corner– Top View



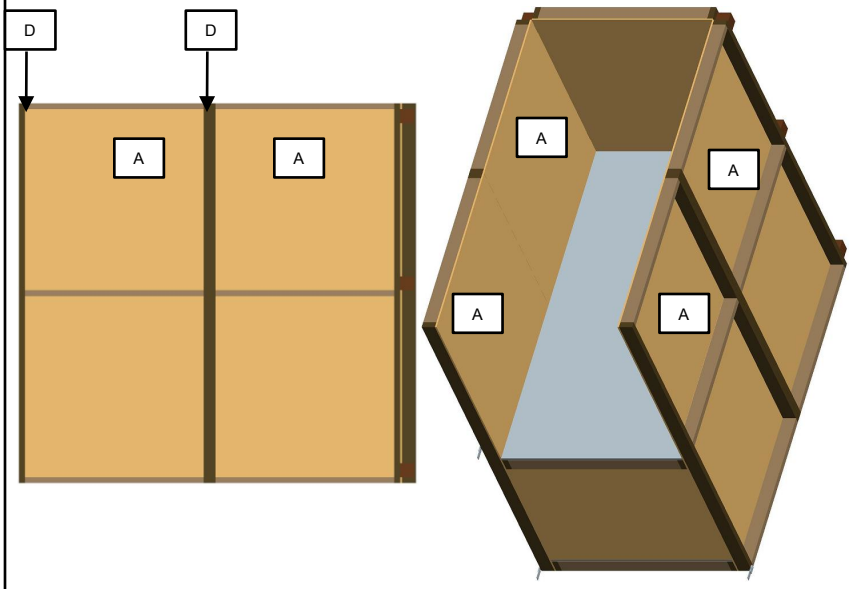
(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(F) Connection Block
100 x 100 x 90 mm (4 x 4 x 3.5 in)

MOBILITY: OBSTACLES: STAIRS - 35° LANDING UNIT

FABRICATION INSTRUCTIONS (continued) – Wall Panel Element

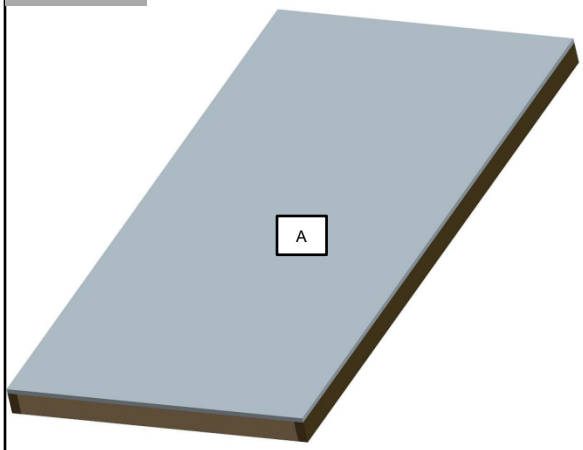
- Attach two wall panel (A) elements together to form a corner. Use three connection blocks (F). Blocks are placed 40 mm (1.5 in) from top and bottom. Third block is centered. Attach blocks by screwing into adjacent stud plate (C). As shown in Figure B. Repeat for other side.
- Attach wall panel (A) to constructed corner and repeat for other side as shown in Figure C.

FIGURE C Side View

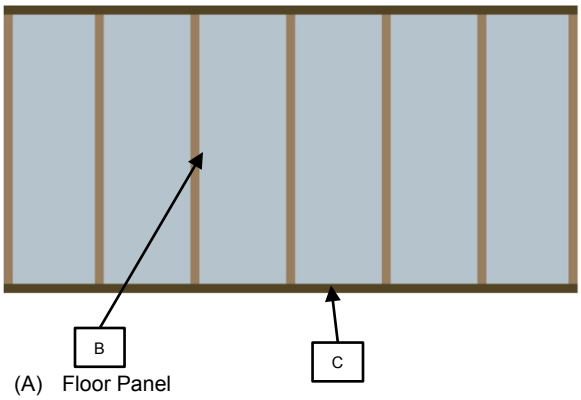


(A) Wall Panel - 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Support Stud - 50 x 100 x 1100 mm (2 x 4 x 45 in)
(D) Stud Plate - 50 x 100 x 2400 mm (2 x 4 x 96 in)

FIGURE A Top ISO View



Bottom View



(A) Floor Panel
2400 x 1200 x 19 mm (96 x 48 x 3/4 in)
(B) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)

MOBILITY: OBSTACLES: STAIRS- 35° DECK ELEMENT

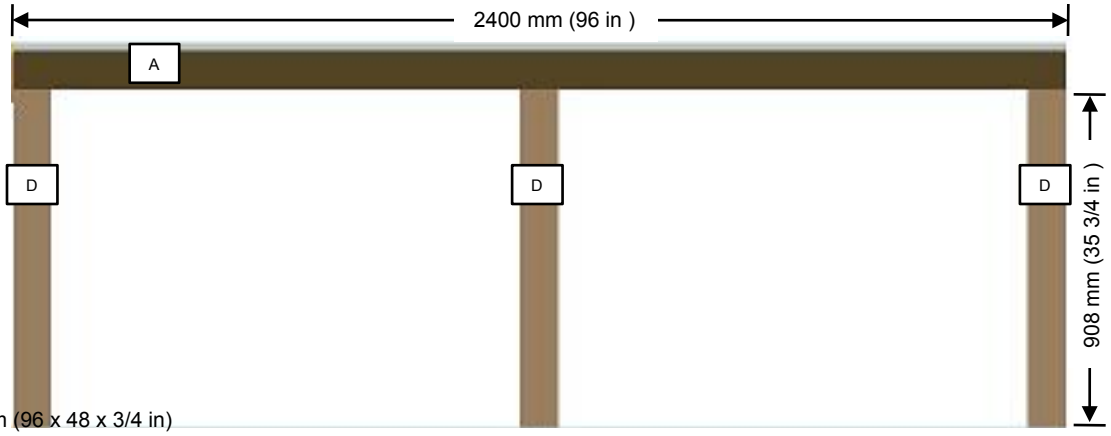
MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [1] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)
  [1] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in) – Deck Floor (A)
- ❑ Solid wood posts cut to length (non pressure treated)
  [6] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [7] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)
  [2] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plates (C)
  [3] 100 x 100 x 2400 mm (4 x 4 x 96 in)
  [6] 100 x 100 x 908 mm (4 x 4 x 35 ¾ in) – Deck Post (D)
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Deck Floor Element

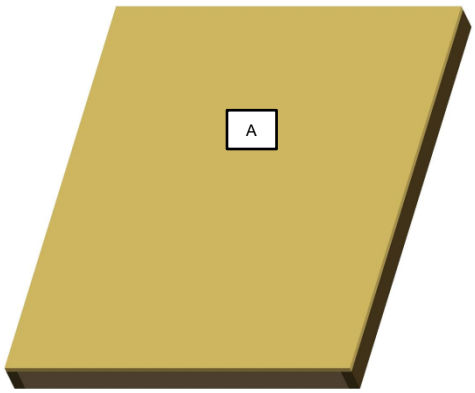
- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 400 mm (16 in) on center. Attach OSB deck floor (A) to stud frame.
- Attach deck posts (D) to deck floor as shown in Figure B. Posts should be under frame.

FIGURE B Side View

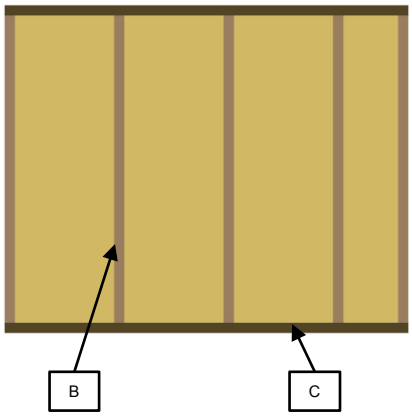


(A) Deck Floor
2400 x 1200 x 19 mm (96 x 48 x 3/4 in)
(D) Post
100 x 100 x 770 mm (2 x 4 x 35 3/4 in)

FIGURE A Top ISO View



Bottom View



(A) Floor Panel
1200 x 1500 x 19 mm (48 x 59 x 3/4 in)
(B) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)
(C) Stud Plate
50 x 100 x 1780 mm (2 x 4 x 59 in)

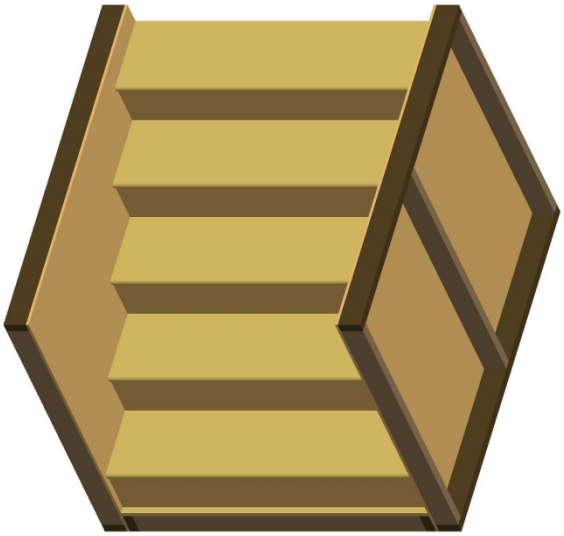
MOBILITY: OBSTACLES: STAIRS SUB FLOOR ELEMENT FOR 35° STAIR UNIT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [1] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)
  [1] 1200 x 1500 x 19 mm (48 x 59 x 3/4 in) – Subfloor (A)
- ❑ Solid wood posts cut to length (non pressure treated)
  [4] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [5] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)
  [2] 50 x 100 x 1500 mm (2 x 4 x 59 in) - Stud Plates (C)
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Sub Floor Element

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 400 mm (16 in) on center. Attach OSB wall panel (A) to stud frame.



MOBILITY: OBSTACLES: STAIRS
35° STAIR UNIT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [3] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

  [2] 1500x 1200 x 11 mm (59 x 48 x 7/16 in) – Wall Panel (A)

  [5] 180 x 1200 x 11 mm (7 x 48 x 7/16 in) – Riser (F)

- ❑ Solid wood posts cut to length (non pressure treated)

  [11] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [4] 50 x 100 x 1500 mm (2 x 4 x 59 in) – Stud Plate (C)

  [6] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Stud Support (D)

  [3] 50 x 300 x 3600 mm (2 x 12 x 144 in)

  [3] 50 x 300 x 3600 mm (2 x 12 x 144 in) – Stringer (E)

  [5] 25 x 295 x 1200 mm (1 x 11 ½ x 48 in) – Bull nose Treads (G)

- ❑ **Flathead wood screws (phillips/crosshead)**

  M5 x 40 mm (#10 x 1-1/2 in)

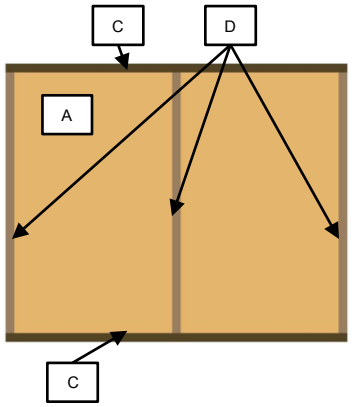
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS

Wall Panels (Note: Wall panel uses one sheet of OSB)

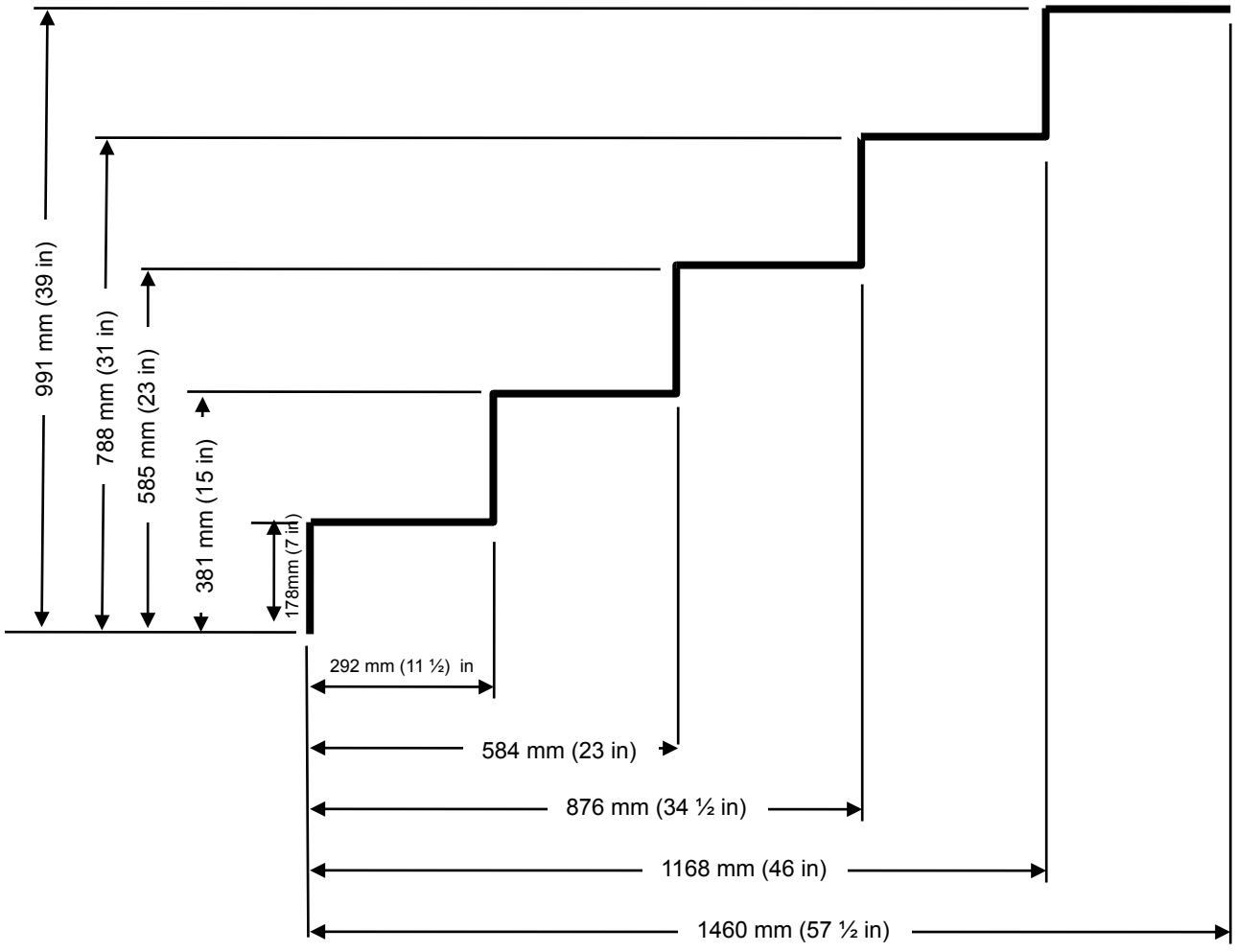
- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (D) to stud plates as shown in Figure A. Studs are 750 mm (29 1/2 in) on center. Attach one sheet of OSB wall panel (A) to stud frame. Repeat for additional 1500 mm (59 in) panel.
- Layout stringer as shown in Figure B (next page). Repeat for additional two stringers.
- Attach wall panel (A) to 1500 mm (59 in) sub floor. Repeat for other side.
- Attach stringer (E) to wall panel (A) and repeat for other side
- Attach risers (F) and treads (G) to stringers.
- Slide in middle stringer and attach to treads (G).

