

2/20/2019



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## ***Acknowledgements***

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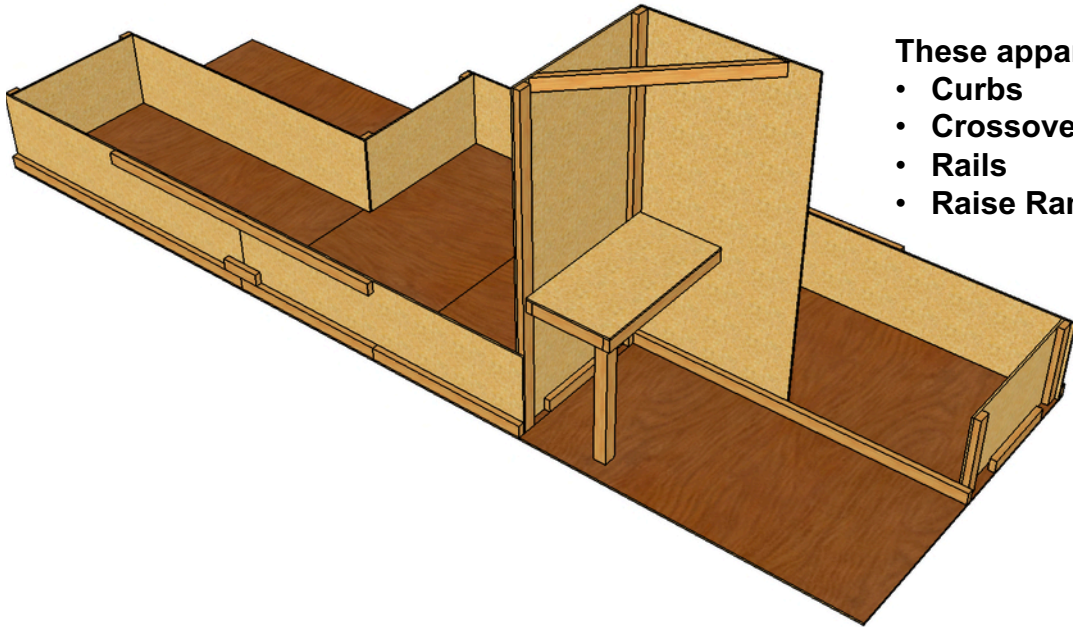
Dozens of people have contributed to the development and validation of these test methods. They include FEMA urban search and rescue task force teams, firefighters, law enforcement, collaborating test facilities, other civilian and military organizations, and commercial manufacturers.

## ***Disclaimer***

Commercial equipment shown in this document are for illustrative purposes only. This does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the products identified are necessarily the best available for the purpose.

# Containment

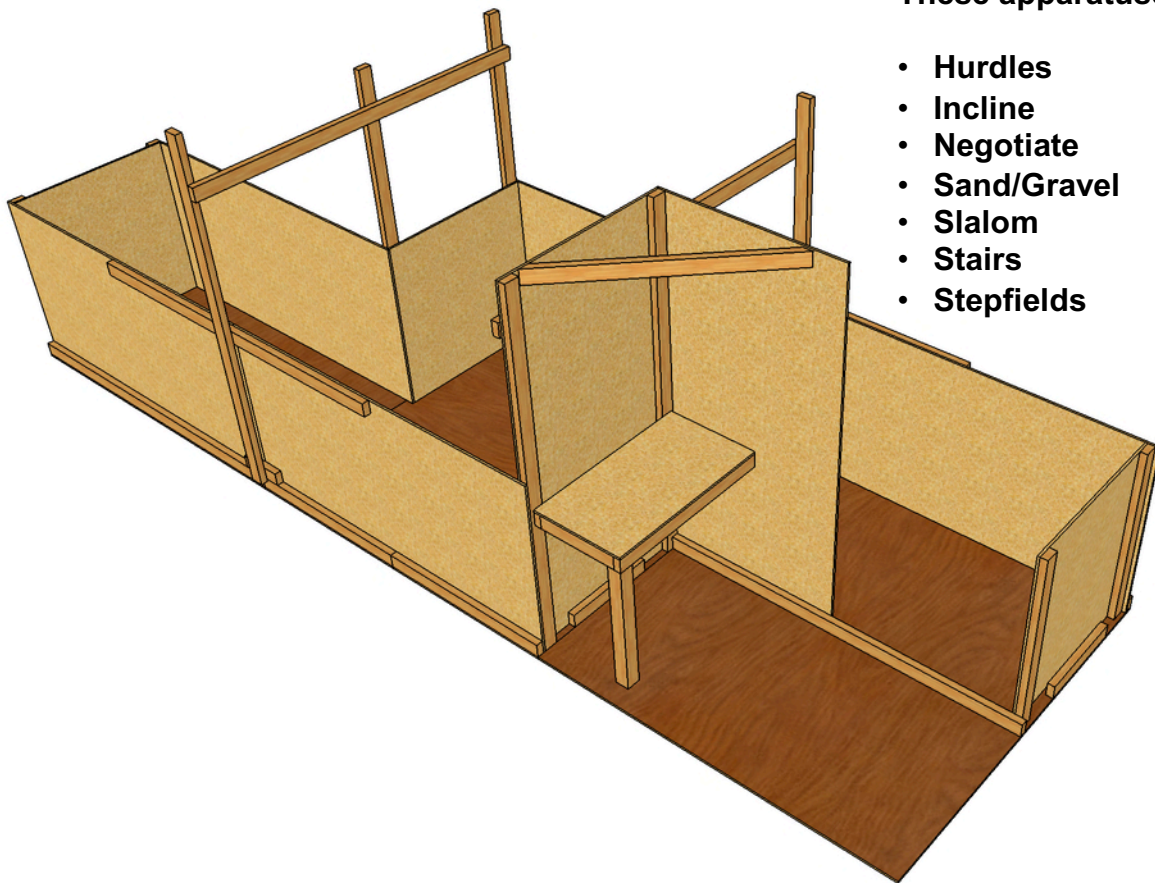
Short Wall Bay - 4



**These apparatuses use this bay**

- Curbs
- Crossover Ramps
- Rails
- Raise Ramps

Regular Wall Bay/with super structure - 7

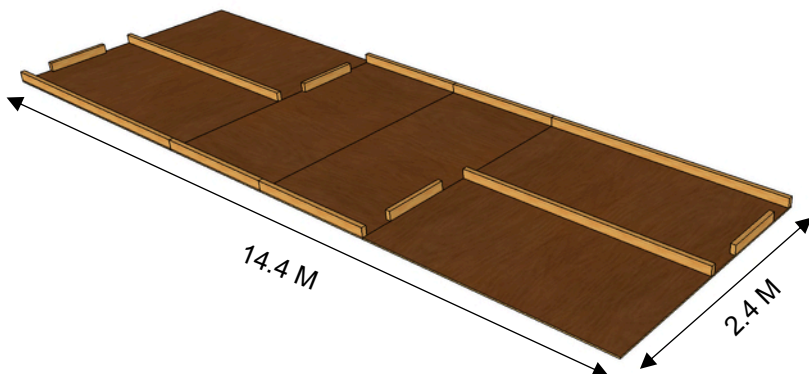


**These apparatuses use this bay:**

- Hurdles
- Incline
- Negotiate
- Sand/Gravel
- Slalom
- Stairs
- Stepfields



## Containment – Trays (11 bays (6 trays per bay))



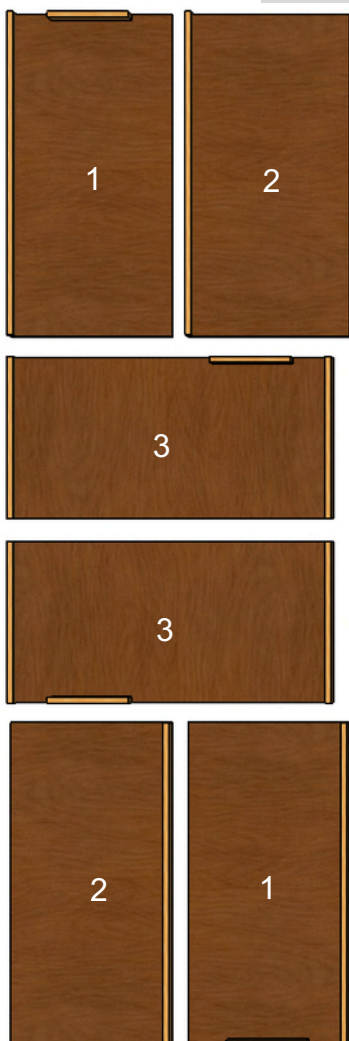
### **PURCHASE LIST:**

- ☐ [66] 1200 x 2400 x 15 mm OSB
- ☐ [77] 45 x 70 x 2400 mm post

### **CUT LIST:**

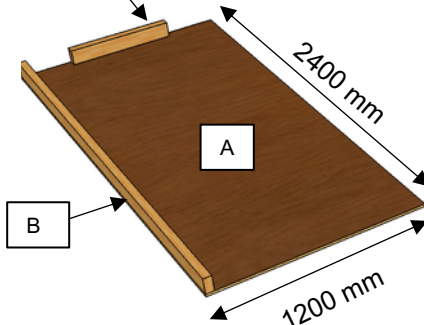
- ☐ [66] 1200 x 2400 x 15 mm OSB **(A)**
- ☐ [44] 45 x 90 x 2400 Post **(B)**
- ☐ [44] 45 x 90 x 1200 Post **(C)**
- ☐ [44] 45 x 90 x 600 Post **(D)**

**FIGURE A**



**D**

Note: Post D is centered on Panel 1



**FIGURE B**

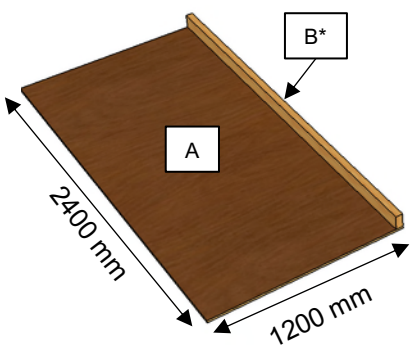
Panel 1 (22)

### **Fabrication**

- **There are 3 “types” of floor panels**
- Attach post: B/C/D on edge to panel A as shown in **Figure B, C, D**.
- **Note: Post D is centered on Panel 1**
- **Note: Post D on Panel 3 is 600 mm from edge.**

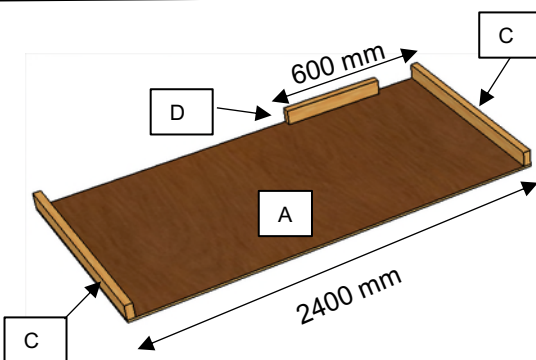
**FIGURE B**

Panel 1 (22)



**FIGURE C**

Panel 2 (22)



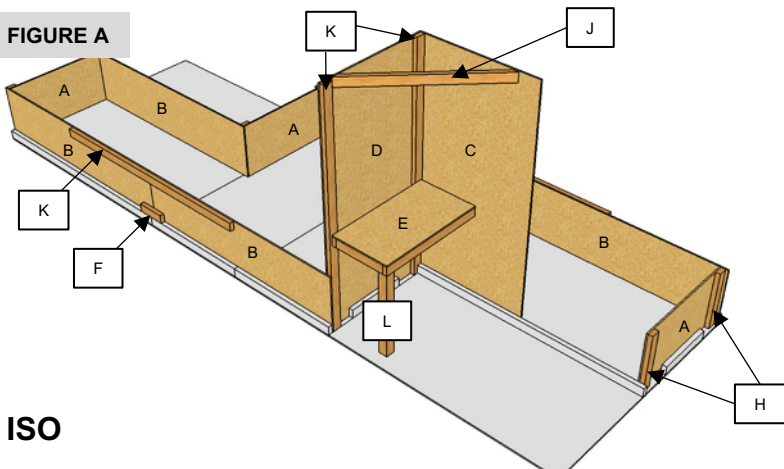
**FIGURE D**

Panel 3 (22)



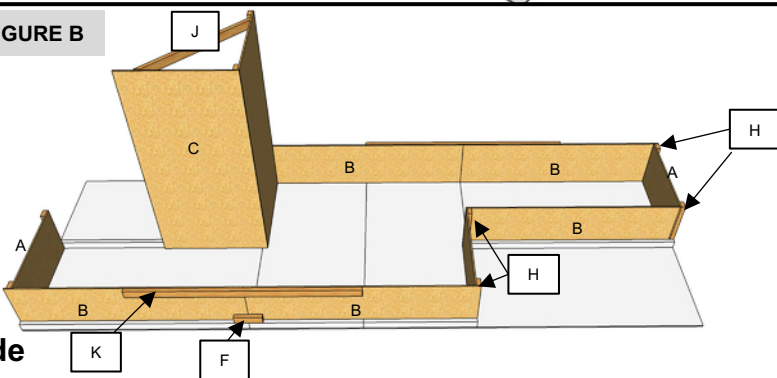
## Containment – Walls ( 4 bays)

