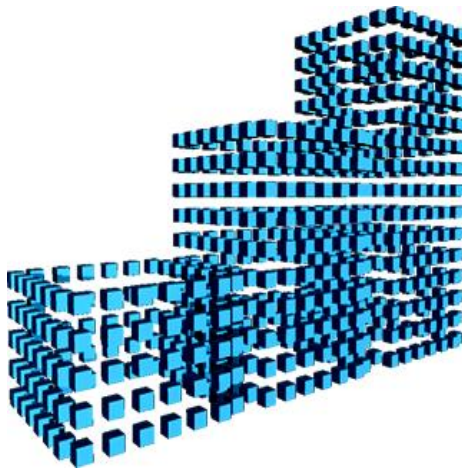


Unity3D Asset

Building Construction Set

Editor Extension



BLACKSTEP GAMES

Email: blackstepgames@gmail.com

Description

This document contains the description of instructions for work with Building Construction Set Unity3D Asset.

Basic purpose of this asset - designing of 3D buildings and interiors from modular parts. This asset is intended for work in mode of the Unity3D editor and can help fast to design a set of 3D models of buildings for a short time period.

Contents

This asset mainly contains scripts, and also a textures and 3D models for the demonstration project. 100 completed prefabs models of buildings located in the folder: **Building Construction Set\Prefabs\CompleteBuildings**.

In the folder: **Building Construction Set\Scenes** the same models of buildings at a modeling stage are located, you can modify them and use as base for creation of own new models of buildings. You will find in the same folder also other examples for work with asset.

The main kernel of this asset – tools for modeling of buildings which considerably will save your time when modeling. This asset is simple in use and does not demand deep knowledge in area of 3D design, enough basic abilities of work in the environment of Unity. Enough to learn the principles of work with parameters on a control panel for a solution of the majority of tasks of buildings design.

As models will be constructed from separate blocks, it allows to regulate level of detailing of target model, and you can completely control developing process at any stage of modeling.

Opportunities and functions

At creation of models of buildings the principle of splitting into modules is used, it means that the final model of the building will consist of a set of separate blocks (modular parts). When design and configuration of model will be complete, you can combine all blocks in one model.

At choice 2 approaches to modeling are offered to you:

1. Procedural creation of meshes

This option is not limited to the sizes of blocks (modular parts) and allows to change more flexibly a form and the size of model, to apply scaling and to regulate UV a mapping, but at the same time has restriction on level of detailing of geometry of model.

2. Creation of meshes of in advance prepared modules

This option is limited to the block sizes (a modular part), but allows to improve quality of final model, as so for construction blocks you can use any geometry with any level of detailing.

Both approaches use the shared management system of resources, which provides quick access to prefabs and materials, of which the final model of the building will be constructed.

The script of BCS_Assistant will help you to collect the building from separate parts in complete construction, and also at any time to edit necessary elements of the building, exempting you from routine work on placement and positioning of models modules on the scene.

Such approach allows to create quickly buildings and interiors of a different forms, changing such parameters as width, height, depth it is possible to design the building according to the preferences.

It is also possible to control and configure separate parts of the building, for example if you want to change appearance of windows of the building, then just switch to other type of windows available in library prefabs / models.

Main features

- Creation of any 3D models of buildings randomly
- Change of a forms and sizes of constructions
- Procedural generation of separate elements of the building
- Corrected and aligned UV mapping
- Manager of resources/project

Contents of documentation

In the first part of documentation, workflow of modeling of the building with use of a control panel, on the example of the demonstration project will be considered.

In the second part the order of loading of resources and creation of the new project is considered.

In the third part the description of the main and additional settings available on panel of Inspector (BCS_Assistant.cs script) is given.

Terms

Modular part – Any 3D model, with fixed sizes. Within this project, a modular part can be part of walls of building, decor elements, a roof, a floor, etc. A modular part in the environment of Unity is prefab.

Resources – materials and/or prefabs of Unity.

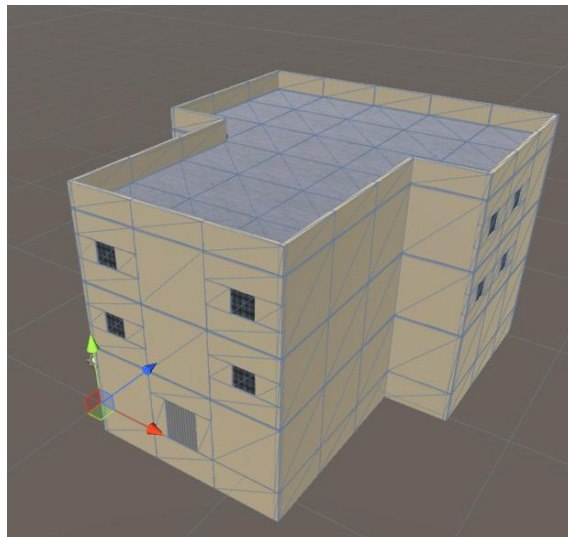
Part 1. Workflow of modeling

Beginning of work

To start work you will select

GameObject-> Building Construction Set-> New Build

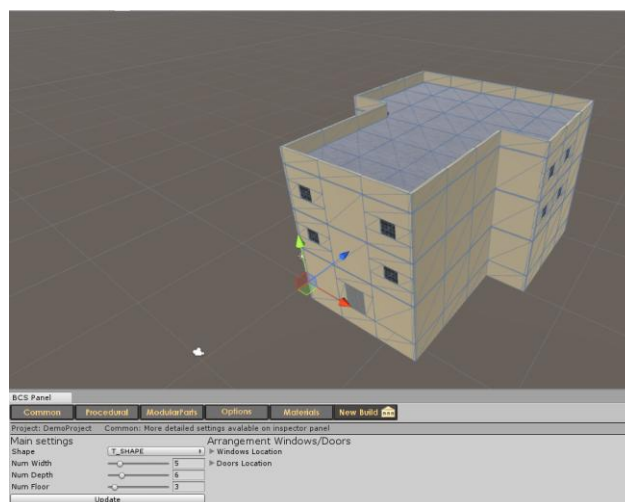
At you should the following will turn out approximately (the result will differ from given below):



Further on the Hierarchy panel you will select root object of construction (by default a new object will carry the name BUILDING);

Then open a control panel:

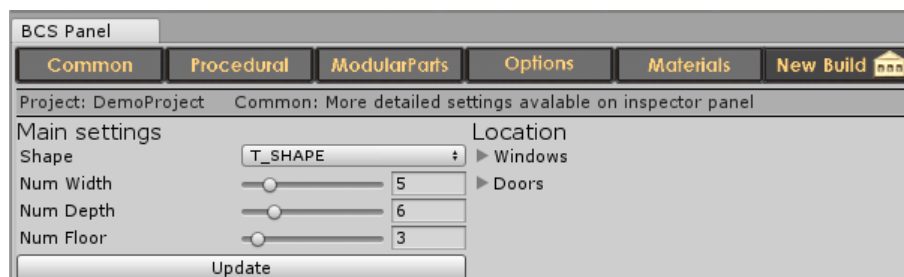
GameObject-> Building Construction Set-> Control Panel



By means of the **New Build** button on a control panel you can also create new model of the building.

After clicking New Build button, new GameObject (the active model will not be replaced) will be created and the control panel will switch to it automatically.

In the course of modeling it is recommended to use a control panel, so all basic functions necessary for modeling are collected there. On Inspector of a panel it is possible to get full access to all other parameters.



The control panel will work only with the object selected on the scene (it should be GameObject containing BCS_Assistant script).

In an upper part of a control panel buttons switches are located, they open access to different functions which will be considered further.

Editing form and size of model of the building

On the **Common** tab of a control panel the main settings are placed:

Num Width – quantity of modular parts on X axis.

Num Depth – quantity of modular parts on axis Z.

Num Floor – the number of floors of the building.

Shape – the main geometrical form of the building (the detailed description is given in 3 parts of documentation)

Update – changes in model should be updated automatically, but if for some reasons so did not occur, use this button.

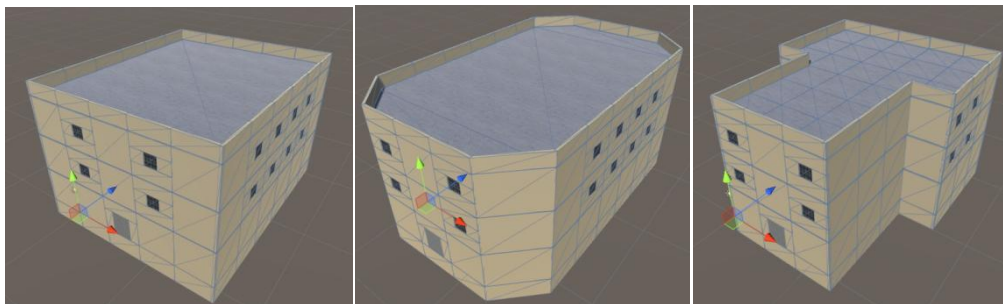
Windows/Doors/Windowcase Location – here are collected functions for positioning of windows, doors, show-windows of the building.

