WoodWorks®
Design Office
Sizer | Shearwalls | Connections | Database Editor

2017 User Guide – U.S. Shearwalls Tutorial Instructions
For Design Office 11

Canadian Wood Council
American Wood Council

Developed by
Acronym Software Inc.
Limited Warranty

The American Wood Council and the Canadian Wood Council make no representations or warranties with respect to the contents of this user guide and specifically disclaim any implied warranties of merchantability or fitness for any particular purpose. The contents of this documentation may include technical inaccuracies or typographical errors.

The American Wood Council and the Canadian Wood Council disclaim all warranties with respect to the software contained on disk or in printed form, including all expressed or implied warranties of merchantability and fitness; and any stated or expressed warranties are in lieu of all obligations or liabilities of the American Wood Council and the Canadian Wood Council for damages, including, but not limited to special, indirect or consequential damages arising out of or in connection with the performance of the software.

As always, the engineer is ultimately responsible for his or her design.

Refer to Read Me for further information.

© 2017 Copyright by CWC
1 **Shearwalls Tutorial 1 – Design a Single Shearwall (US)**

Click [here](#) to download the shearwalls file (.wsw) which will be created after running through the instructions in this tutorial.

1.1 **Modify Design Settings**

1. Click the *Settings*... button in the main menu to open the design settings.
2. In the *Design* tab, under the *Design procedures* section, uncheck the box *Include deflection analysis*.

*Note doing this will automatically modify the Rigidity for shear force distribution based on... to Shearwall Capacity*. 

3. Press *OK* to exit the Settings window.

![Image of Settings window](image.png)

**Figure 1:** *Shearwalls Tutorial 1 – Design Settings*

1.2 **Creating a Structure Block**

1. Start *Shearwalls*. The Structure button is highlighted and the *Structure Input* form is active.
2. Define a structure block by clicking & holding the left mouse button while the cursor points at approximately *X=0 & Y=0* and dragging the cursor to approximately *X=15 & Y=15*. You may need to manually adjust the *Location and Extents* in the *Structure Input* form to define the structure block. It may be necessary to adjust the *View* in the *Settings tab*, so that the entire
block can be seen. Note that the Y extent dimension is irrelevant in this case as load will on be applied to a shearline along the x-axis.

3. In the Structure Input window, under Diaphragm flexibility, uncheck the Rigid Analysis checkbox.

4. Leave all other parameters as default, although both the wall length and wall height are defined in this window.

1.3 Modifying Wall Details

1. Click the Walls button and highlight all the walls by pressing Ctrl+a.

2. Leave the Type of wall as Segmented.

3. In the wall and shearline input view, ensure that there are no unknowns on the Exterior Side of the wall.

4. On the Interior Side of the wall, specify the Sheathing Material as None.
1.4 Creating Openings

1. Click the **Openings** view, and add openings as desired (None have been added for this tutorial)
1.5 Modifying Roof Shape

1. Click on the *Roof Blocks* button. In the *Roof Input* form, under *Construction* select the *flat roof* checkbox.
Figure 5: Shearwalls Tutorial 1 – Modifying Roof Block
1.6  Add Loads and Forces

1. Click on the **Loads and Forces** button to open the **Load input** Window.

![Image of Shearwalls Tutorial 1 – Loads and Forces View]

**Figure 6:**  Shearwalls Tutorial 1 – Loads and Forces View

2. In the Load input Window, click **Add...**, select the **Type** as **Seismic**, the **Profile** as **Point load**, click the checkbox to **Add as factored force directly (parallel) to the shearline**, under **Location, Apply to...Shear line** specify **A**, input a **Magnitude (lbs)** of **3000**, and press **OK**.
1.7 Run Design and View Results

1. Click on the **Run Design** button and view the **Results** report.
2. Navigate to the flexible diaphragm seismic shear results, by using the **Go To Table**, button.
3. Review the Shear results for shearline A. Click [here](#) to download a pdf of the design results.

**Figure 8:** Shearwalls Tutorial 1 – Go To Table navigation

**Figure 9:** Shearwalls Tutorial 1 – Shearline A Elevation View

### SHEAR RESULTS (flexible seismic design)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>E W</td>
<td>200</td>
<td>3000</td>
<td>-</td>
<td>1.0</td>
<td>-</td>
<td>280</td>
<td>-</td>
<td>280</td>
<td>-</td>
<td>4200</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linh, Lvl</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**

- **W Gp:** Wall design group defined in Sheathing and Framing Materials tables, where it shows associated Standard Wall. “*” means that this wall is critical for all walls in the Standard Wall group.
- **For Dir:** Direction of seismic force along shearline.
- **v:** Design shear force on segment = ASD factored shear force per unit FHS
  - **vmax:** Collector shear force for perforated walls as per SDPWS eqn. 4.3.8 = V/FS/Co. Full height sheathing (FSH) factored for narrow segments as per 4.3.4.3
  - **V:** ASD factored shear force. For shearline: total shearforce. For wall: total of all segments on wall. For segment: shear force on segment
  - **Asp/Cub:** For wall: Unblocked structural wood panel factor Cub from SDPWS 4.3.1.2. For segment: Aspect ratio adjustment from SDPWS 4.3.3.2
  - **Int:** Unit shear capacity of interior sheathing, Ext: Unit shear capacity of exterior sheathing. For wall: Unfactored. For segment: Include Cub factor and aspect ratio adjustments.
  - **Co:** Adjustment factor for perforated walls from SDPWS Equation 4.3-8.
  - **C:** Sheathing combination rule, A = Add capacities, S = Strongest side or twice weakest, G = Stiffness-based using SDPWS 4.3.3.
  - **Cmb:** Combined interior and exterior unit shear capacity including perforated wall factor Co.
  - **Resp:** Factor of factored shear capacity of shearline, wall or segment
  - **Resp Ratio:** Response ratio = v/Cmb = design shear force/unit shear capacity. "W" indicates that the wind design criteria was critical in selecting wall.

**Notes:**

Refer to Elevation View diagrams for individual level for uplift anchorage force for perforated walls given by SDPWS 4.3.6.4.2.4.
2 Shearwalls Tutorial 2 - Quick Start (U.S.)

A copy of the shearwalls file (.wsw) created from going through this tutorial can be downloaded by clicking [here](#).

2.1 Creating Main Block and Adjusting View

1. Start Shearwalls. The Structure button is highlighted and the Structure Input form is active.
2. Define a structure block by clicking & holding the left mouse button while the cursor points at approximately X=0 & Y=0 and dragging the cursor to approximately X=25 & Y=35. You may need to manually adjust the Location and Extents in the Structure Input form to define the structure block. It may be necessary to adjust the View in the Settings tab, so that the entire block can be seen.
3. Increment No. of Levels in the Structure Input form to 3 levels for the selected structure block.

![Shearwalls Tutorial 2 - Creating Main Block and incrementing levels](image)

Figure 1: Shearwalls Tutorial 2 - Creating Main Block and incrementing levels
2.2 Modifying Block Walls

1. Click the **Walls** button and highlight wall 2-1. You may change the length, location, type or material of the wall in the **Wall Input** form.

2. Split wall 2-1 by pointing the cursor at \((25,20)\) holding down the left mouse button while dragging the cursor to \((25,0)\), then releasing the left mouse button. Walls 2-1 and 2-2 will now be created.

3. Move wall 2-1 by pointing the cursor at \((25,10)\) holding down the **shift key & left mouse button** while dragging the cursor to \((15,10)\), then releasing the **shift key & left mouse button**.

---

**Figure 2:**  *Shearwalls Tutorial 2 – Modifying Block Walls*
2.3 Creating Openings

1. Click the Openings button, point the cursor at \((15,5)\), hold down the left mouse button & drag the cursor to \((15,15)\) and release the left mouse button. You may change the offsets, width and height of the opening in the Opening Input form.
2.4 Extending Levels and Creating Roof

1. Click on the **Extend Levels** button. This will automatically create the levels 2 and 3 as a copy of level 1.

2. Click on the **Roof Blocks** button. In the **Roof Input** form, under *Construction* select **Hip** for the north and south sides of the building, and enter overhangs of 2 ft for all sides of the building.