**FIGURE A**



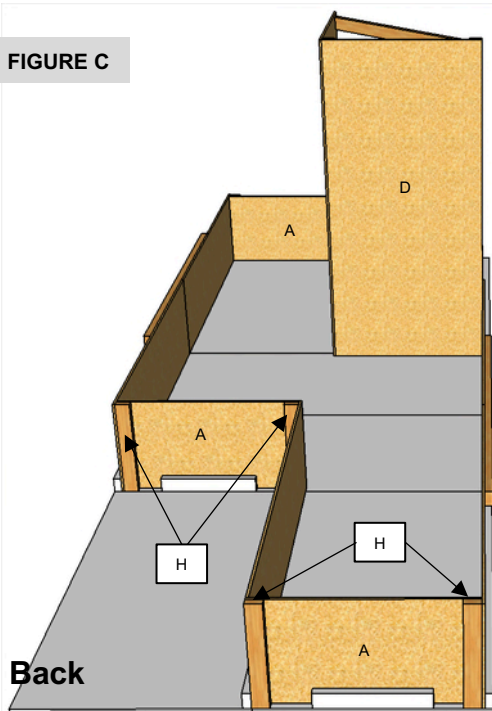
ISO

**FIGURE B**



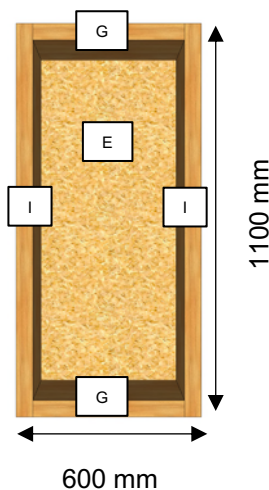
Side

**FIGURE C**



Back

**FIGURE D**



Desk

### PURCHASE LIST:

- ❑ [24] 1200 x 2400 x 15 mm OSB
- ❑ [36] 45 x 90 x 2400 mm Post
- ❑ [2] 90 x 90 x 2400 mm Post

### CUT LIST:

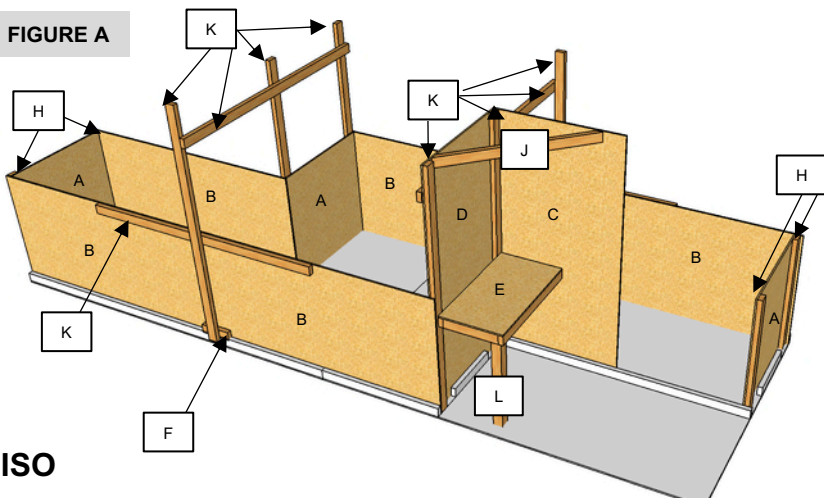
- ❑ [12] 600 x 1140 x 15 mm short wall (A)
- ❑ [20] 600 x 2400 x 15 mm long wall (B)
- ❑ [4] 1200 x 2400 x 15 mm long wall (op) (C)
- ❑ [4] 1140 x 2400 x 15 mm short wall (op) (D)
- ❑ [4] 600 x 1100 x 15 mm desk top (E)
- ❑ [8] 45 x 90 x 300 mm Post (F)
- ❑ [8] 45 x 90 x 510 mm Post (G)
- ❑ [24] 45 x 90 x 600 mm Post (H)
- ❑ [8] 45 x 90 x 1100 mm Post (I)
- ❑ [4] 45 x 90 x 1400 mm Post (J) **45° Mitre cut long to long point**
- ❑ [16] 45 x 90 x 2400 mm Post (K)
- ❑ [4] **90 x 90 x 1000 mm Post 45 (L)**

### Fabrication

- Attach wall panels and posts as shown in **Figure A/B/C**.
- **NOTE: Post H should be attached to Panel A before attaching to Panel B.**
- Attach bracing as shown in **Figure A/B/C**
- Fabricate desk top as shown in **Figure D** and place as shown in **Figure A**.

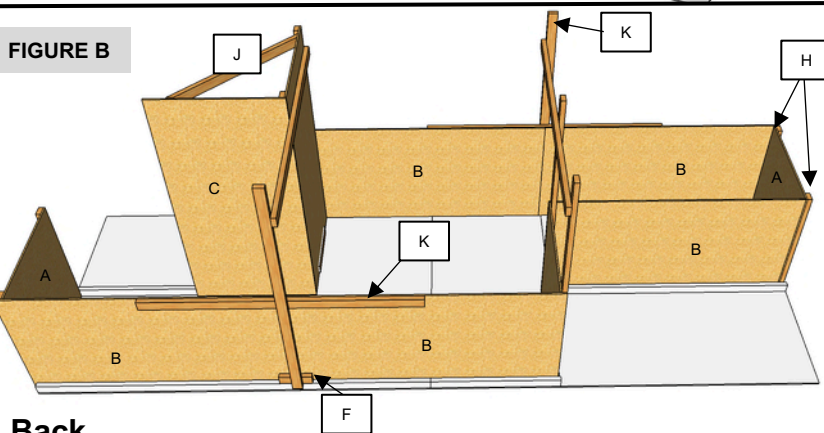
## Containment – Walls (7 bays)

**FIGURE A**



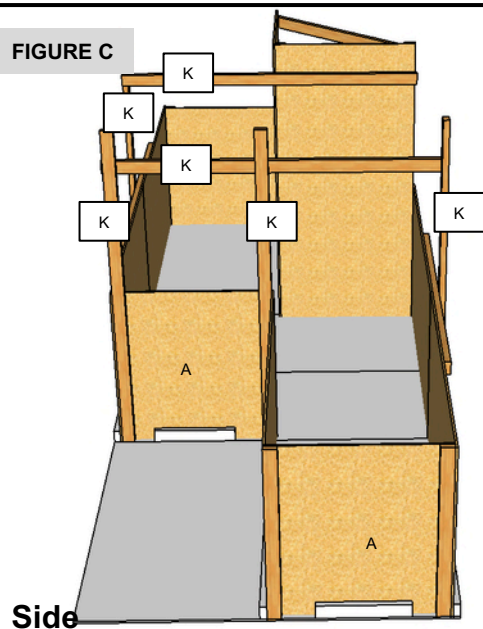
ISO

**FIGURE B**



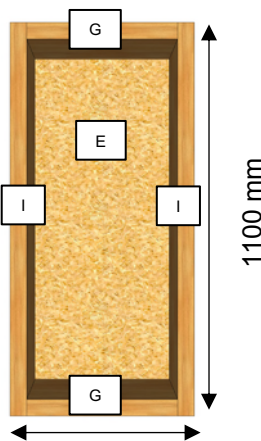
Back

**FIGURE C**



Side

**FIGURE D**



Desk

### **PURCHASE LIST:**

- ☐ [72] 1200 x 2400 x 15 mm OSB
- ☐ [112] 45 x 90 x 2400 mm Post
- ☐ [4] 90 x 90 x 2400 mm Post

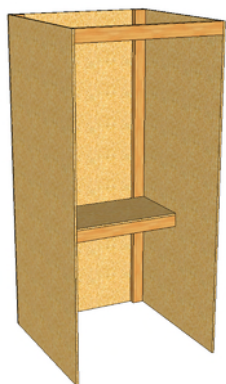
### **CUT LIST:**

- ☐ [21] 1200 x 1140 x 15 mm short wall (**A**)
- ☐ [35] 1200 x 2400 x 15 mm long wall (**B**)
- ☐ [7] 1200 x 2400 x 15 mm long wall op (**C**)
- ☐ [7] 1140 x 2400 x 15 mm short wall op (**D**)
- ☐ [7] 600 x 1100 x 15 mm desk top (**E**)
- ☐ [14] 45 x 90 x 300 mm Post (**F**)
- ☐ [14] 45 x 90 x 510 mm Post (**G**)
- ☐ [28] 45 x 90 x 1200 mm Post (**H**)
- ☐ [14] 45 x 90 x 1100 mm Post (**I**)
- ☐ [7] 45 x 90 x 1400 mm Post (**J**) **45° Mitre cut long to long point**
- ☐ [70] 45 x 90 x 2400 mm Post (**K**)
- ☐ [7] **90 x 90 x 1000 mm Post 45 (L)**

### **Fabrication**

- Attach wall panels and posts as shown in **Figure A/B/C**.
- **NOTE: Post H should be attached to Panel A before attaching to Panel B.**
- **NOTE: Post F and K (on the horizontal wall) should be attached before vertical post K.**
- Attach bracing as shown in **Figure A/B/C**
- Fabricate desk top as shown in **Figure D** and place as shown in **Figure A**.

## Operator Booth (9)



### PURCHASE LIST:

- ❑ [56] 1200 x 2400 x 15 mm OSB
- ❑ [68] 45 x 90 x 2400 in post

### CUT LIST:

- ❑ [18] 1200 x 2400 x 15 mm - Wall Panel Side(A)
- ❑ [9] 1140 x 2400 x 15 mm - Wall Panel Back (B)
- ❑ [18] 45 x 90 x 2400 mm – Post (C)
- ❑ [9] 600 x 1100 x 15 mm - Shelf (D)
- ❑ [9] 45 x 90 x 1100 mm - Brace (E)
- ❑ [18] 45 x 90 x 1100 mm - Shelf Support Long (F)
- ❑ [18] 45 x 90 x 510 mm - Shelf Support (G)

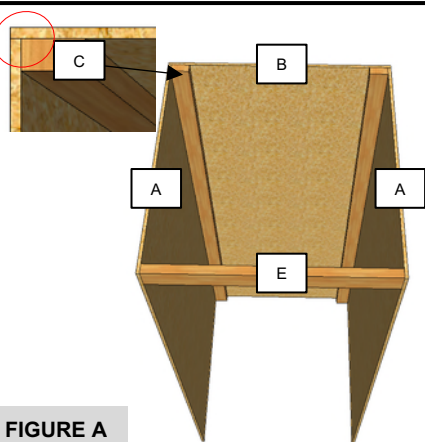


FIGURE A

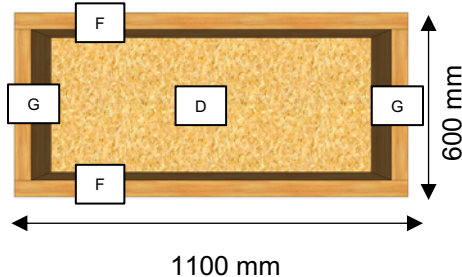


FIGURE B

### Fabrication

- Attach OSB panels A, B shown in Figure A.
- Attach cross brace as shown in Figure A.
- Lay out two Shelf support long (F) 510 mm from each other such that post are on edge. Attach Shelf support short (G) to stud plates as shown in Figure B. Attach OSB panel (D) to stud frame.
- Install shelf unit into operator station . Shelf height is 1000 mm from floor as shown in Figure C.

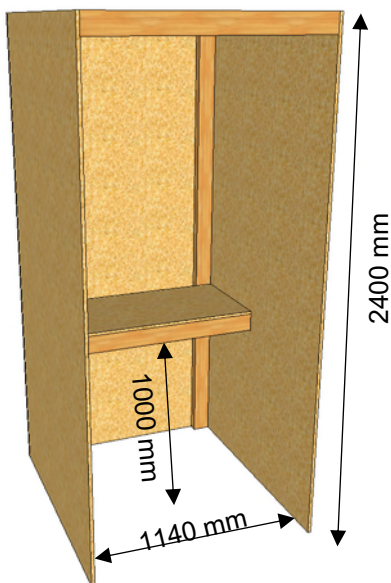
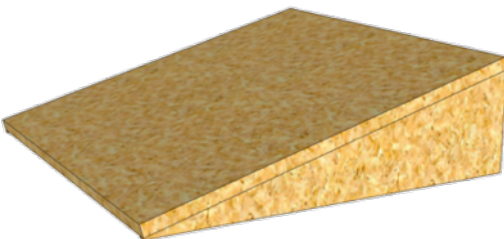


FIGURE C



## Ramps - 220

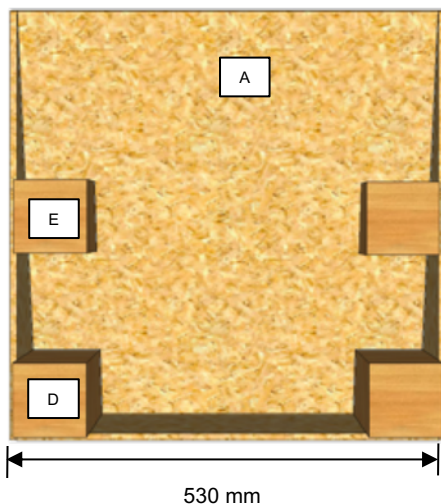
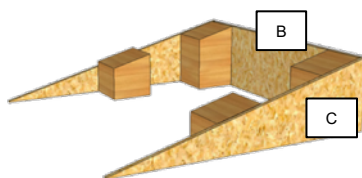
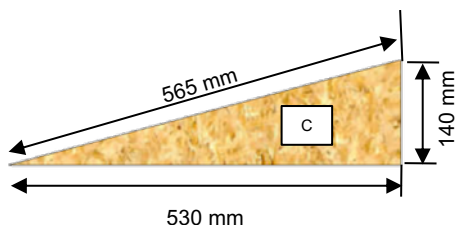


### PURCHASE LIST:

- ☐ [62] 1200 x 2400 x 19 mm OSB
- ☐ [46] 90 x 90 x 2400 mm in post

### CUT LIST:

- ☐ [220] 550 x 565 x 19 mm OSB (top) (A)
- ☐ [220] 140 x 550 x 19 mm OSB (back) (B)
- ☐ [440] 140 x 530 x 19 mm OSB triangle (sides) (C)
- ☐ [440] 90 x 90 x 140 mm Post **15° Mitre cut sq. to long point** (back legs) (D)
- ☐ [440] 90 x 90 x 60 mm Post **15° Mitre cut sq. to long point** (front legs) (E)

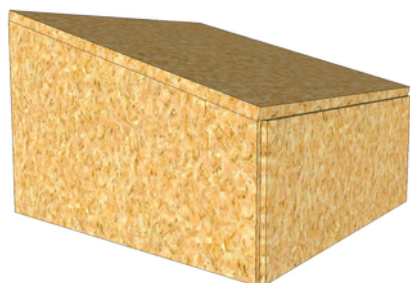


### Ramp Fabrication

- Place triangles (C) flatly on the floor. Attach one top post (E) to support triangle (C) and repeat for additional **side as shown in Figure A**. Note: Posts will be flush with the top of support triangle (C).
- Attach Front Leg (E) as shown in **Figure A**.
- Attach ramp surface (A) to support triangles (C). **Note: Use rougher side up as the ramp surface if there is a difference in surface texture.**
- Attach back plate (B) to high side of ramp as shown in **Figure A**.

