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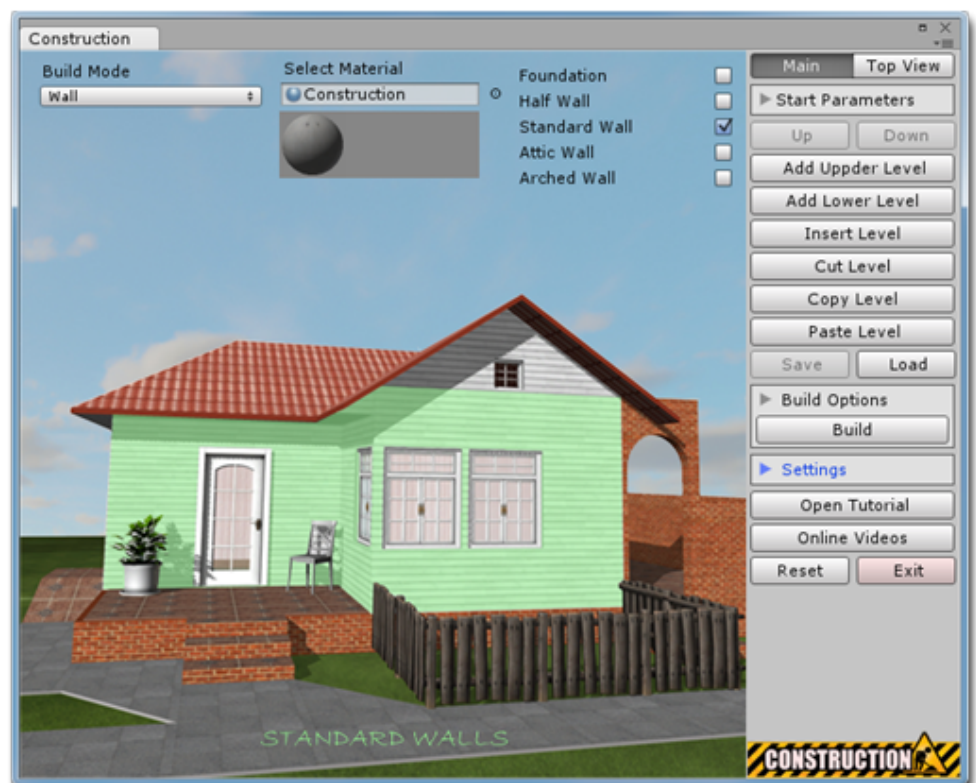
Starting Construction

After importing the package you will notice a new folder called Construction has been added to the project window. To open the program click on the Window menu item in Unity, hover the mouse over the Construction item and then click on Open Window. The window is tabbed so you can dock the window by clicking on its tab and dragging it next to the other windows.

Build Modes

When the program starts a new window is shown with a picture of a house on it. As you mouse over the picture, different parts of the house will change color and clicking on each part allows you to quickly switch between the different build modes available. The picture to the right shows the highlight for the standard walls.

As well as using the interactive picture you can also change build modes by clicking on the drop down list at the top left corner of the window.



Each build mode allows you to work on different parts of the building and we will cover each of these modes later in this tutorial.

Settings

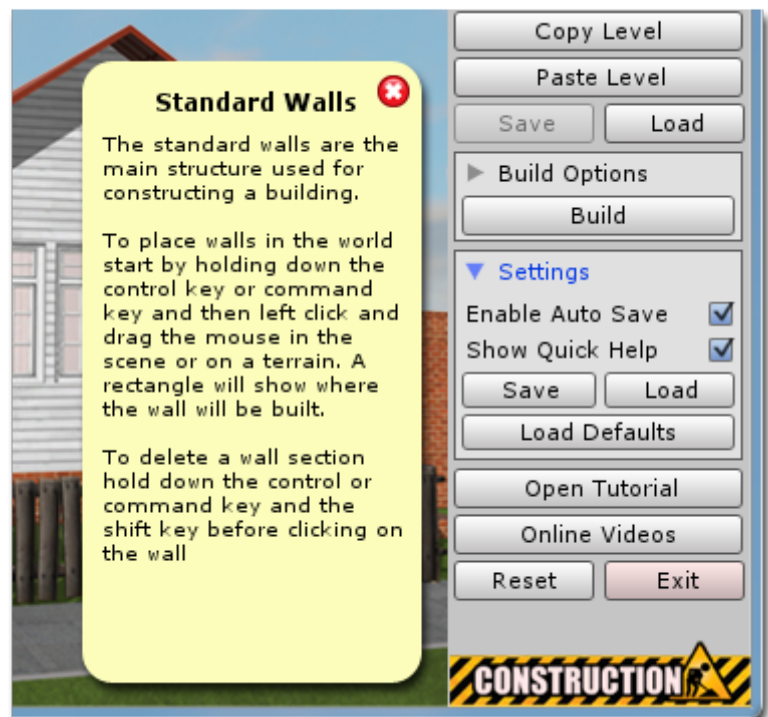
You can access the current setting used by the program by clicking on the small arrow next to the Settings label. The current state of the window and the build modes are saved automatically to file when the window is closed but you can save or load the current state manually by clicking on the Save and Load buttons within this section. If you need to, you can also click on the Load Defaults button to reset the program back to its initial state.