![Image of Shearwalls Tutorial 2 – Extending Levels and Creating Roof](image)

*Figure 4: Shearwalls Tutorial 2 – Extending Levels and Creating Roof*
2.5 Add Loads and Forces

1. Click on the Generate Loads button to open the Generate Loads View. Loads will be added manually for this example, therefore do not generate loads and proceed to step 2 below.

2. Click on the Loads & Forces button, click Add..., select Wind Shear, West Building Face, Line Load, apply from level 1 to 3, Magnitude equal to 50 plf and click OK.

![Add a New Load](image)

Figure 5: Shearwalls Tutorial 2 – Add Wind Shear Line Load
Figure 6:  Shearwalls Tutorial 2 – Plan View: Loads and Forces
2.6 Run Design and View Results

1. Click on the Run Design button and view the Results report. Note that Rigid Analysis will not be completed because the structure is only loaded in one direction. You can navigate directly to the desired results in the Results view using the Go To Table button. Click Go to Table, Wind Design, Flexible Diaphragm Design, Shear Results.

2. A pdf of the design results can be downloaded by clicking here.

Figure 7: Shearwalls Tutorial 2 – View Results
3. Click on the ** Loads and Forces ** button, highlight wall ** A-1 ** and click on the ** Elevation View ** button to see the load distribution graphically on a shearwall or entire shearline.

4. If you close an ** Input form **, click on the ** Forms ** button to restore the appropriate form.

**Figure 8:**  
*Shearwalls Tutorial 2 – Shearline A Elevation View*
3  **Shearwalls Tutorial 3 – Two Storey Structure Tutorial (U.S.)**

In this tutorial you will create a two-story wood-frame structure with a one-story garage and design it for automatically generated wind and seismic loads. The following tutorial is also demonstrated in the following online video.

The example.wmf file which is imported in this tutorial can be downloaded by clicking on here. The shearwalls file (.wsw) which you will create by going through this tutorial can be downloaded by clicking here.

To begin, start the *Shearwalls* program or select **File/New** to start a new file if you are already in *Shearwalls*.

**3.1 Define Settings**

Define the initial settings and preferences for your project.

**3.1.1 Company Information**

1. From the **Settings** menu, select the **Company Information** tab.
2. Enter your company information.

![Figure 1: Shearwalls Tutorial 3 – Company Information](image-url)
3.1.2 Project Description

1. Now click on the **Project Description** tab.
2. Enter the relevant project description.

![Project Description Tab](image)

**Figure 2:** *Shearwalls Tutorial 3 – Project Description*
3.1.3 View Options

1. Click on the **Plan View** tab.
2. Set the snap increment to **6 (in)**.
3. Set **Fit View Area** to **Window** and **Fit Building** to **View Area** to off.
4. Set the **Display Gridlines...** to off.
3.2 Design Options

1. Click on the **Design** tab.
2. Click on Reset Original Settings.
3. Click **OK**.

Figure 4: *Shearwalls Tutorial 3 – Design Settings*
3.3 CAD Import

1. Click on the **Import CAD Drawing** button and select **Number of Levels with CAD drawings** as 2.
2. Click **Import file**, change the file format to **Metafile (*.emf,*.wmf)**, select the file **example.wmf** file and click **Open**. Repeat for second level.

Note: The file **example.wmf** file can be downloaded by clicking [here](#).

Note: For multi-level buildings with varying layouts on each level, importing different metafiles for each level can be done.

![CAD Import Wizard](image)

**Figure 5: Shearwalls Tutorial 3 – Import Metafiles**
3. Following the **Import Wizard** instructions, select the **Start Positioning** button and enter the first reference point as the bottom left hand corner of the building using the mouse.

4. Use Default coordinates of \((0,0)\), and Select **Next**.

![Figure 6: Shearwalls Tutorial 3 – Specify Default Coordinates for Level 1](image)
5. Select the bottom right corner of the building as the second reference point.
6. Enter 20 (ft) as the distance between the two reference points.
7. Click Finish level 1.
8. Continue with CAD Import Wizard scaling instructions for level 2, and repeat steps 4 to 6.

Figure 7: Shearwalls Tutorial 3 – Specify Default Coordinates for Level 2
3.4 Structure Blocks & Levels

1. Click on the **Structure** button.
2. Use the **Zoom In** and **Zoom Out** buttons to adjust the CAD building image to fill the viewing area.
3. Layout the first **Structure Block** along the exterior walls by clicking and dragging a rectangle from the top right hand corner of the structure to the only inside corner on the left hand side of the building. With the block still highlighted, enter **Main** in the **Block Name** field and select 2 as the number of levels. This block will represent the two-story living space of the structure.

![Image of CAD building with highlighted block](image-url)

**Figure 8:** *Shearwalls Tutorial 3 – Create Main Block*
4. Layout a second structure block representing the garage portion of the structure by clicking and dragging a rectangle from the bottom left hand corner of the structure to the inside corner on the right hand side of the building where the garage ends. Blocks must abut or overlap slightly. Enter **Garage** as the block name and select 1 as the number of levels.

5. Set the foundation elevation as **3 ft**. Modifying the foundation elevation for the **Garage** block will automatically modify the foundation elevation for the **Main** block to the same height.

**Figure 9: Shearwalls Tutorial 3 – Create Garage Block**
3.5 Create Walls for Level 1

1. Click on the **Walls** button.
2. Extend outward the main entrance of the structure. Click on wall 4-1 and click and the mouse from a point on wall 4-1 where the main entrance extension first begins to where it ends. There should now be three walls along shearline 4, including 4-1, 4-2 and 4-3.

---

**Figure 10: Shearwalls Tutorial 3 – Splitting Shearline 4**
3. Move wall 4-2 to the right to extend the main entrance and match the CAD file by holding the Shift key and clicking on wall 4-2. While holding the **shift key & left mouse button** down, move the arrows to the new position and release.

**Figure 11:** *Shearwalls Tutorial 3 – Extend Shearline 4 to match CAD drawing*
4. Continue this process until the building footprint matches the CAD file as shown below.
5. Add three walls by clicking at the start of each wall and dragging the mouse to the end of the wall.
6. Select all three interior walls by holding **CTRL** and clicking on walls.
7. Change all three walls to **Interior Segmented** in **Wall and Shearline Input**.

Note: The CAD drawing has been toggled off in the Figure below to see where the interior shearwalls were specified.

![Shearwalls Tutorial 3 – Add Interior shearwalls on Level 1](image)
3.6 Create Openings for Level 1

1. Click on the **Openings** button.
2. Create a garage door opening by selecting wall 3-1 and clicking on a point offset 3 ft from the edge of the building and dragging a **14 (ft)** opening. This can also be achieved by directly entering input in the **Opening Input** form.
3. Continue to place door and window openings around the structure as desired.
4. To ease viewing, click on the **Import CAD** button to remove the CAD image from the background. This can be turned back on at any time.

Note: Other Openings can be drawn, but for the purpose of the Tutorial only the garage opening has been drawn on level 1.

![Image of Shearwalls Tutorial 3 – Creating Garage Door Opening](image)

**Figure 13**: Shearwalls Tutorial 3 – Creating Garage Door Opening
3.7 Create Walls for Level 2

1. It is recommended that the model be saved at this point. It is not possible to go back once the next step of extending walls upwards is complete, so saving the model beforehand is best practice. Click on the **Extend Walls** button. This automatically creates the upper levels for all multi-leveled blocks. In this case the second level is created for the **Main** structure block.

2. The current level should be **level 2**.

3. Click on the **Walls** button. Add interior walls on the **level 2** directly above the interior walls on **level 1**, as desired.