FIGURE A

## Tall Ramps - 4



### PURCHASE LIST:

- ☐ [3] 1200 x 2400 x 19 mm OSB
- ☐ [3] 90 x 90 x 2400 mm in post

### CUT LIST:

- ☐ [4] 550 x 565 x 19 mm OSB (top) (A)
- ☐ [4] 550 x 380 x 19 mm OSB (back) (B)
- ☐ [8] 380 x 530 x 220 x 19 mm OSB triangle (sides) (C)
- ☐ [4] 235 x 512 x 19 mm OSB (front) (D)
- ☐ [8] 90 x 90 x 380 mm Post **15° Mitre cut sq. to long point** (back legs) (E)
- ☐ [8] 90 x 90 x 260 mm Post **15° Mitre cut sq. to long point** (front legs) (F)

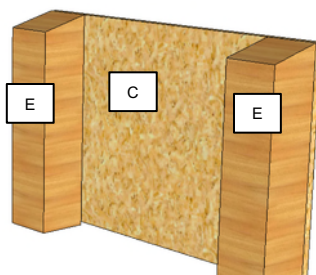
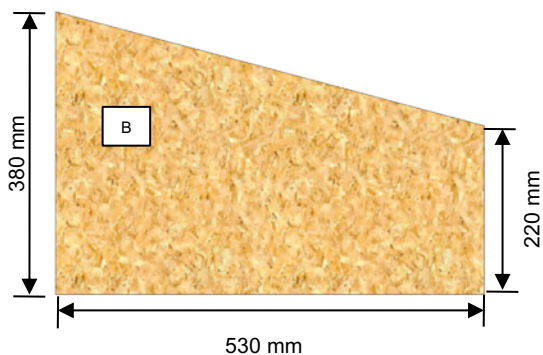


FIGURE A

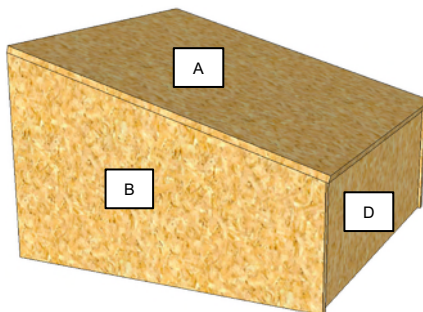
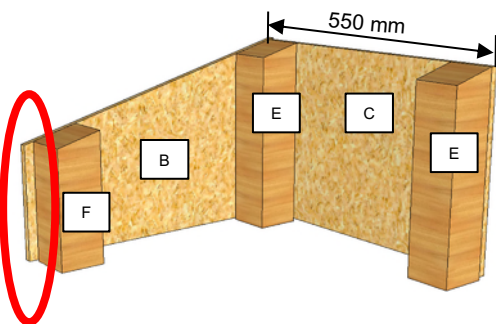


FIGURE B

### Ramp Fabrication

- Cut out (8) sides as shown in **Figure A**.
- Attach back plate C to Post E as shown in **Figure A**.
- Attach side B to Post E as shown in **Figure B**
- Attach post F as shown in **Figure B** . Repeat for additional side.  
**NOTE: Inset post F by 25mm (1 in).**
- Attach front plate D to post F as shown in **Figure B**.
- **Attach ramp surface (A). Note: Use rougher side up as the ramp surface if there is a difference in surface texture.**

## Maze Wood

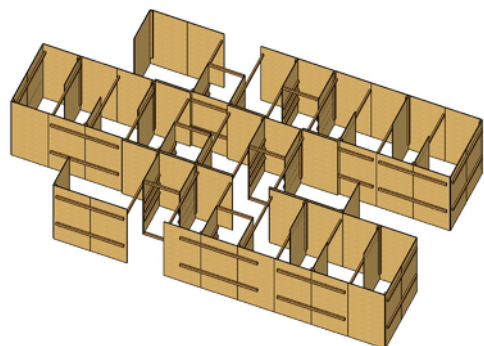
### PURCHASE LIST:

- ☐ [75] 1200 x 2400 x 11 or 15 mm OSB
- ☐ [147] 45 x 90 x 2400 mm in post

### CUT LIST:

- ☐ [75] 1140 x 2400 x 11 or 15 mm OSB
- ☐ [18] 45 x 90 x 2400 mm Post (Green)
- ☐ [24] 45 x 90 x 2280 mm Post (Orange)
- ☐ [57] 45 x 90 x 2100 mm Post (Green)
- ☐ [48] 45 x 90 x 1100 mm Post (Black)

**Cut down maze walls KEEP scrap wood for padding.**



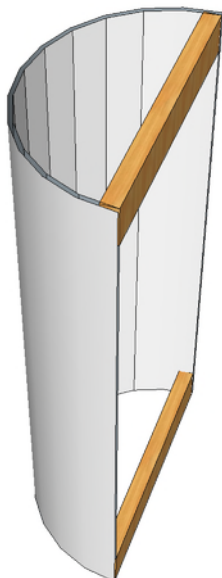
- To be constructed on site.



**Cut down maze walls KEEP scrap wood for padding.**



## Victim Fidcials (40 halves)

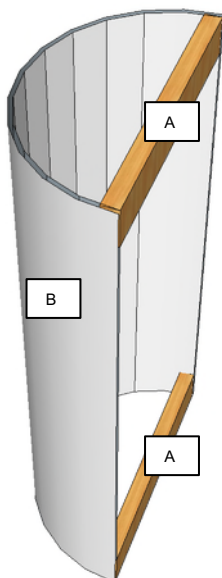
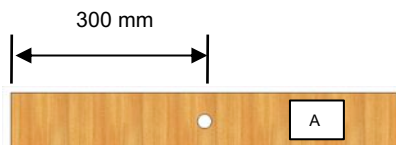


### PURCHASE LIST:

- ☐ [20] 45 x 90 x 2400 mm in post
- ☐ [20] 600 ID x 1200 mm Concrete Form

### CUT LIST:

- ☐ [80] 45 x 90 x 600 mm Post (A)
- ☐ [20] 600 ID x 1200 mm Concrete Form (B)



**FIGURE A**

### Fabrication

#### **FABRICATION INSTRUCTIONS – Barrels**

- Cut concrete form in half lengthwise

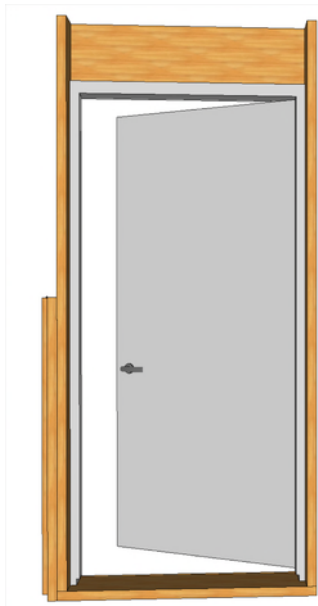
#### **FABRICATION INSTRUCTIONS – Barrel Braces**

- Drill 1/4 in thru hole centered in barrel braces as shown in Figure A. Repeat for additional 39.

#### **FABRICATION INSTRUCTIONS – Barrel halves**

- Attach braces as shown in Figure B. Repeat for additional 39 halves.

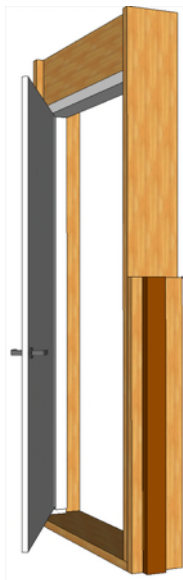
## Doors



### PURCHASE LIST:

- ☐ [1] Right Hung Door
- ☐ [1] Left Hung Door
- ☐ [12] 45 x 250 x 2500 mm post
- ☐ [4] 45 x 90 x 2400 mm post
- ☐ [4] Lever style handles
- ☐ [2] Door Closers

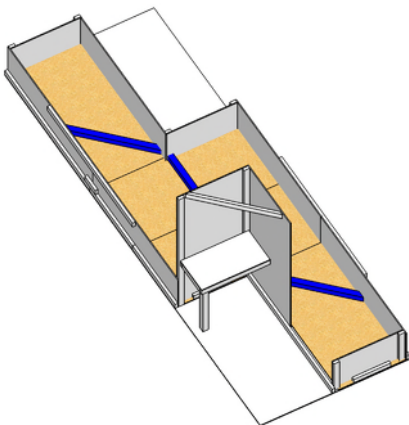
<https://www.amazon.com/ryobi-doorman-door-closer-dm85d/dp/b0053xz1o4>



### Fabrication

#### Fabrication on-site

## Curbs



### PURCHASE LIST:

- ☐ [4] 1200 x 2400 x 15 mm OSB
- ☐ [2] 90 x 90 x 2400 mm Post

### CUT LIST:

- ☐ [2] 1100 x 2200 x 15 mm OSB (A)
- ☐ [2] 1100 x 2400 x 15 mm OSB (B)
- ☐ [2] 90 x 90 x 1510 mm Post (C) **45° Mitre cut long to short point**
- ☐ [2] 90 x 90 x 1100 mm Post (D)

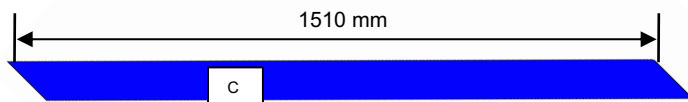


FIGURE A

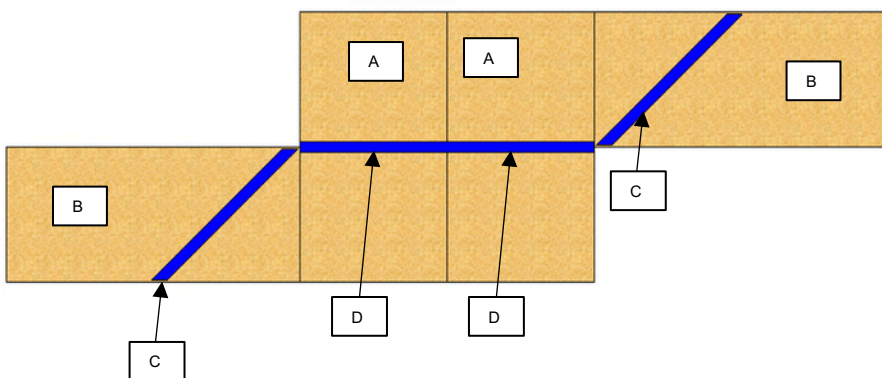


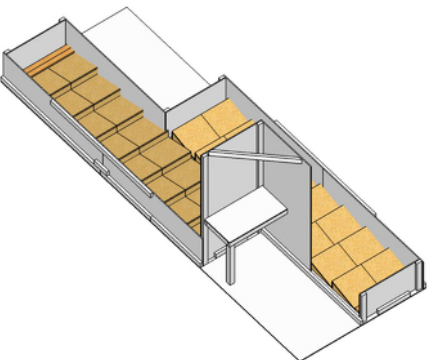
FIGURE B

### Fabrication

- Cut (2) post C as shown in **Figure A**.
- Attach OSB Panels A/B to Posts C/D as shown in **Figure B**.



## Crossover Ramps



### PURCHASE LIST:

- ☐ [2] 45 x 90 x 2400 mm post

### CUT LIST:

- ☐ [4] 45 x 90 x 1100 post (A)
- ☐ [32] ramps from Pg. 9 (B)

### Fabrication

- Arrange ramps B as shown in **Figure A**.
- Add spacer as shown in **Figure A**. spacer.