Quick Help

By default the quick help guide is shown above the picture of the house. It is there to help new users of the program get started without having to read this tutorial. Once you are familiar with the basics of using the program you can close the quick help by clicking on the red button to the top right of the overlay. To enable the quick help guide again go to the Settings and tick the box for Show Quick Help.

Auto Save

Also in the Settings is the option to enable or disable Auto Save. When enabled the program will save the current building design to a file called autosave.xml every five minutes. Other times when the design is saved to this file is when you click on the Build button and when closing the program.



The program will also save and load the design automatically using another file called playmodesave.xml when entering or leaving Play Mode in the editor.

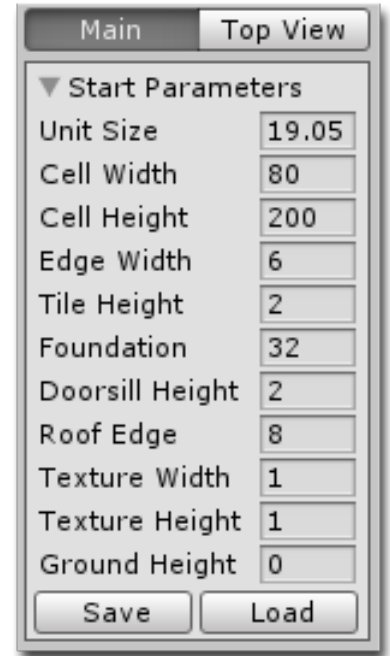
Save & Load Designs

Once you have started creating a new building you can save the current work to a design file or load a previous design by clicking on the Save and Load buttons located just above the Build Options on the main menu.

Start Parameters

To accommodate all of the various scales used by different projects you are able to tailor the program to use custom dimensions. All of the widths and heights used by the program derive from a single unit size. The unit size is measured in millimeters and by default this unit size is 19.05mm. You can see from the picture to the right that the width of a cell is currently 80 units and has a height of 200 units.

These dimensions were inspired by those used in the game Half-Life, but the widths and heights used for the cells have been adjusted and tested to work with the standard character controller.



Map Grid	Imperial	Metric
1	= 0.75"	= 19.05mm
2	= 1.5"	= 38.10mm
4	= 3"	= 76.20mm
8	= 6"	= 152.40mm
16	= 1'	= 304.80mm
32	= 2'	= 609.60mm
64	= 4'	= 1.22m
128	= 8'	= 2.44m
(160	= 10'	= 3.05m
256	= 16'	= 4.88m
512	= 32'	= 9.75m

Player Collision Hull	
32	= 2' 0" width & length
36	= 2' 3" height crouching
72	= 4' 6" height standing

Player Eyelevel	
28	= 1' 9" height crouching
64	= 4' 0" height standing

Architecture	
128	= 8' 0" normal corridor height
64	= 4' 0" normal corridor width
108	= 6' 9" normal door height
48	= 3' 6" normal door width

Dimensions used in Half-Life

These default values may change over time and I would be happy to hear any suggestions for a better set of values. To help with this there is also a feature to Save and Load the parameters to an XML file. They can then be shared among teams using the same program to quickly change the default set of parameters.

Most of these parameters should be self evident but one to watch out for is the Edge Width. This is actually half the thickness of a wall.

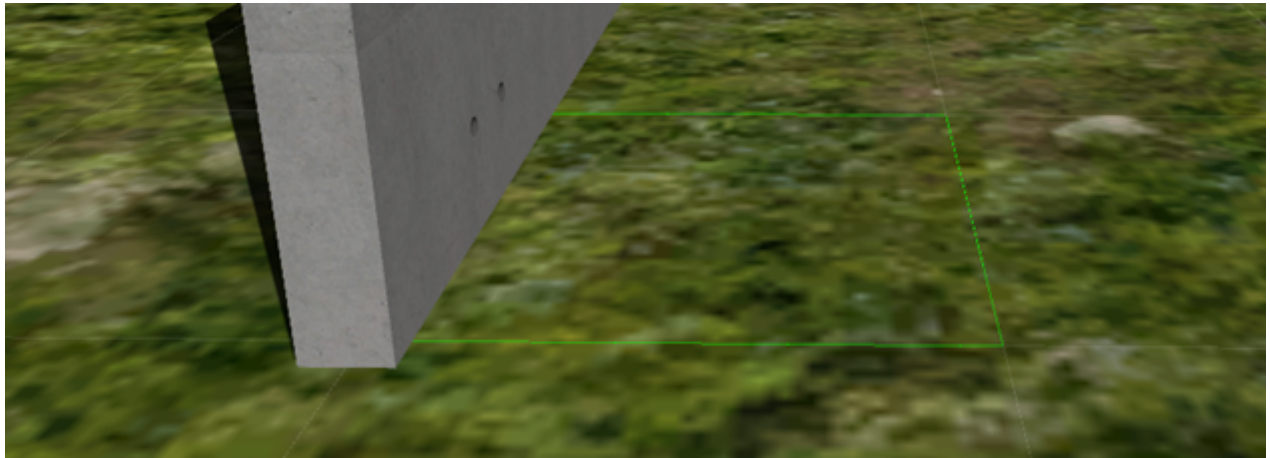
The Doorsill Height should be the same or larger than the Tile Height as it is a shortcut for raising doors above the tiles. This is most commonly used for exterior doors that lead into a tiled room.