Example of change of a form:

[RECT]

[RECT_ROUNDED]

[T_Shape]

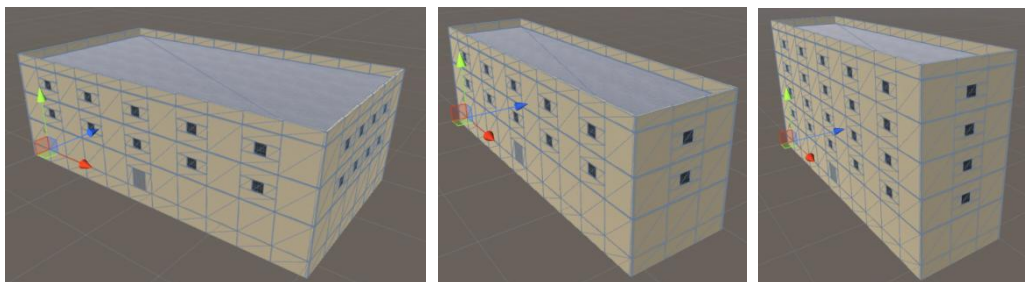


Example of size variation (quantity of modular parts):

[Width = 11]

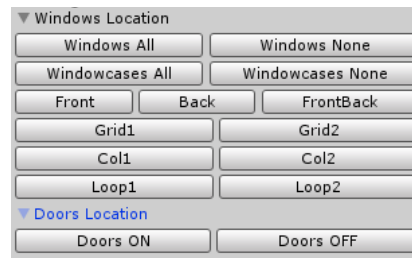
[Depth = 3]

[Floor = 5]



Positioning of elements of model of the building

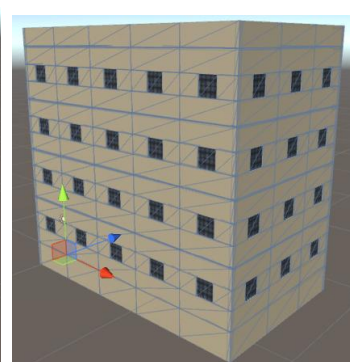
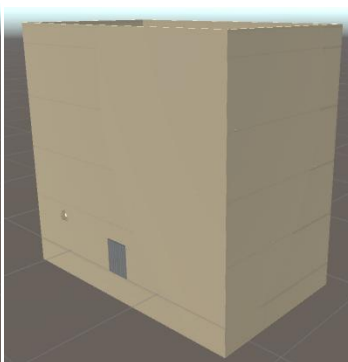
Let's review examples of use of functions of positioning:



[Windows ALL]

[Windows None]

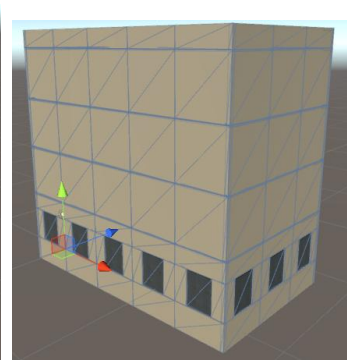
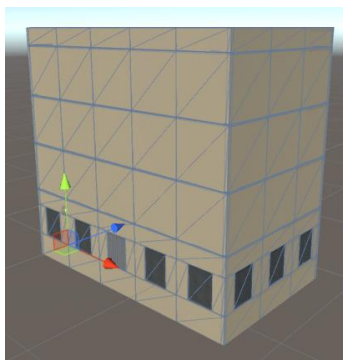
[Doors Off]



[Windowcases ALL]

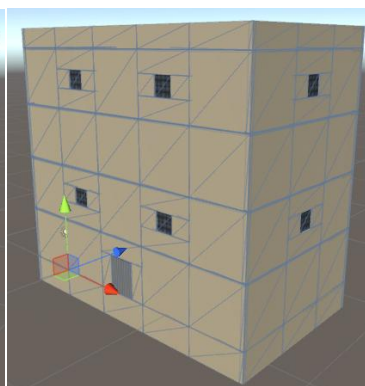
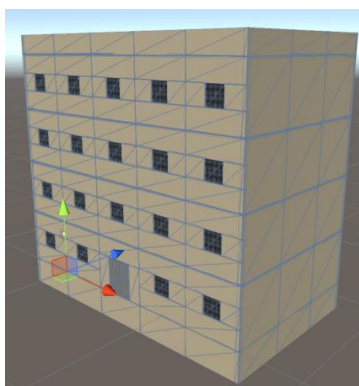
[Windowcases None]

[Doors Off]

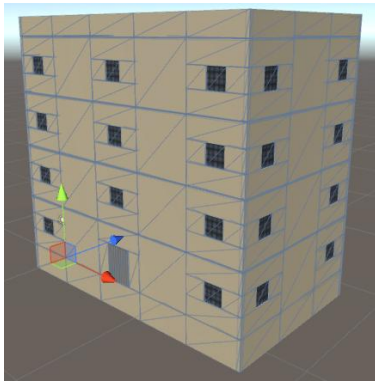


[Front]

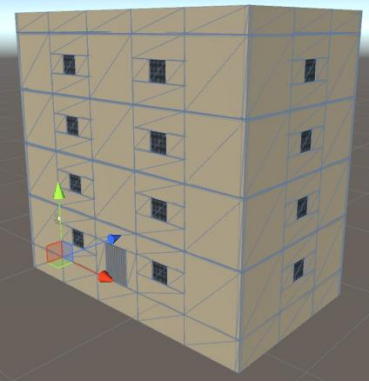
[Grid]



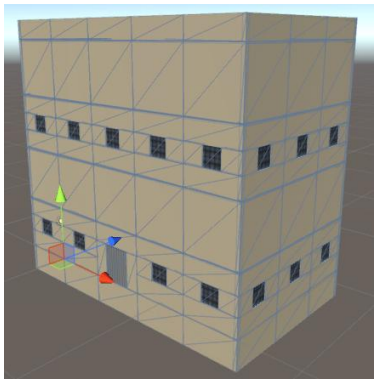
[Col1]



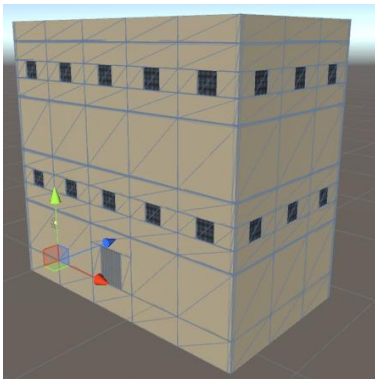
[Col2]



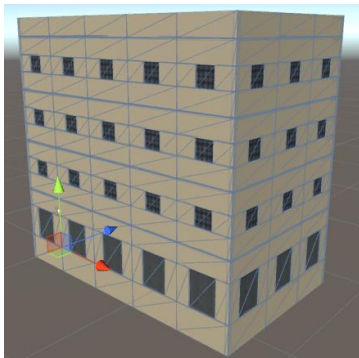
[Loop1]



[Loop2]

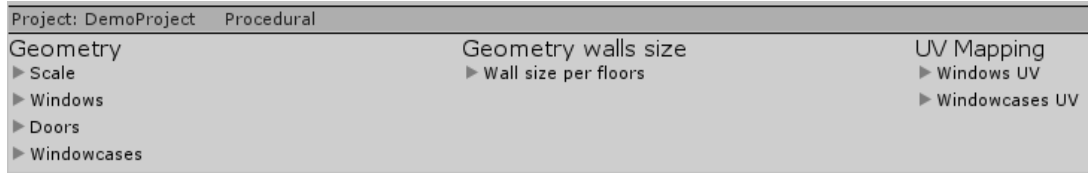


[Windows All + Windowcases All]



Editing geometry of model of the building

On the tab **Procedural** of control panel there are functions for procedural generation of geometry of the building and UV of a mapping.



When scaling by means of these functions, UV the mapping is calculated automatically taking into account scale, thus, you can freely change the sizes of models. Range of values for coefficients of scaling is not limited.

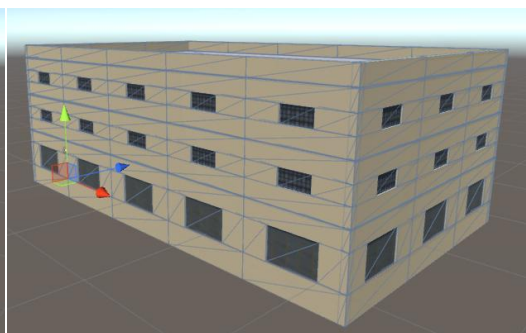
ScaleLength – coefficient of scaling of length of modular parts

ScaleHeight – coefficient of scaling of height of modular parts

[ScaleLength = 0.5]

[ScaleLength = 1.5]

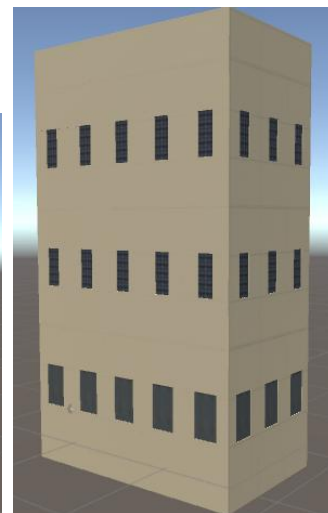
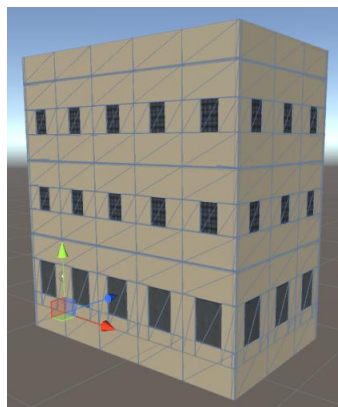
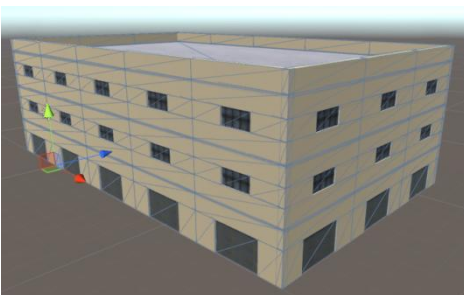
[ScaleLength = 2]