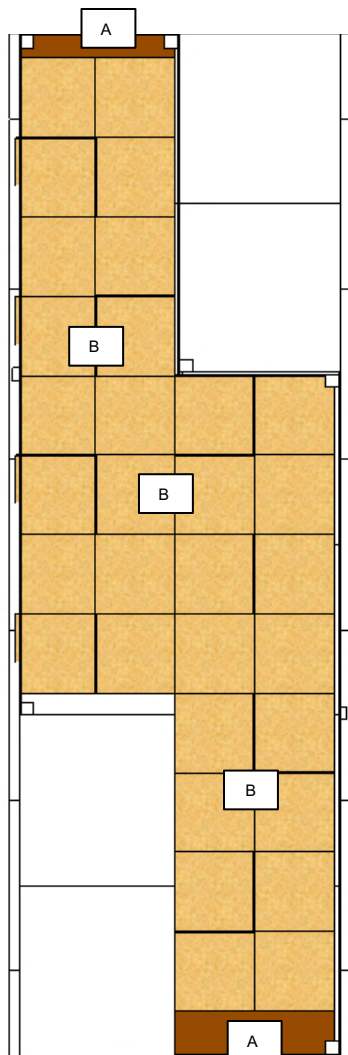
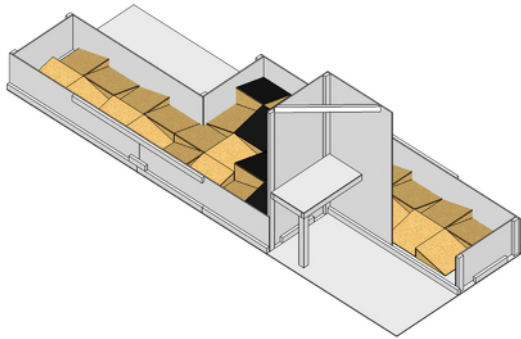


FIGURE A

## Raised Ramps

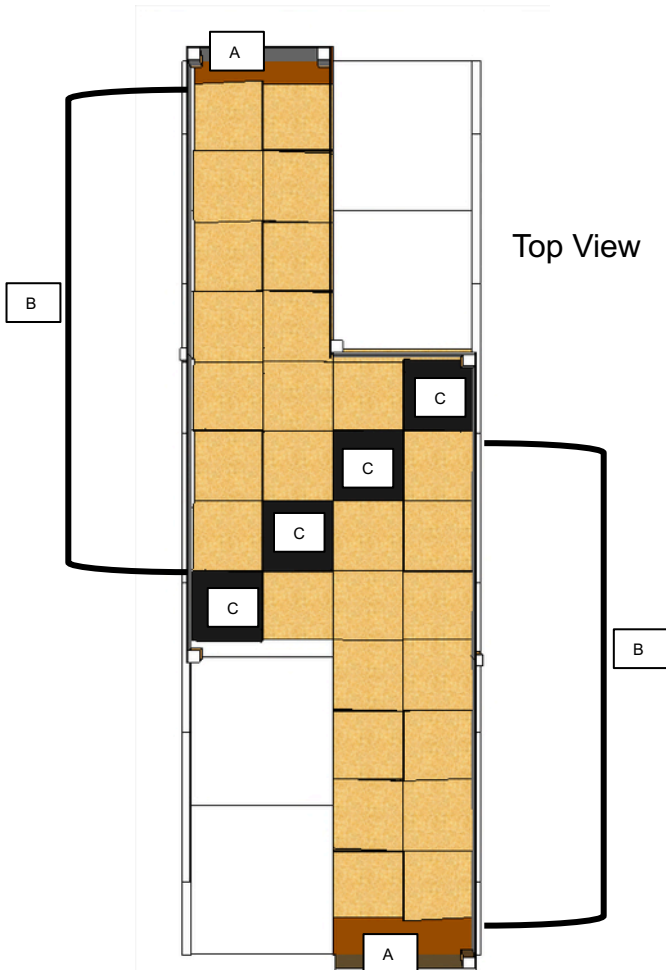


### PURCHASE LIST:

- ☐ [2] 45 x 90 x 2400 mm post

### CUT LIST:

- ☐ [4] 45 x 90 x 1100 post (A)
- ☐ [28] ramps from Pg. 9 (B)
- ☐ [4] ramps from Pg. 10 (C)

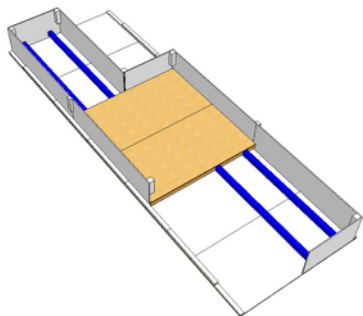


### Fabrication

- Arrange ramps B and C as shown in **Figure A**.
- Add spacer as shown in **Figure A**.

**FIGURE A**

## Rails



### PURCHASE LIST:

- ☐ [2] 1200 x 2400 x 15 mm OSB
- ☐ [10] 45 x 90 x 2400 mm in post
- ☐ [4] 90 x 90 x 2400 mm in post
- ☐ [8] 90 mm angle brackets

### CUT LIST:

- ☐ [2] 1100 x 2200 x 19 mm OSB (A)
- ☐ [4] 45 x 90 x 2200 mm in post (B)
- ☐ [12] 45 x 90 x 1010 mm in post (C)
- ☐ [4] 90 x 90 x 2400 mm in post (D)

Floor Panel - QTY 2

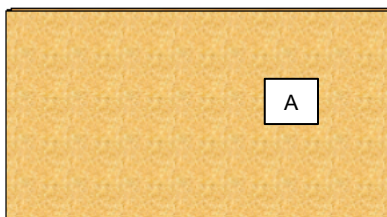
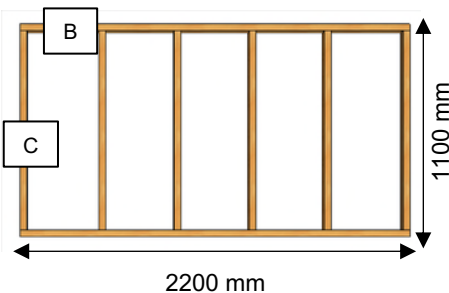


FIGURE A

### Fabrication

- Lay out two post (B) 1100mm from each other such that post are on edge. Attach post (C) to post as shown in **Figure A**. Repeat for 1 additional frame.
- Attach (1) OSB panel (A) to frame. Repeat for one additional panel as shown in **Figure A**.
- **Attach post (D) using angle brackets.** Repeat for 3 additional posts.

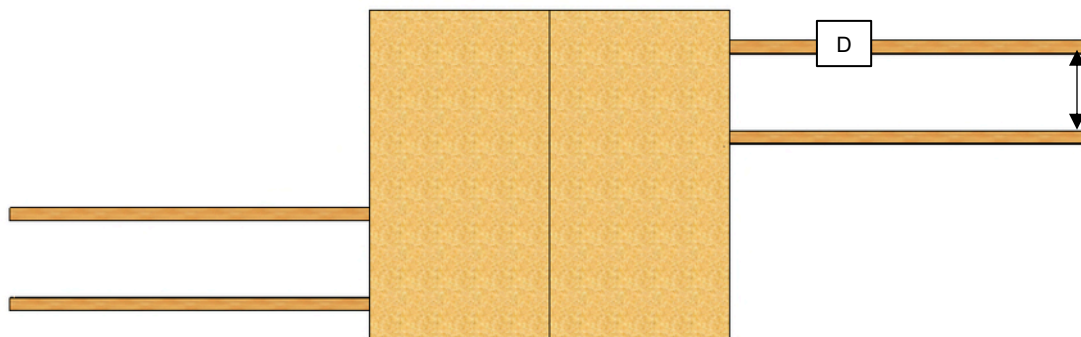


FIGURE B



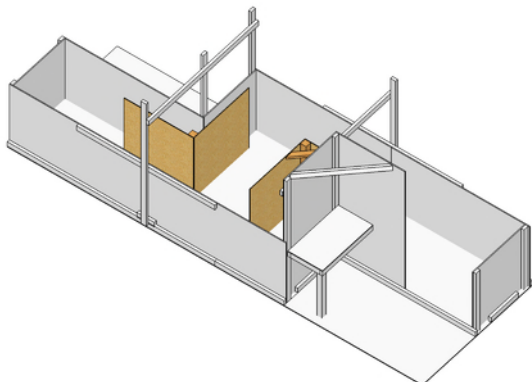
## Slalom Walls

### PURCHASE LIST:

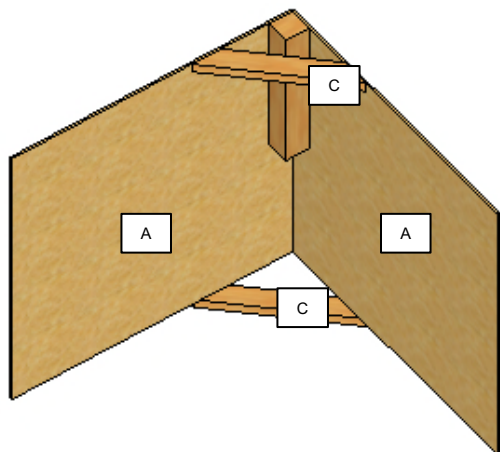
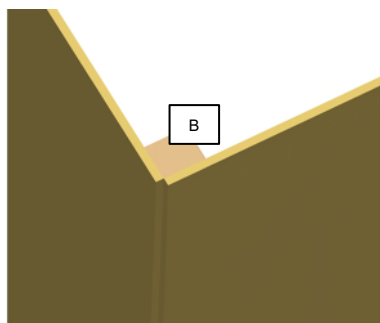
- ☐ [2] 1200 x 2400 x 15 mm OSB
- ☐ [1] 90 x 90 x 2400 mm Post
- ☐ [1] 45 x 90 x 2400 mm Post

### CUT LIST:

- ☐ [4] 1100 x 1200 x 15 mm OSB (A)
- ☐ [2] 90 x 90 x 600 mm Post (B)
- ☐ [4] 45 x 90 x 600 mm Post **45° Mitre cut long to long point (C)**



Back seam of maze wall

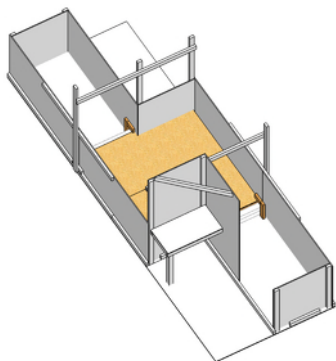


### Fabrication

- Assemble slalom walls as shown in **Figure A**.
- Add brace C to walls for support.

FIGURE A

## Hurdles



### PURCHASE LIST:

- ☐ [6] 1200 x 2400 x 15 mm OSB
- ☐ [32] 45 x 90 x 2400 mm post
- ☐ [5] 100 mm OD PVC X 2400 mm

### CUT LIST:

- ☐ [6] 1100 X 2200 x 15 mm OSB (A)
- ☐ [12] 45 x 90 x 2200 mm Post (B)
- ☐ [36] 45 x 90 x 1010 mm Post (C)
- ☐ [4] 45 x 90 x 200 mm Post (D)
- ☐ [4] 45 x 90 x 300 mm Post (E)
- ☐ [6] 100 mm OD PVC 1100 mm (F)

Floor Panel - QTY 6

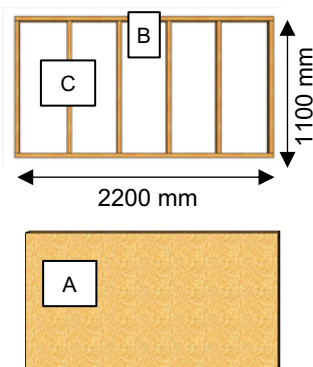


FIGURE A

### Fabrication

- Lay out two post (B) 1100mm from each other such that post are on edge. Attach post (C) to post as shown in Repeat for 5 additional frame.
- Attach (1) OSB panel (A) to frame. Repeat for nine additional panel as shown in **Figure A**. Repeat for 5 additional frame.
- Attach brackets fabricated in **Figure B to sidewall of apparatus.**

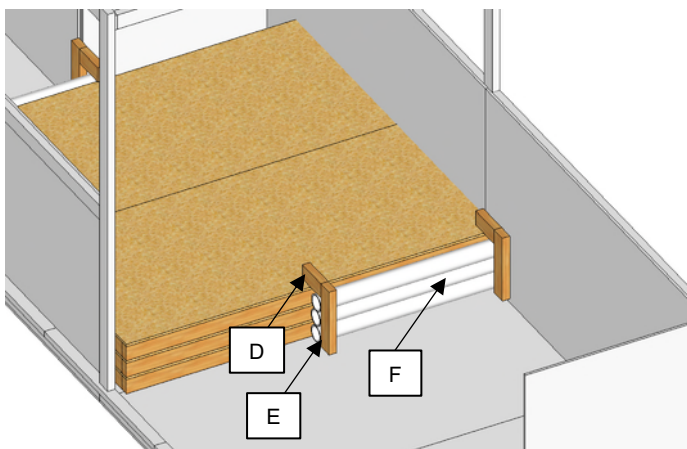
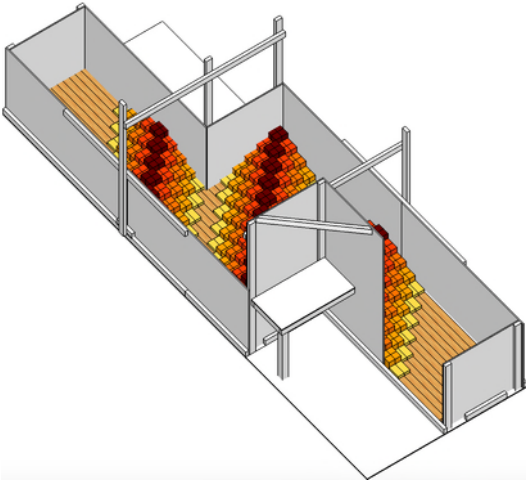


FIGURE B

## Stepfields



### PURCHASE LIST:

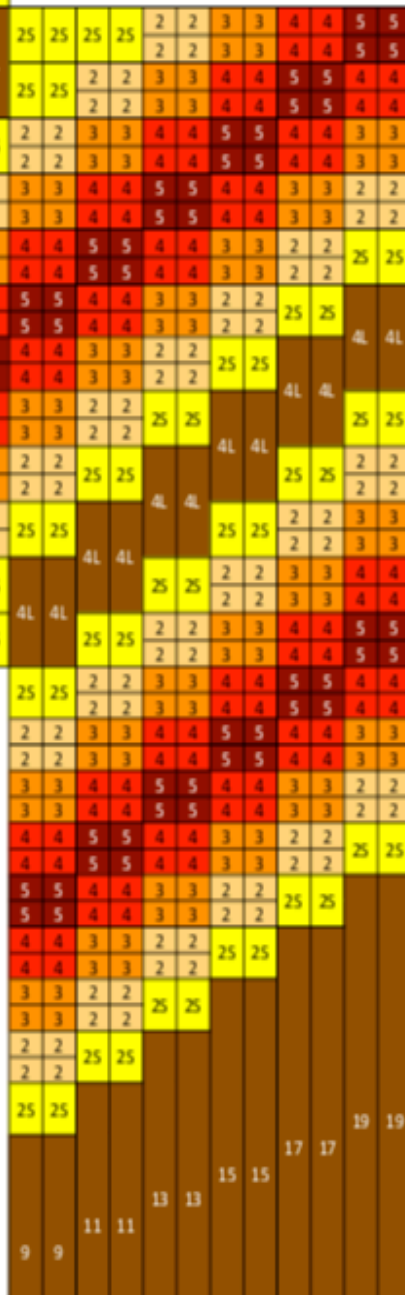
- ☐ [90] 90 x 90 x 2400 mm Post
- ☐ [15] 45 x 90 x 2400 mm Post