The last three parameters are not based on the unit size. The Texture Width and Texture Height values are for tiling textures and the Ground Height is used when starting a building where there is no terrain.

General Building

In a future release there will be an option to build in a top down view window (which will be accessible by clicking on the Top View button at the top of the main menu) but at the moment all of the building work takes place in the scene view window.

The general practice is to choose a build mode, select a material and enable or disable the various options for that build mode. Once you have done this you can start building by holding down the hotkey (left or right control/command keys by default) and then left click and drag the mouse anywhere in the scene view window. A rectangle will be shown where the selected structure is to be placed when the mouse button is released. If you have dragged out a rectangle and decide not to place the structure then just release the hotkey before releasing the mouse button.



If you click on a terrain the program will grab the height value of the terrain at the point where you first clicked. If the click intersected with a game object then the height of that intersection point will be used, otherwise the program will use the ground height as set in the Start Parameters as the starting height.

Deleting

In general you can delete everything by first holding down the hotkey plus the shift key before left clicking on the part you want to delete.

Walls with a feature like a door or window are a special case. When you go to delete a wall section with a feature, the feature is first deleted from the wall, and then you can delete the wall as normal.

Levels

Construction has been designed to allow for the creation of multi-story buildings and each floor is also referred to as a level. The Ground level is considered to be equal to the starting height. Floors above the Ground level are labeled in the scene as Floor 1, Floor 2 and so on. Floors below the Ground level are labeled as Floor B1, Floor B2 and so on.

The label for the current level is highlighted in yellow and the other levels are highlighted in green. When you have more than one level you can move between the different floors by clicking on the Up and Down arrows on the main menu. Another way to quickly jump between levels is to click on a part of the building at the level you want to change to.

At any time you can increase the number of levels by clicking on the Add Upper Level and Add Lower Level buttons. The first button will add a level to the top of the building while the second button will add a new level to the basement of the building.

The other menu options allow you to insert levels between existing floors as well as cut, copy and paste levels into the building. If you insert or paste a level above the ground floor then the levels higher than the current level will be shifted up. Inserting or pasting a level below the ground level will cause all levels lower than the current level to be shifted down.



Materials

If the Select Material control is visible in the current build mode then the option to change the materials of existing parts of the building is available.

Painting

To paint parts of the building you start by left clicking on any of the materials being displayed. Once you have the material that you want then hold down the shift key before left clicking on the part you want to paint.



Selecting New Materials

If you want to add to the available materials you do this by clicking on the small circle to the right of the material name. This will open the Select Material window where you can double click on a material to add it to the ones already available.

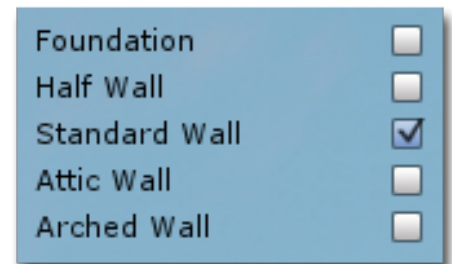
A good tip is that when the Select Material window is open you can left click on as many materials as you want to add them all to the available materials at the same time. You can also remove materials from the ones available by right clicking on them.

Picking Materials

Another way change materials is by picking it from the existing building. To pick up a material start by holding down the shift key and right clicking on the part of the building you want to copy the material from. The material will then be made the current material for that build mode and you can paint with it as normal.

Walls

The standard wall is the most common type used while building but you can also choose from the other varieties by checking the box next to their name.



Foundation Walls

Foundations are a special type of wall in that it will set the maximum height for the whole level. To begin laying a foundation make sure it is selected and is the first structure to be created before adding any other structures to that level.

You can also insert a foundation level at any place in the building but you must remember to select it before clicking on the Insert Level button.

Half Walls

To create interior walls or solid fences you can use the half walls. One point to remember is that they don't blend nicely with other walls if the materials aren't the same. This is a known issue and it will be addressed in a future update.