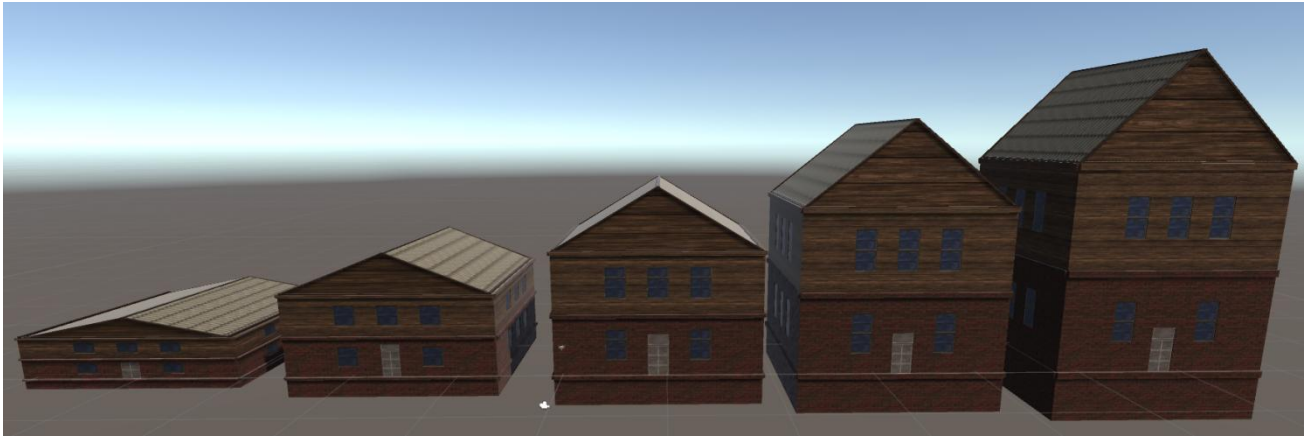
[ScaleHeight = 0.5]

[ScaleHeight = 1.5]

[ScaleHeight = 2.5]



[ScaleHeight Example] [from left to the right, coefficient of scaling have step of increase on 0.5]

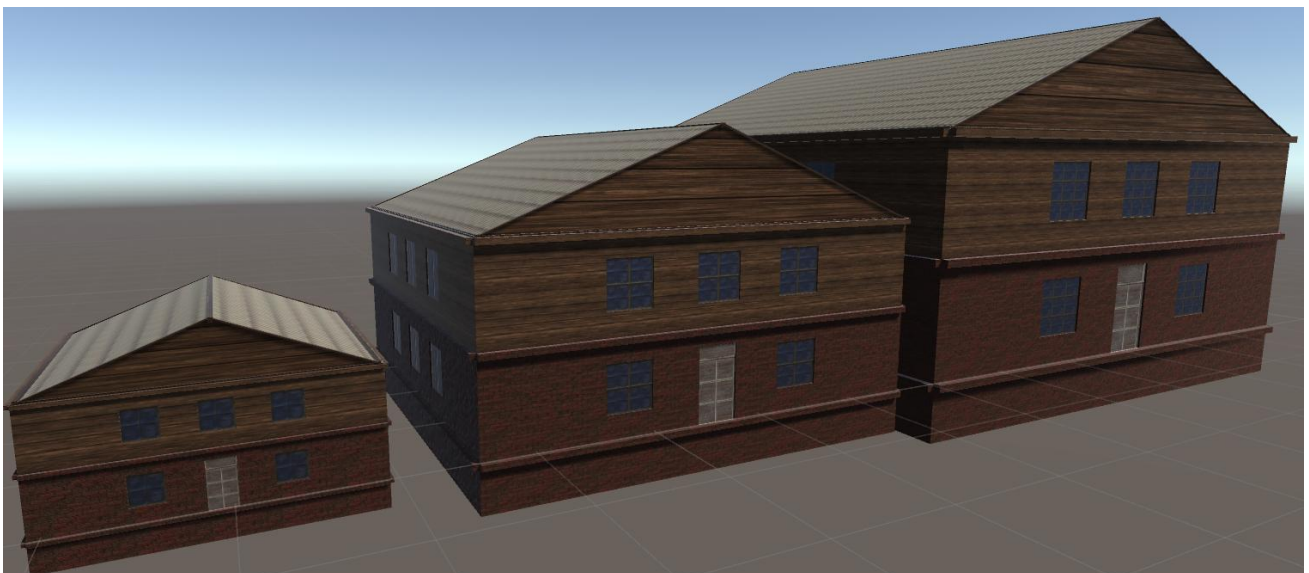


[ScaleLength Example] [from left to the right, coefficient of scaling have step of increase on 0.5]



[ScaleLength/ ScaleHeight Example]

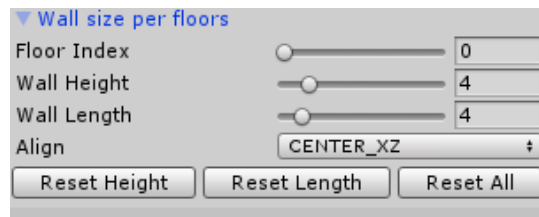
[from left to the right, coefficient of scaling have step of increase on 1.0]



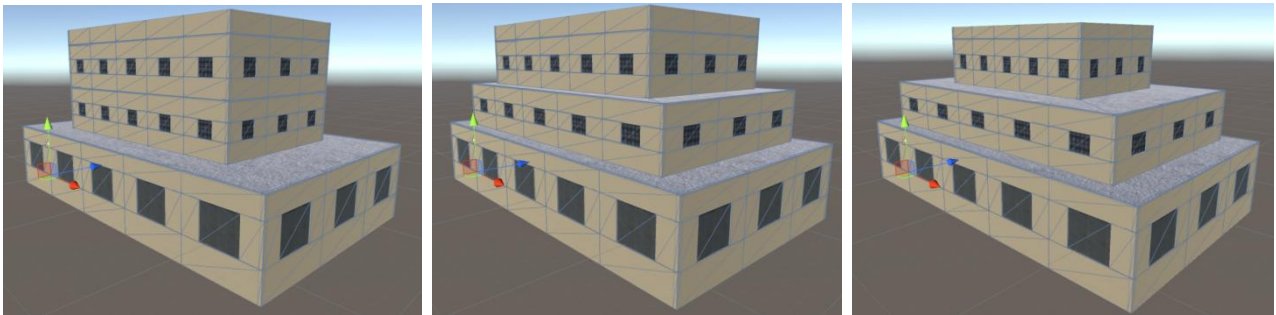
When using scaling, the following restrictions at the moment work (in the following updates, can be eliminated):

- It not work with shape RECT_ROUNDED
- It is impossible to use together with [Wall size per floors]

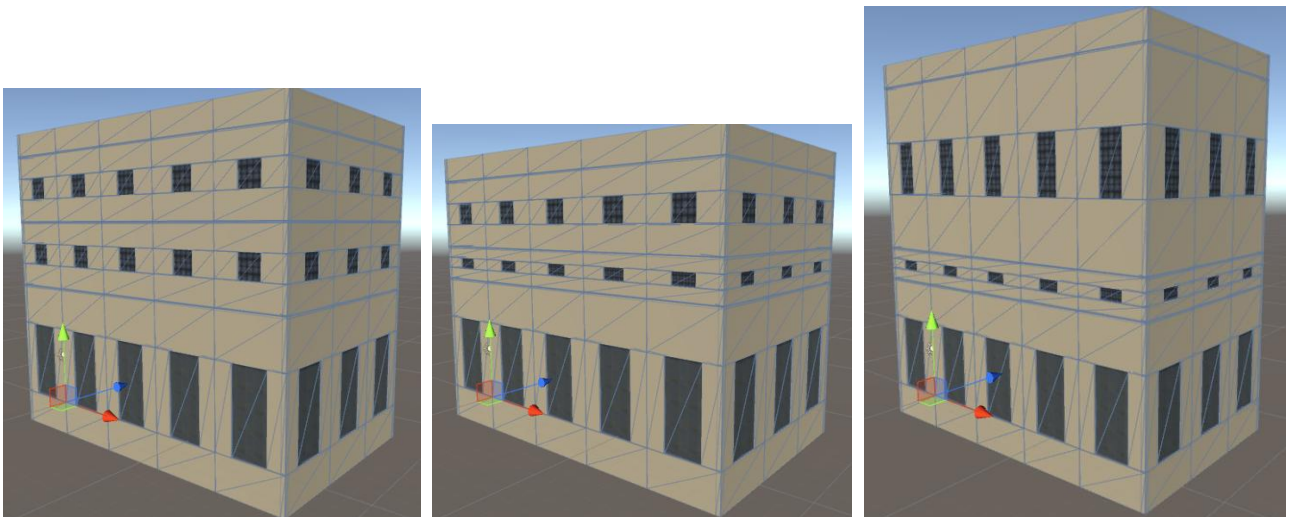
Wall size per floors – in this section can set the size of modular parts for each floor of model of the building.



[WallLength = 6 FloorIndex = 0] [WallLength = 5 FloorIndex = 1] [WallLength = 3 FloorIndex = 2]



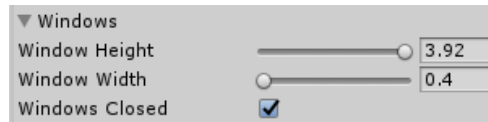
[WallHeight = 7 FloorIndex = 0] [WallHeight = 2 FloorIndex = 1] [WallHeight = 10 FloorIndex = 2]



WallLength and WallHeight values can be set at the same time for each floor and be shared.

Before this moment, examples of adjustment of a form and the size of the whole building were reviewed, we will consider now how we can modify separate elements of model of the building.

Geometry of windows



The **WindowHeight** and **WindowWidth** parameters set height and width of windows respectively. The size of windows is limited to only a size of a wall, thus, you can set any size of windows.

Windows Closed – if is active, windows will have mesh and texture, otherwise, in a wall there will be an open frame.