### CUT LIST:

	Lumber (mm)	Height (mm)	Count
2S	90 x 90 x	90	84
2	90 x 90 x	180	168
3	90 x 90 x	270	176
4	90 x 90 x	360	184
5	90 x 90 x	450	96
4L	45 x 90 x	360	24
9	45 x 90 x	810	4
11	45 x 90 x	990	4
13	45 x 90 x	1170	4
17	45 x 90 x	1530	4
19	45 x 90 x	1710	4



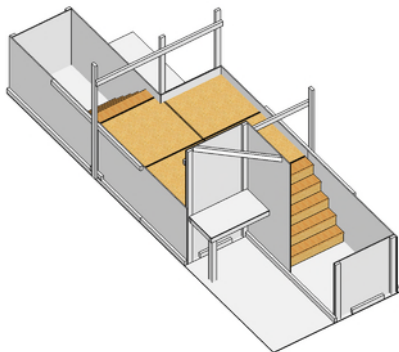
	Lumber (mm)	Height (mm)	Count
2S	90 x 90 x	90	84
2	90 x 90 x	180	168
3	90 x 90 x	270	176
4	90 x 90 x	360	184
5	90 x 90 x	450	96
4L	45 x 90 x	360	24
9	45 x 90 x	810	4
11	45 x 90 x	990	4
13	45 x 90 x	1170	4
17	45 x 90 x	1530	4
19	45 x 90 x	1710	4





**ASTM E2804**  
**Mobility: Confined Area Obstacles**

## Stairs/Landings – 40/45 degree



**PURCHASE LIST (Landing):**

- ❑ [10] 1200 x 2400 x 15 mm OSB
- ❑ [8] 90 x 90 x 2400 mm Post
- ❑ [20] 45 x 90 x 2400 mm Post

**CUT LIST (Landing):**

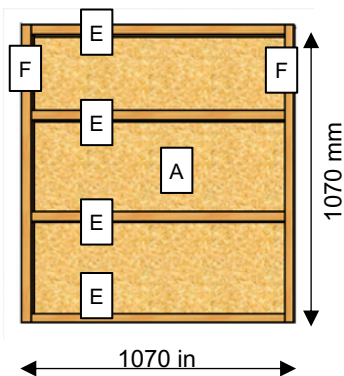
- ❑ [4] 1070 x 1070 x 15 mm OSB (A)
- ❑ [8] 900 x 1070 x 15 mm OSB (B)
- ❑ [8] 900 x 1070 x 15 mm OSB (C)
- ❑ [16] 90 x 90 x 895 mm Post (D)
- ❑ [16] 45 x 90 x 980 mm Post (E)
- ❑ [24] 45 x 90 x 1070 mm Post (F)

**PURCHASE LIST (Stair):**

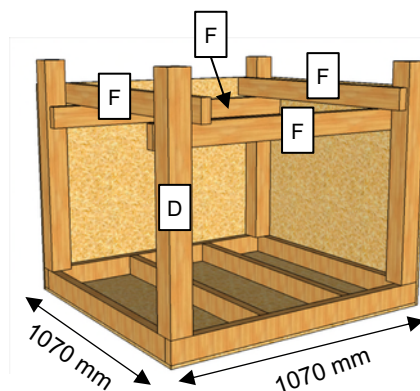
- ❑ [2] 1200 x 2400 x 15 mm OSB
- ❑ [6] 50 x 300 x 3600 mm Post
- ❑ [5] 25 x 3240 x 1100 mm Bull nosed stair tread - 40°
- ❑ [5] 25 x 2740 x 1100 mm Bull nosed stair tread - 45°
- ❑ [7] 45 x 90 x 2400 mm Post

**CUT LIST (Stair):**

- ❑ [10] 175 x 1100 x 15 mm OSB (H)
- ❑ [2] 900 x 1100 x 15 mm OSB (I)
- ❑ [3] 45 x 90 x 780 mm (J) **40° Mitre cut sq. to long pt**
- ❑ [3] 45 x 90 x 690 mm (K) **40° Mitre cut sq. to long pt**
- ❑ [3] 45 x 90 x 780 mm (L) **45° Mitre cut sq. to long pt**
- ❑ [3] 45 x 90 x 555 mm (M) **45° Mitre cut sq. to long pt**
- ❑ [2] 45 x 90 x 1100 mm Post (N)
- ❑ [6] 50 x 300 x 3600 mm Post (O) (cut as shown in Fig A)
- ❑ [5] 25 x 2740 x 1100 mm Bull nosed stair tread 40° - (P)
- ❑ [5] 1 45 x 90 x 2400 mm Bull nosed stair tread 45° - (Q)



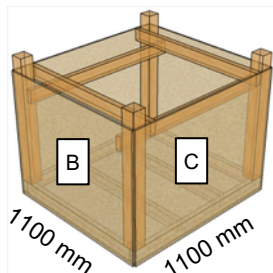
**FIGURE A**



**FIGURE B**

**Fabrication**

- Lay out two post (G) 1100mm from each other such that post are on **edge**. Attach post (E) to post as shown in **Figure A**. Repeat for 3 additional panels.
- **Place fabricated panel OSB side down** and toe nail the legs (D) into the panel as shown in **Figure B**. Repeat for 3 additional panels.
- Attach cross bracing (F/G) as shown in **Figure B**. Repeat for 3 additional panels.
- Attach OSB (B/C) to the cube as shown in **Figure C**. Repeat for 3 additional cubes.



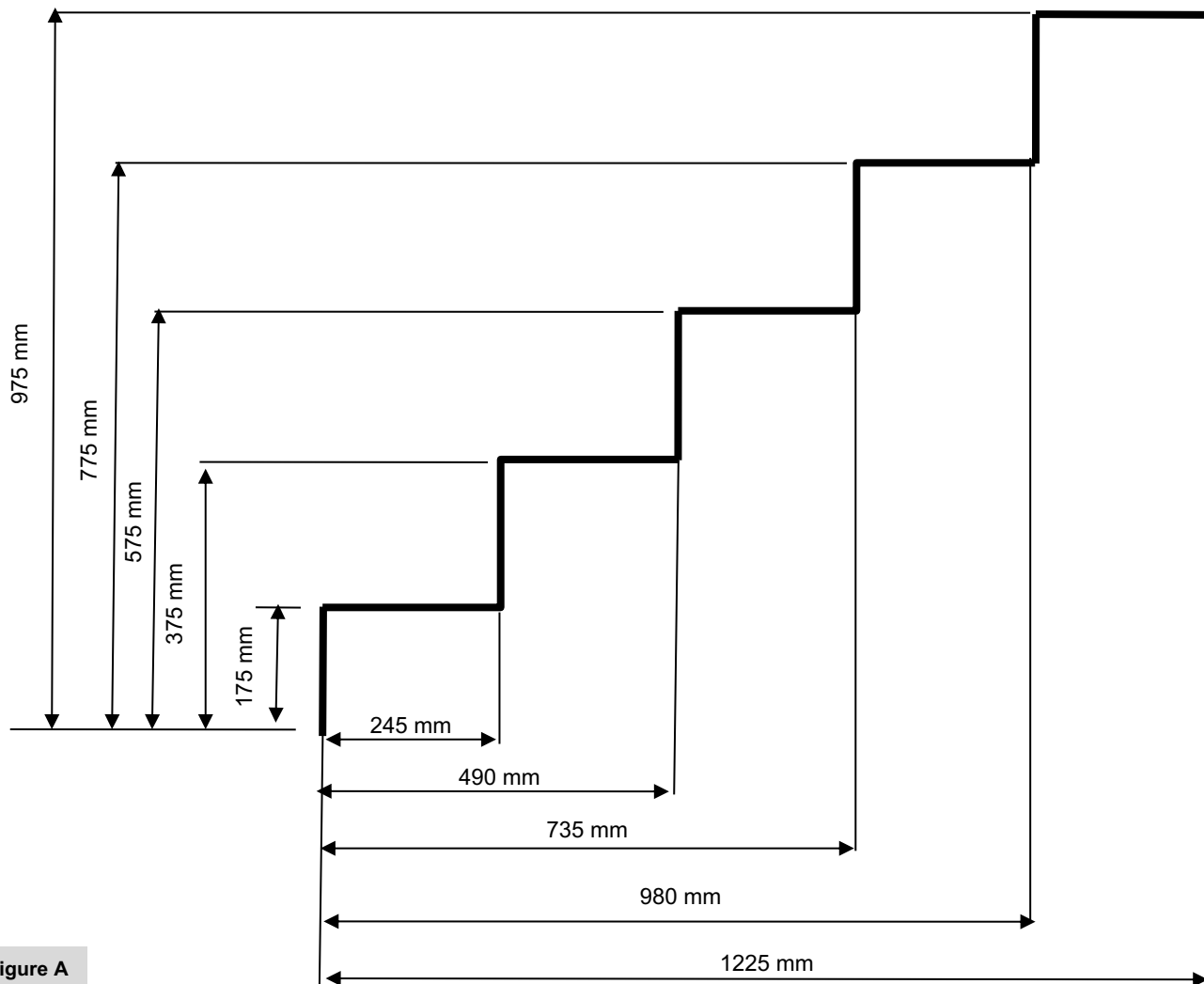
**FIGURE C**

**ASTM E2804**  
**Mobility: Confined Area Obstacles**

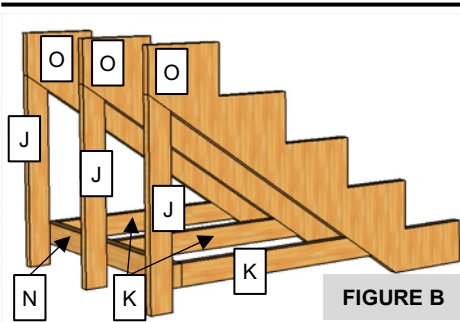
# Stairs/Landings 40°

## Fabrication 40°

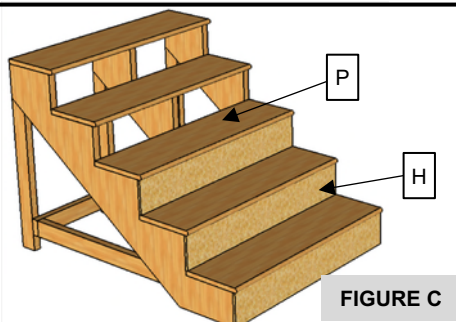
- Layout stringer (O) as shown in **Figure A**. Repeat for additional two stringers.
- Attach bracing (J K N) as shown **Figure B**.
- Attach kickplates(H) and stair treads (P) as shown in **Figure C**.
- Attach back plate (I) as shown in **Figure D**.