Attic Walls

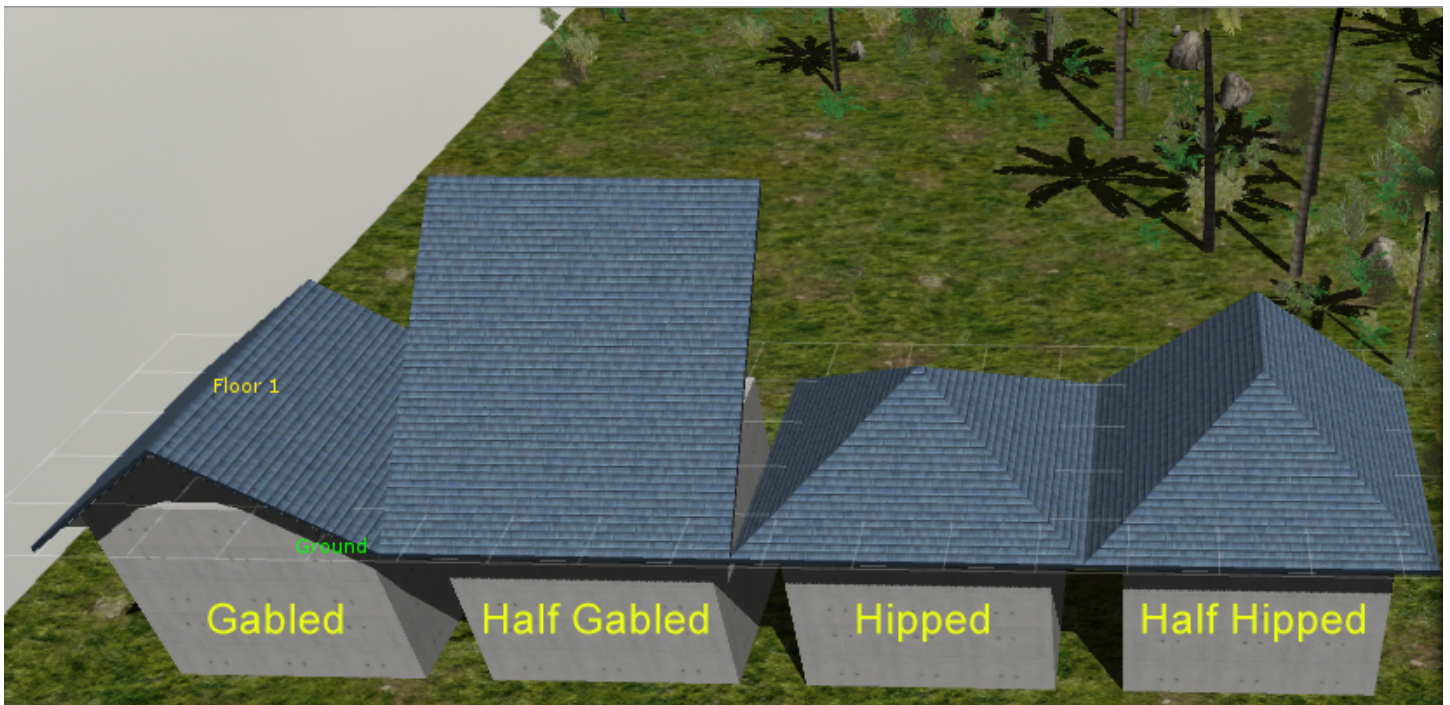
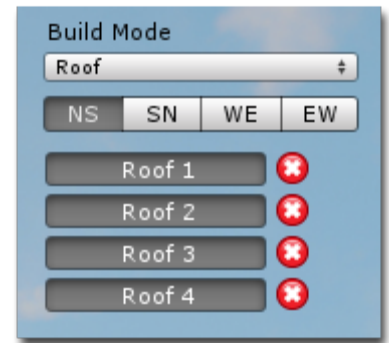
When creating walls for the ends of a gabled roof or when adding walls to the interior of a roof you need to use attic walls. If they are placed where there isn't a roof above them then no walls will be created. When placed under a roof section they will automatically adjust their height to fit. One problem with attic walls is that they don't always meet at the corners properly and this is another issue that will be addressed in a future update.

Arched Walls

These walls are the first of many decorative walls that are planned for future releases. You can place them just the same as you do for a standard wall but they can't contain a door, window or other feature.

Roofs

There are four types of roofs to choose from as shown in the picture below. They are created by first selecting the Roof build mode and then holding down the hotkey while left clicking and dragging out a rectangle where you want to place the roof. There is a control below the build mode selector for changing the orientation which allows you to change between North to South, South to North, West to East and East to West. The orientation is based on the slope of the roof with North being equal to the positive Z axis. So the gabled roof shown below was created with a West to East orientation while the others were created with a South to North orientation.



Below the orientation selector are buttons for hiding and deleting the existing roofs. You can temporarily hide a roof by clicking on its button to see how it changes the design and if you decide that you want to delete the roof you can this by clicking on the red button to the right.