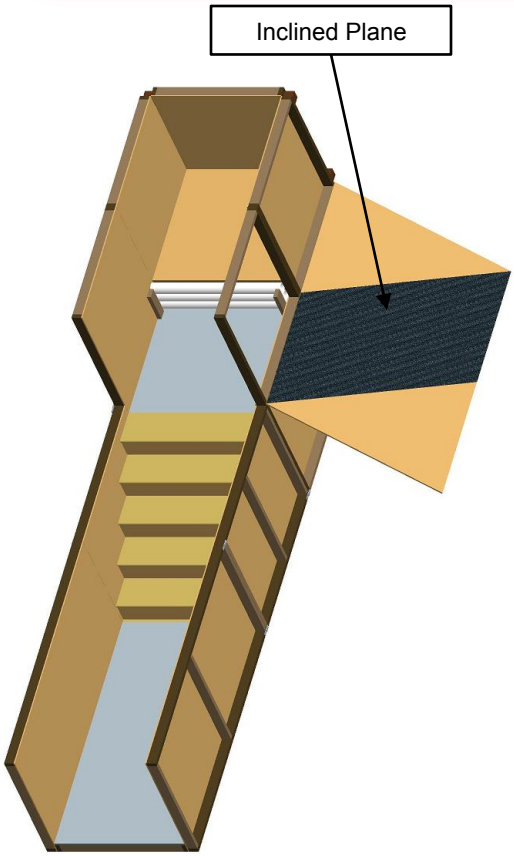
FIGURE A Wall Panel (1500 mm (59 in)) Front View



(A) Wall Panel
1500 x 1200 x 11 mm (59 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 1500 mm (2 x 4 x 59 in)
(D) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

MOBILITY: OBSTACLES: STAIRS
35° STAIR STRINGER





MOBILITY: OBSTACLES: INCLINED PLANE (45 DEGREE) MODIFIED

ELEMENTS

- ❑ [1] Incline Plane

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [2] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)

  [2] 1200 x 1750 x 19 mm (48 x 69 x 3/4 in) – Ramp Surface (A)

- ❑ Solid wood posts cut to length (non pressure treated)

  [12] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [14] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)

  [4] 50 x 100 x 2400 mm (2 x 4 x 69 in) - Stud Plates (C)

- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 in)

  M5 x 80 mm (#10 x 2-1/2 in)

- ❑ **A grated friction surface**

  [1] 1000 x 2660 x 76 mm (36 x 1402 x 1/2 in)

- ❑ **Torx wood screws**

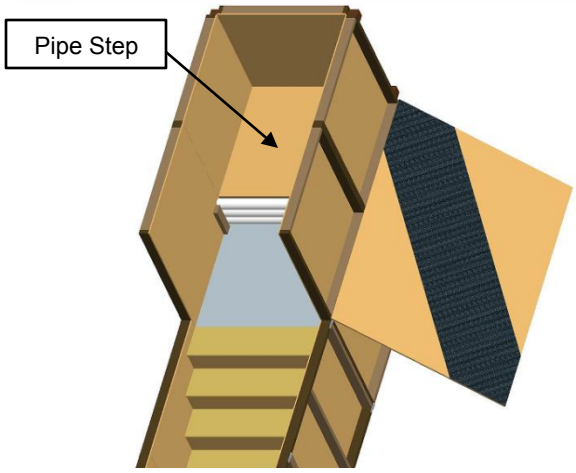
  M5 x 40 mm (#10 x 1-1/2 in)

  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Inclined Plane - Modified

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates. Studs are 400 mm (16 in) on center. Attach OSB wall panel (A) to stud frame.

  Repeat for additional panel.



MOBILITY: OBSTACLES: PIPE STEPS (10 cm to 100 cm) FLAT FLOOR PALLET ELEMENT MODIFIED

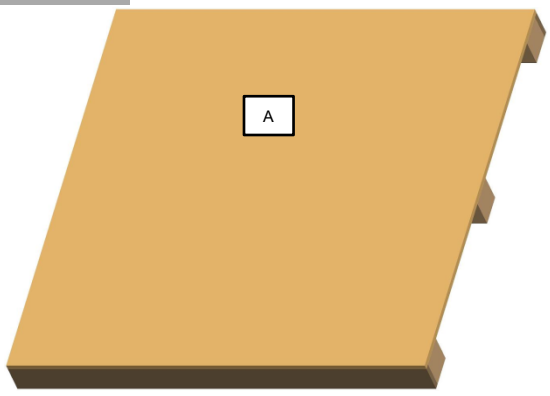
MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [2] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)
  [3] 1200 x 1200 x 19 mm (48 x 48 x ¾ in) -Floor Panel (A)
  [6] 1200 x 100 x 19 mm (48 x 4 x ¾ in) – Face plate (C)
- ❑ Solid wood posts cut to length (non pressure treated)
  [2] 100 x 100 x 2400 mm (4 x 4 x 96 in)
  [27] 100 x 100 x 81 mm (4 x 4 x 3 1/4 in) – Support Block (B)
- ❑ **[3] 100 x 1195 mm (4 x 47 3/4 in) PCV pipe**
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

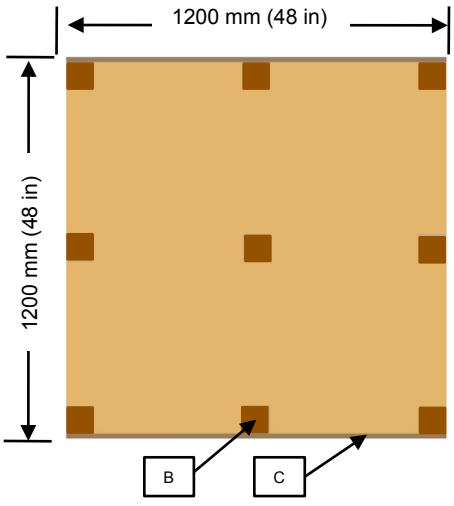
FABRICATION INSTRUCTIONS (continued)

- **Note: Flat floor pallet element is 100 mm (4 in) in height. Adjust post height if not using 19 mm (3/4 in) OSB.**
- Attach nine support blocks (B) to floor panel (A) as shown in Figure A. Offset side support blocks by 19 mm (3/4 in) from edge. Middle post should be centered.
- Attach face plate (C) to support block (B) as shown in Figure B. Repeat for other side.
- Repeat additional pallet elements.

FIGURE A ISO View

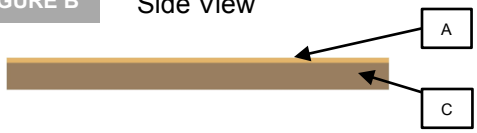


Bottom View



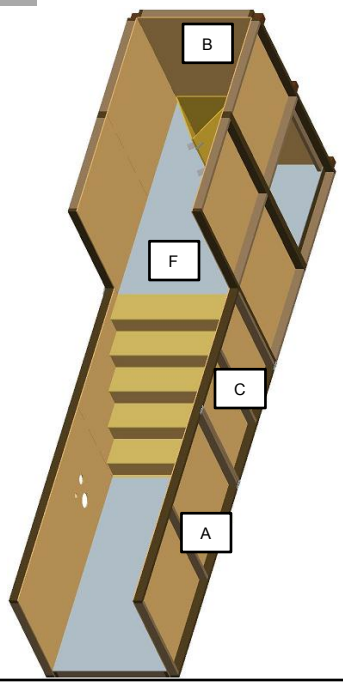
(A) Floor Panel - 1200 x 1200 x 19 mm (96 x 48 x 3/4 in)
(B) Support Block – 100 x 100 x 81 mm (4 x 4 x 3 1/4 in)
(C) Face Plate - 1200 x 100 x 19 mm (48 x 4 x ¾ in)

FIGURE B Side View



(A) Floor Panel - 1200 x 1200 x 19 mm (48 x 48 x 3/4 in)
(C) Face Plate - 1200 x 100 x 19 mm (48 x 4 x ¾ in)

FIGURE A ISO View Stair 35 Degree



MOBILITY: OBSTACLES: STAIRS - 45°

ELEMENTS

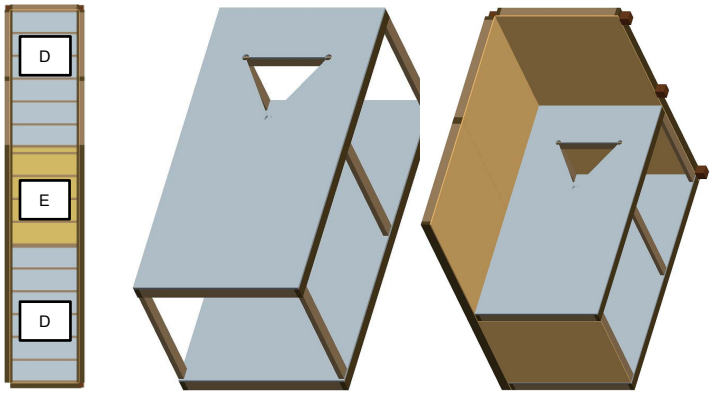
- ❑ [1] Containment Unit – Start Unit (A)
- ❑ [1] Containment Unit – End Landing (B)
- ❑ [1] Stair Unit (C)
- ❑ [2] Sub floor element 2400 mm (96 in) (D)
- ❑ [1] Sub floor element 1780 mm (70 in) (E)
- ❑ [1] Deck Unit (F)

FABRICATION INSTRUCTIONS

Note: This design uses the same start/end unit. The stair unit changes for the different degrees.

- Place subfloor element (D) and (E) in the position of the apparatus as shown in Figure B.
- Place deck unit (F) on sub floor (D)
- Place containment unit-end landing (B) around deck unit (F)
- Place stair unit (C) as shown in Figure B.
- Place start unit (A) as shown in Figure B.
- Place triangle insertion as shown in Figure B.