Note: Other Interior shearwalls can be drawn, but for the purpose of the Tutorial only two walls have been drawn on level 2.
3.8 Create Openings for Level 2

1. Click on the **Openings** button.
2. Select wall **E-1** and create two small 6 (ft) wide window openings with a 3.75 (ft) height and 3 (ft) offset from the bottom.
3. To view the current openings, select wall **E-1** and click on the **Elevation** button.
4. Select level 1 to 2 in the data bar.

Note: Other Openings can be drawn, but for the purpose of the Tutorial only the two openings along shearline E have been drawn on level 2. Also, it can be seen in elevation view that based on the two openings, there is only one 8 ft section of shearline E which meets the required code aspect ratio and will be utilized for resisting shear forces when the analysis is complete. Non-shear wall segments are indicated with a grey hatch in elevation view.

![Image](image.png)

Figure 15: *Shearwalls Tutorial 3 – Shearline Elevation View*
3.9 Creating Roof Blocks

1. Click on the **Roof Blocks** button. Roof blocks will automatically be assigned to all structure blocks having an initial geometry based on the defaults set in **Settings/Default Settings**.

2. Select the **Main** block. Set the East and West slopes of the roof at **30 degrees** and set overhangs of **2 ft** on all sides of the roof.

![Image of Shearwalls - Roof Input](image)

**Figure 16: Shearwalls Tutorial 3 – Modifying Roof Input for Main Block**
3. Select the **Garage** block. Set the ridge direction to **E-W**, set the **North** and **South slopes** of the roof at **30 degrees** and set overhangs of **2 ft** on all sides of the roof.

![Image of Shearwalls Tutorial 3 - Modifying Roof Input for Garage Block](image)

**Figure 17:** *Shearwalls Tutorial 3 – Modifying Roof Input for Garage Block*
3.10 Generating Loads

1. Before generating loads, click on the **Site Information** toolbar icon. From the **Load Generation Site Information** input dialog you can set the parameters to be used to generate wind and seismic loads. To change the **Design Code** selection, go to the **Settings/Design** tab.

![Shearwalls Tutorial 3 – Load Generation Site Information](image-url)
2. Close Site Information.

*Note:* You can limit load generation to specific levels by selecting only the range of floors. Skipping floor load generation can be achieved by selecting the "Loads and Forces" screen, select the floor for which you do not want loads generated and "Delete all Showing."

3. Click on the **Generate Loads** toolbar icon.
4. Select Wind and Seismic loads to be generated from **level 1** to **2**. All other setting should remain as shown.
5. Click on **Generate Loads on Selected Levels** to automatically generate loads.
6. The log file, which includes the details for the loads generated by shearwalls is now available to be viewed. Click **here** to download a pdf of the log file.
7. Use the **Show** button menu in the data bar to turn on and off viewing of a variety of data.
8. To view seismic loads, click on **Show/Seismic/Seismic Loads and Forces**. Go to **Show/Orientation to view** an alternative load orientation.

---

**Figure 19:** *Shearwalls Tutorial 3 – Plan View Generated Loads Level 1*
3.11 Modifying & Manually Applying Loads

1. Click on the **Loads and Forces** button.
2. Select the **South wall (A-1)** on **level 1**. All generated loads acting on wall A-1 will appear in the **Load Input** form.
3. Generated loads can be modified or deleted at this stage based on your judgement.

Figure 20. *Shearwalls Tutorial 3 – Plan View: Loads and Forces*
3.12 Plan View

To view the various loads and forces applied, use the **Show** menu.

1. Select **Show/Seismic** to switch to the seismic loads generated by the program

Figure 21: *Shearwalls Tutorial 3 – Show Forces in Plan View*
3.13 Elevation View

1. Select wall **E-1** and click on the *Elevation* button.
2. Set the levels from 1 to 2 to show both levels at once.
3. Shear forces, hold-down forces and drag strut forces are shown.
4. Select *Show/Forces/Hold-downs/Separate* to view the hold-down force broken-up by its components.

![Shearwalls Tutorial 3 – Forces in Elevation View](image)
3.14 Results

1. Click on the Design button. The Design Results view will appear. You can download a pdf of the design results by clicking here.

2. A pdf of the log file, which now includes additional details for the torsional analysis can be downloaded by clicking here.

3. Scroll up and down to view the results. There are still a number of deficiencies which need to be addressed by modifying the wall details and hold-downs along the shearlines for the purpose of creating a design that meets the code.

4. The Show button options allow the Design Results to be customized.

5. Print the results by clicking on the Print button.
4  **Shearwalls Tutorial 4 – Structure and Roof Block Strategy (US)**

The decision to model a structure using a single structure block or several structure blocks depends on the configuration of the structure and the designer’s intentions regarding the generation of lateral loads on each level. If a structure is to be designed for wind loads generated by the software using the low-rise method, the designer has no choice but to define the structure using only one block, as it is not possible to generate loads for multiple blocks using the low rise method, as the ASCE 7-10 does not provide guidance for this situation. In cases where multiple roof blocks are utilized in a model, it is necessary to utilize the all heights method to generate wind loads.

Structure blocks establish the initial shell of exterior walls for all levels of the structure. Blocks maintain the integrity of the structure by ensuring that this shell does not have any gaps. Two common misconceptions with *Shearwalls* is that the blocks of the structure must match the roof shape perfectly and that you must utilize multiple structure blocks to achieve the shape of your structure, although this is not the case. The reason for using multiple blocks in a model would be if you have portions of your structure which vary in height (i.e. 2 story house with a 1 story garage attached). If your entire structure is consistently the same elevation on each level, then you only need one structure block to start modelling your building. Once in walls view, it is possible to adjust the model to match the actual perimeter of the structure by splitting walls (tracing over them) and then utilizing the shift key on your keyboard to move the walls to achieve the shape of the building. If your roof is not flat and includes multiple hips and valleys, once in Roof view, it is possible to add multiple roof blocks to achieve the desired roof shape.

This tutorial will go over the structure block creation strategy for a two story house, as well the roof block creation for the two story structure.

Each model and structure is different, and the choice to use 1, 2 or more blocks is ultimately up to the user. In the experience of the WoodWorks Software Technical Support Team, it has been found that using too many structure blocks over complicates models, and it best practice to limit the number of structure blocks utilized in a model.

Note: The pdfs of the floor print of the structure can be downloaded by clicking the following link: [Level 1, Level 2]

**4.1 Structure Block and Roof Block Creation Strategy**

The following three figures include the 1st floor, 2nd floor and roof plan view of the structure. Note that the second story, does not cover the full area of the garage. Some users would assume that it is necessary to utilize more than one structure block to model this structure accurately, but it is possible to move walls into the structure when on the second story, so for this structure it is only necessary to utilize one structure block. Furthermore, some users would assume that multiple structure blocks would need to be utilized to create the roof, but it will be demonstrated in the roof block generation portion of the tutorial that it is possible to add multiple roof blocks once in the roof block view. Throughout this project a strategy for saving multiple versions of the file after various steps is demonstrated.
Figure 1: Shearwalls Tutorial 4 – 1st Story Plan

Figure 2: Shearwalls Tutorial 4 – 2nd Story Plan

Figure 3: Shearwalls Tutorial 4 – Roof Plan View
4.2 Define Settings
Define the initial settings and preferences for your project.

4.2.1 Company Information
1. From the **Settings** menu, select the **Company Information** tab.
2. Enter your company information.

Figure 4: *Shearwalls Tutorial 4 – Company Information*
4.2.2 Project Description

1. Now click on the **Project Description** tab.
2. Enter the relevant project description.

![Image of Project Description tab with company information entered](image)

**Figure 5:** Shearwalls Tutorial 4 – Project Description
4.2.3 Default Values

1. Click on the Default Values tab.
2. Click on Reset Original Settings.

Figure 6: Shearwalls Tutorial 4 – Default Values
4.2.4 Snap Increment

1. Click on the Plan View tab.
2. Set the Mouse clicks recorded at to 2 in snap increments.

Figure 7: Shearwalls Tutorial 4 – Set Snap Increment
4.2.5 Design Settings

1. Click on the Settings, Design Tab.
2. Change the Wind Load generation procedure to ASCE 7-10 Directional (All heights).
3. Unclick the box Include deflection Analysis.
4. Rigidity for shear force distribution based on... will automatically change to Shearwall capacity (wood based panels and Fiberboard only).
5. Under Ignore non-wood panel contribution... click the All gypsum-based materials, fiberboard and lumber sheathing for seismic design.
6. Press OK for the settings changes to take effect.