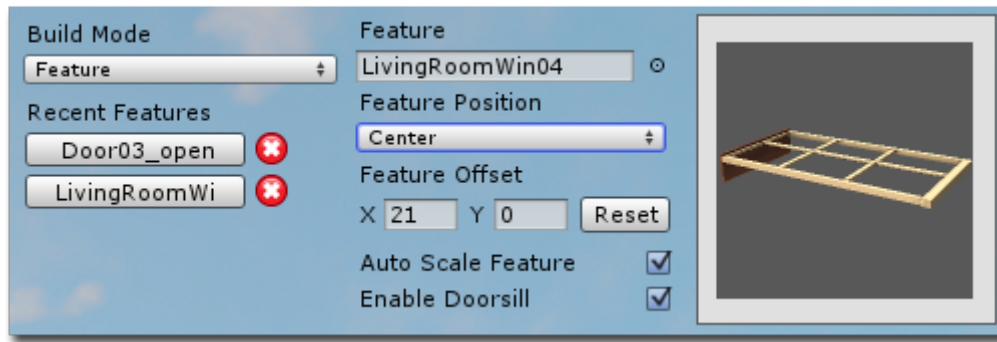
Any roofs that are hidden when the final prefab is made will not be included in the final build.

To the right of the window are the options for selecting between the different types of roof. There are also sliders for changing the Roof Pitch and Eave Width. At the moment they affect all of the roofs at the same time but in a future release they will operate on selected roofs only which will allow for varying height roofs and eave widths. The flat underside parts of the eaves are called soffits and at the end of the roof types is an option to turn these on or off for the whole building. You can change the materials for the roof sections, eaves and soffits just as you do for walls and other parts of the building.



Features

In the Feature build mode you can add doors, windows or other objects to the walls of your building.



The control in the middle labeled Feature allows you to select the game object you want to use as a feature. Once selected you can add it to a wall by first holding down the shift key and then left clicking on a section of wall. To delete a feature from a wall just hold down the hotkey and the shift key at the same time when left clicking on the wall section.

All features that have been previously selected are added to the Recent Features list. You can quickly choose one of these by clicking on its button to make it the currently selected feature. If you want to delete a feature from this list you can click on the red delete button next to its name.

Below the feature selector are options for setting the Feature Position, Feature Offset, Auto Scale and Doorsill. The Feature Position selector makes orientating the feature on the wall a lot easier than just using the offset values alone. If the feature is a door you would probably want to set the feature position to Bottom and a window feature would typically be set to Center.

While the Auto Scale makes placing the feature easier it is recommended to add the selected game object to the scene before selecting it as the current feature. The reason for this is that the selected feature is expected to be orientated to be facing the negative Z axis and have its pivot point located at the bottom center of the object.

Once the object has been added to the scene you can scale and rotate it to work well as a feature. Sometimes the pivot point might be in the wrong position as shown for the window below. It is located at the bottom right instead of the bottom center so it will be misaligned when placed on the wall. When this happens it will appear as if the feature is half buried into a neighboring wall or is outside the bounds of the wall.

In the previous picture you can see that the Feature Offset was set to 21 units on the X axis to compensate for the badly positioned pivot point of the window.



The Auto Scale Feature option will do its best to resize the object to fit on the wall but you can also resize the object manually should this fail.

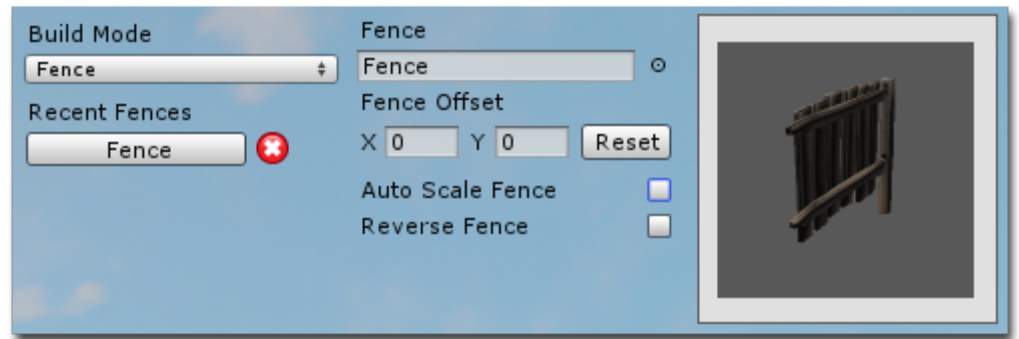
The Enable Doorsill option will shift the feature up by the doorsill height (as set in the start parameters) to raise it to the height of any tiles around it. This is most obvious when the door is placed on an exterior wall where it leads into a tiled room.

Picking Features

Just as with materials, you can pick up a feature from one previously placed on a wall. To do this first hold down the shift key and right click on the wall section where the feature you want to copy is located. This will also pick up the offsets and other settings used by the selected feature. This is a very fast way to switch between features without having to adjust the settings each time.