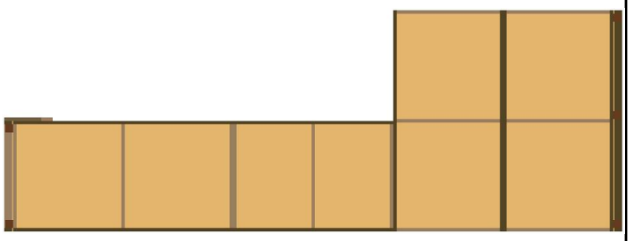
FIGURE B



Sub Floor element Bottom View

Deck element on Sub Floor

Wall around Deck element on Sub Floor



Containment Unit Side view

Containment Unit internal Side view

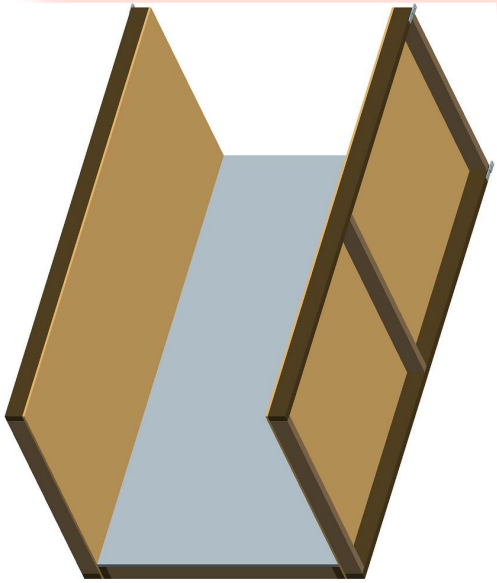
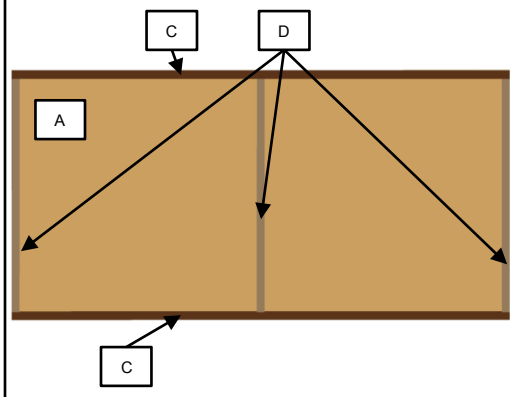


FIGURE A Wall Panel (2400 mm (96 in)) Front View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(D) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

MOBILITY: OBSTACLES: STAIRS - 45° START UNIT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [2] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
  [2] 2400x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall Panel (A)

- ❑ Solid wood posts cut to length (non pressure treated)
  [11] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [4] 50 x 100 x 2400 mm (2 x 4 x 96 in) – Stud Plate (C)
  [6] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Stud Support (D)

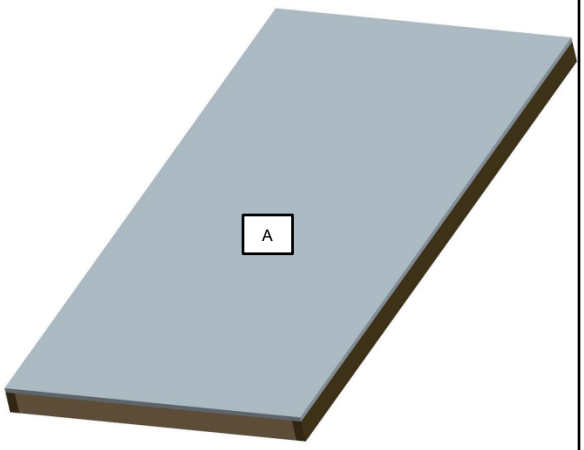
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS

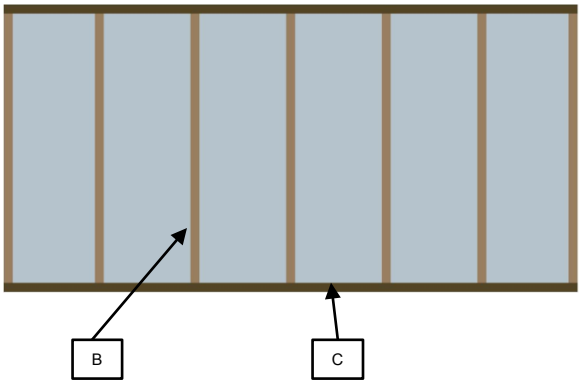
Wall Panels (Note: Wall panel uses one sheet of OSB)

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (D) to stud plates as shown in Figure A. Studs are 1200 mm (48 in) on center. Attach one sheet of OSB wall panel (A) to stud frame. Repeat for additional 2400 mm (96 in) panel.

FIGURE A Top ISO View



Bottom View



(A) Floor Panel - 2400 x 1200 x 19 mm (96 x 48 x 3/4 in)
(B) Support Stud - 50 x 100 x 1100 mm (2 x 4 x 45 in)
(C) Stud Plate - 50 x 100 x 2400 mm (2 x 4 x 96 in)

MOBILITY: OBSTACLES: STAIRS- 45° SUB FLOOR ELEMENT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [2] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)

  [2] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in) – Subfloor (A)

- ❑ Solid wood posts cut to length (non pressure treated)

  [12] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [14] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)

  [4] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plates (C)

- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 in)

  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Sub Floor Element

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 400 mm (16 in) on center. Attach OSB wall panel (A) to stud frame. Repeat for additional sub floor element
- Cut Triangle hole

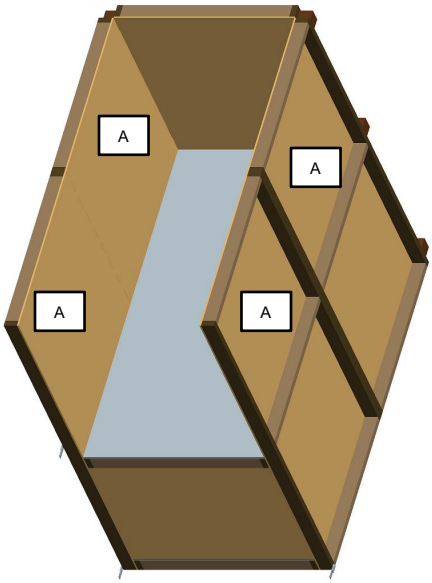
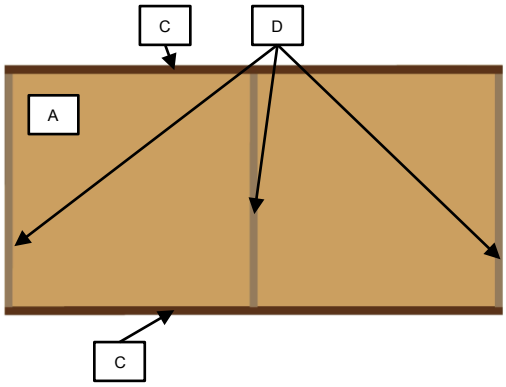


FIGURE A Wall Panel (2400 mm (96 in)) Front View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(D) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

MOBILITY: OBSTACLES: STAIRS- 45° LANDING UNIT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [6] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

  [5] 2400x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall Panel (A)

- ❑ Solid wood posts cut to length (non pressure treated)

  [18] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [10] 50 x 100 x 2400 mm (2 x 4 x 96 in) – Stud Plate (C)

  [15] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Stud Support (D)

  [1] 100 x 100 x 2400 mm (4 x 4 x 96 in)

  [6] 100 x 100 x 90 mm (4 x 4 x 3.5 in) – Blocks (F)

- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 in)

  M5 x 80 mm (#10 x 2-1/2 in)

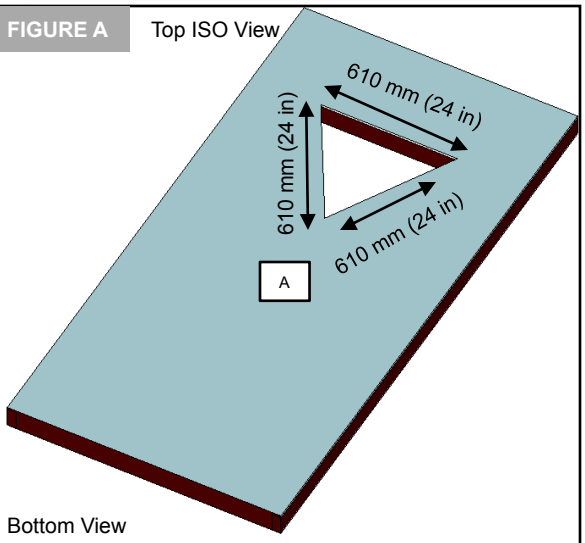
NOTE: For the configuration used in RoboCup no divider is used.

FABRICATION INSTRUCTIONS

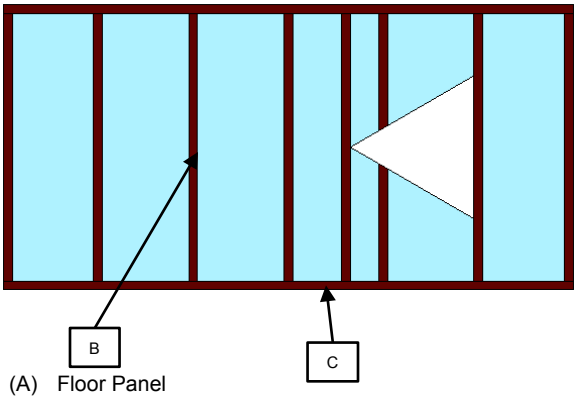
Wall Panels (Note: Wall panel uses one sheet of OSB)

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (D) to stud plates as shown in Figure A. Studs are 1200 mm (48 in) on center. Attach one sheet of OSB wall panel (A) to stud frame. Repeat for additional four 2400 mm (96 in) panels.

FIGURE A Top ISO View



Bottom View



(A) Floor Panel
2400 x 1200 x 19 mm (96 x 48 x 3/4 in)
(B) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)
(C) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)

MOBILITY: OBSTACLES: STAIRS - 45° DECK ELEMENT

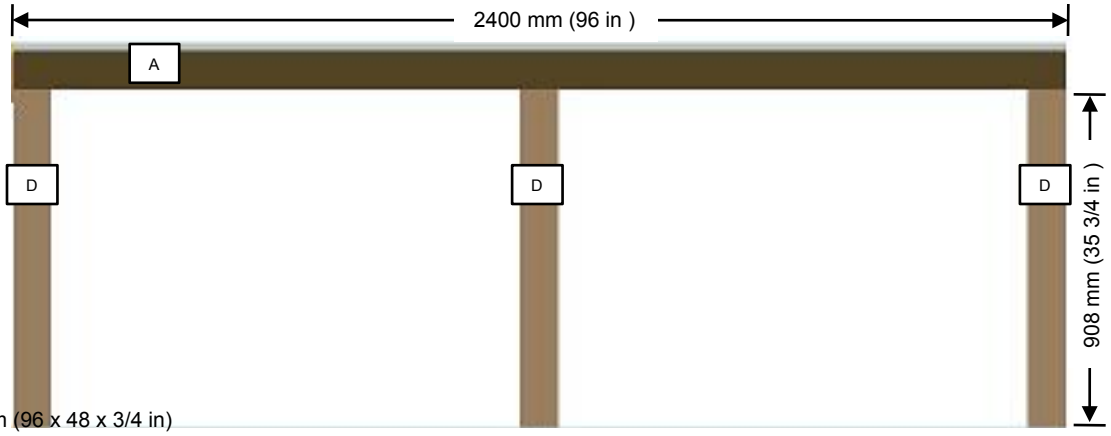
MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [1] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)
  [1] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in) – Deck Floor (A)
- ❑ Solid wood posts cut to length (non pressure treated)
  [6] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [7] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)
  [2] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plates (C)
  [3] 100 x 100 x 2400 mm (4 x 4 x 96 in)
  [6] 100 x 100 x 908 mm (4 x 4 x 35 ¾ in) – Deck Post (D)
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Deck Floor Element

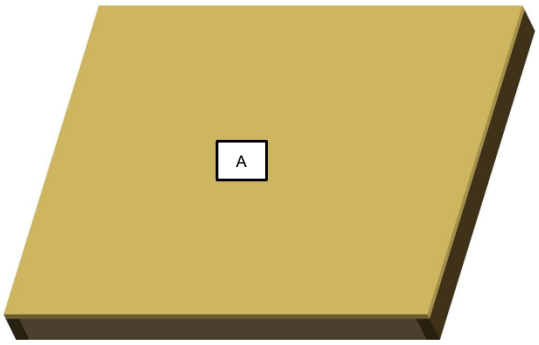
- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 400 mm (16 in) on center. Attach OSB deck floor (A) to stud frame.
- Attach deck posts (D) to deck floor as shown in Figure B. Posts should be under frame.

FIGURE B Side View

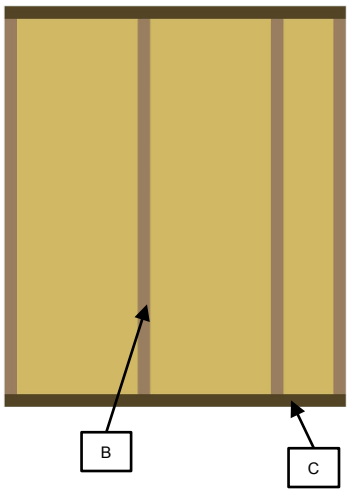


(A) Deck Floor
2400 x 1200 x 19 mm (96 x 48 x 3/4 in)
(D) Post
100 x 100 x 770 mm (2 x 4 x 35 3/4 in)

FIGURE A Top ISO View



Bottom View



(A) Floor Panel
1200 x 1040 x 19 mm (48 x 41 x 3/4 in)
(B) Support Stud
100 x 1100 mm (2 x 4 x 45 in)
(C) Stud Plate
50 x 100 x 1040 mm (2 x 4 x 41 in)

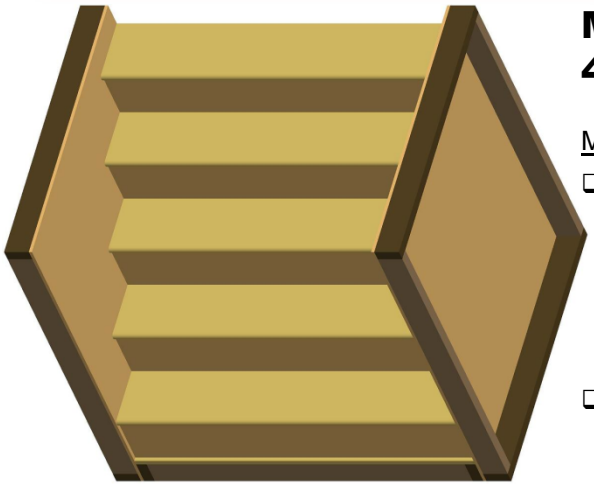
MOBILITY: OBSTACLES: STAIRS - 45° SUB FLOOR ELEMENT FOR 45° STAIR UNIT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [1] 1200 x 2400 x 19 mm (48 x 96 x 3/4 in)
  [1] 1200 x 1040 x 19 mm (48 x 41 x 3/4 in) – Subfloor (A)
- ❑ Solid wood posts cut to length (non pressure treated)
  [3] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [4] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)
  [2] 50 x 100 x 1040 mm (2 x 4 x 41 in) - Stud Plates (C)
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS – Sub Floor Element

- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 400 mm (16 in) on center. Attach OSB wall panel (A) to stud frame.