7. Save a copy of the model Tutorial_4_settings.wsw

4.3 CAD Import

1. Click on the Import CAD Drawing button and select Number of Levels with CAD drawings as 2.
2. For Level 1, Click Import file, select the file Tutorial_11_Floor_1.pdf file and click Open.
3. For Level 2, Click Import file, select the file Tutorial_11_Floor_2.pdf file and click Open.

Note: The pdfs of the floor print of the structure can be downloaded by clicking the following link: Level 1, Level 2
4. Following the **Import Wizard** instructions, select the **Start Positioning** button and enter the first reference point as the bottom left hand corner of the garage bump-out using the mouse (See red circle in figure below).

5. Use Default coordinates of \((30,0)\), and Select **Next**.
6. Select the bottom right corner of the building as the second reference point (See red circle in figure below).
7. Enter \textbf{10 (ft)} as the distance between the two reference points.
8. Click \textit{Finish level 1}.
9. Continue with \textit{CAD Import Wizard} scaling instructions for \textit{level 2}, and repeat steps 4 to 8.

\textbf{Figure 10: Shearwalls Tutorial 4 – Specify Default Coordinates for Level 1}
8. **Save** a new copy of the model *Tutorial_4_CAD_import.wsw*

### 4.4 Structure Blocks & Levels

1. Click on the *Structure* button.
2. Use the *Zoom In* and *Zoom Out* buttons to adjust the CAD building image to fill the viewing area.
3. Layout the first *Structure Block* by clicking and dragging a rectangle from the top left corner of the structure to the bottom right corner. This is the only structure block which is necessary to create an accurate model of the structure. With the block still highlighted, make the following modifications:
   a) Enter *House* in the *Block Name* field.
   b) Specify the *X location* as 0 ft
   c) Specify the *X extent* as 40 ft
   d) Specify the *Y location* as 0 ft
   e) Specify the *Y extent* as 55.5 ft
   f) Select 2 as the number of levels.
   g) Modify the *Foundation elevation* to 1 ft.
4. **Save** a new copy of the model *Tutorial_4_Block.wsw*

4.5 **Create Walls for Level 1**

1. Click on the **Walls** button.
2. Click on wall **B-1** and click and the mouse from the point on wall **B-1** where the main structure ends to the end of the wall. There should now be two walls along **shearline B**, segments **B-1** and **B-2**.
3. Click on segment **B-2**, while holding the **shift key & left mouse button** down, move the wall down to the wall on the exterior North side of the structure and release.
Click on wall A-1, and using the same technique as described for Shearline B, split the wall into four equal segments of 10 ft. There should now be four walls along shearline A, segments A-1, A-2, A-3 and A-4.

Note: The location of the segments can be adjusted using the Wall Form view (See red Box in Image below)
5. Click on segment A-1, while holding the **shift key & left mouse button** down, move the wall upwards to match exterior of the structure on the South Side and release.

6. Click on segment A-2, while holding the **shift key & left mouse button** down, move the wall upwards to match exterior of the structure on the South Side and release. Note that the wall segment will rename itself shearwall A-1 based on step 5.

7. Click on segment A-3, while holding the **shift key & left mouse button** down, move the wall upwards to match exterior of the structure on the South Side and release. Note that the wall segment will rename itself shearwall A-1 based on step 6.
8. **Save** a new copy of the model *Tutorial_4_wall_before_extending.wsw*

Note: For the purpose of simplifying this tutorial, no interior walls will be drawn in the model. If desired interior shearwalls or interior non-shearwalls could be added to the model, but note that any walls which are added to the model before extending walls upwards will be included on the 2nd storey, so adding interior walls after extending walls upwards would make more sense as the interior walls between the two storeys is not consistent throughout the structure.

### 4.6 Extend Walls Upwards and Adjust Walls on Second Storey

1. Click on the extend walls upwards icon.
2. Click on wall *A-1*, and move it so that it is in line with wall *B-1*, effectively creating one shearline, with wall segments *B-1* and *B-2*.
3. Click on wall *B-2*, and press the **delete key** to create one wall segment known as *B-1*. 

---

**Figure 16:** Shearwalls Tutorial 4 - Extend Shearline A to match CAD drawing
To move wall B-1 to be on the other side of wall C-1, it must be done in two steps. First you must align wall B-1 with wall C-1, then adjust wall B-1 a second time to be on the other side of wall C-1.

4. Click on wall **B-1**, hold the **shift key** and move the wall to be in line with wall **C-1**.
5. Click on the portion of wall now known as **C-2** (based on step 4), hold the **shift key** and move wall **C-2** to be in line with the exterior wall above the garage.
6. **Save** a new copy of the model *Tutorial_4_wall_level_2.wsw*

### 4.7 Create Wall Openings on Levels 1 and 2

1. Click on the **Openings** button.
2. Create openings by clicking on a wall and tracing a line where an opening should be. Follow the opening on the CAD drawing and adjust accordingly using the **Opening form** view.

**Note:** Although the size of the openings does not matter for segmented shearwalls, for the purpose of this tutorial, all doors will have a height of 6.75 ft with a 0 ft offset from bottom, and all windows will be a height of 2.75 ft with a 3 ft offset from bottom.
Figure 19: Shearwalls Tutorial 4 – Openings on Level 1
3. **Save** a new copy of the model *Tutorial_4_openings.wsw*

### 4.8 Creating Roof Blocks

1. Click on the **Roof Blocks** button. One large roof block will automatically be generated by the program which follows the initial shape of the structure block. The initial geometry will be based on the defaults set in **Settings/Default Settings**. The next steps will go over how to create the roof shape of the model.
2. Set the **current level** to 2.
3. Select the **House** block.
   a) Adjust the roof block so that it only covers the main structure. See Figure for geometry.
   b) Adjust the **Ridge orientation** to **East-West**.
   c) Adjust both the **East** and **West** ends of the roof block to be **Hip**.
   d) Set the **Slopes** of the roof at **30 degrees**
   e) Set the **Overhangs** to **2 ft** on all sides of the roof.
4. Create a second roof block, by clicking the top left corner of the structure and running the new roof block into the main roof block. Make the following adjustments to the new roof block known as Block 2:
   a) Adjust the roof block so that it matches the extents of the structure. See Figure for geometry.
   b) Set the Ridge orientation to North-South.
   c) Adjust the North end to be a Gable, and the South end to be Joined.
   d) Set the Slopes of the roof at 30 degrees.
   e) Set the Overhangs to 2 ft on all sides of the roof.
5. Create a third roof block, by clicking the just below the location of the front door and run the new block into the main roof block. Make the following adjustments to the new roof block known as **Block 3**:
   a) Adjust the roof block so that it matches the extents of the structure. See Figure for geometry.
   b) Set the **Ridge orientation** to **North-South**.
   c) Adjust the **South** end to be a **Gable**, and the **North** end to be **Joined**.
   d) Set the **Slopes** of the roof at **30** degrees.
   e) Set the **Overhangs** to **2 ft** on all sides of the roof.
6. Set the **Current Level** to 1.

7. Create a fourth roof block, by clicking the bottom left corner of the structure and running the new roof block into the main roof block. Make the following adjustments to the new roof block known as **Block 4**:
   a) Adjust the roof block so that it matches the extents of the structure. See Figure for geometry.
   b) Set the **Ridge orientation** to **North-South**.
   c) Adjust the **North** end to be a **Joined**, and the **South** end to be **Hip**.
   d) Set the **Slopes** of the roof at 30 degrees
   e) Set the **Overhangs** to **2 ft** on all sides of the roof.
8. Create a fifth roof block, by clicking near the bottom right corner of the structure and running the new roof block into Block 4. Make the following adjustments to the new roof block known as Block 5:

   a) Adjust the roof block so that it matches the extents of the structure. See Figure for geometry.
   b) Set the Ridge orientation to North-South.
   c) Adjust the South end to be a Gable, and the North end to be Joined.
   d) Set the Slopes of the roof at 30 degrees
   e) Set overhangs of 2 ft on all sides of the roof.