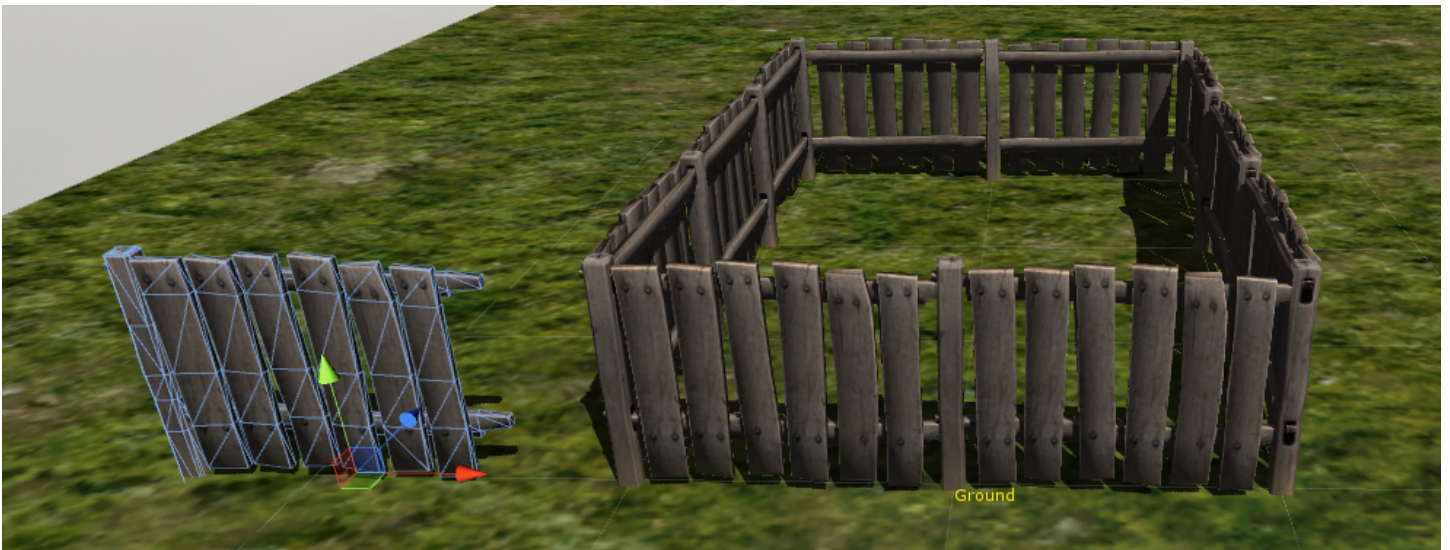
Fences

To add fences to your build start by switching to Fence build mode and then choose a game object by clicking on the small circle next to the object selector. Once you have a fence selected you can place them by holding down the hotkey and left clicking and dragging out a rectangle in the scene view.



All fences that have been previously selected are added to the Recent Fences list. You can quickly choose one of these by clicking on its button to make it the currently selected fence. If you want to delete a fence from this list you can click on the red delete button next to its name.

Just as with features you can adjust the horizontal and vertical position of the fences by changing the values in the Fence Offsets. The other two options allow you to Auto Scale and reverse the fence orientation.



While the Auto Scale makes placing the fence easier it is recommended to add the selected game object to the scene before selecting it as the current fence. The reason for this is that the selected fence is expected to be orientated to be facing the negative Z axis and have its pivot point located at the bottom center of the object. Once the object has been added to the scene you can then scale and rotate it to work well as a fence.

Tiles

To construct a floor or a ceiling for your building start by changing to the Tiles build mode, select a material and then either a Full Tile or a Half Tile from the options.