Note:

For each model of the building limits of values of parameters can differ, therefore not exact value of parameters, but conditional will be specified in examples:

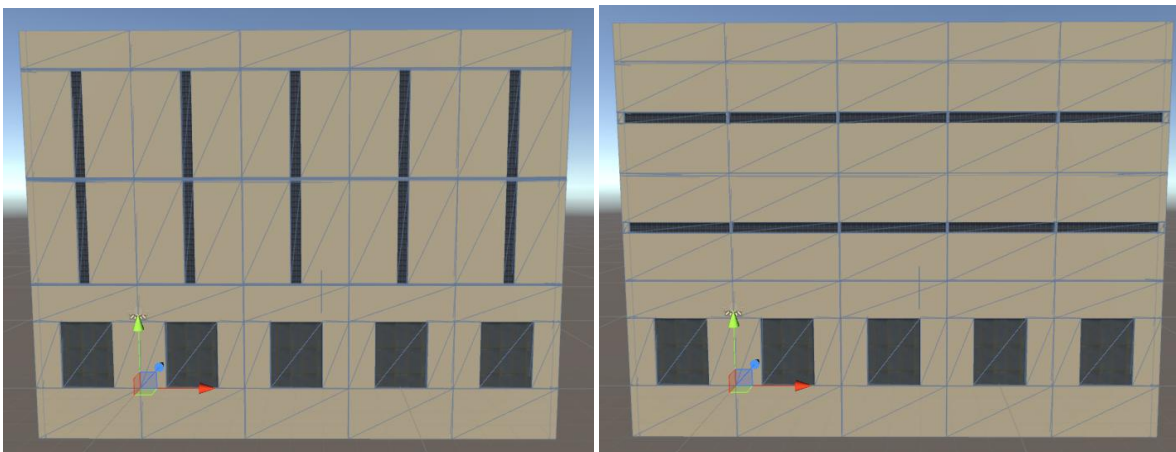
Max – the greatest possible value of parameter

Min – minimum possible value of parameter

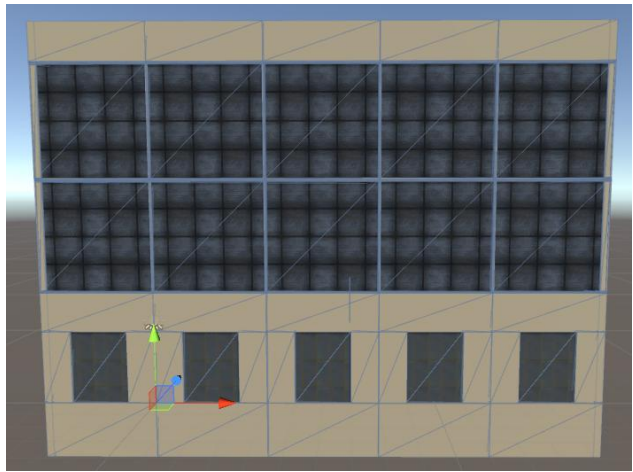
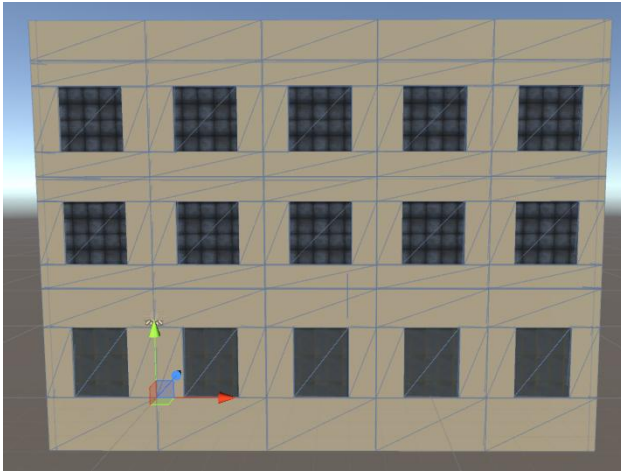
Middle – middle possible value of parameter

At installation of values it is also necessary to remember that the sizes are indicated in meters without recalculation scaling coefficient.

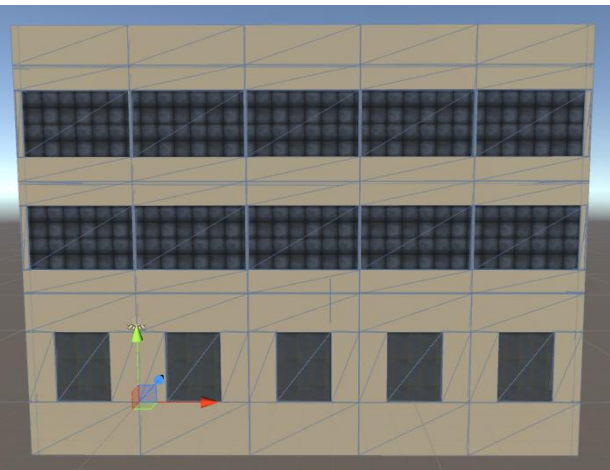
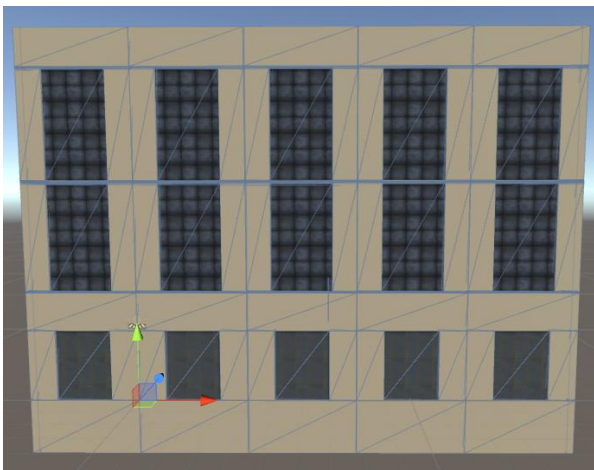
[WindowHeight = Max WindowWidth = Min] [WindowHeight = Min WindowWidth = Max]



[WindowHeight = Middle WindowWidth = Middle] [WindowHeight = Max WindowWidth = Max]

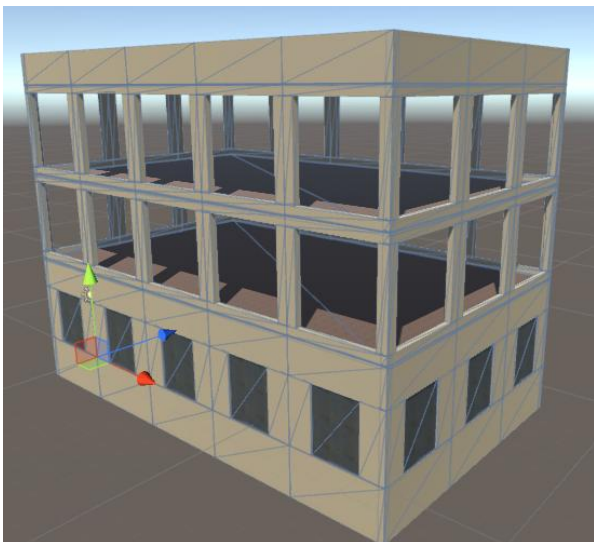


[WindowHeight = Max WindowWidth = Middle] [WindowHeight = Middle WindowWidth = Max]

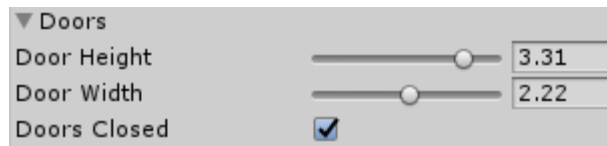


[WindowClosed is disabled]

[WindowClosed is disabled]

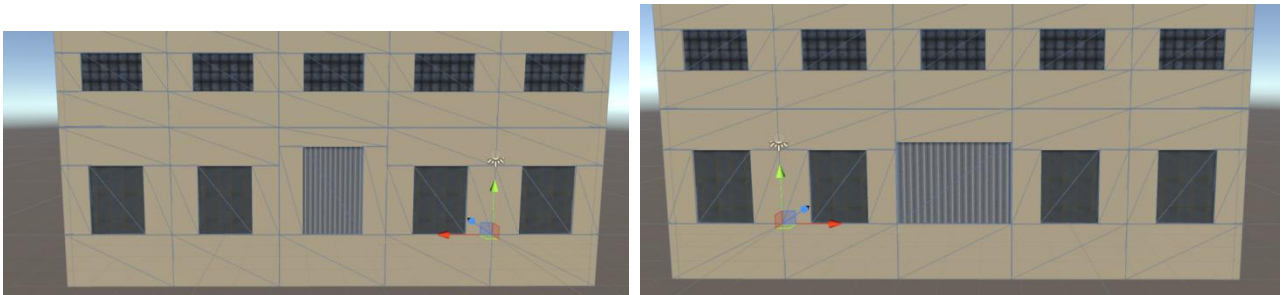


Geometry of doors

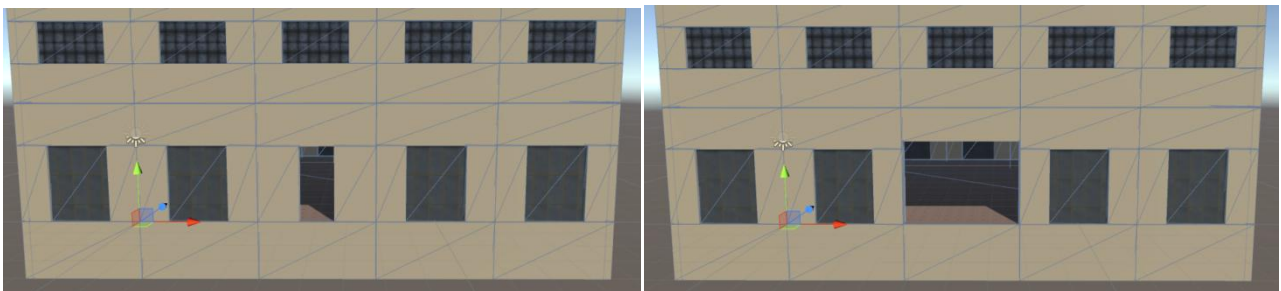


The **DoorHeight** and **DoorWidth** parameters set height and width of doors respectively. The size of doors is limited to only a size of a wall, thus, you can set any size of doors.