Figure 24: Shearwalls Tutorial 4 - Creating and Modifying Roof Block 4
9. **Save** a new copy of the model *Tutorial_4_roof.wsw*

### 4.9 Generating Loads

1. Before generating loads, click on the **Site Information** toolbar icon. From the **Load Generation Site Information** input dialog you can set the parameters to be used to generate wind and seismic loads. It is recommended to use the links provided in the wind speed and spectral response acceleration to determine appropriate inputs.
2. Click on the **Generate Loads** toolbar icon.
3. Select Wind and Seismic loads to be generated from **level 1** to **2**. All other setting should remain as shown.
4. Click on **Generate Loads on Selected Levels** to automatically generate loads.
5. Use the **Show** button menu in the data bar to turn on and off viewing of a variety of data.
6. To view wind loads, click on **Show/Wind**.
7. Save a new copy of the model Tutorial_4_loads_generated.wsw

4.10 Results

1. Click on the Loads and Forces icon to enable the Run Design icon.
2. Click on the Design button to run the design. The Design Results view will appear.
3. Scroll up and down to view the results.
4. The Show button options allow the Design Results to be customized.
5. Print the results by clicking on the Print button. Click here to download a pdf of the design results.
6. Click here to download a pdf of the log file including the load generation and torsional analysis results.
7. Save a new copy of the model Tutorial_4_final_design.wsw.
### WoodWorks® Shearwalls

**SOFTWARE FOR WOOD DESIGN**

**Tutorial 4: loads generated.wswr**

**Jan. 19, 2017 12:41:07**

**Project Information**

<table>
<thead>
<tr>
<th>Company</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Wood Council</td>
<td>Block Creation Strategy</td>
</tr>
<tr>
<td>69 Bank Street, Suite 400</td>
<td>Ottawa, Ontario</td>
</tr>
<tr>
<td><a href="mailto:support@woodworks-software.com">support@woodworks-software.com</a></td>
<td>WoodWorks JobNumber01</td>
</tr>
</tbody>
</table>

**Design Settings**

<table>
<thead>
<tr>
<th>Design Code</th>
<th>Wind Standard</th>
<th>Seismic Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBC 2015/ACI SDPS 2015</td>
<td>ASCE 7-10 Directional (All heights)</td>
<td></td>
</tr>
<tr>
<td>Building Code Capacity Modification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td>Seismic</td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Load Combinations</th>
<th>For Deflection (Strength)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75 Seismic</td>
<td>1.00 Seismic</td>
</tr>
<tr>
<td>0.60 Wind</td>
<td>1.00 Wind</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration Factor</th>
<th>Service Conditions and Load Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.60</td>
<td>Temperature Range</td>
</tr>
<tr>
<td>To=100°F</td>
<td>Moisture Content</td>
</tr>
<tr>
<td>Dry</td>
<td>Fabrication</td>
</tr>
<tr>
<td>Dry</td>
<td>Service</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wood panels</th>
<th>Fiberboard</th>
<th>Maximum Height-to-width Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>Seismic</td>
<td>-</td>
</tr>
<tr>
<td>3.0</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lumber</th>
<th>Gypsum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>Seismic</td>
</tr>
<tr>
<td>Never</td>
<td>Never</td>
</tr>
<tr>
<td>Collector forces based on:</td>
<td></td>
</tr>
<tr>
<td>Hold-downs</td>
<td>Applied loads</td>
</tr>
<tr>
<td>Drag struts</td>
<td>Applied loads</td>
</tr>
</tbody>
</table>

**Figure 28:** Shearwalls Tutorial 4 – Review Results
5 Shearwalls Tutorial 5 – Matching Published Design example (U.S.)

The following Tutorial goes through how to recreate the shearline from SDPWS Commentary C4.3.3.4.1. The tutorial will go over commentary example for capacity based distribution (C4.3.3.4.1-2), although the distribution method along shearlines can be modified to deflection based distribution to recreate example C4.3.3.4.1-1.

Note that it is not possible to 100% recreate the calculations demonstrated in the SDPWS commentary example problem for two main reasons.

1. Shearwalls does not use the same load level for calculating shear resistance and calculating deflection as is done in the SDPWS commentary examples. Shearwalls software utilizes ASD level forces when checking the shear capacity of a shearline, but when calculating deflection, the load level is brought back to strength level loads as per ASCE 7-10.
2. When using deflection based distribution, Shearwalls software iterates the load going between segments along a shearline until deflections are equalized, while the SDPWS commentary example C4.3.3.4.1-1 determines how much the segment SW2 will deflect based on the deflection of SW1 when it is loaded to capacity.

Click here to download the shearwalls file (.wsw) which will be created by going through this tutorial.

5.1 Define Settings

1. Click on the Settings, Design Tab.
2. Under Rigidity for shear force distribution based on... select Shearwall capacity (wood panels and fiberboard only).

![Shearwalls Tutorial 5 – Design Settings](image)

Figure 1: Shearwalls Tutorial 5 – Design Settings
5.2 Plan View Settings

1. Click on the **Settings, Plan View Tab**.
2. Modify *Mouse clicks recorded at to 2 in snap increment*.
3. Click **OK**.

![Image of Settings window]

Figure 2: *Shearwalls Tutorial 5 – Plan View settings*

5.3 Structure Blocks & Levels

1. Click on the **Structure** button.
2. Create a **Structure Block**, and adjust its dimensions so that the **X and Y locations** are both set to 0 (ft), set the **X extent** equal to 15 (ft), and the **Y extent** equal to 15 (ft).
3. Set the **Wall height** of **Level 1** to 8 (ft).
4. Set the **Floor/Ceiling depth** of 0 (ft) between each level.
5. Adjust the **Foundation elevation** equal to 0 (ft).
6. Under **Diaphragm flexibility**, uncheck the **rigid analysis** checkbox.

Note: The Y extent is irrelevant for this problem as manual loads will be generated for the shearline along the Southern end of the model.
Figure 3: Shearwalls Tutorial 5 – Creating Structure Block
5.4 Create Openings for Levels 1 and 2

1. Click on **Walls** View.
2. Click on **Openings** View.
3. Toggle Shearline **A-1**.
4. Add an opening that is **offset from edge** by 8 (ft), with a **width** of 4.67 (ft).

Note the height and offset from bottom of the opening are irrelevant since segmented shearwalls will be specified, which do not account for the areas above and below wall openings when completing shear analysis.

![Shearwalls Tutorial 5 – Adding Openings in Shearline A](image)

5.5 Creating Standard Walls

As default, all of the walls on level 1 should be specified as **exterior segmented**, which consists of wood structural panels on the exterior and gypsum wallboard on the interior. These details need to be modified to match the SDPWS commentary example.

5.5.1 Modifying Wall A-1 on Level 1

1. Click on **Walls**.
2. Click on **ctr+A**, to toggled all the walls on the storey.
3. Specify the Type as \textit{segmented}.
4. Specify the following parameters for the \textit{Exterior Side}:
   a) \textit{Material} is \textit{Structural Sheathing}.
   b) \textit{Thickness} is \textit{15/32 in.}.
   c) \textit{Orientation} is \textit{Horizontal}.
   d) Click on the \textit{OSB} box.
   e) Click on \textit{Blocking} box.
   f) Fasteners type as \textit{Common wire nails}.
   g) Fasteners \textit{Sizer} of \textit{8d}.
   h) Fastener \textit{Edge Spacing} as \textit{6 (in).}
   i) Fastener \textit{Interior Spacing} as \textit{12 (in).}
   j) Framing \textit{material} as \textit{Lumber}.
   k) Framing \textit{Species} as \textit{D.Fir-L}.
   l) Framing \textit{Grade} as \textit{No.2}.
   m) Framing \textit{Thickness b} as \textit{2 in nom.}.
   n) Framing \textit{Width d} as \textit{4 in nom.}.
   o) Framing \textit{Stud Spacing} as \textit{16 in.}
   p) \textit{End studs} at \textit{left} is \textit{2}.
   q) \textit{End Studs} at \textit{Right} is \textit{2}.
   r) Specify \textit{Hold-down HDUS-SDS2.5} for the \textit{Left} and \textit{Right Ends} of the wall.