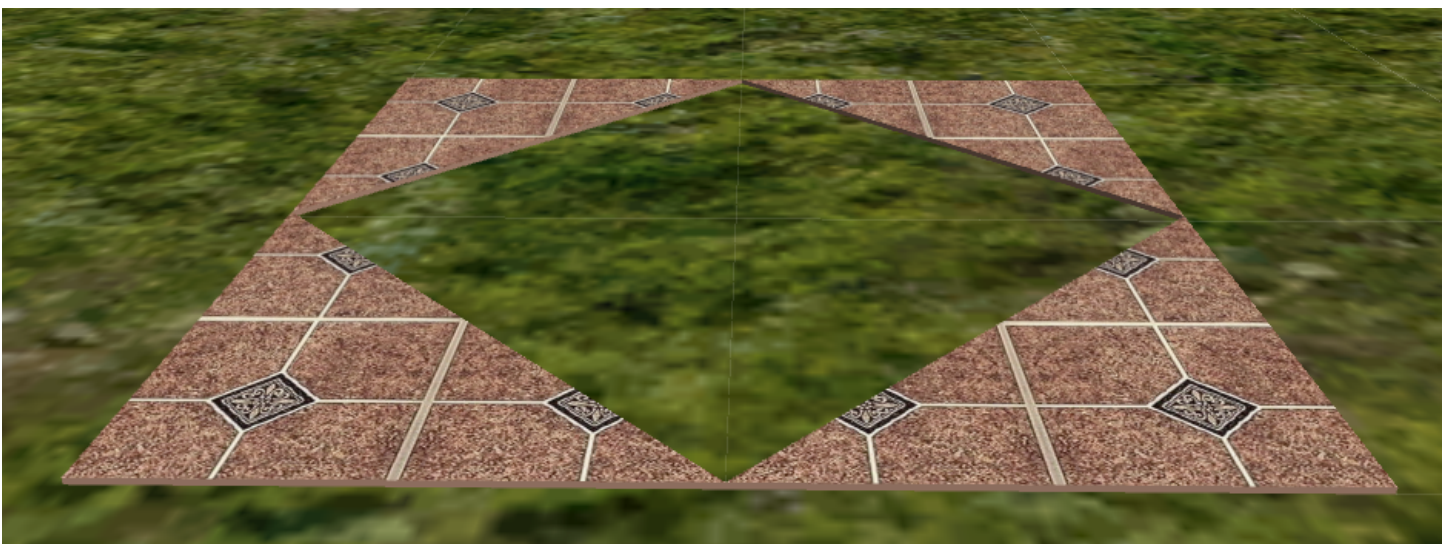


Tiles can be painted on the top, bottom and sides.



Half Tiles

By ticking the option for Half Tiles and then on one of the four rotations you can create diagonal holes or paths. The rotations shown assume the camera is facing towards the positive Z axis.

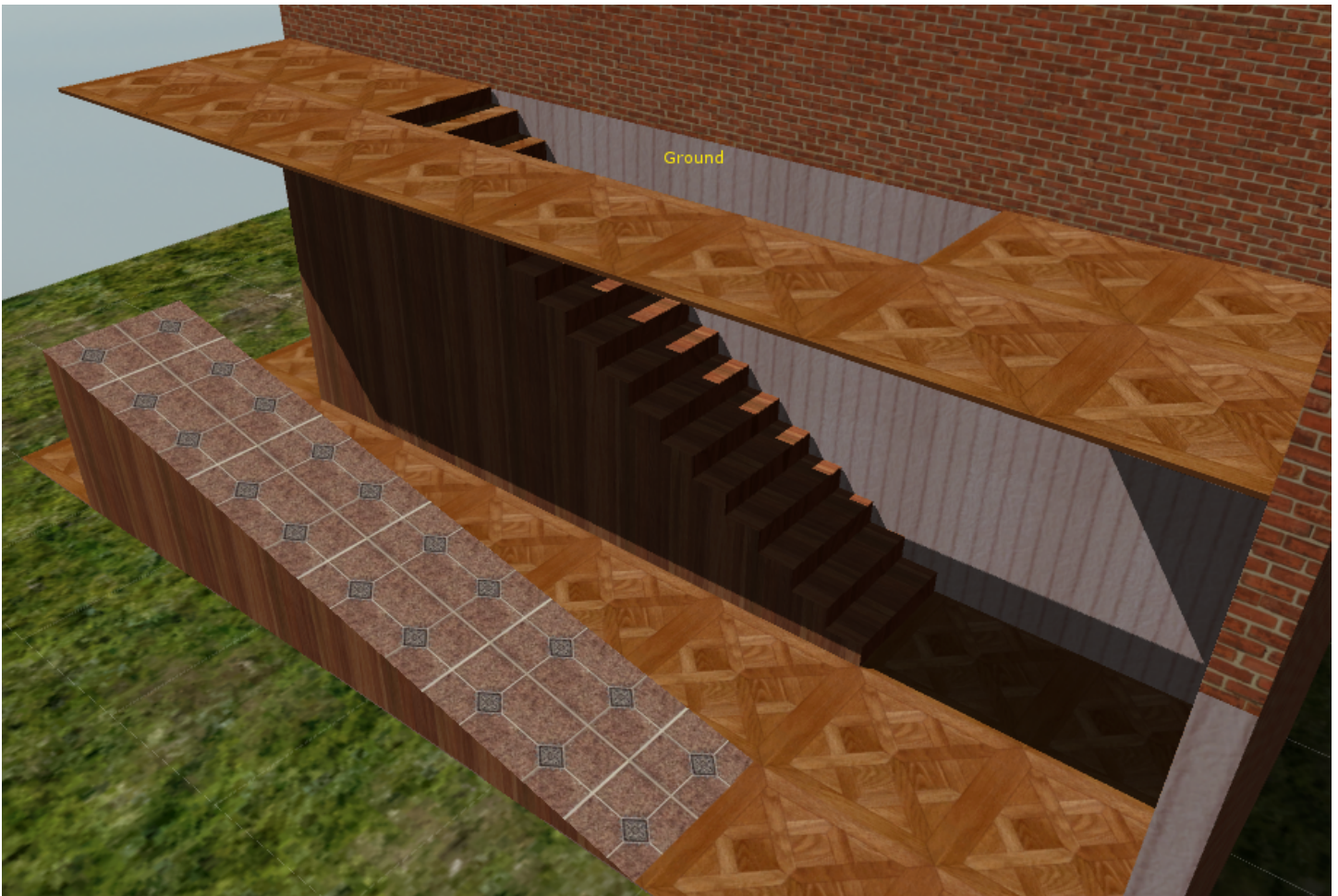


Stairs & Ramps

To add stairs or ramps to the building start by selecting the Stairs build mode. Once you have selected the orientation that you want and the material, then tick the box next to either Steps or Ramp before creating them.