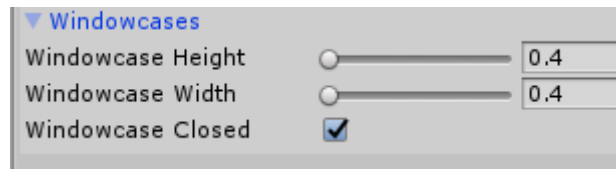
[DoorsClosed is enabled]



[DoorsClosed is disabled]



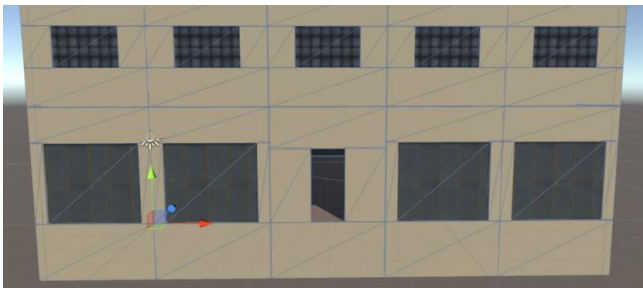
Geometry of show-windows



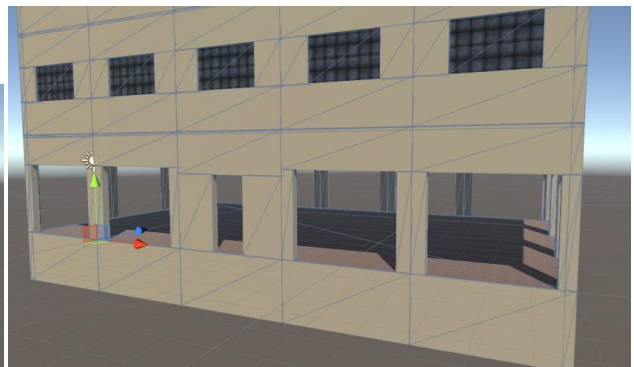
The **WindowcaseHeight** and **WindowcaseWidth** parameters set height and width of show-windows respectively. The size of show-windows is limited to only a size of a wall, thus, you can set any size of show-windows.

Difference of models of doors from models of show-windows consists in the location and the used materials. Show-windows can occupy all space on the first floor of the building, doors are located on the center of the building. At the moment the door can locate only on a front and reverse side of the building. (In the following updates there will be more opportunities for positioning of doors)

[WindowCaseClosed is enabled]



[WindowCaseClosed is disabled]



Assignment of materials. UV mapping

Materials – in this section can regulate what materials will be assigned to building elements.

It is recommended to begin editing this section after you prepared geometry and decided on the size and a form of model of the building.

Note: It is necessary to take into account that size variation of model of the building will lead to recalculation of UV of coordinates.

Within the demonstration project, the tab Materials will look as follows:



In more detail loading process of materials is described in 2 parts of documentation.

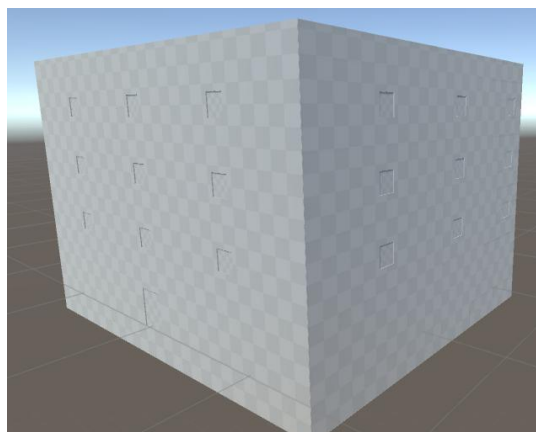
Materials are divided into groups, each group is intended for texturing of separate elements of model.

Use button **Reset Materials** if it is necessary for reset all materials in default values.

Use button **Update Materials** if it is necessary to force materials update. (This action must will be executed automatically)

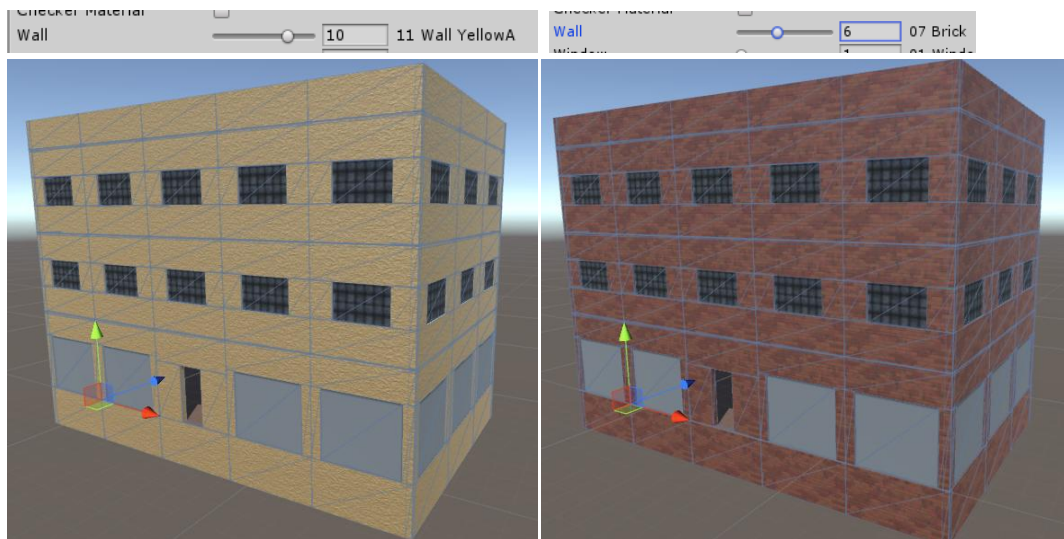
Note: The name of the selected material is displayed to the right of sequence number.

You can use option **Checker Material** for check UV mapping:

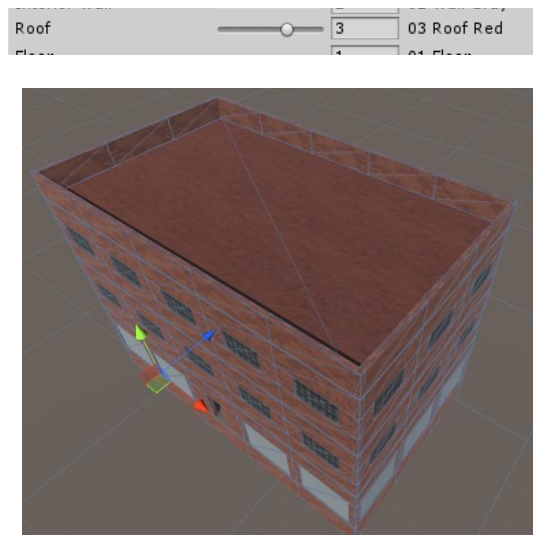


Let's review examples of use of materials:

[Assignment of material to all walls of model of the building]



[Assignment of material to a roof of building]



[Assignment of material to side walls of model of the building]



[Assignment of material to walls of the first floor of model of the building]



[Assignment of material to windows of building]

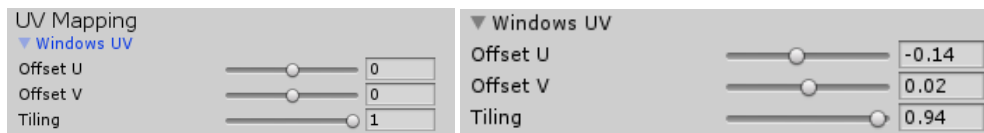


As you can notice, texture does not match the window sizes, it is necessary to correct UV a mapping. For this purpose go to a tab **Control Panel-> Procedural-> UV Mapping-> WindowUV** for editing UV of coordinates.

Values of shift and tiling will be unique for each model, it depends on the window size. Thus, you can adjust UV a mapping not only for windows, and if necessary and for other elements of the building.

[Before UV correction]

[After UV correction]



Also you can adjust the sizes for windows to fit texture, having changed the window model geometry size as was considered above.

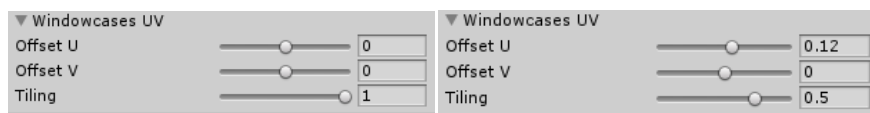
[Assignment of material to show-windows of model of the building]



Let's edit UV of coordinate for models of show-windows of the building, for this purpose pass to **Control Panel-> Procedural-> UV Mapping-> WindowCaseUV**

[Before UV correction]

[After UV correction]



As you can notice in example, the tiling was reduced twice and small shift is added. Here we also changed the size of show-windows, thus that the texture exactly would lay down on geometry.

In this way you can adjust UV mapping for other elements of model of the building: doors, walls, etc. Let's consider assignment of materials for other groups shortly:

Interior Walls – material for internal walls

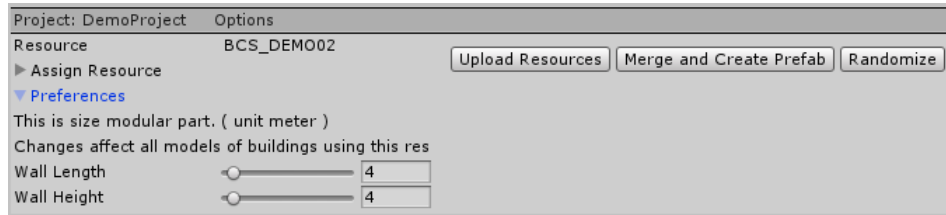
Floor – material for floors

Window Wall – material for walls with windows

Door – material for doors

Part 2. Service functions

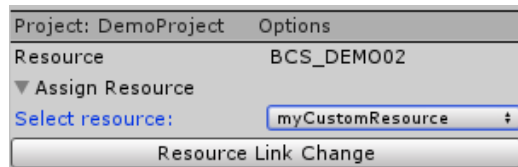
Let's consider the **Options** tab on a control panel.



In an upper part you can see the name of the connected resource for the selected building model.

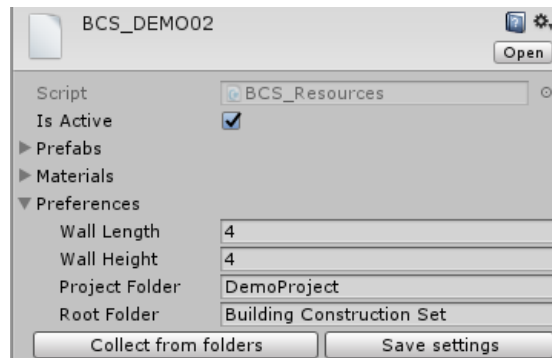
You can use an unlimited number of resource files, but only one of them can be active. All new models of buildings automatically will use an active resource by default.