5. Specify the following parameters for the \textit{Interior Side}:
   a) \textit{Material} as \textit{None}.
5.6 Roof Block

1. Navigate to *Roof Input View*.
2. Specify the *Construction* as *Flat roof*.
5.7 Applying Manual Loads

Skip the *Building Site* and *Generate Loads* buttons, as loads will be manually applied for this tutorial.

1. Click on the *Loads and Forces* button.

2. Set the **current Level** to **1**.
   a) Click on wall **A-1**, Click **Add...**,
   b) Click on **Add as a factored force directly (parallel) to the shearline**.
   c) Select **Type** of load as **Seismic Shear**
   d) Select **Profile** type as **Point Load**
   e) Modify **Levels** to From **1 To 1**.
   f) Modify **Location** to **Apply to... Shearline A**
   g) Specify a **Magnitude** of **2400 lbs**.
   h) Set **Distribution method** as **Both**.
   i) Click **OK**.
5.8 Run Design and Compare Design Results to Wood Design Manual

1. Click on Run Design.
2. In the Results View, click on Go To Table, Seismic Design, Flexible Diaphragm Design, Shear Results.
3. Compare Seismic Shear results to those shown in SDPWS 2015 Example C4.3.3.4.1-2.
4. Click here to download a pdf of the design results.
5.9 Additional Practice

1. Go to the Design Settings tab
2. Under Rigidity for shear force distribution based on... select Deflection of wall segments or perforated walls.
3. Press OK.
4. Click on Run Design.
5. Compare seismic shear results to those shown in SDPWS 2015 Example C4.3.4.1-1 (Take note of the differences as per explanation at the beginning of the tutorial).
6 Tutorial 6 – Shearwalls Model – 3 Storey Apartment Building (U.S.)

The 3storeybuilding.pdf file used to create the shearwalls model in this tutorial can be downloaded by clicking here.

Click here to download the shearwalls model (.wsw) which has been saved at the point just before extending walls upwards. If using this file, you may want to move forward to step 6.7.

To begin, start the Shearwalls program or select File/New to start a new file if you are already in Shearwalls.

6.1 Define Settings

Define the initial settings and preferences for your project.

6.1.1 Company Information

1. From the Settings menu, select the Company Information tab.
2. Enter your company information.

![Image of Settings window]

Figure 1: Tutorial 6 – Shearwalls Company Information

6.1.2 Project Description

1. Click on the Project Description tab.
2. Enter the relevant project description.

![Settings Window](image)

**Figure 2:** Tutorial 6 – Shearwalls Project Description

### 6.1.3 Design Settings

1. Click on the *Design Settings* tab.
2. Under *Rigidity for shear force distribution based on...* select *Shearwall Capacity (wood panels and fiberboard only).*
3. Under *Ignore non-wood-panel contribution...* select *All gypsum-based materials, fiberboard and lumber sheathing for seismic design.*
6.1.4 Plan View Settings

1. Click on the **Plan View** tab
2. Adjust the **Mouse clicks recorded** at to 2 in.
3. Adjust the **Display Gridlines** to **Every 36 snap increments**.
4. Click **OK**.
6.2 CAD Import

1. Click on the **Import CAD Drawing** button and select **Number of Levels = 3**.
2. Click **Import pdf** from the **Examples** subdirectory under the **Shearwalls** directory, select the **Three_storey_apartment-Model.pdf** file and click **Open**. Repeat for second and third levels.
3. Following the **Import Wizard** instructions, select the **Start Positioning** button and enter the first reference point as the bottom left hand corner of the building using the mouse. Do not select the corner of the balcony, select the bottom left corner of the family room in apartment 3.

4. Use Default coordinates of \((12,0)\), and Select **Next**.
5. Select the bottom right corner of the building as the second reference point. Do not select the corner of the balcony, select the top left corner of the family room in apartment 1.

Note: That picking the second reference point as the other end of the structure is not necessary. If there is a closer known distance, or gridlines are included in the sketch, then it is recommended to utilize a shorter distance as the second reference point.

6. Enter 60 (ft) as the distance between the two reference points.
7. Click Finish level 1.
8. Continue with the same CAD Import scaling instructions for levels 2 and 3.

Note that setting the default coordinates for the structure may take several iterations until the Cad drawing is properly placed in shearwalls. For this particular import, suggest clicking on points at the exterior edges of the exterior walls, as to ensure the walls will line up in both the x and y directions on each storey.

6.3 Structure Blocks & Levels
1. Click on the Structure button.
2. Use the Zoom In and Zoom Out buttons to adjust the CAD building image to fill the viewing area, or hold the ctrl key and use the scroll wheel on your mouse to zoom in or out.

Note: There are many ways in which the shape of the structure can be modelled. For the purpose of this example, one block will be created, then exterior walls will be split and moved.
3. Create a **Structure Block** along the most Northern and Southern exterior walls by clicking and dragging a rectangle from the top right hand corner of the structure to the only inside corner on the left hand side of the building. Coordinates of the block can be seen in the Figure below. With the block still highlighted, select 3 as the number of levels.

![Figure 7: Tutorial 6 – Shearwalls Creating Structure Block](image)

### 6.4 Extending East and West Walls of Structure

1. Click on the **Walls** button.

2. Split both walls **1-1** and **2-1** into three separate walls by drawing additional walls on top of the walls. Click on wall **1-1** and click and the mouse from the bottom to the point where the bedroom begins (ie. From 0 ft to 12 ft along wall length). Draw another line along the wall **1-1** from the edge of Bedroom 2 in Apartment 1 to the end of the wall line (ie, From 12 ft to 68 ft along wall length). There should now be three walls along shearline **1**, including **1-1, 1-2** and **1-3**. Repeat the same steps for shearline **2-1**. (Note: The CAD drawing has been hidden by toggling the Import CAD Drawing button in the screen capture below for clarity).
3. Move wall 1-2 to the left to extend the block and match the CAD file by holding the Shift key and clicking on wall 1-2. While holding the left mouse button down, move the arrows to the new position and release (Wall should now be located along gridline -3 ft). Repeat the same steps for wall 2-2 (Wall should now be located along gridline 87 ft, and will be renamed to 4-1).
Now that the exterior perimeter of the structure has been established, it is time to draw all of the interior walls. For now, we will not worry about wall types as it is more important to establish the walls within the building. Modifying wall types will be done once all of the walls have been drawn and openings have been added. There are two options when drawing interior walls. Either draw every wall, including partitions, or only those walls which will be utilized as shearwalls. For simplicity, only the walls which are going to be utilized as shearwalls will be drawn. Below is a summary of the walls drawn in the model.