Once you have added the stairs or ramp to the building they will become the currently selected stairs, highlighted by a wireframe box. When selected you can adjust the Number of Steps and the Stairs Pitch to suit your building. Below the orientation selection are buttons which control which stairs are currently selected. You can select more than one to change the number of steps and pitch of them at the same time. To delete a set of stairs from the building simply click on the red button to the right of their name.

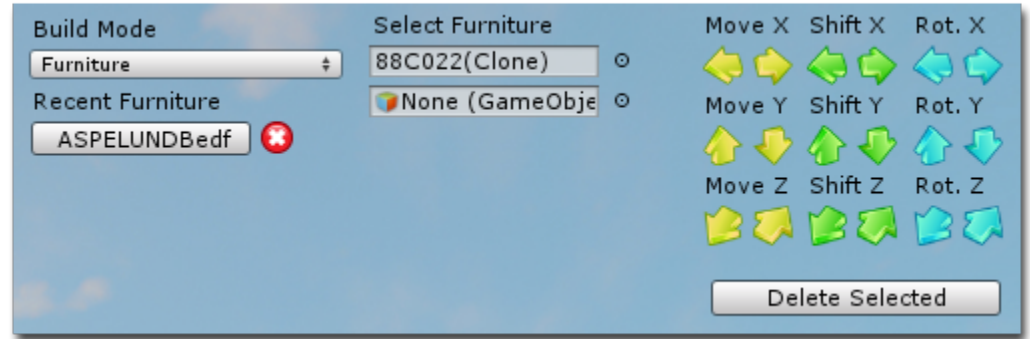


You can also delete parts of stairs by holding down both the hotkey and the shift key while left clicking on a section of the stairs.

Furniture

To make adding and positioning furniture in your new building easier you can use the Furniture build mode. Start by selecting a tile or wall in the building where you want to place the furniture and then

use the Select Furniture control to pick the piece you want to add. It will be placed above the tile in its default rotation. The item will also be added to the Recent Furniture list just under the build mode selector where you can quickly select it again if you want to add the same piece to another part of the building.



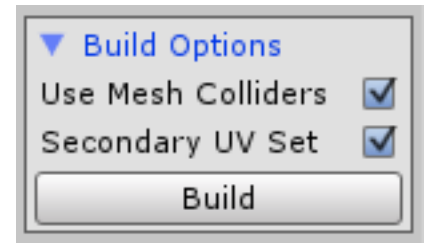
To move, shift or rotate the furniture piece you need to select it within the scene. Once selected you can use the arrow buttons to position the piece. If more than one are selected then all of them will be transformed at once.



The move buttons will translate the object relative to the grid square they are on. When the camera is facing the positive Z axis they move the object left and right, up and down or front to back. When a furniture piece is selected within the scene you can use the Delete Selected button to remove that piece from the building.

Build

The most important part of the program is the Build button. After you have finished your design all you need to do is click on this button, after which you will be asked to create a new folder somewhere within your project to store the prefab and meshes. Once the build process is finished you can drag the new prefab into the scene and use it as often as you want. The design of the building will be saved along with the prefab in a subfolder called Design.



Just above the build button is a foldout for the build options. At the moment there are only two options but more will be added in future releases. The first option allows you to turn off the automatic creation of mesh colliders for each mesh in the prefab. The second option is to automatically generate a secondary UV set for each mesh. This is required if you are planning to use the building within a lightmapped scene.

Future Development

This program is an early release and there are a lot of opportunities to improve the speed of the program so that it works well with larger buildings. The memory management will also be improved to eliminate the mesh leaks. Other optimizations will be made to the final prefab meshes by combining them based on their materials and using submeshes where possible. Options for using box colliders and simplified mesh colliders when building the final prefab will also be added.

New features like a top down view of the floor plan will be added to the program to allow for faster construction and the placing of furniture objects. The roofs and eaves will be improved to allow for individually adjustable pitch and eave widths. As well as double or triple width walls that can fit larger windows and other features.

Some ideas for extending the building are:

- Diagonal walls
- Road and footpath tiles
- Pillars and posts
- Rails for stairs
- Beams
- Pipes
- Chimneys
- Awnings
- Moldings
- Guttering

If you have a specific request please let me know and I'll try to add them to the feature list.

Attributions

I highly recommend the Modern Furniture II pack by publisher [BBO Studio](https://www.assetstore.unity3d.com/en/#!/content/16461). It contains 966 pieces of furniture which work well with Construction. The furniture models have a good balance between visual quality and polygon count for most projects. The asking price may seem a bit high at first but it is really a great deal when you consider it works out at about 12 cents apiece. It is available from <https://www.assetstore.unity3d.com/en/#!/content/16461>

Thank You

Thanks for your support for Mesh Maker and Construction. I hope you find it very useful for creating new buildings and other structures for your projects.



To learn more about Construction and to view the tutorial videos you can visit

[MeshMaker.com](https://www.meshmaker.com)