MOBILITY: OBSTACLES: STAIRS
45° STAIR UNIT

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [3] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
  [2] 1040x 1200 x 11 mm (41 x 48 x 7/16 in) – Wall Panel (A)
  [5] 180 x 1200 x 11 mm (7 x 48 x 7/16 in) – Riser (F)

- ❑ Solid wood posts cut to length (non pressure treated)
  [5] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [4] 50 x 100 x 1040 mm (2 x 4 x 41 in) – Stud Plate (C)
  [4] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Stud Support (D)
  [3] 50 x 300 x 3600 mm (2 x 12 x 144 in)
  [3] 50 x 300 x 3600 mm (2 x 12 x 144 in) – Stringer (E)

  [5] 25 x 200 x 1200 mm (1 x 8 x 48 in) - Bull nose Treads (G)

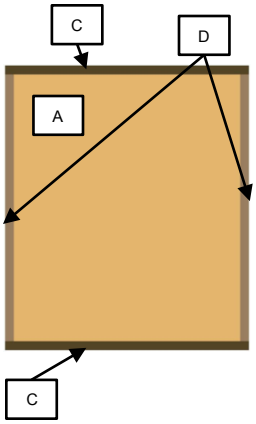
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS

Wall Panels (Note: Wall panel uses one sheet of OSB)

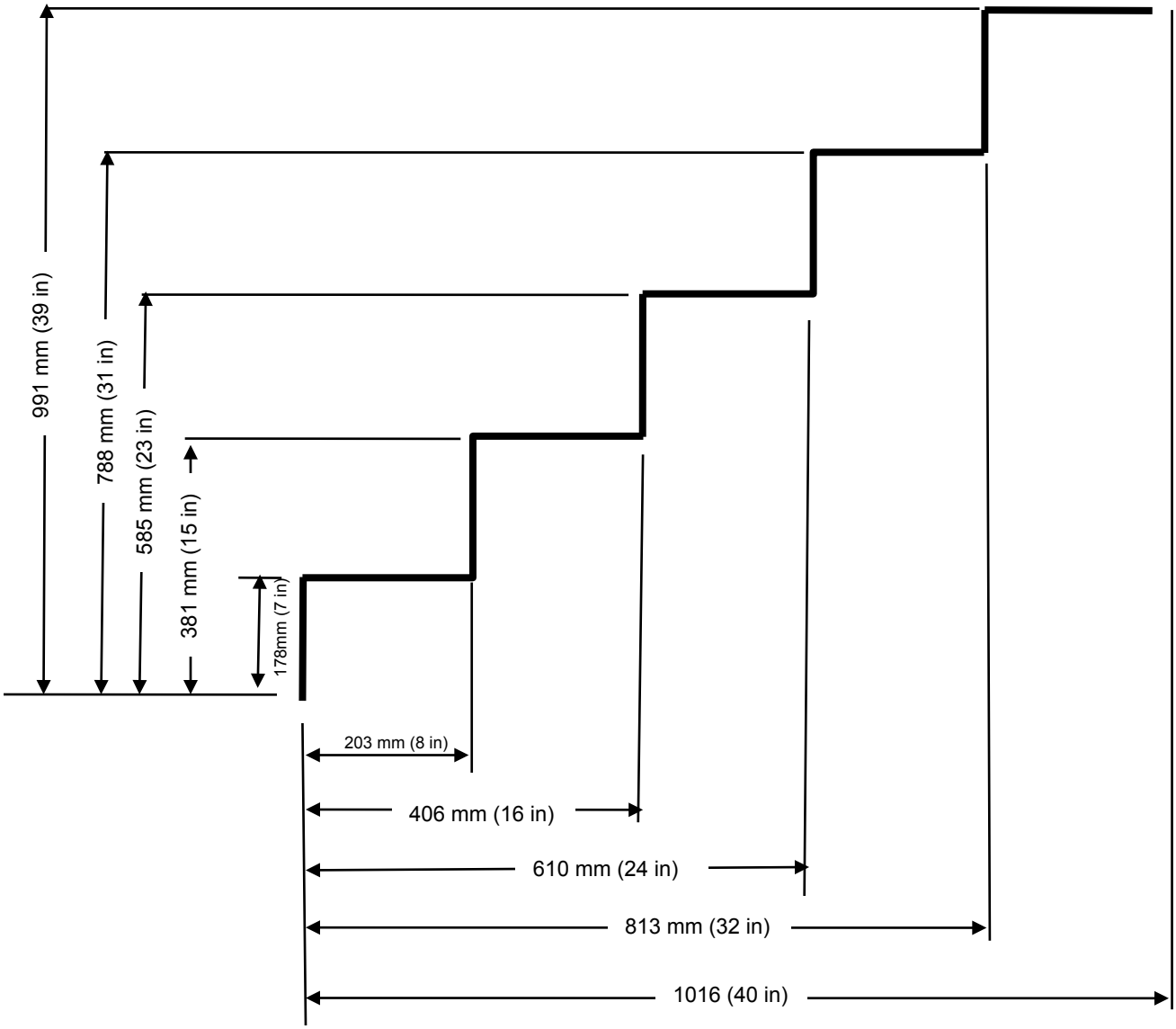
- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (D) to stud plates as shown in Figure A. Studs are 1040 mm (41 in) on center. Attach one sheet of OSB wall panel (A) to stud frame. Repeat for additional 1040 mm (50 in) panel.
- Layout stringer as shown in Figure B (next page). Repeat for additional two stringers.
- Attach wall panel (A) to 1040 mm (41 in) sub floor. Repeat for other side.
- Attach stringer (E) to wall panel (A) and repeat for other side
- Attach risers (F) and treads (G) to stringers.
- Slide in middle stringer and attach to treads (G).

FIGURE A Wall Panel (1040 mm (41 in))
Front View



(A) Wall Panel
1040 x 1200 x 11 mm (41 x 48 x 7/16 in)
(C) Stud Plate
50 x 100 x 1040 mm (2 x 4 x 41 in)
(D) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

MOBILITY: OBSTACLES: STAIRS
45° STAIR STRINGER



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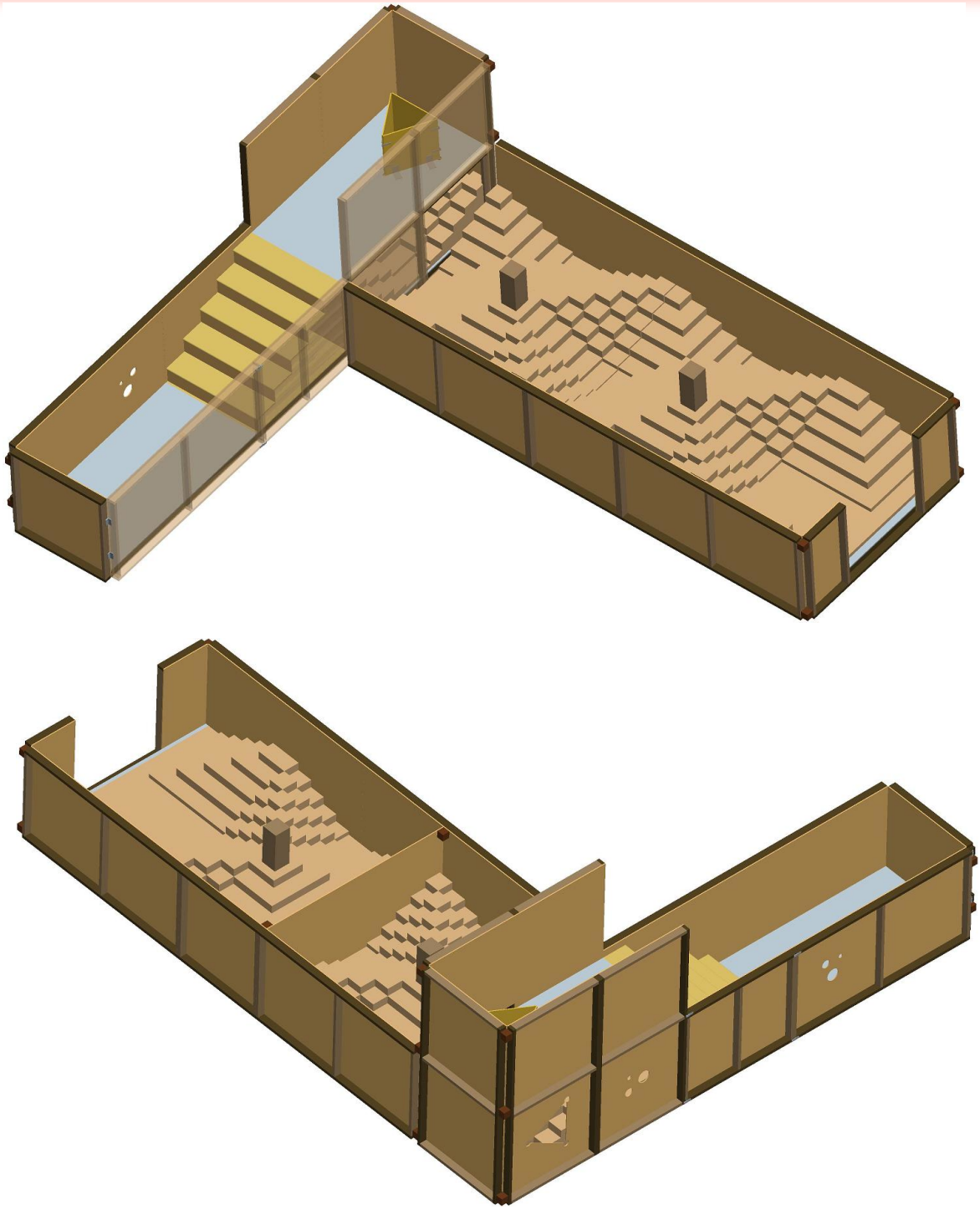
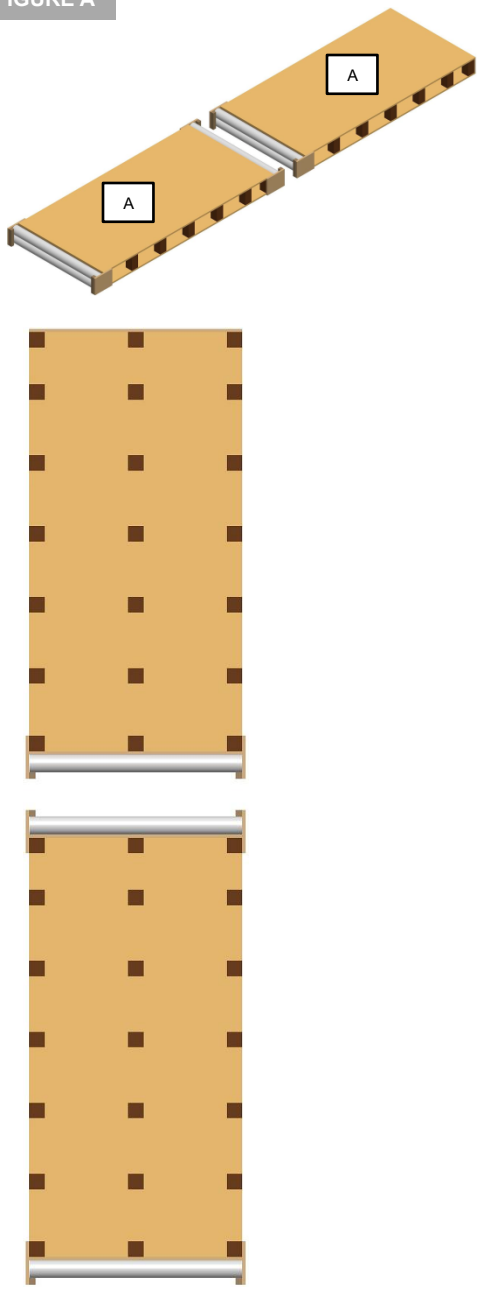


Note: Red step fields are under the 45 degree stair.