But you can also change a binding to the file of a resource for other models of buildings:



Resource Link Change – this function allows to assign a new resource for the edited building model. Be careful, applying this function, it will lead to full replacement of model of the building.

Settings of the resource file



On Inspector of a panel of the file of a resource you can set the following parameters also:

WallLength – length of a modular part

WallHeight – height of a modular part

ProjectFolder – project directory name

RootFolder – directory name in the Assets folder

Further it will be considered for what the file of a resource and these parameters are used.

Note: Changes of WallLength and/or WallHeight extend to all models of buildings which share this resource.

Merge and Create Prefab – use this function on a control panel for combine of parts of geometry and creation of prefab. Will return to editing model of the building, after using of this function it will be impossible therefore is recommended to make a backup copy before merging, it is also recommended to set unique names for the models.

By default prefabs will be located in the directory:

RootFolder/Prefabs/CompleteBuildings

Also the folder for storage meshes will be created (do not delete this folder and its contents, otherwise prefab will be destroyed and lost):

RootFolder/Meshes

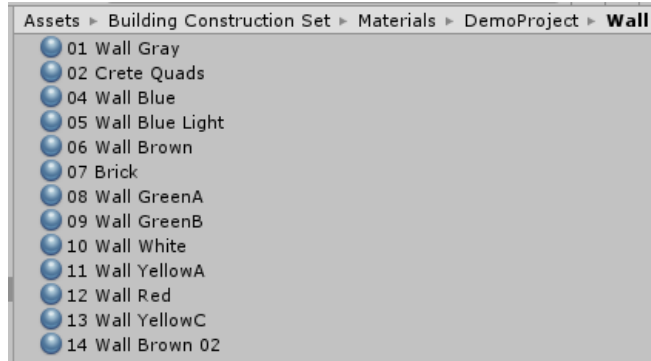
Randomize – use this function on a control panel for generation of a random model of the building. Use with care, all changes made in model will be reset.

Upload Resources – use this function on a control panel for loading of materials and/or prefabs.

Loading of Materials

To accelerate and simplify process of texturing of model, the following approach is used:

1. Materials are placed previously in folders of the project



2. Further **Control Panel-> Options-> Upload Resources** are loaded
3. On control panel, on a tab Materials should be specified sequence number of material, and it will be automatically applied to model.

For example, to add materials for building roof model, copy or move material to the RootFolder\Materials\ProjectFolder\Roof folder.

If it is necessary to add material for walls, place it in the RootFolder\Materials\ProjectFolder\Wall folder.

If it is necessary to add material for windows, place it in the RootFolder\Materials\ProjectFolder\Window folder.

Etc. for other categories of materials.

Removal of materials: delete material from the folder, or move it out of the folder of the project. Then is necessary update for the resource file:

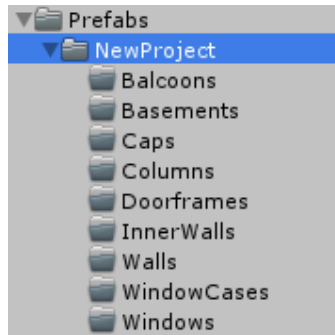
Control Panel-> Options-> Upload Resources

Loading of modular parts (prefabs)

Loading process of Prefabs is similar to loading of materials.

At first we will consider a fast way of loading, further there will be more detailed example:

1. Prefabs are placed previously in folders of the project



2. Further **Control Panel-> Options-> Upload Resources** are loaded

For example, to add prefab for building wall model, copy or move material to the RootFolder\Prefabs\ProjectFolder\Walls folder.

If it is necessary to add prefab for walls with windows, place it in the RootFolder\Prefabs\ProjectFolder\Windows folder.

If it is necessary to add prefab for walls with doors, place it in the RootFolder\Prefabs\ProjectFolder\Doorframes folder.

Etc. for other categories prefabs.

Removal of modular parts: delete prefab from the folder, or move it out of the folder of the project. Then is necessary update for the resource file:

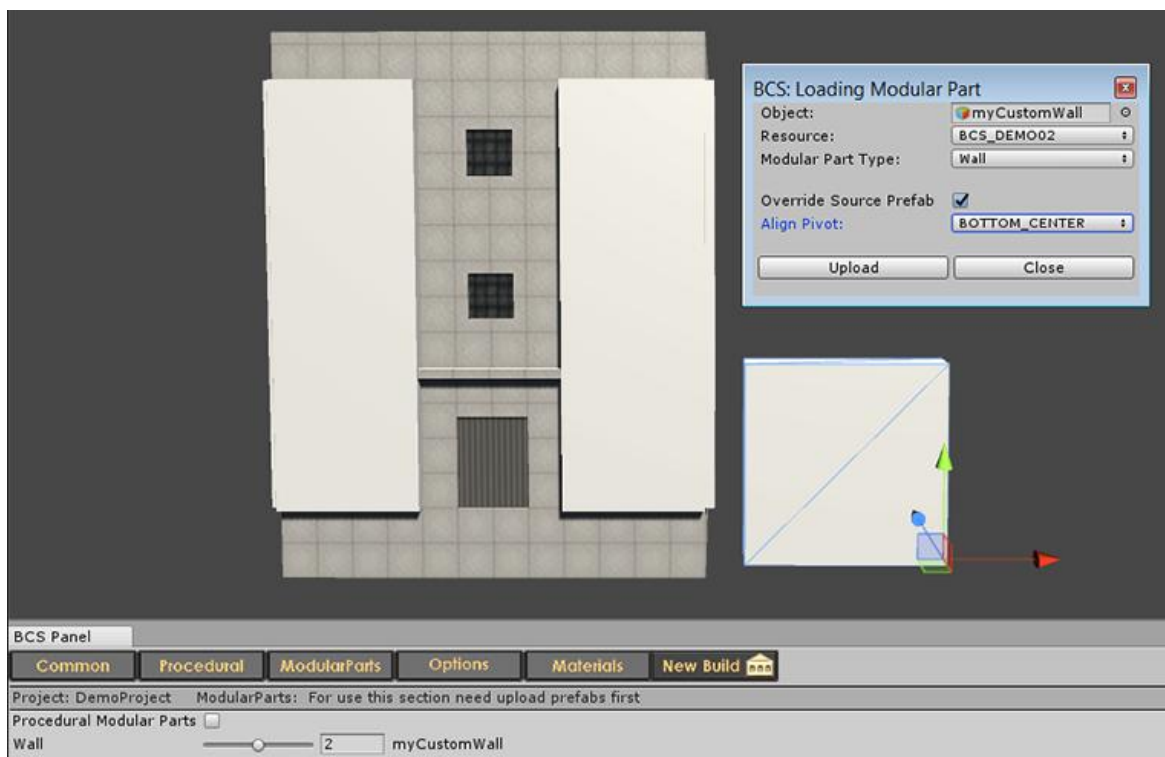
Control Panel-> Options-> Upload Resources

Adding a modular part with help of service function

As a modular part it is possible to use any object / prefab, but for correct work of this application it is necessary to use objects of fixed sizes and the corresponding form, depending on type of a modular part. Let's consider service function which will help you to load modular parts and to make necessary settings properly.

The operations procedure will be following:

1. Place an object which you plan to use as a modular part on the scene and then select this object.
2. Select **GameObject->Building Construction Set->Utils->UploadModularPart**



3. On a panel of this utility it is necessary to set the following parameters: In the field of **Object** the name of the loaded object should be displayed if it did not occur, so an object was not selected on the scene and it is necessary to fill this field again.

In the field of **Resource** select a name of a target resource manager.

In the field of **ModularPartType** select type of a modular part:

- Wall – objects of this category will be used for building model walls
- WallWindow – objects of this category will be used for walls with windows
- WallWindowCase – objects of this category will be used for walls with show-windows
- WallDoor – objects of this category will be used for walls with doors
- WallDoorInner – objects of this category will be used for internal walls with doors

Override Source Prefab – select this option if it is necessary to rewrite the existing prefab.

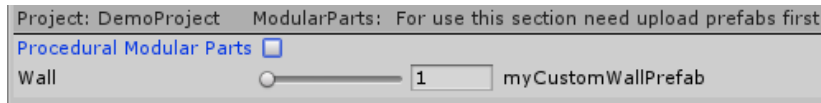
Align Pivot – if you configured pivot point for your models in advance, leave this option not touched. (value by default is <None>)

AssignDefaultMaterial – do not use this option if a modular part the model with a set of materials is used, or you want to save already assigned material. When everything is ready click Upload

4. At **ControlPanel->ModularParts** the new element should be added.

Management of modular parts

After Prefabs were loaded, on the **ModularParts** tab of a control panel functions of management of modular parts will become available:



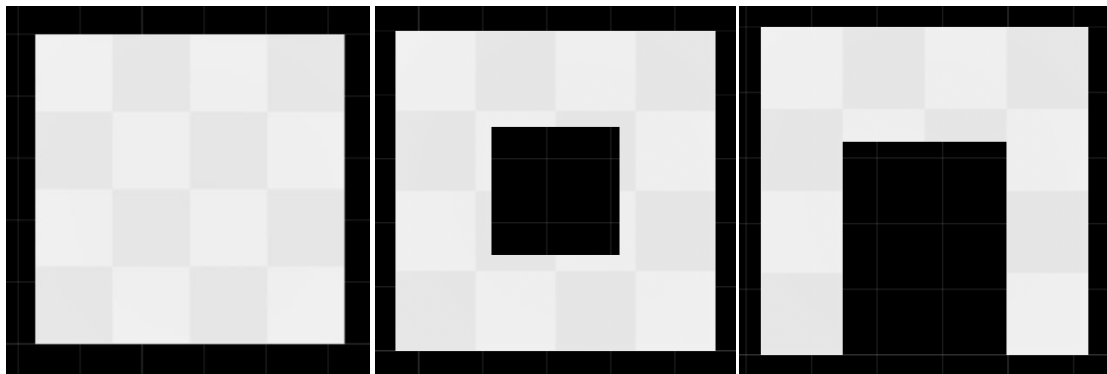
At the left the name of a modular part is located, the name of the selected prefab is displayed on the right.