**North-South Walls**

<table>
<thead>
<tr>
<th>Name</th>
<th>X (ft)</th>
<th>Start Y (ft)</th>
<th>End Y (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>-3</td>
<td>12</td>
<td>68</td>
</tr>
<tr>
<td>2-1</td>
<td>12</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>2-2</td>
<td>12</td>
<td>12</td>
<td>40.5</td>
</tr>
<tr>
<td>2-3</td>
<td>12</td>
<td>40.5</td>
<td>68</td>
</tr>
<tr>
<td>2-4</td>
<td>12</td>
<td>68</td>
<td>80</td>
</tr>
<tr>
<td>3-1</td>
<td>37</td>
<td>0</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>X (ft)</th>
<th>Start Y (ft)</th>
<th>End Y (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1</td>
<td>47</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>5-1</td>
<td>72</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>5-2</td>
<td>72</td>
<td>12</td>
<td>40.5</td>
</tr>
<tr>
<td>5-3</td>
<td>72</td>
<td>40.5</td>
<td>68</td>
</tr>
<tr>
<td>5-4</td>
<td>72</td>
<td>68</td>
<td>80</td>
</tr>
<tr>
<td>6-2</td>
<td>87</td>
<td>12</td>
<td>68</td>
</tr>
</tbody>
</table>
### East-West Walls

<table>
<thead>
<tr>
<th>Name</th>
<th>Y (ft)</th>
<th>Start X (ft)</th>
<th>End X (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>0</td>
<td>12</td>
<td>72</td>
</tr>
<tr>
<td>B-1</td>
<td>12</td>
<td>-3</td>
<td>12</td>
</tr>
<tr>
<td>B-2</td>
<td>12</td>
<td>72</td>
<td>87</td>
</tr>
<tr>
<td>C-1</td>
<td>40.5</td>
<td>-3</td>
<td>37</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Y (ft)</th>
<th>Start X (ft)</th>
<th>End X (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-2</td>
<td>40.5</td>
<td>47</td>
<td>87</td>
</tr>
<tr>
<td>D-1</td>
<td>68</td>
<td>-3</td>
<td>12</td>
</tr>
<tr>
<td>D-2</td>
<td>68</td>
<td>72</td>
<td>87</td>
</tr>
<tr>
<td>E-1</td>
<td>80</td>
<td>12</td>
<td>72</td>
</tr>
</tbody>
</table>

Note: In the Figure below, the CAD drawing has been hidden by toggling the Import CAD Drawing button in the screen capture below for clarity.

#### 6.6 Create Openings for Level 1

Click on the **Openings** button. For simplicity, all doors and window will have the same **height** and **offset from bottom** as specified in the table below:

<table>
<thead>
<tr>
<th>Opening Type</th>
<th>Height (ft)</th>
<th>Offset from bottom (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door (D)</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Window (W)</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Note: It is possible to quickly draw openings within walls by clicking and dragging a line where the opening is to be placed. It is recommended to draw all of the window openings using this method and then adjusting them accordingly.

### North-South Wall

<table>
<thead>
<tr>
<th>Name</th>
<th>Opening Type</th>
<th>Offset from Edge (ft)</th>
<th>Width (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>W</td>
<td>5.5</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>19.5</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>32</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>46</td>
<td>4.5</td>
</tr>
<tr>
<td>2-1</td>
<td>D</td>
<td>2.5</td>
<td>7</td>
</tr>
<tr>
<td>2-2</td>
<td>D</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>2-3</td>
<td>D</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>2-4</td>
<td>D</td>
<td>2.5</td>
<td>7</td>
</tr>
<tr>
<td>3-1</td>
<td>D</td>
<td>35.5</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>41</td>
<td>3.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Opening Type</th>
<th>Offset from Edge (ft)</th>
<th>Width (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1</td>
<td>D</td>
<td>35.5</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>41</td>
<td>3.5</td>
</tr>
<tr>
<td>5-1</td>
<td>D</td>
<td>2.5</td>
<td>7</td>
</tr>
<tr>
<td>5-2</td>
<td>D</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>5-3</td>
<td>D</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>5-4</td>
<td>D</td>
<td>2.5</td>
<td>7</td>
</tr>
<tr>
<td>6-1</td>
<td>W</td>
<td>5.5</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>19.5</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>32</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>46</td>
<td>4.5</td>
</tr>
</tbody>
</table>
### East-West Walls

<table>
<thead>
<tr>
<th>Name</th>
<th>Opening Type</th>
<th>Offset from Edge</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>W</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>W</td>
<td>26.5</td>
<td>7</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td>39</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Opening Type</th>
<th>Offset from Edge</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1</td>
<td>W</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>W</td>
<td>26.5</td>
<td>7</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td>39</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: Now that the walls and openings have been established, the CAD drawing has been toggled off so that it is easier to view the walls in the model.

![Image of shearwall creation](image.png)

Figure 11: Tutorial 6 – Shearwalls Creating Wall and Door Openings
6.7 Creating Standard Walls

For the purpose of the tutorial, a number of different standard walls will be utilized. Except for shearlines B and D, all of the exterior walls will be specified as non-shearwalls. The exterior non-shearwall standard wall will be named `extnosh`ear. Three standard segmented standard wall types will be created (1 for floor). Each floor will be designated a Standard wall type known as `shear#`. The # will be numbered 1, 2, or 3, depending on the story. The goal is to have one standard shearwall construction for each story of the structure. Standard Wall `Shear1` will be specified on the stop story, `Shear2` on the second story, and `Shear3` on the bottom story. The model will have four shearlines in the North-South direction (Circled in Black in Figure below), and three shearlines in the East-West direction (Circled in Red in Figure below).

All the standard walls will be created before extending walls upwards. Doing this will help facilitate easily modifying the shearlines on the upper storeys.

Figure 12: Tutorial 6 – Establishing Shearlines for Model
6.7.1 Creating Standard Wall Shear1

1. Click on Walls.
2. Go to Form View.
3. Click on Edit Standard Walls.
4. Click New.
5. Name new standard wall Shear1.
6. Under Type, specify Segmented.
7. Leave the Relative Rigidity per unit length equal to 1.
8. Specify the following parameters on the Exterior Side:
   a) Material is Structural 1.
   b) Thickness is 15/32 mm.
   c) Click on the OSB box.
   d) Click on Blocking box.
   e) Set Span rating to 32/16.
   f) Orientation is Horizontal.
   g) Fasteners type as Common wire nails.
   h) Fasteners Sizer of 10d
   i) Fastener Edge Spacing as 6 in.
   j) Fastener Interior Spacing as 12 in.
   k) Framing material as Lumber Stud.
   l) Framing Species as D.Fir-L.
   m) Framing Grade as No.2.
   n) Framing Thickness b as 2 in.
   o) Framing Width d as 4 in.
   p) Framing Stud Spacing as 16 in.
   q) End studs at left is 2.
   r) End Studs at Right is 2.
9. Click on the Interior Side and set the material to None.
10. Click OK.
11. Click Yes to the pop up window to save standard wall details.
Figure 13: Tutorial 6 – Shearwalls Creating Standard Wall Shear1
6.7.2 Creating Standard wall Shear 2

1. Click on *Edit Standard Walls*.
2. Set the Standard wall to *Shear1*.
3. Click *Copy*.
4. Name new standard wall *Shear2*.
5. Set the Fastener *Edge Spacing 4 in.*.
6. Click *Save*.
7. Click *OK*.
8. Click *Yes* to the pop up window to save standard wall details.

![Standard wall window](image)

**Figure 14:** Tutorial 6 – Shearwalls Creating Standard Wall Shear2

6.7.3 Creating Standard wall Shear 3

1. Click on *Edit Standard Walls*.
2. Set the Standard wall to *Shear1*.
3. Click *Copy*.
4. Name new standard wall *Shear3*.
5. Set the Fastener *Edge Spacing 3 in.*.
6. Click *Save*.
7. Click *OK*.
8. Click *Yes* to the pop up window to save standard wall details.
6.7.4 Modifying Exterior Non-shear Standard Wall

1. Click on **Edit Standard Walls**.
2. Specify **Standard wall** as **Shear1**.
3. Click **Copy**.
4. Rename the Standard Wall as **Extnoshear**.
5. Specify a hold-down configuration of **non-shearwall**.
6. On the **Exterior Side** of the wall, specify the following parameters:
   a) **Material** is **Structural 1**.
   b) **Thickness** is **15/32** mm.
   c) Click on the **OSB** box.
   d) Click on **Blocking** box.
   e) Set **Span rating** to **32/16**.
   f) **Orientation** is **Horizontal**.
   g) Fasteners **type** as **Common wire nails**.
   h) Fasteners **Sizer** of **10d**
   i) Fastener **Edge Spacing** as **6 in**.
   j) Fastener **Interior Spacing** as **12 in**.
   k) Framing **material** as **Lumber Stud**.
   l) Framing **Species** as **D.Fir-L**.
m) Framing Grade as No.2.
 n) Framing Thickness b as 2 in.
 o) Framing Width d as 4 in.
 p) Framing Stud Spacing as 16 in.
 q) End studs at left is 2.
 r) End Studs at Right is 2.