FIGURE A



(A) Panel
2400 x 1200 x 19 mm (96 x 48 x ¾ in)
(B) Face Plate
1200 x 200 x 19 mm (48 x 8 x ¾ in)
(C) Support Block
100 x 100 x 200 mm (2 x 4 x 8 in)

MOBILITY: OBSTACLES: GAPS (10 cm to 100 cm) MODIFIED

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [5] 2400 x 1200 x 19 mm (96 x 48 x ¾ in)
  [4] 2400 x 1200 x 19 mm (96 x 48 x ¾ in) – Panel (A)
  [4] 1200 x 200 x 19 mm (48 x 8 x ¾ in) – Face Plate (B)
  [6] 200 x 269 x19 mm (8 x 9 ¾ x ¾ in) – PVC Support Plate (D)

- ❑ Solid wood posts cut to length (non pressure treated)
  [4] 100 x 100 x 2400 mm (4 x 4 x 96 in)
  [42] 100 x 100 x 200 mm (2 x 4 x 8 in) – Support Block (C)
  [1] 50 x 50 x 2400 mm (2 x 2 x 96 in)
  [6] 50 x 50 x 200 mm (2 x 2 x 8 in) – PVC Support (E)

- ❑ **[6] 100 X 1195 mm (4 x 47 3/4 in) PVC pipe**
  [6] 100 x 1195 mm (4 x 47 3/4 in) PVC pipe (F)

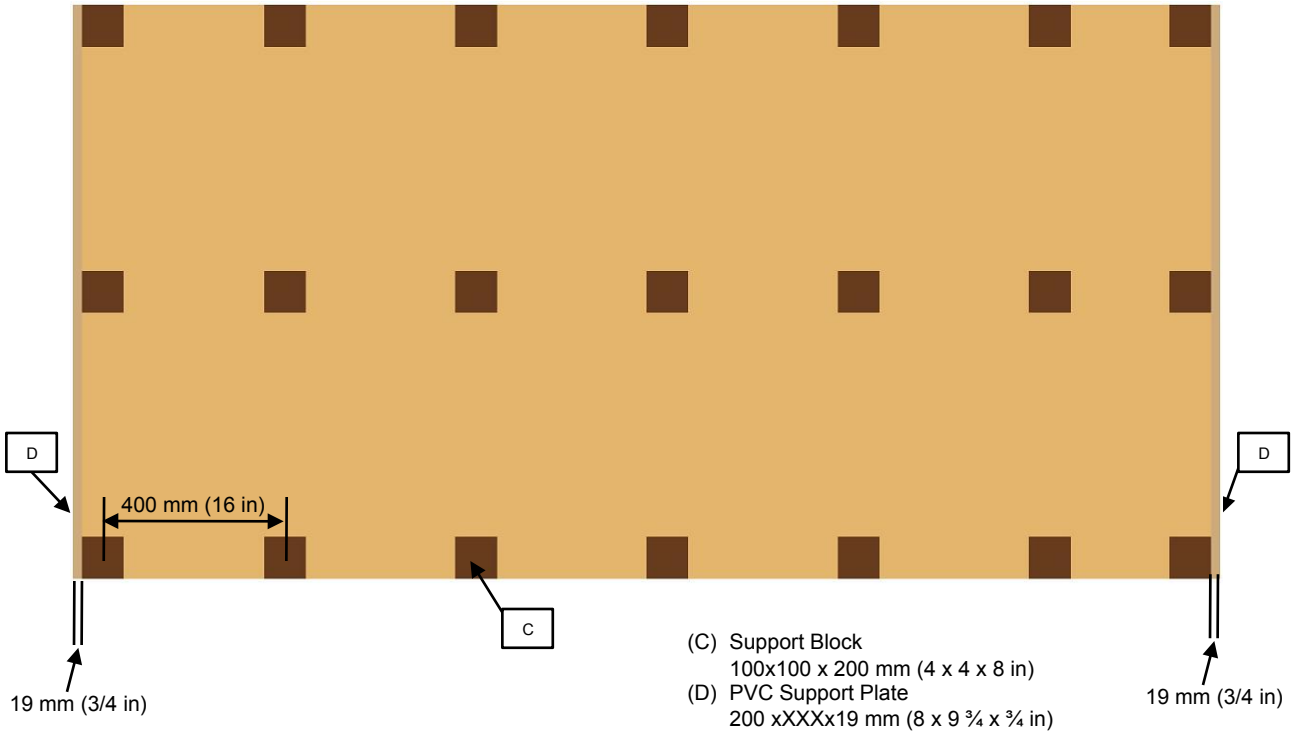
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS

- Attach support blocks (C) to **top** panel (A). Support blocks are 400 mm (16 in) on center with an offset of ¾ in as shown in Figure B (next page).
- Attach additional panel (A) to support blocks (C).
- Attach faceplates (B) to floor panel element as shown in Figure B (next page).
- Attach PVC Support Plate (D) as shown in Figure C (next page).
- Attach PVC Support (E) as shown in Figure C (next page).
- Repeat for additional panel.

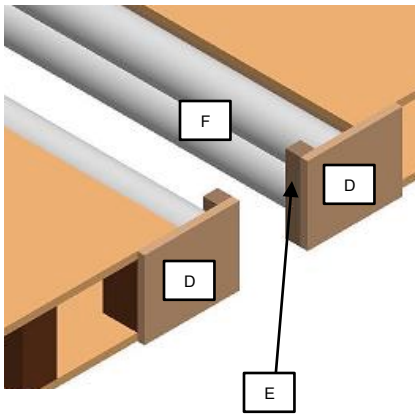
MOBILITY: OBSTACLES: GAPS (10 cm to 100 cm) MODIFIED

FIGURE B



(C) Support Block
100x100 x 200 mm (4 x 4 x 8 in)
(D) PVC Support Plate
200 xXXXx19 mm (8 x 9 ¾ x ¾ in)

FIGURE C



(D) PVC Support Plate
200 x 269 x19 mm (8 x 9 ¾ x ¾ in)
(E) PVC Support
50 x 50 x 200 mm (2 x 2 x 8 in)
(F) PVC
100 x 1195 mm (4 x 47 3/4 in)

FIGURE A Front View

Prototype

MANIPULATION:DIRECTED PERCEPTION TASKS: OPEN ACCESS - MODIFIED

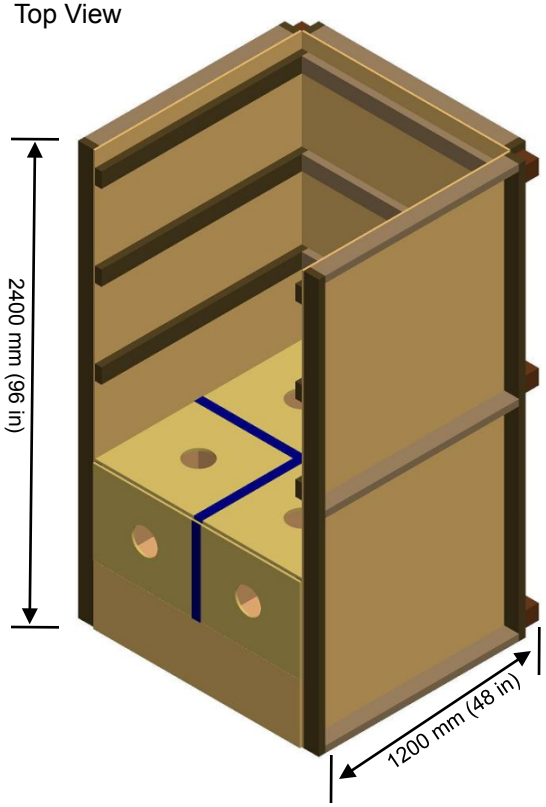
ELEMENTS

- ❑ [2] Alcove
- ❑ [3] Full Ramp Terrain Elements

FABRICATION INSTRUCTIONS

- Place the alcove walls in the position of the apparatus.

FIGURE B Top View



ROBOCUPRESCUE
ARENA ASSEMBLY GUIDE

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

[6] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

[6] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in) –Wall Panel (A)

[3] 2400 x 1200 x 16 mm (96 x 48 x 5/8 in)

[2] 1200 x 1200 x 16 mm (48 x 48 x 5/8 in) – Shelf (H)
[2] 1200 x 500 x 16 mm (48 x 19 5/8 x 5/8 in) – Facade with hole (I)
[2] 1200 x 500 x 16 mm (48 x 19 5/8 x 5/8 in) – Facade w/o hole (J)
[2] 1200 x 300 x 16 mm (48 x 11 3/4 x 5/8 in) – Facade w/o hole (G)

- ❑ Plywood

[3] 2400 x 1200 x 16 mm (96 x 48 x 5/8 in)

[48] 166 x 166 x 16 mm (6 5/8 x 6 5/8 x 5/8 in) – Box wall (K)
[12] 150 x 150 x 16 mm (6 x 6 x 5/8 in) – Box bottom (L)

- ❑ Solid wood posts cut to length (non pressure treated)

[44] 50 x 100 x 2400 mm (2 x 4 x 96 in)

[12] 50 x 100 x 2400 mm (2 x 4 x 96 in) – Stud Plate (B)
[18] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Stud Support (C)
[10] 50 x 100 x1143 mm (2 x 4 x 45 in) – Shelf Support (E)
[20] 50 x 100 x 2400 mm (2 x 4 x 48 in) – Shelf Railing (D)
[24] 50 x 100 x 182 mm (2 x 4 x 7 1/4 in) – Box Support (M)
[4] 50 x 100 x 2400 mm (2 x 4 x 48 in) – Under Shelf Support (N)

[1] 100 x 100 x 2400 mm (4 x 4 x 96 in)

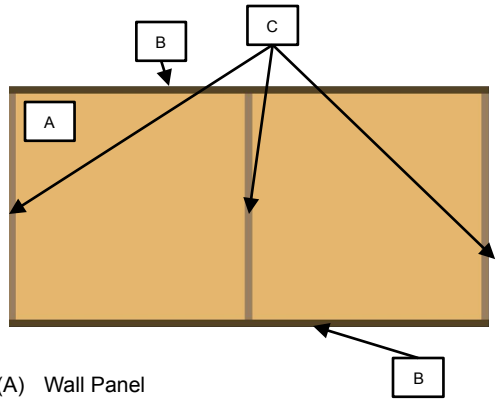
[12] 100 x 100 x 90 mm (2 x 4 x 3 1/2 in) – Connection Block (F)

- ❑ **Torx wood screws**

M5 x 40 mm (#10 x 1-1/2 in)
M5 x 80 mm (#10 x 2-1/2 in)

- ❑ [12] hazmat labels
- ❑ Blue Paint or tape

FIGURE A Wall Panel – Front View



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(B) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(C) Support Stud
50 x 100 x 1100 mm (2 x 4 x 45 in)

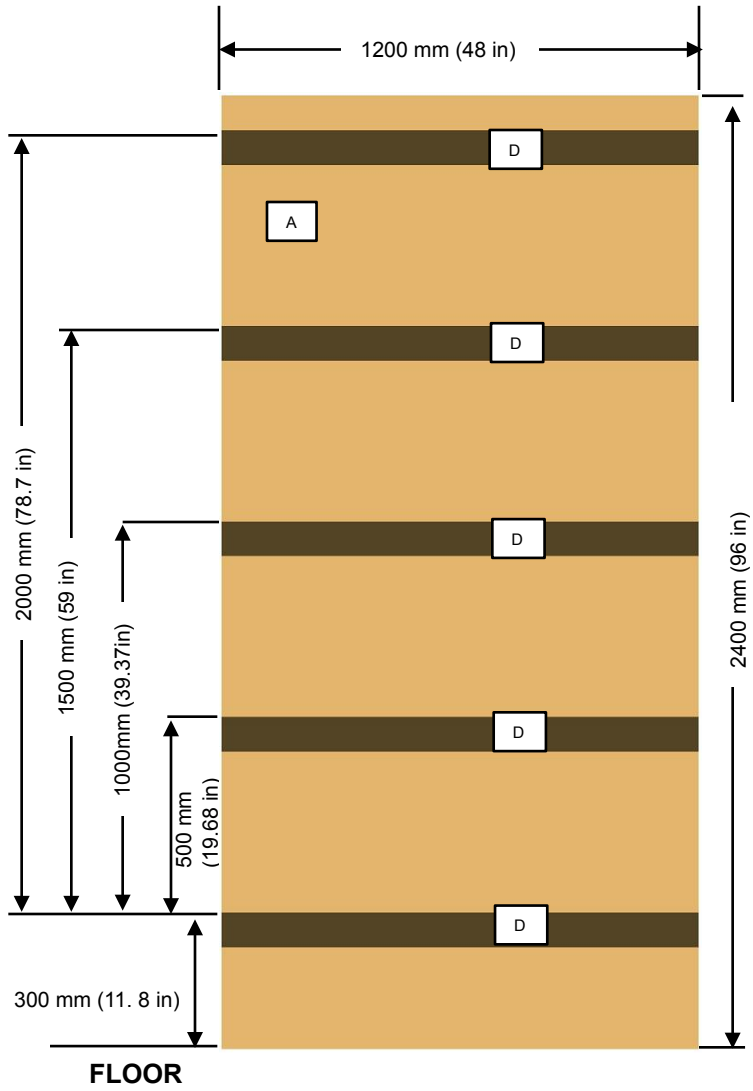
MANIPULATION:DIRECTED PERCEPTION TASKS: OPEN ACCESS WALL ASSEMBLY

FABRICATION INSTRUCTIONS – Wall Panels

Wall Panel (1200 x 2400 x 11 mm) (6EA)

- Lay out two stud plates (B) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (C) to stud plates as shown in Figure A. Studs are 1200 mm (48 in) on center. Attach **one** sheet of OSB wall panel (A) to stud frame. Repeat for five additional 2400 mm (96 in) panels.