At the moment you can use the following main types of geometry for modular parts:

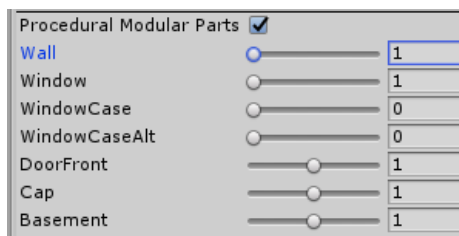
[Wall]

[Window]

[Door]

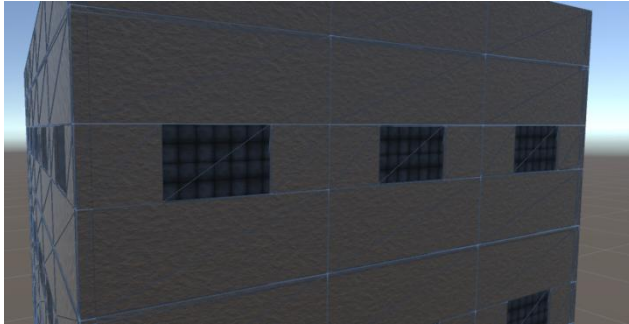


If you do not plan to use the any modular parts, there is an opportunity to use built-in by default. For this purpose activate the option Procedural Modular Parts:

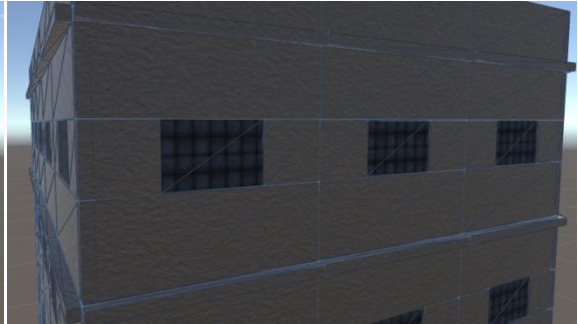


Example of use of the built-in modular parts (on the images on right side new details were added to geometry of walls):

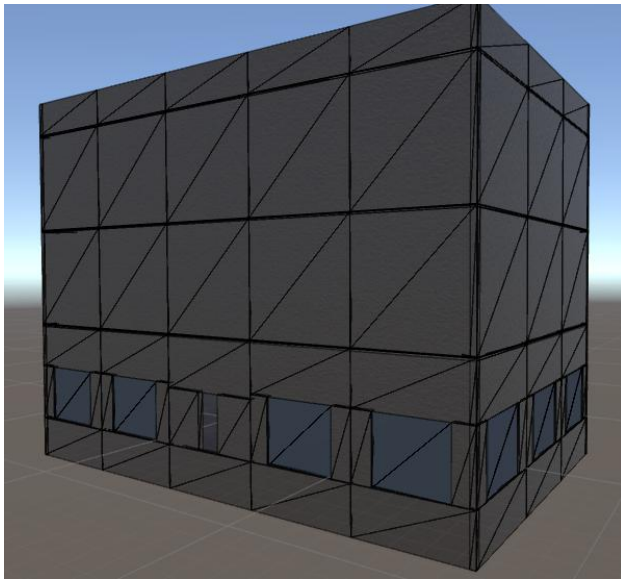
[Window = 1]



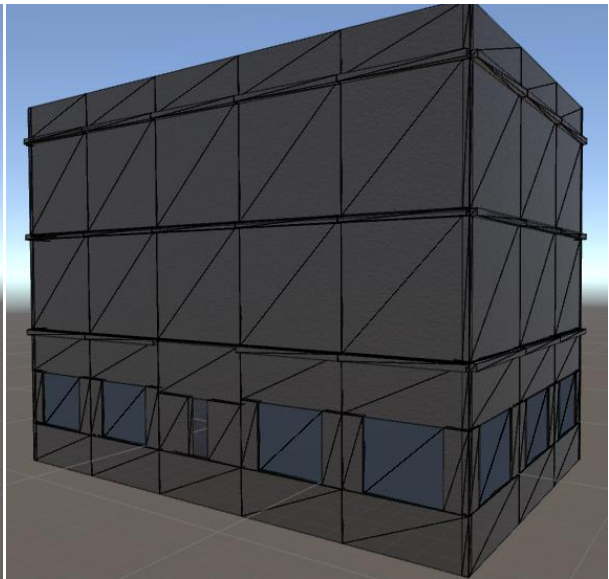
[Window = 2]



[Wall = 1, Windowcase = 0]



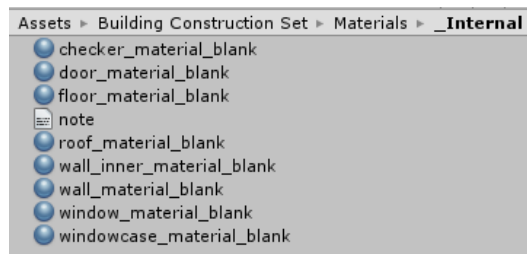
[Wall = 2, Windowcase = 2]



You can create in advance modular parts in any 3D editor, including Unity and load them as prefabs as it was considered above.

For correct loading of such models it is necessary to take the following into account:

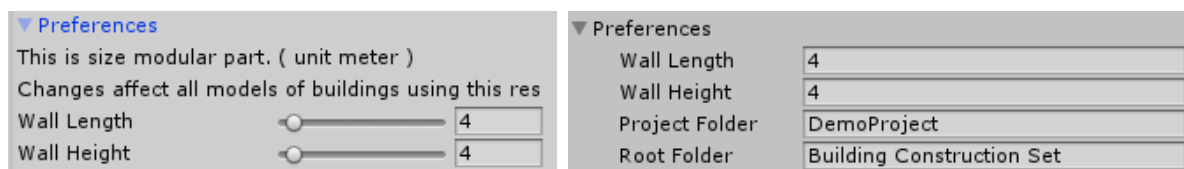
1. Alignment of a pivot point of model is required.
2. To have an opportunity to assign materials, it is also necessary to apply material by default:



For example, if you create new model for a building wall, apply to model material by default of **wall_material_blank**. If you create new model for walls with windows, assign **window_material_blank**, etc.

This step could pass, if it is not required to update materials for your modular parts.

3. And the main requirement for modular parts is a fixed size. Within one project / of resource all modular parts should have the fixed size which needs also to be set on a control panel or in settings of the resource file:



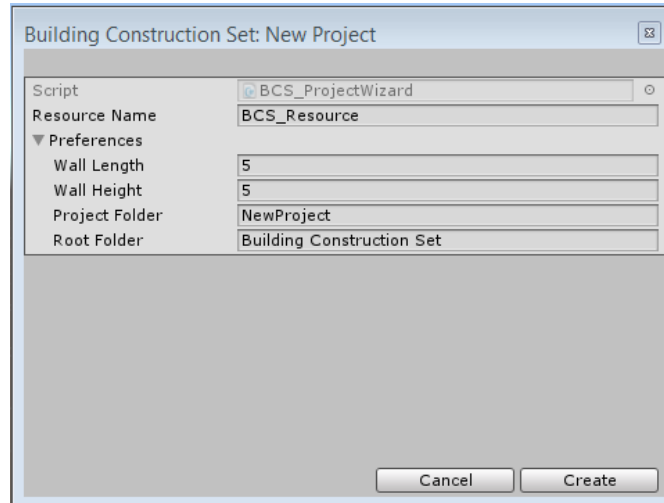
As it is possible to notice by default the size of a modular part is set in 4x4 meters.

Creation of the new project

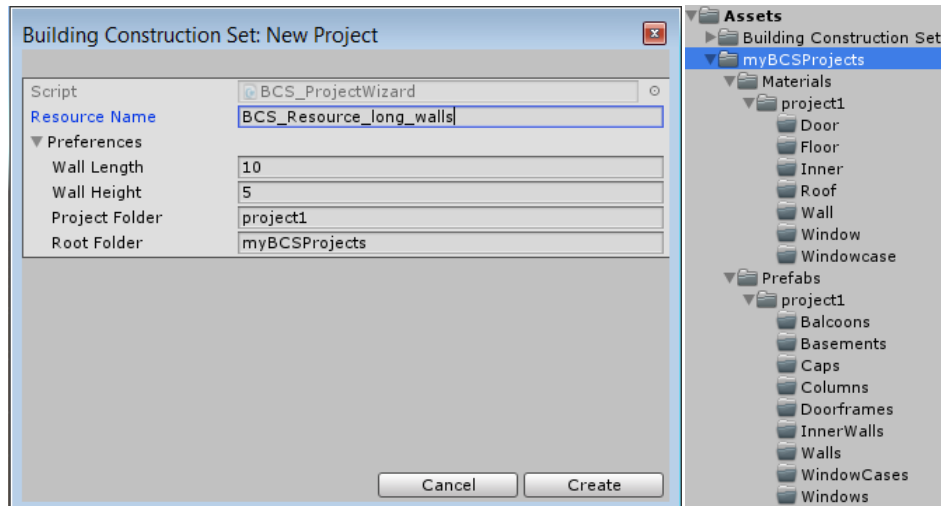
Let's consider process of creation of the new project.