7. Leave the Interior Side of the wall Material as None.
8. Click Save.
9. Click OK.
10. Click Yes to the pop up window to save standard wall details.

Figure 16: Tutorial 6 – Shearwalls Standard Wall Ext noshear
6.8 Specifying Wall Types on Level 1

1. Click **Ctrl+A** to select all of the walls.
2. Specify all of the walls as **Shear1**.

---

**Figure 17: Tutorial 6 – Specifying all walls as Shear1**
3. Click elsewhere on the screen so that no walls are toggled.
4. Hold the Ctrl key and Click on walls 1-1, 6-1, A-1 and E-1, and specify the walls as Extnoshear.

Figure 18: Tutorial 6 – Specifying Extnoshear walls
6.9 Extending Walls Upwards

1. Click on the *Extend Walls Upwards* Button.
2. Set the current Level to 2.
3. Hold the *Ctrl key* and Click on walls B-1, B-2, C-1, C-2, D-1, D-2, 2-1, 2-2, 2-3, 2-4, 3-1, 4-1, 5-1, 5-2, 5-3, and 5-4. Modify the wall types by specifying them as *shear2* from the drop-down menu in the wall form view.
4. Set the current Level to 1.
5. Hold the *Ctrl key* and Click on walls B-1, B-2, C-1, C-2, D-1, D-2, 2-1, 2-2, 2-3, 2-4, 3-1, 4-1, 5-1, 5-2, 5-3, and 5-4. Modify the wall types by specifying them as *shear3* from the drop-down menu in the wall form view.

![Image of a wall diagram with materials and dimensions](image)

Figure 19: *Tutorial 6 – Specifying Shearwalls on Level 1 as standard wall Shear3*
6.10 Creating Roof Blocks

1. Click on the **Roof Blocks** button.
2. Modify the roof block **Construction** to be specified as **Flat roof**.

Note: Additional steps can be taken to adjust the location of the roof block to match the shape of the structure perfectly, then additional roof blocks can be added where. The size of the flat roof block is going to affect the seismic load generation. For simplicity, in this model the roof block will be left as is covering the four corners of the model.

![Image of WoodWorks interface with roof blocks](image)

**Figure 20. Tutorial 6 – Modifying Roof**

6.11 Generating Loads

1. Before generating loads, click on the **Site Information** toolbar icon. From the **Load Generation Site Information** input dialog you can set the parameters to be used to generate wind and seismic loads. The following parameters of been input for load generation.
2. Click **OK**.
3. Click on the **Generate Loads** toolbar icon.
4. Select Wind and Seismic loads to be generated from level 1 to 3.
5. Click on **Generate Loads on Selected Levels** to automatically generate loads.
6.12 Modifying & Manually Applying Loads

1. Click on the Loads and Forces button.
2. Select the south wall (A-1) on level 1. All generated loads acting on wall A-1 will appear in the Load Input form.
3. Generated loads can be modified or deleted at this stage based on your judgment.
4. For the purpose of the tutorial, no generated loads will be modified or deleted.

6.13 Run First Design and Review Results

1. Click on the Run Design Button.
2. Once the analysis is complete, click on Go To Table, Structural Data, Sheathing and Framing Materials.
3. From this page, it will be possible to review the resultant shearwall nail spacing needed to resist the loads lateral loads.

<table>
<thead>
<tr>
<th>SHEATHING MATERIALS by WALL GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grp</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

Legend:
Grp – Wall Design Group number, used to reference wall in other tables
Surf – Exterior or interior surface when applied to exterior wall
Rating – Span rating, see SDPWS Table C4.2.2.2C
Thick – Nominal panel thickness
GU - Gypsum underlay thickness
Ply – Number of plies (or layers) in construction of plywood sheathing
Or – Orientation of longer dimension of sheathing panels
GtVt – Shear stiffness in lb/in. of depth from SDPWS Tables C4.2.2A-B
Type – Fastener type from SDPWS Tables 4.3A-D: NaI – common wire nail for structural panels and lumber, cooler or gypsum wallboard nail for GWB, plasterboard nail for gypsum lath, galvanized nail for gypsum sheathing: Box – box nail; Casing – casing nail; Roof – roofing nail; Screw – drywall screw
Size – Common, box, and casing nails: refer to SDPWS Table A1 (casing sizes = box sizes).
Gauges: 11 ga = 0.120” x 1-3/4” (gypsum sheathing, 25/32” fiberboard), 1-1/2” (lath & plaster, 1/2” fiberboard); 13 ga plasterboard = 0.92” x 1-1/8”.
Cooler or gypsum wallboard nail: 5d = .086” x 1-5/8”; 6d = .092” x 1-7/8”; 8d = .113” x 2-3/8”; 8/8d = 6d base ply, 8d face ply for 2-ply GWB.
Drywall screws: No. 6, 1-1/4” long.
5/8” gypsum sheathing can also use 6d cooler or GWB nail
Df – Deformed nails (threaded or spiral), with increased withdrawal capacity
Ed – Panel edge fastener spacing
Fd – Field spacing interior to panels
Bk – Sheathing is nailed to blocking at all panel edges; Y(es) or N(o)
Apply Notes – Notes below table legend which apply to sheathing side

Notes:
2. Framing at adjoining panel edges must be 3” nominal or wider with staggered nailing according to SDPWS 4.3.7.1.4

Figure 23: Tutorial 6 – View Sheathing Materials Results

4. Click on **Go To Table, Design Summary**.
5. From this page it can be observed that the sheathing framing details determined by the program are adequate in resisting all of the Wind and Seismic Loads for both a rigid and flexible diaphragm.

<table>
<thead>
<tr>
<th>SHEARWALL DESIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Shear Loads, Flexible Diaphragm All shearwalls have sufficient design capacity.</td>
</tr>
<tr>
<td>Wind Shear Loads, Rigid Diaphragm All shearwalls have sufficient design capacity.</td>
</tr>
<tr>
<td>Components and Cladding Wind Loads, Out-of-plane Sheathing All shearwalls have sufficient design capacity.</td>
</tr>
<tr>
<td>Components and Cladding Wind Loads, Nail Withdrawal All shearwalls have sufficient design capacity.</td>
</tr>
<tr>
<td>Seismic Loads, Flexible Diaphragm All shearwalls have sufficient design capacity.</td>
</tr>
<tr>
<td>Seismic Loads, Rigid Diaphragm All shearwalls have sufficient design capacity.</td>
</tr>
</tbody>
</table>

Figure 24: Tutorial 6 – Reviewing Shearwall Design Summary
6. Scroll down the page, and the **Hold-down design** summary should be visible. From the summary, it can be observed that the specified hold-downs do not currently have adequate capacity along a number of shearlines at each level.

![Hold-down design summary](image)

**Figure 25: Tutorial 6 – Reviewing Hold-down Design Summary**

7. To remedy these failures, it will be necessary to go back into the **Walls View**, and modify the specified hold-downs on levels 1 to have a higher capacity.

8. Set **Current Level** to 1, Hold the **Ctrl key**, and click on all the shearwalls (**Shear3**). In the shearwalls **Form View**, modify the hold-downs to **HDU14-SDS2.5**.
9. Click on Run Design.
10. Review the design results in the Design View. Check all other designs, such as story drift, components and cladding loads, etc. Continue to modify wall details until a final solution is found.
11. Accept the design by clicking on the Accept Design icon.
12. Click here to download a copy of the design results created from the model.
13. Click here to download a copy of the log file created from this model.