FIGURE B Alcove Wall – Side View



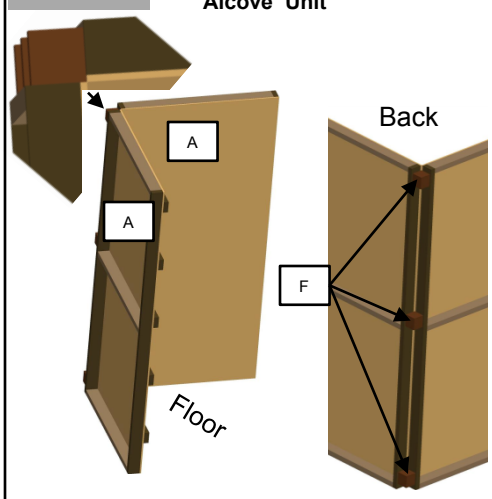
(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(D) Shelf Railing
50 x 100 x 1200 mm (2 x 4 x 48 in)

MANIPULATION:DIRECTED PERCEPTION TASKS: OPEN ACCESS
ALCOVE WALL ASSEMBY

FABRICATION INSTRUCTIONS

- **Alcove Walls (Should be done after wall panel assembly)**
- Attach shelf railing (D) to wall panel (A) as shown in Figure B. Repeat for 3 additional alcove panels. **Note: Measure from top of support shelf (D)**

FIGURE C



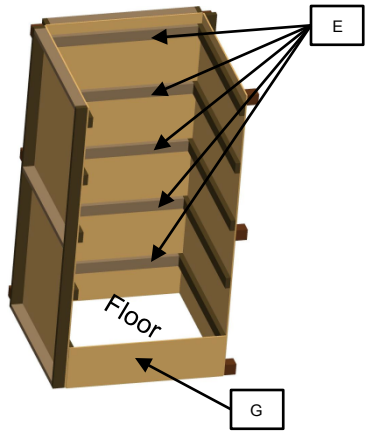
(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(F) Connection Block
100 x 100 x 90 mm (4 x 4 x 3 1/2 in)

MANIPULATION:DIRECTED PERCEPTION TASKS: OPEN ACCESS ALCOVE WALL ASSEMBY

FABRICATION INSTRUCTIONS (continued)

- Attach two wall panels (fabricated in previous section) (A) using 3 connection blocks (F) . Corners should be at 90 degree as shown in Figure C.
- Repeat for additional alcove unit.
- Attach Shelf Support (E) to back on alcove as shown in Figure D.
- Attach façade (G) as shown in Figure D.

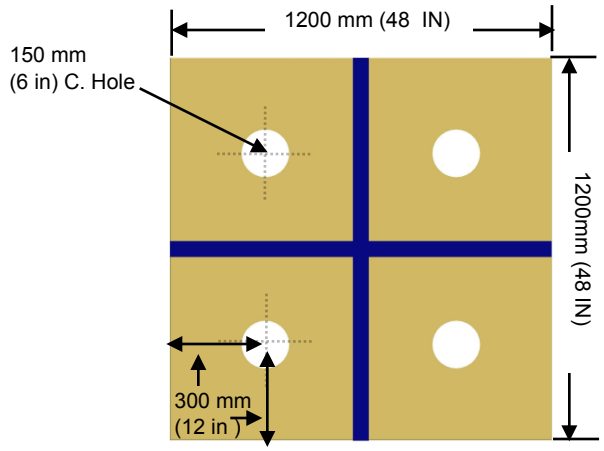
FIGURE D



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(E) Shelf Support
50 x 100 x 1100 mm (2 x 4 x 45 in)
(F) Connection Block
100 x 100 x 90 mm (4 x 4 x 3 1/2 in)
(G) Façade without hole
1200 x 300 x 16 mm (48 x 11 3/4 x 5/8 in)

FIGURE E

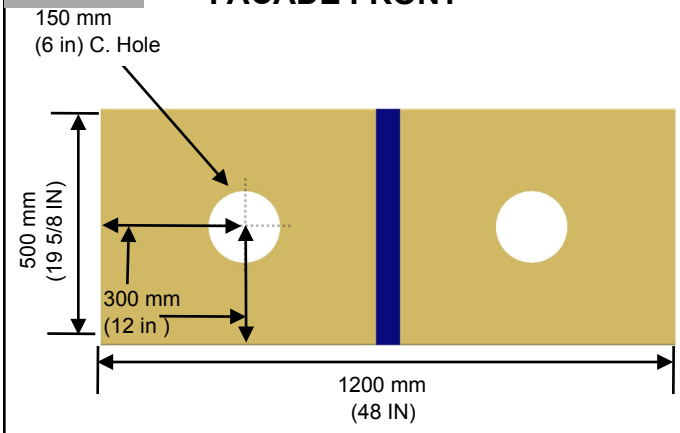
SHELF TOP



(H) Shelf
1200 x 1200 x 16 mm (48 x 48 x 5/8 in)

FIGURE F

FACADE FRONT



(I) Facade
1200 x 500 x 16 mm (48 x 19 5/8 x 5/8 in)

MANIPULATION: DIRECTED PERCEPTION TASKS: OPEN ACCESS Shelf/Façade

FABRICATION INSTRUCTIONS

Shelf

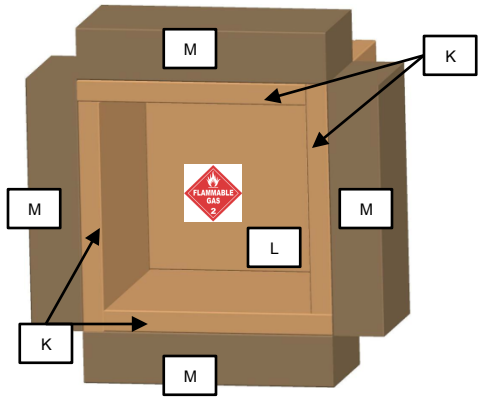
- Shelf is not attached to structure.
- Using a hole saw, drill four 150 mm (6 in) holes 300 mm (12 in) from both corners of shelf (E). See Figure J. Note: Holes on centered in quad.
- Duct tape quad pattern on OSB. Tape is centered. See Figure E.
- Repeat for additional shelf.

Façades

- Façades are attached to structure.
- Using a hole saw, drill two 150 mm (6 in) holes 300 mm (12 in) from both corners of façade (I). See Figure F.
- Duct tape stripe on OSB. Tape is centered. See Figure F.
- Repeat for additional facade.

FIGURE G

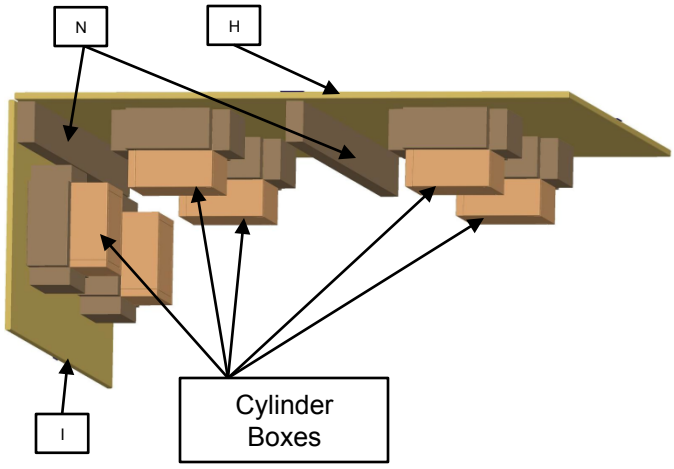
Cylinder Box



(K) Box Wall
166 x 166 x 16 mm (6 5/8 x 6 5/8 x 5/8 in)
(L) Box Bottom
182 x 182 x 16 mm (6 x 6 x 5/8 in)
(M) Box Support
50 x 100 x 182 mm (2 x 4 x 7 1/4in)

FIGURE H

Shelf with Cylinder Box



(H) Shelf
1200 x 1200 x 16 mm (48 x 48 x 5/8 in)
(I) Facade
1200 x 500 x 16 mm (48 x 19 5/8 x 5/8 in)
(N) Under Shelf Support
50 x 100 x 2400 mm (2 x 4 x 48 in)

MANIPULATION: DIRECTED PERCEPTION TASKS: OPEN ACCESS Shelf/Façade

FABRICATION INSTRUCTIONS (continued)

Cylinder Box (12ea)

- Cylinder boxes are attached to the underneath of the shelf and façade.
- Attach supports (M) to box walls (K) as shown in Figure G.
- Build box using four box walls (K) and one box bottom (L) as shown in Figure G.
- Center hazmat label to bottom of box as shown in Figure G.
- Attach cylinder box to shelf and façade as shown in Figure H.
- Attach under shelf supports (N) to shelf (H) flush with front and centered between holes has shown in Figure H.
- Attach façade (I) to front under shelf support (N) as shown in Figure H.

FIGURE A

HALF RAMP FULL RAMP

FULL RAMP ELEMENT (without sides) (15 DEGREE) (FOR MANIPULATION)

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [3] 2400 x 1200 x 19 mm (96 x 48 x 3/4 in)

  [3] 1237 x 1200 x 19 mm (49 1/2 x 48 x 3/4 in)-Surface (A)
- ❑ Solid wood posts cut to length with a 15° angle cut on one end (optional if clamping and gluing is possible)

  [2] 100 x 100 x 2400 mm (4 x 4 x 96 in)

  [6] 100 x 100 x 320 mm (4 x 4 x 12 13/16 in) – Top Post 15° cut (B)

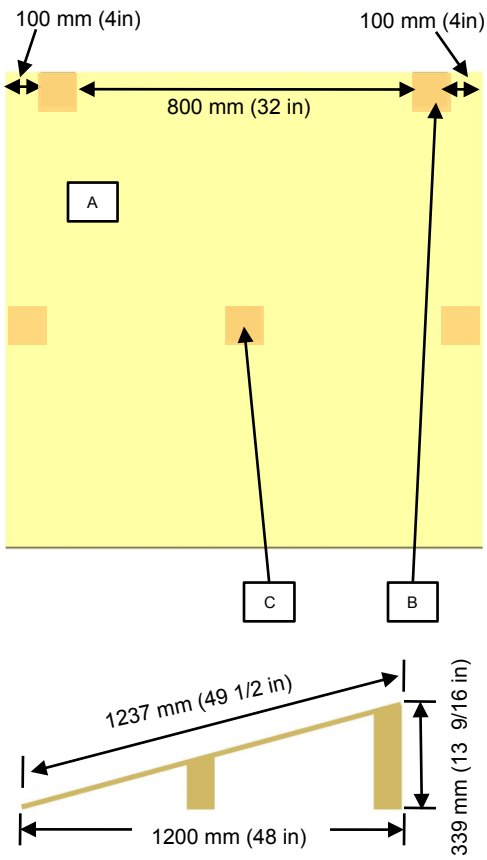
  [9] 100 x 100 x 160 mm (4 x 4 x 6 3/8 in) – Middle Post 15° cut (C)
- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 inch)

FABRICATION INSTRUCTIONS

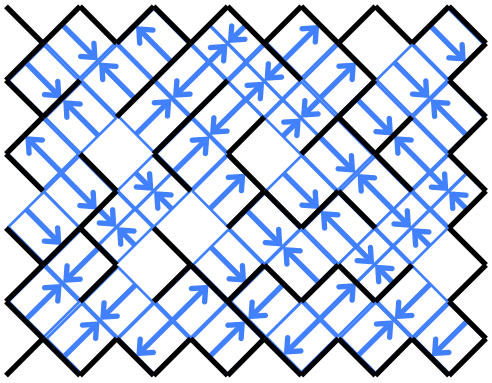
- Note that “Full Ramp” and “Half Ramp” elements have similar inclines but different cut dimensions as shown in Figure A .
- Lay out two top post (B) as shown in Figure B. Attach top post (B) to ramp surface (A).
- Lay out three middle posts (B) to ramp surface (A) as shown in Figure B. Note: Middle Post (B) should be flush with edge of ramp surface (A).
- Note: **Use rougher side up as the ramp surface if there is a difference in surface texture**.

FIGURE B Bottom View



(A) Ramp Surface
1237 x 1200 x 19 mm (49 1/2 x 48 x 3/4 in)
(B) Top Post 15° cut
100 x 100 x 320 mm (4 x 4 x 13 in)
(C) Middle Post 15° cut
100 x 100 x 160 mm (4 x 4 x 6 3/8 in)

FIGURE A



HUMAN-SYSTEM INTERACTION: NAVIGATION TASKS: RANDOM MAZES

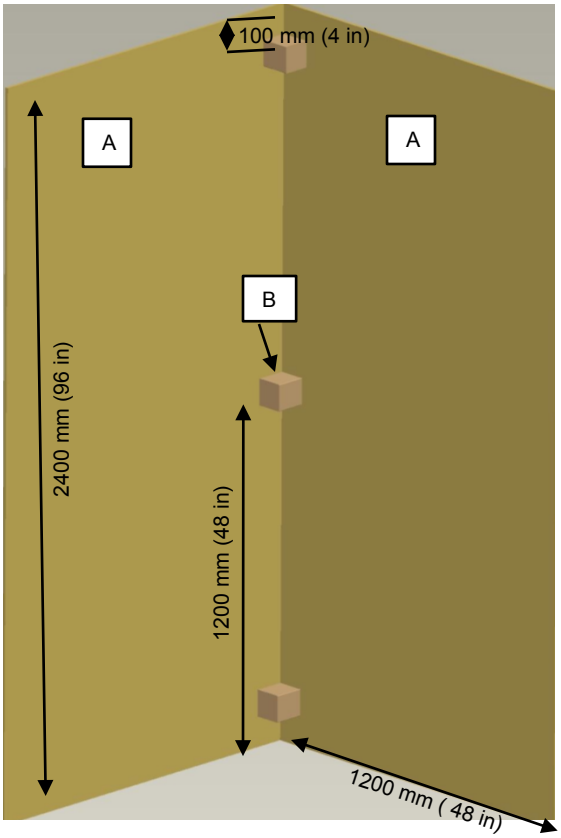
ELEMENTS

- ❑ [35] Maze Walls
- ❑ [30] Full Ramp Terrain Elements
- ❑ [20] Half Ramp Terrain Elements

FABRICATION INSTRUCTIONS

- Place the Maze Walls in the position of the apparatus to form 1200 mm (4 ft) hallways
- Insert the Full and Half Ramp Elements as shown in the Figure A
- **Note: For ease of fabrication build ramps first. Place walls and ramps as you build the maze**.