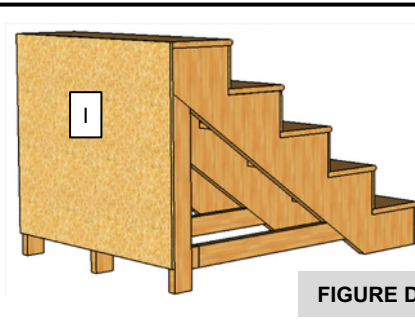
**Figure A**



**FIGURE B**



**FIGURE C**



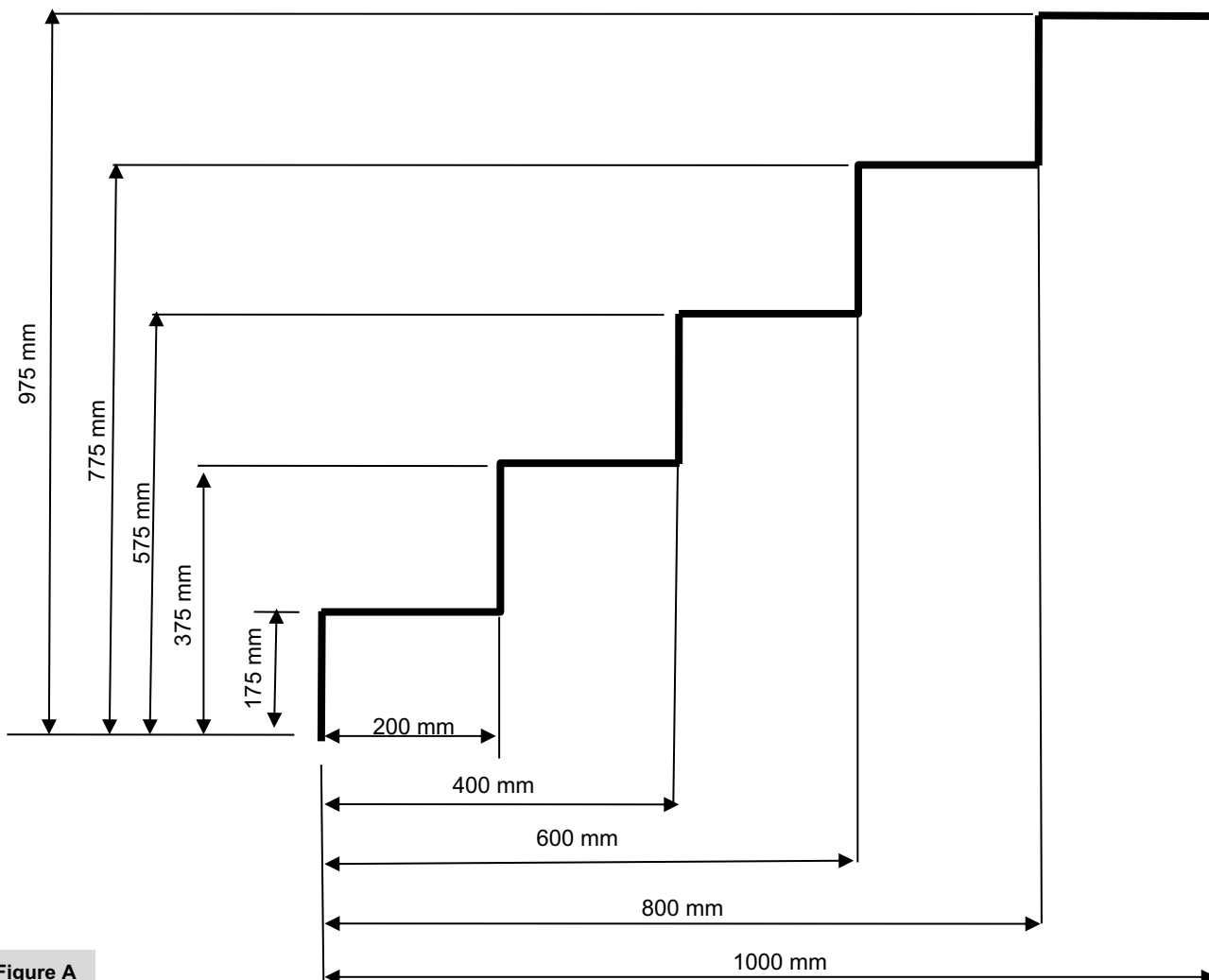
**FIGURE D**

**ASTM E2804**  
**Mobility: Confined Area Obstacles**

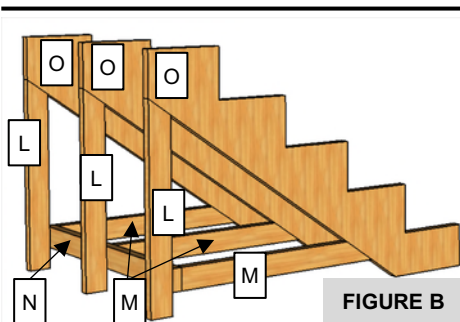
# Stairs/Landings 45°

## Fabrication 45°

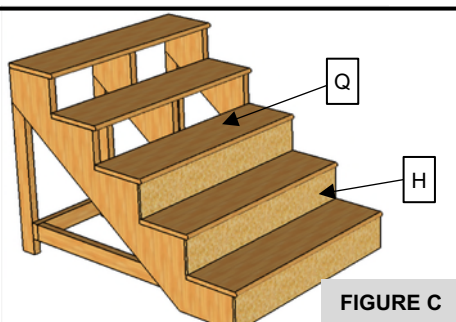
- Layout stringer (O) as shown in **Figure A**. Repeat for additional two stringers.
- Attach bracing (L, M N) as shown **Figure B**.
- Attach kickplates (H) and stair treads (P) as shown in **Figure C**.
- Attach back plate (I) as shown in **Figure D**.



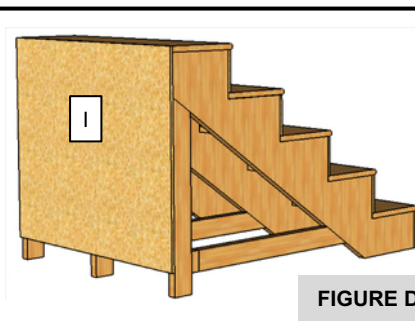
**Figure A**



**FIGURE B**



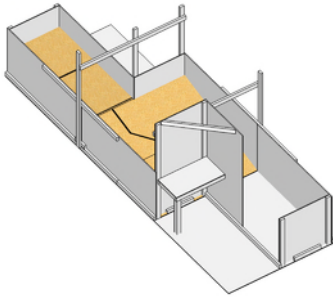
**FIGURE C**



**FIGURE D**

**ASTM E2803**  
**Mobility: Confined Area Obstacles**

## Incline 15 degree



**PURCHASE LIST (Landing):**

- ☐ [3] 1200 x 2400 x 15 mm OSB
- ☐ [2] 90 x 90 x 2400 in Post
- ☐ [4] 45 x 90 x 2400 in Post

**CUT LIST (Landing):**

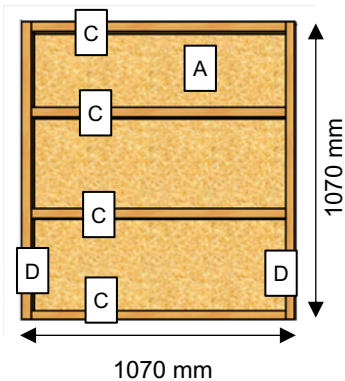
- ☐ [2] 1070 x 1070 x 15 mm OSB (A)
- ☐ [8] 480 x 1070 x 15 mm OSB (B)
- ☐ [4] 45 x 90 x 980 mm Post (C)
- ☐ [4] 45 x 90 x 1070 mm Post (D)
- ☐ [8] 90 x 90 x 480 mm Post (E)

**PURCHASE LIST (Ramp):**

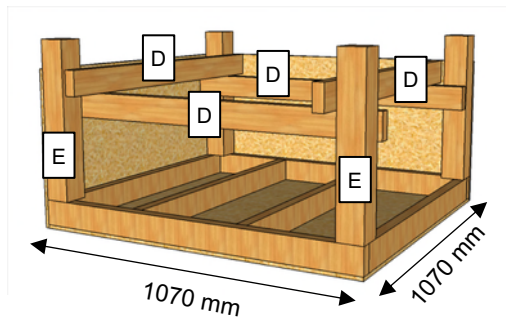
- ☐ [5] 1200 x 2400 x 15 mm OSB
- ☐ [15] 45 x 90 x 2400 mm Post

**CUT LIST (Ramp):**

- ☐ [2] 1100 x 2200 x 15 mm OSB (G)
- ☐ [2] 1100 x 2200 x 15 mm OSB (H)
- ☐ [1] 450 x 2200 x 15 mm OSB (I)
- ☐ [4] 45 x 90 x 300 mm Post (J)
- ☐ [4] 45 x 90 x 550 mm Post (K) **15° Mitre cut sq. to long pt**
- ☐ [2] 45 x 90 x 1100 mm Post (L)
- ☐ [4] 45 x 90 x 1750 mm Post (M)
- ☐ [8] 45 x 90 x 2150 mm Post (N) **75° Mitre cut sq. to long pt**



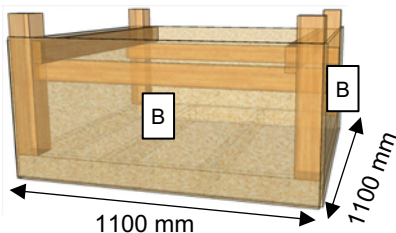
**FIGURE A**



**FIGURE B**

**Fabrication**

- Lay out two post (E) 1070 mm from each other such that post are on **edge**. Attach post (D) to post as shown in **Figure A**. Repeat for 1 additional panel.
- **Place fabricated panel OSB side down** and toe nail the legs (F) into the panel as shown in **Figure B**. Repeat for 1 additional panel.
- Attach cross bracing (D/E) as shown in **Figure B**. Repeat for 1 additional panel.
- Attach OSB (B/C) to the cube as shown in **Figure C**. Repeat for 1 additional cube.



**FIGURE C**



**ASTM E2803**  
**Mobility: Confined Area Obstacles**

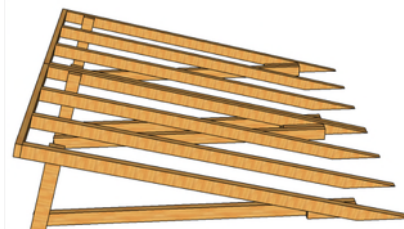
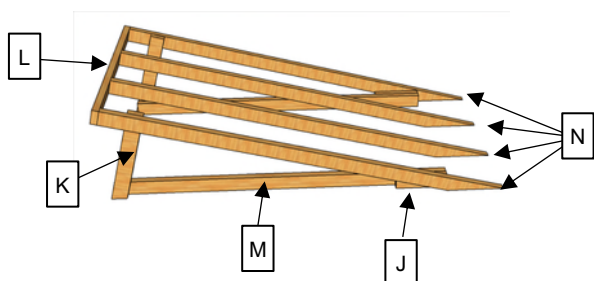
## Incline 15 degree

### Fabrication

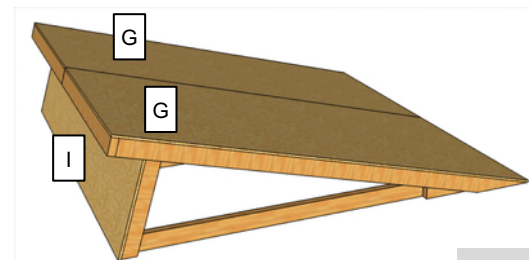
- Assemble the frame as shown in **Figure D**. Repeat for additional frame.
- Attach back panel (H) and Attach ramp sub-face (G) as shown in **Figure E**. **Note orientation of panel.**
- Attach ramp face (G) and mark path as shown in **Figure F**. **Note orientation of panel.**
- Place ramps and deck as shown in **Figure G**. **Note additional bracing may be needed to prevent movement.**

### CUT LIST (Ramp):

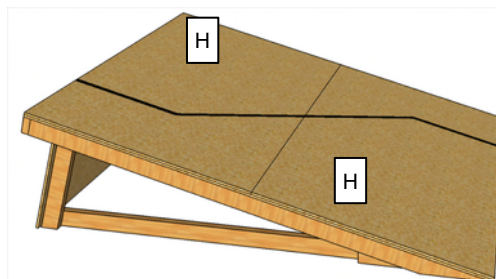
- [2] 1100 x 2200 x 15 mm OSB (G)
- [2] 1100 x 2200 x 15 mm OSB (H)
- [1] 450 x 2200 x 15 mm OSB (I)
- [4] 45 x 90 x 300 mm Post (J)
- [4] 45 x 90 x 550 mm Post (K) **15° Mitre cut sq. to long pt**
- [2] 45 x 90 x 1100 mm Post (L)
- [4] 45 x 90 x 1750 mm Post (M)
- [8] 45 x 90 x 2150 mm Post (N) **75° Mitre cut sq. to long pt**



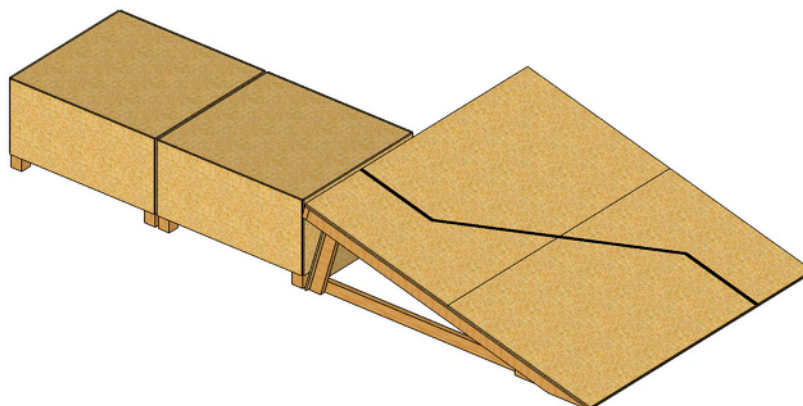
**FIGURE D**



**FIGURE E**



**FIGURE F**



**FIGURE G**

**ASTM E2991/E2992**  
**Traverse Gravel Terrain/Traverse Sand Terrain**

# Gravel or Sand

## PURCHASE LIST:

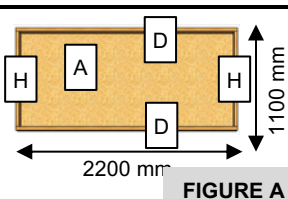
- ☐ [8] 1200 x 2400 x 15 mm OSB
- ☐ [33] 45 x 90 x 2400 in post
- ☐ 2 cubic meter construction sand or 2 metric ton of 3/8 pea gravel

## CUT LIST:

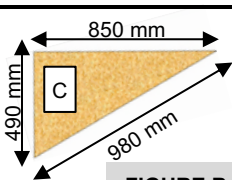
- ☐ [6] 1100 x 2200 x 15 mm OSB (A)
- ☐ [2] 500 x 1100 x 15 mm OSB (B)
- ☐ [2] 490 x 850 x 980 x 15 mm OSB triangle (C)
- ☐ [16] 45 x 90 x 2400 mm Post (D)
- ☐ [8] 45 x 90 x 2150 mm Post **75° Mitre cut sq. to long point (E)**
- ☐ [4] 45 x 90 x 1750 mm Post (F)
- ☐ [2] 45 x 90 x 1100 mm Post (G)
- ☐ [16] 45 x 90 x 1010 mm Post (H)
- ☐ [4] 45 x 90 x 550 mm Post **15° Mitre cut sq. to long point (I)**
- ☐ [4] 45 x 90 x 300 in Post (J)

## PRINT LIST:

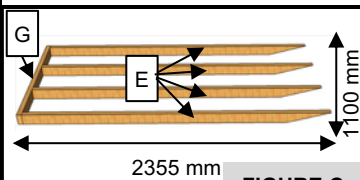
- ☐ None



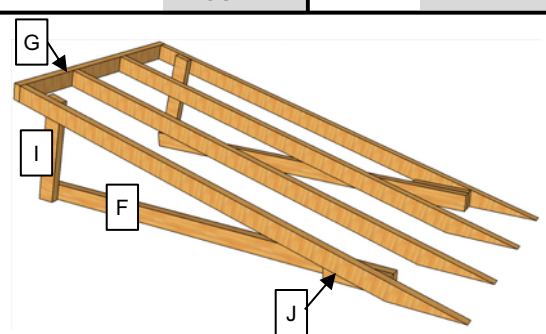
**FIGURE A**



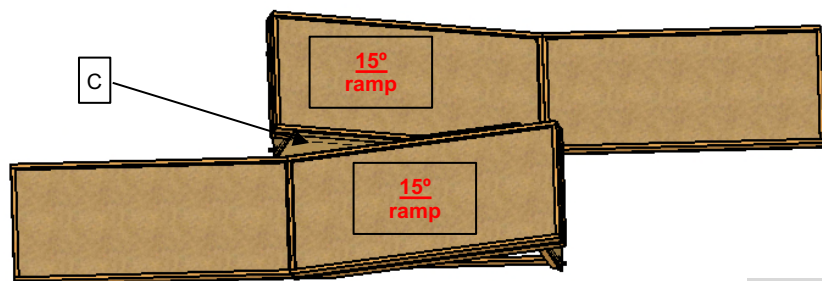
**FIGURE B**



**FIGURE C**



**FIGURE D**

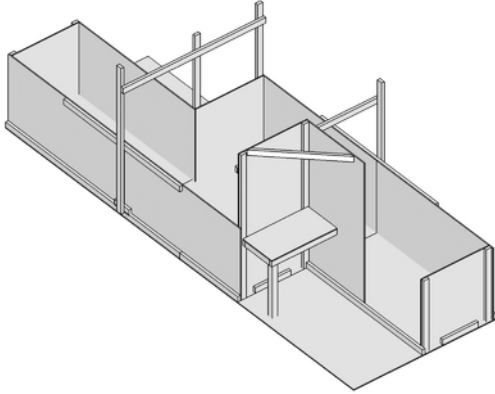


**FIGURE E**

## **Fabrication**

- Lay out two post (D) from each other such that post are on **edge**. Attach post (H) to post (D). Attach (1) OSB panel (A) to frame as shown in **Figure A**. Repeat for 5 additional panels.
- Cut out **two** Triangles (C) as shown in **Figure B**.
- Fabricate deck as shown In **Figure C/D**. Repeat for one additional deck frame.
- Place trays as shown in **Figure E**. **Place tray on top of ramp.**
- Attach triangle (C) as shown in **Figure E**.
- Fill with aggregate.