FIGURE B



(A) – Wall 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(B) – Block 100 x 100 x 90 mm (4 x 4 x 3 1/2 in

HUMAN-SYSTEM INTERACTION: NAVIGATION TASKS: RANDOM MAZES WALLS

PURCHASE/CUT LIST PER ELEMENT

❑ Oriented strand board (OSB) plywood panels

[70] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

[70] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in) – Wall (A)

❑ Solid wood posts cut to length (non pressure treated)

[8] 100 x 100 x 2400 mm (4 x 4 x 96 in)

[210] 100 x 100 x 90 mm (4 x 4 x 3 1/2 in) – Block (B)

❑ **Torx wood screws**

M5 x 40 mm (#10 x 1-1/2 in)

M5 x 80 mm (#10 x 2-1/2 in)

FABRICATION INSTRUCTIONS

- **Maze Wall**
- Attach two A panels using B as shown in Figure B. Blocks are 100 mm (4 in) from top and bottom of maze wall. Third block is centered at 1200 mm (48 in). Note: alignment of wall steam as shown in Figure C.

FIGURE C

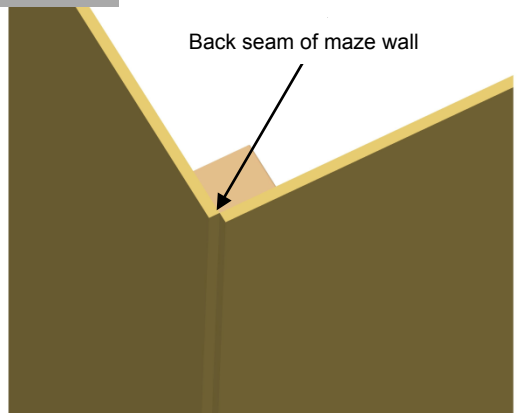


FIGURE A

HALF RAMP FULL RAMP

FULL RAMP ELEMENT (without sides) (15 DEGREE)

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [30] 2400 x 1200 x 19 mm (96 x 48 x 3/4 in)

  [30] 1237 x 1200 x 19 mm (49 1/2 x 48 x 3/4 in)-Surface (A)
- ❑ Solid wood posts cut to length with a 15° angle cut on one end (optional if clamping and gluing is possible)

  [13] 100 x 100 x 2400 mm (4 x 4 x 96 in)

  [50] 100 x 100 x 320 mm (4 x 4 x 12 13/16 in) – Top Post 15° cut (B)

  [60] 100 x100x 160 mm (4 x 4 x 6 3/8 in) – Middle Post 15° cut (C)
- ❑ **Torx wood screws**

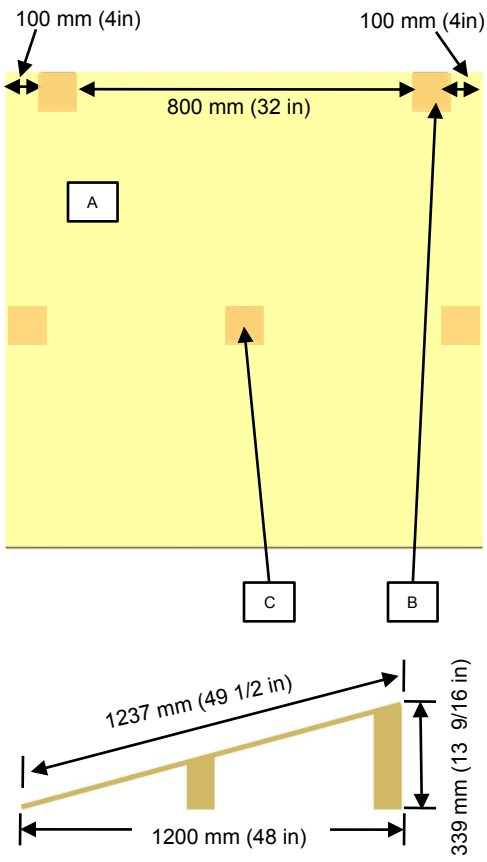
  M5 x 40 mm (#10 x 1-1/2 inch)

FABRICATION INSTRUCTIONS

- Note that “Full Ramp” and “Half Ramp” elements have similar inclines but different cut dimensions as shown in Figure A .
- Lay out two top post (B) as shown in Figure B. Attach top post (B) to ramp surface (A).
- Lay out three middle posts (B) to ramp surface (A) as shown in Figure B. Note: Middle Post (B) should be flush with edge of ramp surface (A).

. Note: **Use rougher side up as the ramp surface if there is a difference in surface texture**.

FIGURE B Bottom View



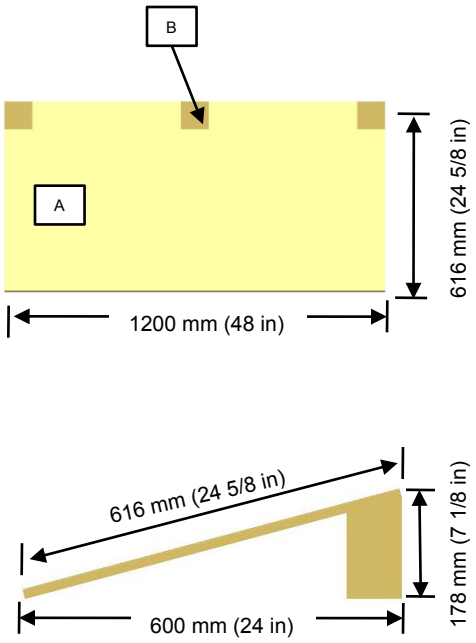
(A) Ramp Surface
1237 x 1200 x 19 mm (49 1/2 x 48 x 3/4 in)
(B) Top Post 15° cut
100 x 100 x 320 mm (4 x 4 x 13 in)
(C) Middle Post 15° cut
100 x 100 x 160 mm (4 x 4 x 6 3/8 in)

HALF RAMP ELEMENT (without sides) (15 DEGREE)

FIGURE A

HALF RAMP FULL RAMP

FIGURE B Bottom View



(A) Ramp Surface
616 x 1200 x 19 mm (24 5/8 x 48 x 3/4 in)

(B) Top Post 15° cut
100 x 100 x 160 mm (4 x 4 x 6 3/8 in)

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [20] 2400 x 1200 x 19 mm (96 x 48 x 3/4 in)
  [20] 616 x 1200 x 19 mm (24 5/8 x 48 x 3/4 in) – Surface (A)
- ❑ Solid wood posts cut to length with a 15° angle cut on one end (optional if clamping and gluing is possible)
  [5] 100 x 100 x 2400 mm (4 x 4 x 96 in)
  [60] 100 x 100 x 160 mm (4 x 4 x 6 3/8 in) – Top Post 15° cut (B)
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 inch)

FABRICATION INSTRUCTIONS

- Note that “Full Ramp” and “Half Ramp” elements have similar inclines but different cut dimensions as shown in Figure A .
- Lay out three top post (B) as shown in Figure B. Attach top post (B) to ramp surface (A).

Barrel on 1400 mm (48 in) maze wall

FIGURE A

MAPPING FIDUCIAL ELEMENT
1.2 METER WALLS

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [1] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
  [50] 200 x 200 x 11 mm (8 x 8 x 7/16 in) – Inside Barrel Support (A)

- ❑ **[10] 55 Gallon Barrels**

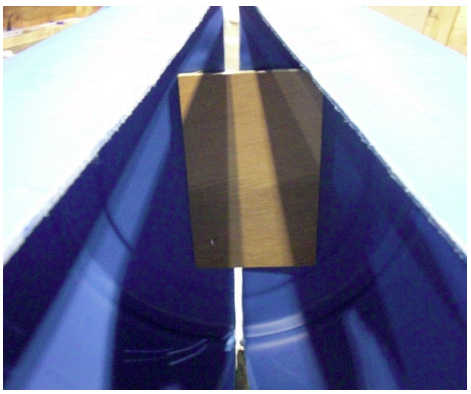
- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 inch)

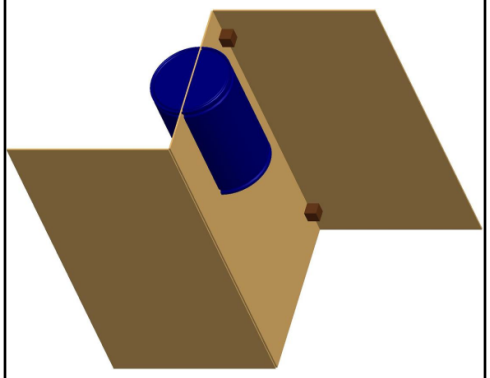
FABRICATION INSTRUCTIONS

- Cut barrel in half with circular saw as shown in Figure A. Cut the removable lid and attach to the barrel with duct tape if necessary to maintain cylindrical shape against crushing by robots.
- Attach inside board support (A) to inside the closed top surface leaving the thickness of a wall panel between the two barrel halves as shown in Figure B. NOTE: BOARD SHOUD BE ATTACHED TO THE BOTTOM OF THE BARREL. BARREL WILL BE HUNG UPSIDE DOWN.

NOTE: Both 1.2 mapping fiducial elements and 2.4 mapping fiducial element (high placement) uses the same fabrication instructions.

FIGURE B





High barrel placement on 2400 mm (96 in) maze wall

MAPPING FIDUCIAL ELEMENT
2.4 METER WALLS

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [1] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

  [50] 200 x 200 x 11 mm (8 x 8 x 7/16 in) – Inside Barrel Support (A)

- ❑ **[10] 55 Gallon Barrels**

- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 inch)

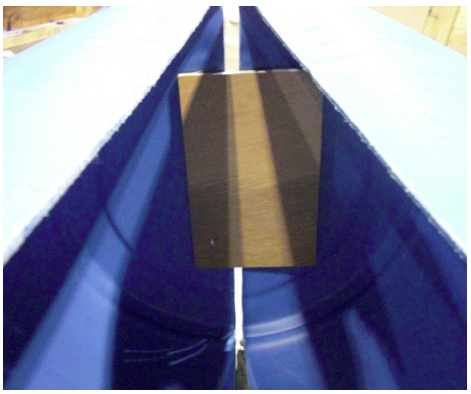
FIGURE A

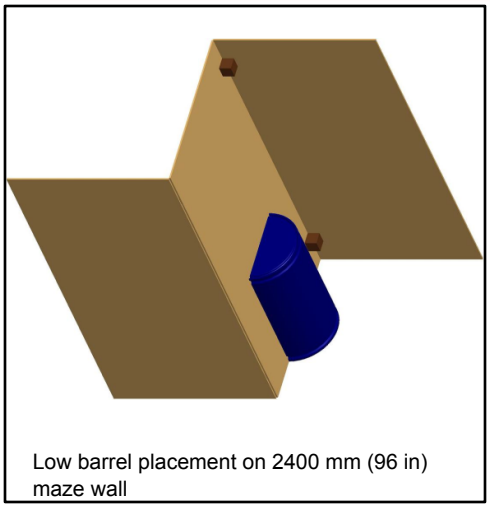
FABRICATION INSTRUCTIONS

- Cut the barrel in half with circular saw as shown in Figure A. Cut the removable lid and attach to the barrel with duct tape if necessary to maintain cylindrical shape against crushing by robots.
- Attach inside board support (A) to inside the closed top surface leaving the thickness of a wall panel between the two barrel halves as shown in Figure B. NOTE: BOARD SHOUD BE ATTACHED TO THE BOTTOM OF THE BARREL. BARREL WILL BE HUNG UPSIDE DOWN.

NOTE: Both 1.2 mapping fiducial elements and 2.4 mapping fiducial element (high placement) uses the same fabrication instructions.

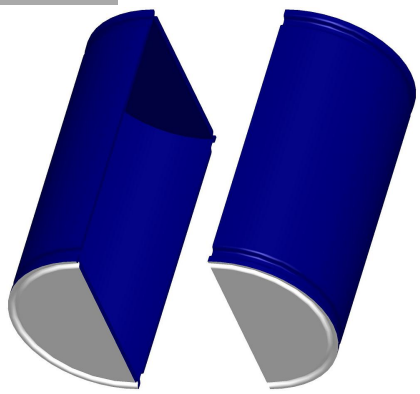
FIGURE B





Low barrel placement on 2400 mm (96 in) maze wall

FIGURE A



FIDUCIAL ELEMENT
2.4 METER WALLS

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels

  [1] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)

  [50] 200 x 200 x 11 mm (8 x 8 x 7/16 in) – Inside Barrel Support (A)

  [3] 50 x 100 x 2400 mm (2 x 4 x 96 in)

  [10] 50 x 100 x 300 mm (4 x 4 x 12 in) – Short Barrel Support (B)

  [10] 50 x 100 x 400 mm (4 x 4 x 16 in) – Long Barrel Support (C)

- ❑ **[10] 55 Gallon Barrels**

- ❑ **Torx wood screws**

  M5 x 40 mm (#10 x 1-1/2 inch)

FABRICATION INSTRUCTIONS

- Cut the barrel in half with circular saw as shown in Figure A. Cut the removable lid and attach to the barrel with duct tape if necessary to maintain cylindrical shape against crushing by robots.
- Attach short barrel support (B) to one side of wall such that barrel will clear flooring. Attach long barrel support (C) to backside of same wall and to ensure same elevation of barrel halves as shown in Figure B.

FIGURE B

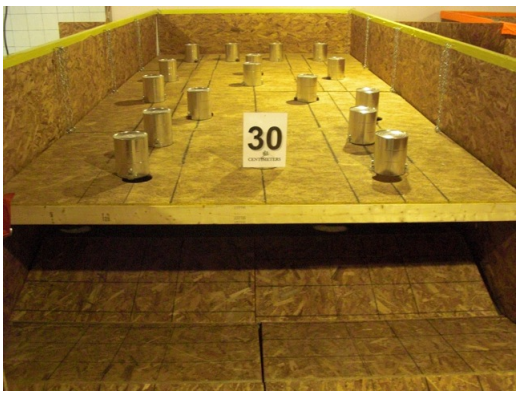
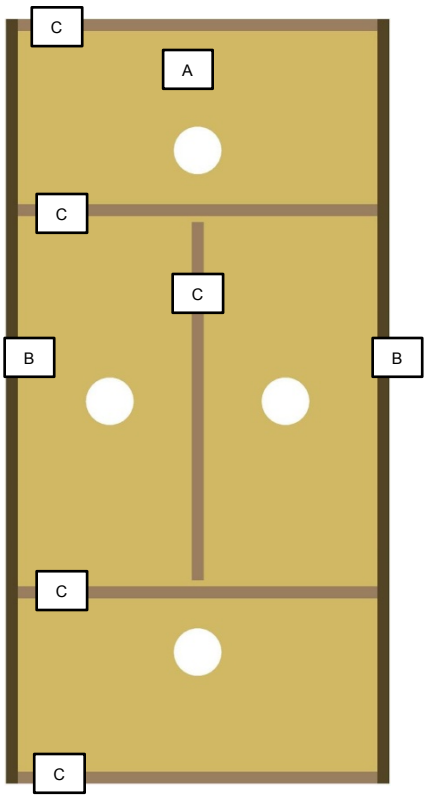


FIGURE A



(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(B) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(C) Support Stud
50 x 100 x 1143 mm (2 x 4 x 45 in)

HUMAN-SYSTEM INTERACTION: SEARCH TASKS: CONFINED SPACE VOIDS UNDERBODY SEARCH PANELS

MATERIALS PURCHASE AND CUT LIST PER ELEMENT

- ❑ Oriented strand board (OSB) plywood panels
  [2] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
  [2] 2400 x 1200 x 11 mm (96 x 48 x 7/16 in) – Panel (A)

- ❑ Solid wood posts cut to length (non pressure treated)
  [9] 50 x 100 x 2400 mm (2 x 4 x 96 in)
  [10] 50 x 100 x 1100 mm (2 x 4 x 45 in) – Support Studs (B)
  [4] 50 x 100 x 2400 mm (2 x 4 x 96 in) - Stud Plate (C)

- ❑ **Torx wood screws**
  M5 x 40 mm (#10 x 1-1/2 in)
  M5 x 80 mm (#10 x 2-1/2 in)

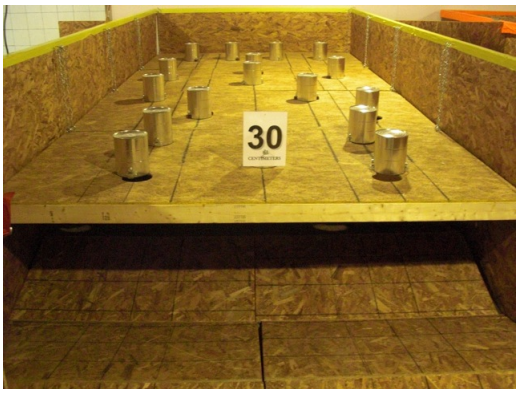
- ❑ **[8] Paint cans to cover holes**

NOTE: CONSTRUCTION OF PANELS ONLY. PANELS WILL BE PLACED IN ORANGE OR RED ARENA BAYS

FABRICATION INSTRUCTIONS – Underbody Search Panel - Diamond

- Drill 150 mm (6” in) through holes in pattern as shown in Figure A.
- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 2400 mm (96 in) on center. Attach OSB wall panel (A) to stud frame as shown in Figure A.
- Attach three additional support stud (C) to complete pattern on OSB.

.

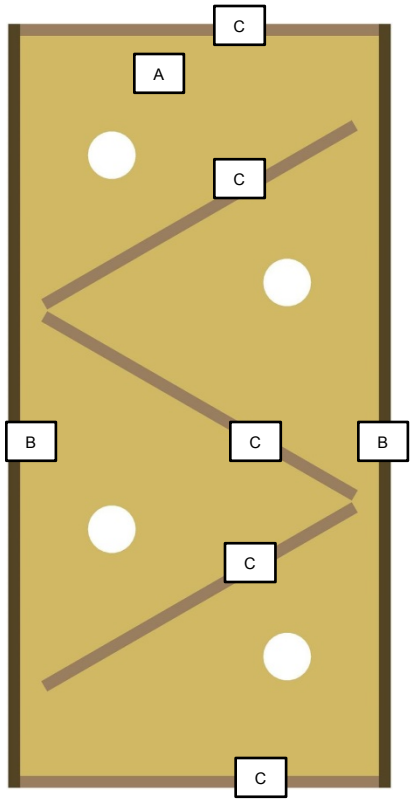


HUMAN-SYSTEM INTERACTION: SEARCH TASKS: CONFINED SPACE VOIDS UNDERBODY SEARCH PANELS

FABRICATION INSTRUCTIONS – Underbody Search Panel - parallelogram

- Drill 150 mm (6” in) through holes in pattern as shown in Figure A.
- Lay out two stud plates (C) 1100 mm (45 in) from each other such that post are on edge. Attach support studs (B) to stud plates as shown in Figure A. Studs are 2400 mm (96 in) on center. Attach OSB wall panel (A) to stud frame as shown in Figure A.
- Attach three additional support stud (C) to complete pattern on OSB.

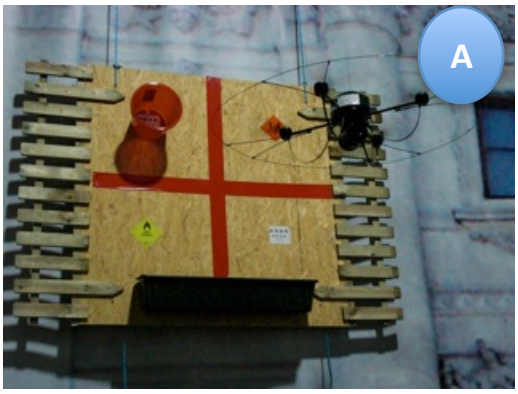
FIGURE A

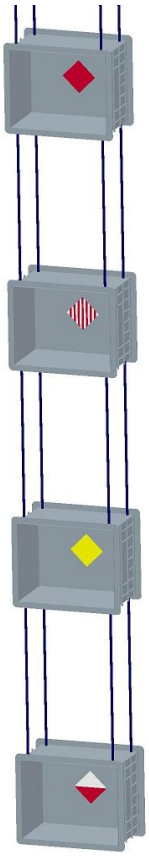


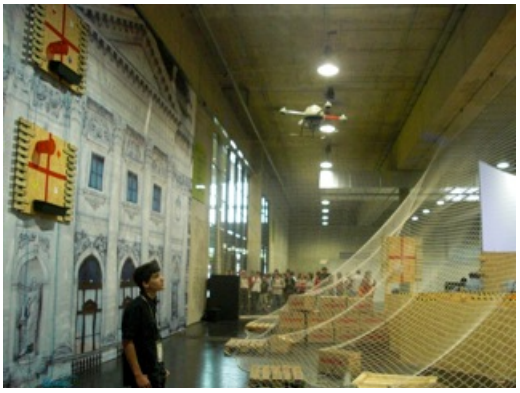
(A) Wall Panel
2400 x 1200 x 11 mm (96 x 48 x 7/16 in)
(B) Stud Plate
50 x 100 x 2400 mm (2 x 4 x 96 in)
(C) Support Stud
50 x 100 x 1143 mm (2 x 4 x 45 in)

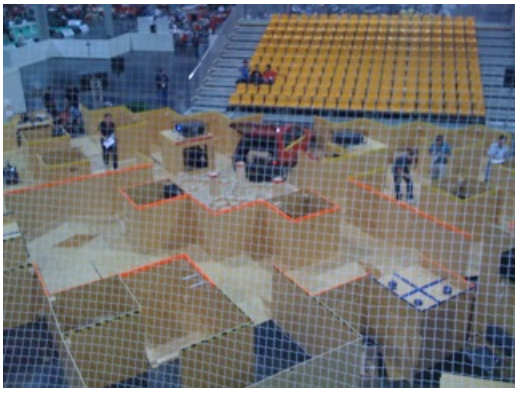
(A) Fake window targets for aerials, with wood backboard, fake shutters of some kind, 1 gallon paint cans like we use everywhere else and (4) box window fans to provide wind effects indoors:

(B) Crates with targets for aerials, with eye charts or hazmat labels. Rope to hang









Golf driving range netting to go between the arenas and the audience (not as shown here where it was behind thearena) and from ceiling to floor (or just above the arena walls). Almost any mesh net will suffice to keep flyers weighing no more than 2 kg (4 lbs) from leaving the arena.

“Crop" or "bird" netting that might suffice and is very cheap! 17ft x 100ft = $70. Two of these would wrap entirely around our arena. If the ceilings are no more than say 21 - 24ft they would hang to 1.2m (6ft) from the floor to the tops of our walls. http://www.vineyardbirdnetting.com/priceorder.php

- ❑ [20] Human form
  - ❑ [20] Babies (1/2 with motion)

- ❑ Plastic Crates
  - ❑ [20] Plastic crates rough dimension 60 cm length x 40 cm width x 20 cm depth

- ❑ Heat
  - ❑ [20] Heating pads 60 cm in size or to cover the entire inside of the crate

- ❑ Co2
  - ❑ [100] 12gm threaded cartridges (bike tire inflation
  - ❑ [2] puncture device

- ❑ Sound
  - ❑ [20] Mp3 Players
  - ❑ USB charging station for 20 devices
  - ❑ [20] Battery operated speakers
  - ❑ [100] AA batteries

- ❑ Cordless drills and accessories
  - ❑ [5] Cordless drills
  - ❑ [5] Battery chargers
  - ❑ [10] Total batteries

- ❑ [2] Corded drill

- ❑ [1] Circular Saw

- ❑ Drill sets
  - ❑ Typical size drill bits
  - ❑ Nut drivers
  - ❑ Torx/Star bit sets
  - ❑ Screw Driver bits

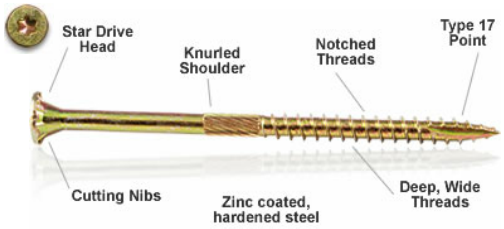
- ❑ Paddle Bit Set
  - ❑ [3] 1- 4cm (1/2 - 1.5 in)

- ❑ Hole saw
  - ❑ [3] 15 cm (6 in) diameter
  - ❑ [3] 5 cm (2 in) diameter

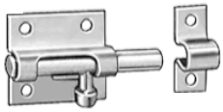
- ❑ Tape Measure
  - ❑ [2] 30m/100ft tape measure
  - ❑ [4] 8m/25ft tape measure

- ❑ Cable Ties
  - ❑ [200] Various sizes
  - ❑ [5] Cable tie cutters

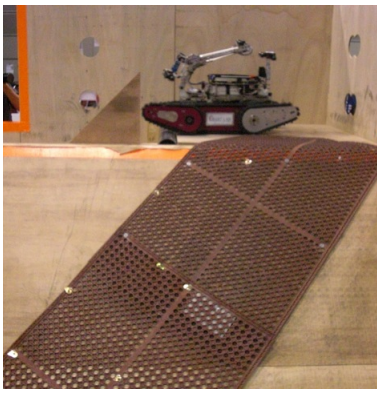
- ❑ Duct tape
  - ❑ [5] Rolls of Safety Yellow duct tape
  - ❑ [5] Rolls of Safety Orange duct tape
  - ❑ [5] Rolls of Safety Red duct tape
  - ❑ [5] Rolls of Blue duct tape
  - ❑ [5] Rolls of Black /Yellow diagonal stripe tape



- ❑ Star/Torx bit screws
  - ❑ [500] 12 mm (½) long
  - ❑ [500] 40 mm (1 1/2 in) long
  - ❑ [500] 60 mm (2 ½ in) long
  - ❑ [20] Matching star/torx bits for each size



- ❑ Hardware
  - ❑ [4] Gate Latches 100 mm (4 in)
  - ❑ [4] Hinges 100 mm (4 in)



- ❑ Fiction Surface for Ramp
  - ❑ [1] rubber matting 1 x 2.6 m (36 x 102 in)

- ❑ Color printer and copier with supplies
  - ❑ [1] Color inkjet printer/copier
  - ❑ USB and power cables
  - ❑ Printer driver software
  - ❑ [2] Spare paper packs
  - ❑ [2] Spare ink colors and black

- ❑ Briefing/planning/task list support
  - ❑ [3] Dry erase whiteboards
  - ❑ [3] Sets of markers/erasers

- ❑ Office supplies
  - ❑ [2] Stapler, staples,
  - ❑ [2] scissors
  - ❑ [1] 3-hole punch
  - ❑ [5] Scotch (clear) tape
  - ❑ [10] Pencils
  - ❑ [100] paper clips
  - ❑ [10] Black permanent Sharpie Markers

- ❑ AV equipment
  - ❑ [2] Large LCD display
  - ❑ [2] VGA cable extension (5m)
  - ❑ [2] Projector [1]
  - ❑ [6] Pan Security Camera
  - ❑ [2] Projection Screens 4m
  - ❑ Ability to switch between the cameras

- ❑ Cat Walk
  - ❑ [2]

Additional lumber (approximate equivalents size)

5	sheets of 19mm OSB
15	sheets of 11mm OSB
20	50 x 100 x 2400 post