## Negotiate



I do not have a good design for the apparatus.  
It uses the a regular wall bay.

Speak with Testu for materials

**Fabrication**

## Task Panel (22)

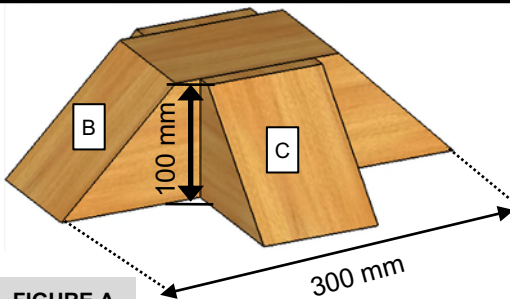
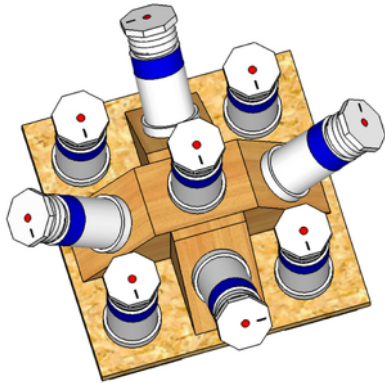


FIGURE A

### PURCHASE LIST:

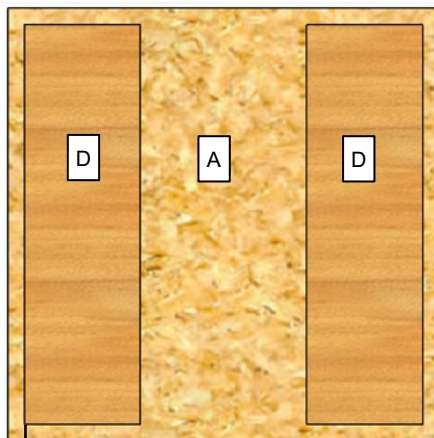
- ☐ [2] 1200 x 2400 x 15 mm OSB
- ☐ [4] 50 x 90 x 2400 mm post
- ☐ [6] 90 x 90 x 2400 mm post
- ☐ [9] 50 ID mm x 2400 mm PVC Pipe
- ☐ [9] 40 ID mm x 2400 mm PVC Pipe
- ☐ [198] 50 mm PVC Caps ([https://www.ferguson.com/product/proflo-dwv-heavy-duty-high-pressure-pvc-cap-pftc/\\_/A-ProdFamily-115673](https://www.ferguson.com/product/proflo-dwv-heavy-duty-high-pressure-pvc-cap-pftc/_/A-ProdFamily-115673))
- ☐ [198] 50 mm Threaded Plug (<http://www.grainger.com/product/LASCO-Threaded-Plug-22FK11?functionCode=P2IDP2PCP>)
- ☐ [1] Blue duct tape
- ☐ [1] Velcro
- ☐ [1] Red/Black Markers

### CUT LIST:

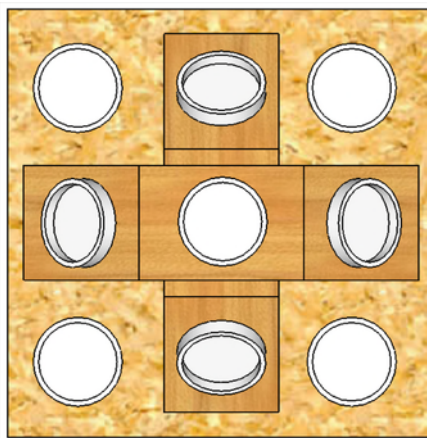
- ☐ [22] 330 x 330 x 15 mm – OSB (A)
- ☐ [22] 90 x 90 x 300 mm Post **45° Mitre cut long to long point (B)**
- ☐ [44] 90 x 90 x 90 mm Post **45° Mitre cut sq. to long point (C)**
- ☐ [44] 45 x 90 x 300 mm Post (D)
- ☐ [198] 50 ID mm x 100 mm PVC Pipe
- ☐ [198] 40 ID mm x 75 mm PVC Pipe

### PRINT LIST:

- ☐ Random Lines.pdf



Back View



Top View

12.5 mm

FIGURE B

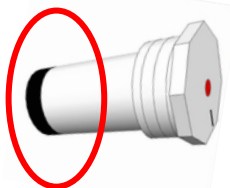
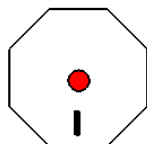


FIGURE C

### Fabrication

- Attach angled posts (B and C) together as shown in **Figure A**.
- Attach caps as shown in **Figure B**.
- Attach post (D) to backside of OSB Panel (A) as shown in **Figure B**.  
**Note: the 12.5 mm offset from edge.**
- Attach pre-printed lines to the inside surface of the pipes. Lines are bottom justified. Number of lines should be between 2-6 and spaced randomly.
- Attach pipes to caps.
- Wrap top of 50 mm pipe with blue tape as shown in **Figure C**
- Mark top of threaded plug as shown in **Figure C**.
- Insert 40 mm pipe into the threaded plug. Wrap 25 mm Velcro at the end of the pipe as shown in **Figure C**.



## Dexterity

### PURCHASE LIST:

- ☐ [7] 1200 x 2400 x 15 mm OSB
- ☐ [3] 90 x 90 x 2400 mm Post
- ☐ [7] 45 x 90 x 2400 mm Post
- ☐ [8] 330 x 330 x 300 in crate  
(<https://www.uline.com/Product/ProductDetailRootItem?modelnumber=S-16317>)

### CUT LIST:

- ☐ [12] 550 x 565 x 19 mm OSB (A)
- ☐ [12] 140 x 550 x 19 mm OSB (B)
- ☐ [24] 140 x 530 x 19 mm OSB triangle (C)
- ☐ [24] 90 x 90 x 140 mm Post (D) **15° Mitre cut sq. to long point**
- ☐ [24] 90 x 90 x 60 mm Post (E) **15° Mitre cut sq. to long point**
- ☐ [4] 45 x 90 x 2355 mm Post (G)

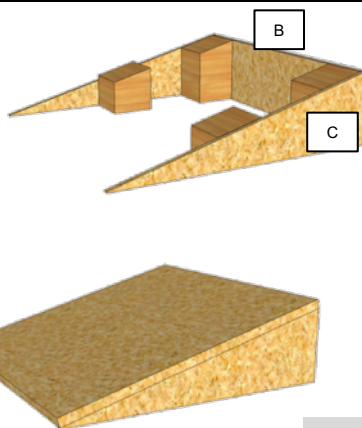
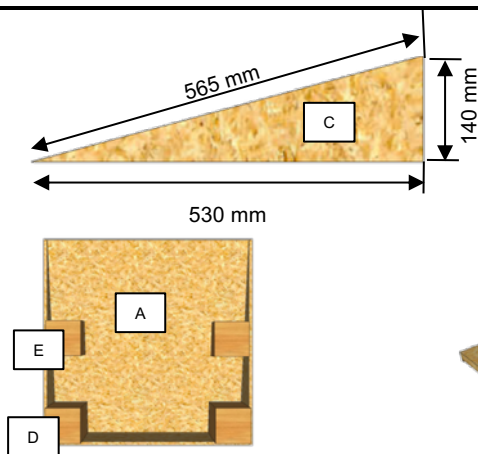
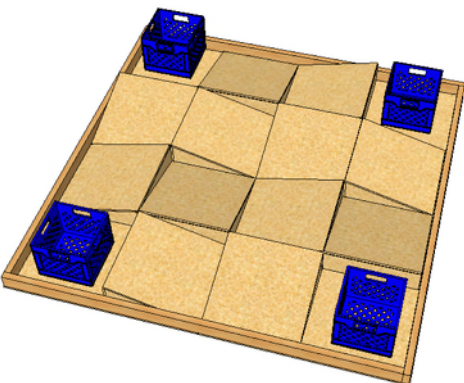


FIGURE A

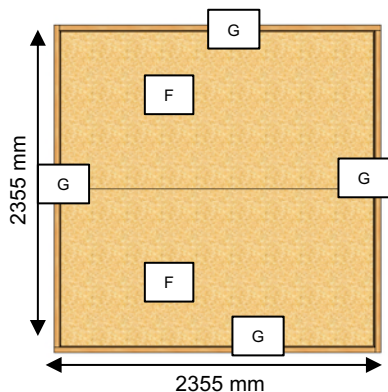
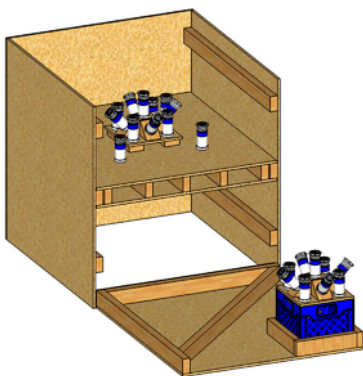


FIGURE B

### Fabrication

- Place triangles (C) flatly on the floor. Attach one top post (E) to support triangle (F) and repeat for additional **side as shown in Figure A**. Note: Posts will be flush with the top of support triangle (C).
- Attach Front Leg (F) as shown in **Figure A**.
- Attach ramp surface (A) to support triangles (C). Note: **Use rougher side up as the ramp surface if there is a difference in surface texture.**
- Attach back plate (B) to high side of ramp as shown in **Figure A**.
- **Attach post (G) to panel F as shown in Figure B .**
- **Crates are screwed to the containment border.**

## Dexterity Unit

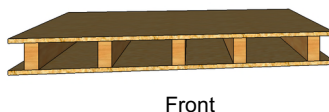
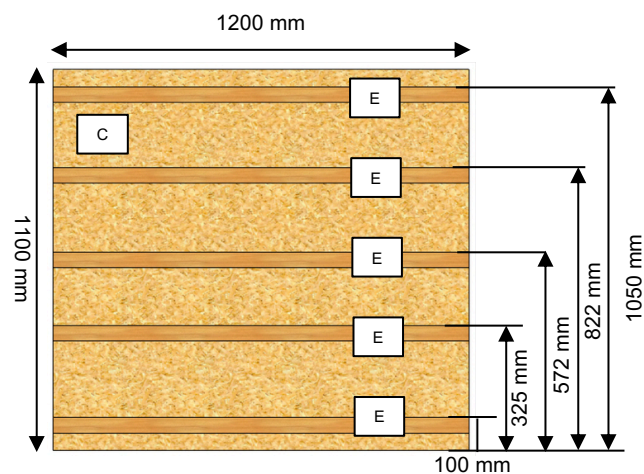


### PURCHASE LIST:

- ☐ [3] 1200 x 2400 x 15 mm OSB
- ☐ [9] 45 x 90 x 2400 mm Post

### CUT LIST:

- ☐ [2] 1200 x 1200 x 11mm OSB (A)
- ☐ [1] 1140 X 1200 X 11 mm OSB (B)
- ☐ [3] 1100 x 1200 x 11 mm OSB (C)
- ☐ [1] 45 x 90 x 1490 mm Post **45° Mitre cut long pt. to long pt.** (D)
- ☐ [12] 45 x 90 x 1200 mm Post (E)
- ☐ [1] 45 x 90 x 1110 mm Post (F)
- ☐ [1] 45 x 90 x 1055 mm Post (G)
- ☐ [4] 45 x 90 x 370 mm Post (H)



**FIGURE A - Shelf**

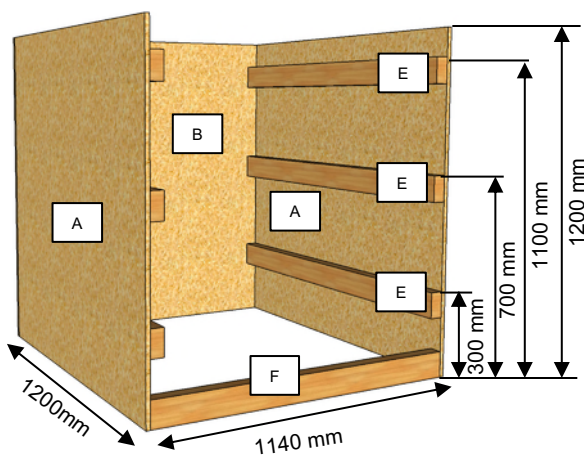
### **Fabrication**

#### Shelf

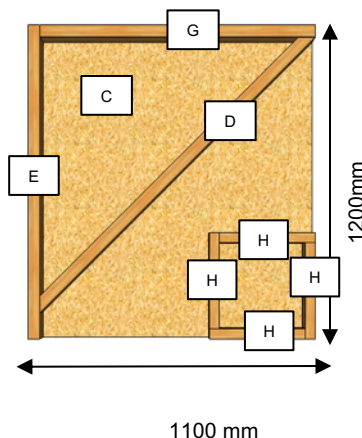
- Attach posts (E) to Panel (C) as shown in **Figure A**.
- **Attach 2<sup>nd</sup> panel (C) to complete shelf.**

#### Container

- Attach posts (E) to Panel (A) as shown in **Figure B**. **Repeat for other side panel.**
- Attach back panel (B) to panels (A) as shown in **Figure B**.
- Attach post F to bottom as shown in **Figure B**



**FIGURE B - Container**



**FIGURE C - Flooring**

#### Flooring

- Attach posts E and G to panel C as shown in **Figure C**.
- Attach post D to panel C as shown in **Figure C**.
- Attach post H to panel C as shown in **Figure C**.

## Additional Under/Over Shelf (6)

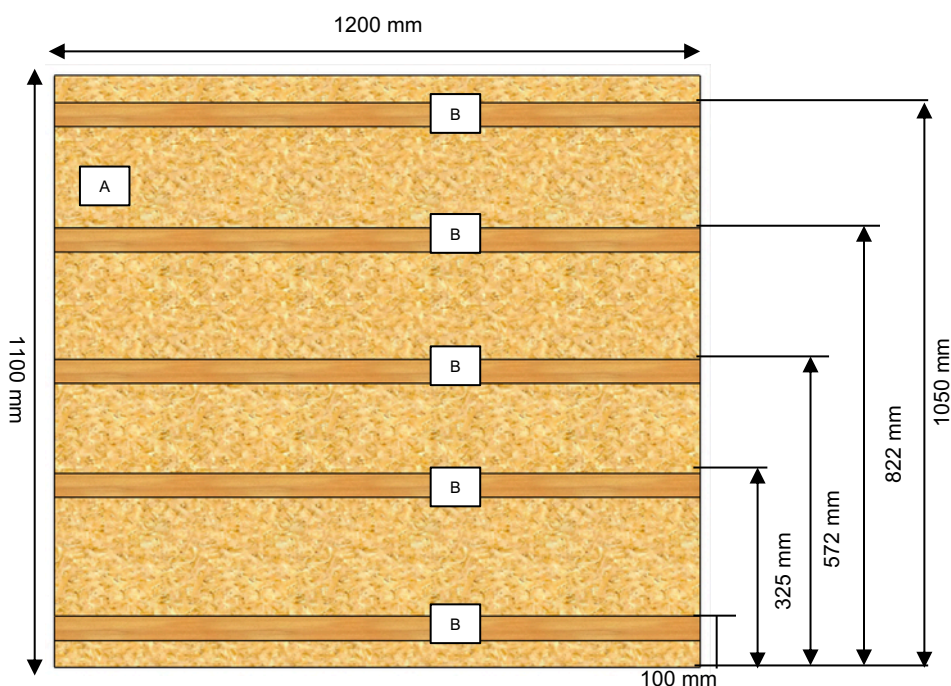


### PURCHASE LIST:

- ☐ [6] 1200 x 2400 x 15 mm OSB
- ☐ [15] 45 x 90 x 2400 mm Post

### CUT LIST:

- ☐ [12] 1100 x 1200 x 11 mm OSB (A)
- ☐ [30] 45 x 90 x 1200 mm Post (B)



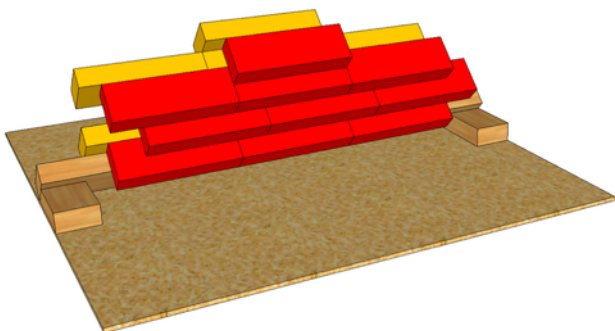
### Fabrication

#### Shelf

- Attach posts (B) to Panel (A) as shown in **Figure A**.
- **Attach 2<sup>nd</sup> panel (A) to complete shelf.** Repeat for 5 additional shelves.

FIGURE A - Shelf

## Block Wall



### PURCHASE LIST:

- ☐ [1] 1200 x 2400 x 15 mm OSB
- ☐ [4] 45 x 90 x 2400 mm Post

### CUT LIST:

- ☐ [1] 1200 x 1200 x 11 mm OSB (A)
- ☐ [1] 45 x 90 x 1200 mm Post (B)
- ☐ [2] 45 x 90 x 150 mm (C) **15° Bevel cut lonsq pt. to long pt.**
- ☐ [20] 45 x 90 x 300 mm (D)

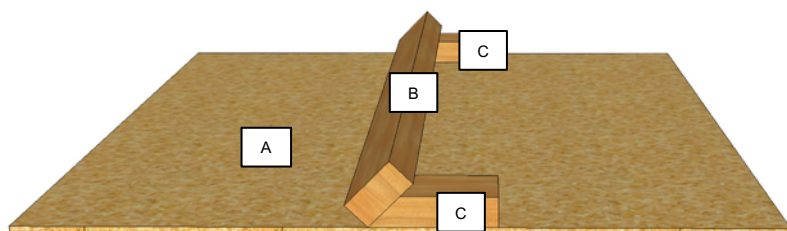


FIGURE A

### Fabrication

- Attach board B and C to board A as shown in **Figure A**.
- Attach board D to board D as shown in **Figure B**. Repeat for 9 additional pairs

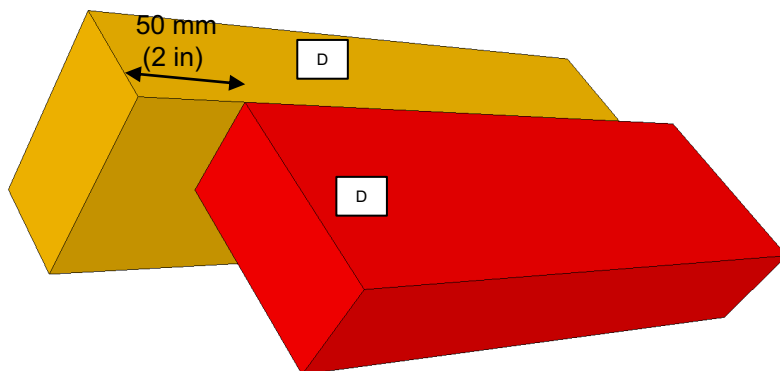
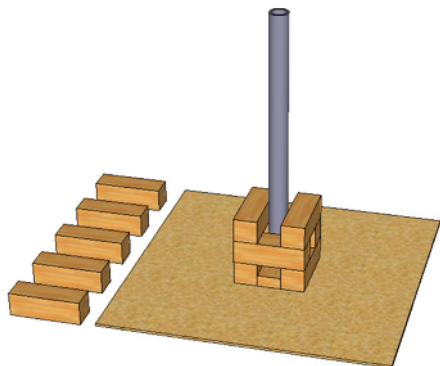


FIGURE B



## Shoring



### PURCHASE LIST:

- ☐ [1] 1200 x 2400 x 15 mm OSB
- ☐ [2] 90 x 90 x 2400 mm Post
- ☐ [1] 45 x 90 x 2400 Post
- ☐ [1] 50 ID mm x 1200 mm Pipe
- ☐ [1] 50 mm Cap

### CUT LIST:

- ☐ [1] 1200 x 1200 x 11 mm OSB (A)
- ☐ [12] 90 x 90 x 300 mm Post (B)
- ☐ [1] 45 x 90 x 300 (C)

### Fabrication

- Attach board B and C on panel A as shown in Figure A.
- Attach pipe cap to board C
- Insert pipe
- Additional 10 boards (B) are used during the task.

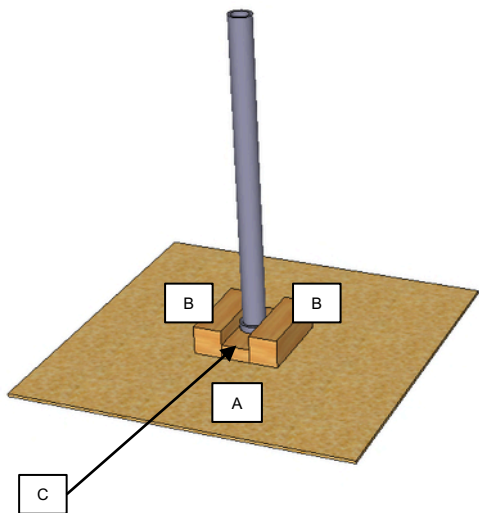


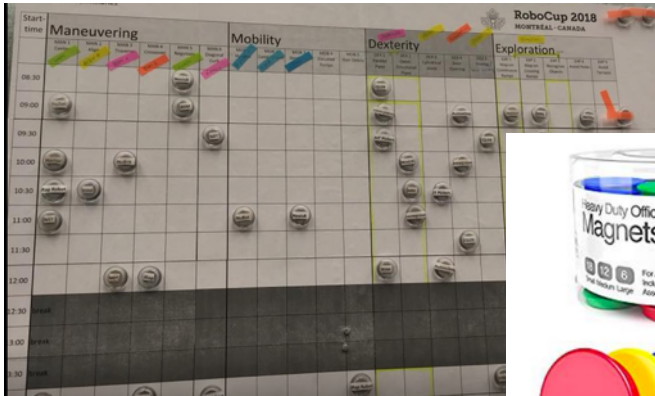
FIGURE A

**NOTE:**

**OSB underlayment to cover the floor is not calculated.**

**This will need to be calculated.**

# Tools and Admin Section



- ☐ (1) – Dispatch board
- ☐ (100+) - Magnets



- ☐ (1) HDMI Computer Monitor >21 in

- ☐ (20) Clipboards





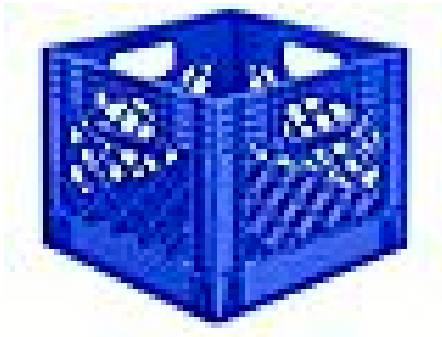
- ☐ (30) -Gloves
- ☐ (5) Safety Glasses
- ☐ (2) Ear Muff
- ☐ (10) Clip on nail pouch
- ☐ (1) First Aid Kit







- ☐ Fire extinguishers/sand buckets/ etc... should be stationed at the operator stations, team paddock and battery charging stations.



- ☐ (32) - Rigid Milk Crates



- ☐ (1) Shipping Scale 440 LB/200 KG Capacity



- ☐ Cordless drills and accessories
  - ☐ [4] Cordless drills
  - ☐ [6] Battery chargers
  - ☐ [12] Total batteries



- ☐ [2] Corded drill



- ☐ [1] Circular Saw
- ☐ [1] Miter 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



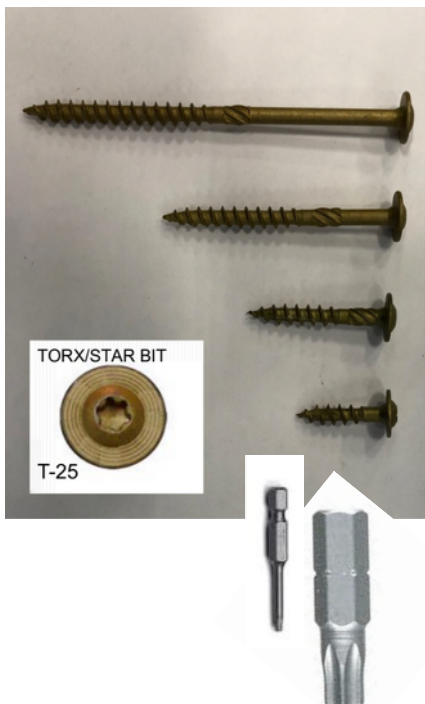
- ☐ Tape Measure
  - ☐ [2] 30m/100ft tape measure
  - ☐ [4] 8m/25ft tape measure



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

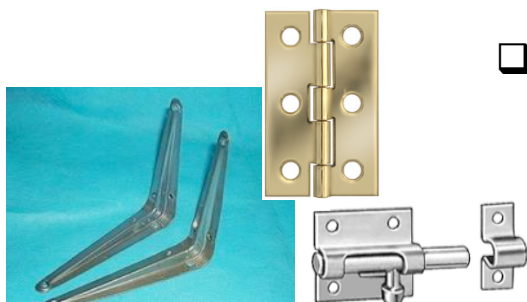


- ☐ Duct tape
  - ☐ [5] Rolls of Safety Yellow duct tape
  - ☐ [5] Rolls of Safety Orange duct tape
  - ☐ [5] Rolls of Safety Red duct tape
  - ☐ [5] Rolls of Blue duct tape
  - ☐ [5] Rolls of Black /Yellow diagonal stripe tape



### Star/Torx bit screws with washer heads

- ☐ [500] 12 mm ( 1 in ) long
- ☐ [1000] 40 mm (1 1/2 in) long
- ☐ [2000] 60 mm (2 ½ in ) long
- ☐ [500] 120 mm (4 in ) long
- ☐ [50] Matching star/torx bits for each size



- ☐ Hardware
  - ☐ [8] Hinges 100 mm (4 in)
  - ☐ [200] washers 25 mm (1 in)



- ☐ [10] Power cords
- ☐ [30] Power Strips





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



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



- ☐ Office supplies
  - ☐ [2] Stapler, staples
  - ☐ **[4] scissors**
  - ☐ [1] Scotch (clear) tape
  - ☐ [50] Pencils
  - ☐ [100] paper clips
  - ☐ [10] Black permanent Sharpie Markers-large
  - ☐ Various sizes binder clips





☐ AV equipment

- ☐ [3] Large LCD display
- ☐ [2-3] Pan Security Camera with cable
- ☐ Ability to switch between the cameras
- ☐ PA system



# Additional Materials Needed



OSB Plywood surface

**NOTE:**

**OSB underlayment to cover the floor is not calculated. This will need to be calculated.**

Additional lumber:

- [5] sheets of 19mm OSB plywood
- [10] sheets of 15mm OSB plywood
- [20] 45 x 90 x 2400 mm post
- [10] 90 x 90 x 2400 mm post



[300] 140 x 400 mm (6 in) concrete  
block