Select GameObject-> **Building Construction Set**-> **Utils**-> **New Project**

[Window of creation of the new project]

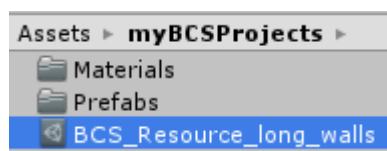


Let's edit parameters and we will click Create:

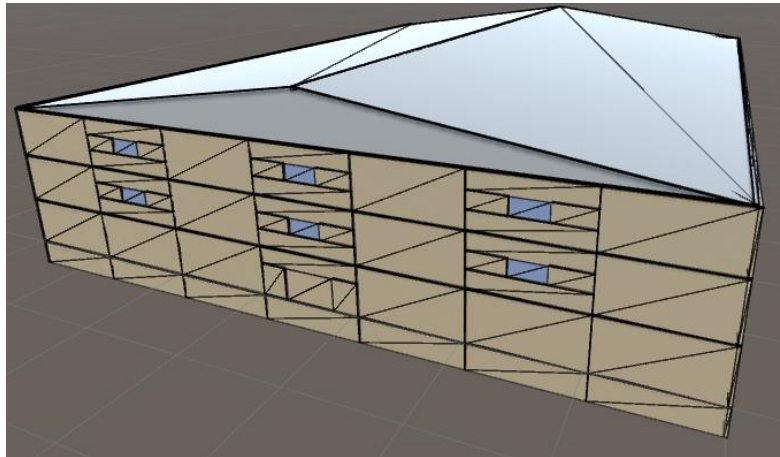


As it is seen from the image, after clicking of the Create button project folder structure was created.

In a root folder the new file of a resource appeared:

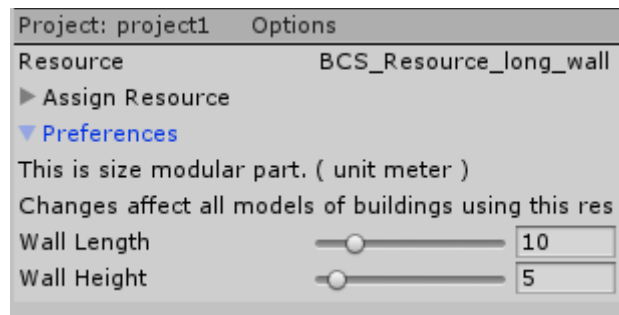


Let's create the new building and we will compare changes with the demonstration project.



As it is seen from the image, length of walls was increased as we specified WallLength = 10 (meters), height of walls is set in value 5 meters.

Let's check changes on control panel (Options tab):



Information on the name of the project, resource and the parameters regulating the size of modular parts was here updated too.

Now you can copy/move the materials and/or prefabs to folders of the new project as it was considered in the section of loading of resources, then select ControlPanel-> Options-> Upload Resources.

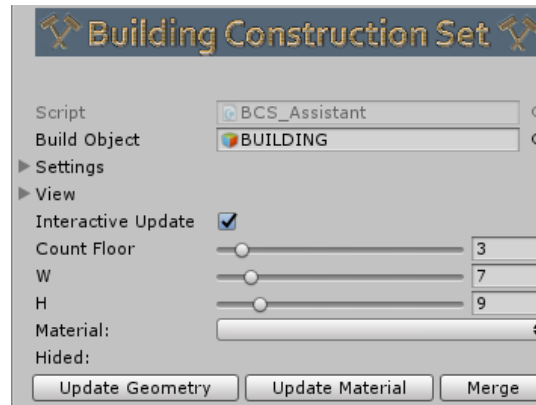
Now all new models of buildings, will use settings from the new resource file and respectively, for new models will be formed the geometry with new sizes of modular parts.

The previous created models will continue to use a linking to other resource files.

Part 3. BCS_Assistant settings on Inspector Panel

Inspector Panel. Basic settings

Let's consider basic settings for the BCS_Assistant panels:



Count Floor – the number of floors of the building (building height)

W – building width (quantity of sections modules on width)

H – building depth (quantity of sections modules in depth)

Material – basic material for building model walls

Hided – here are displayed names of the hidden objects – parts of the building (see the section View if it is necessary to hide some part of the building)

Interactive Update – when a flag is active, all changes made on the BCS_Assistant panel at once are displayed in Scene View. This flag is activated automatically when switching to a control panel.

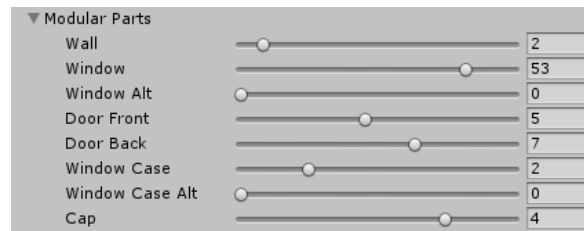
Update Material – updates materials on models, use if Interactive Update is disabled.

Update Geometry – completely rebuilds all model, use if Interactive Update is disabled.

Merge – combines all modular parts in one model, here in difference from the Merge and Create Prefab function on a control panel, prefab is not created.

Inspector Panel. Modular parts

Let's consider settings of modular parts of the building (Settings->ModularParts):



| ▼ Modular Parts | | |
|-----------------|-----------------------|----|
| Wall | <input type="range"/> | 2 |
| Window | <input type="range"/> | 53 |
| Window Alt | <input type="range"/> | 0 |
| Door Front | <input type="range"/> | 5 |
| Door Back | <input type="range"/> | 7 |
| Window Case | <input type="range"/> | 2 |
| Window Case Alt | <input type="range"/> | 0 |
| Cap | <input type="range"/> | 4 |

Value 0 means that this type of the module will not be used when designing the building.

Wall – allows to select type of walls of the building

Window - allows to select type of windows of the building

WindowAlt - allows to select additional (alternative) type of windows of the building

DoorFront - allows to select door type for the central entrance of the building

DoorBack - allows to select door type for a back door of the building

WindowCase - allows to select type of show-windows of the building (always take place on the first floor)

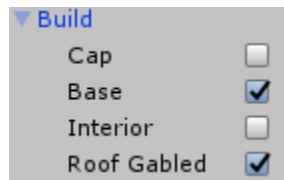
WindowCaseAlt - allows to select additional (alternative) type of show-windows of the building (always take place on the first floor)

Cap - allows to select type of walls of the building (always takes place on a roof)

Note: Do not forget to activate InteractiveUpdate, that to see result of the made changes immediately.

Inspector Panel. Elements of constructions.

The values which are selected checkboxes define what elements of the building will be created. These settings have higher priority, and can cancel any other settings. (Settings-> Build):



Cap – if the flag is disabled, walls on a roof of the building will not participate in construction.

Base - if a flag is disabled, walls in the cellar of the building will not participate in construction.

Interior - if a flag is disabled, walls in the building will not participate in construction.

Roof Gabled - if a flag is removed, gabled roofs of the building will not participate in construction. (It cannot be active along with **Cap**)

Inspector Panel. Visible parts of constructions.

The values which are selected checkboxes define what elements of the building will be displayed in the Scene window of the editor. (-> View):



Roof – if a flag is disabled, the roof and ceilings on floors of the building will not be displayed.

Floor - if a flag is disabled, floors of the building will not be displayed.

Outer Walls - if a flag is disabled, external walls of the building will not be displayed.

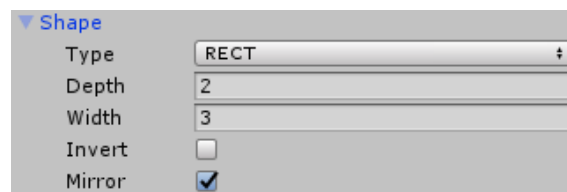
Inner Walls - if a flag is disabled, internal walls of the building will not be displayed.

Inspector Panel. Advanced settings

Here settings are available to change of a form of the building, imposing of materials on separate parts of the building, regulation of a location of windows and show-windows of the building.

Change of a form of the building

Let's consider settings for change of a form of the building (Settings-> of Advanced-> Shape):



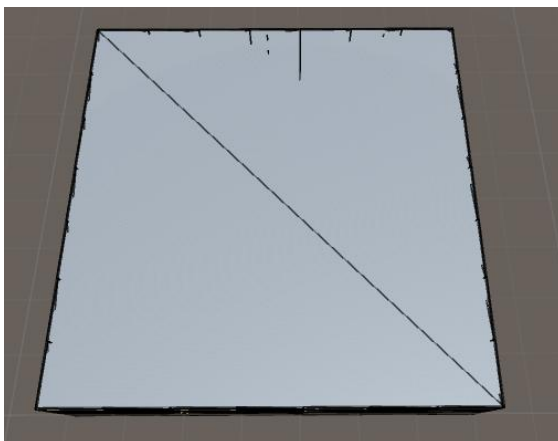
The Width and Depth parameters regulate change of a form on X axes and Z respectively, do not set great values here, try to set values within [0, 1] and further gradually increase, adjusting to required result.

Invert – inversion (reflection) of a form on X axis.

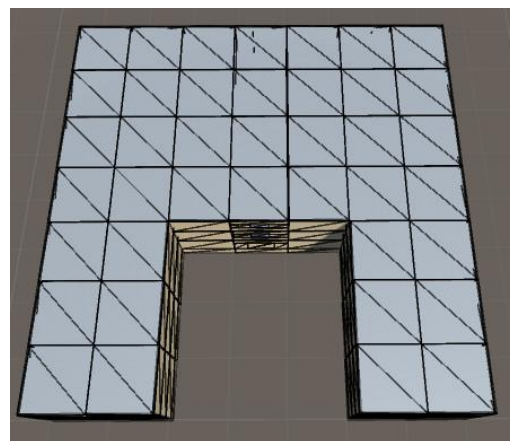
Mirror – inversion (reflection) of a form on axis Z (it can be active along with **Invert**)

In future versions the quantity of available forms can be expanded, the following shapes are at the moment available:

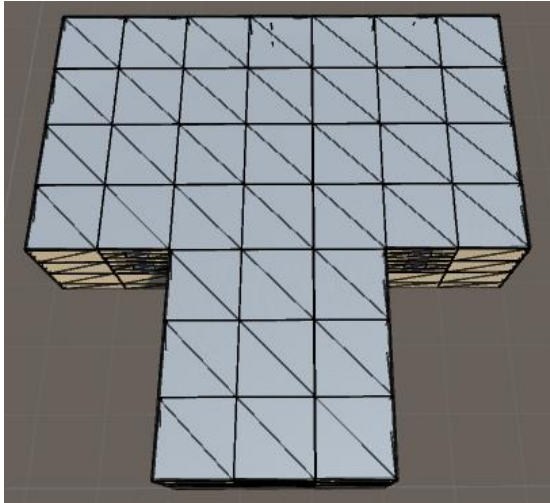
[RECT]



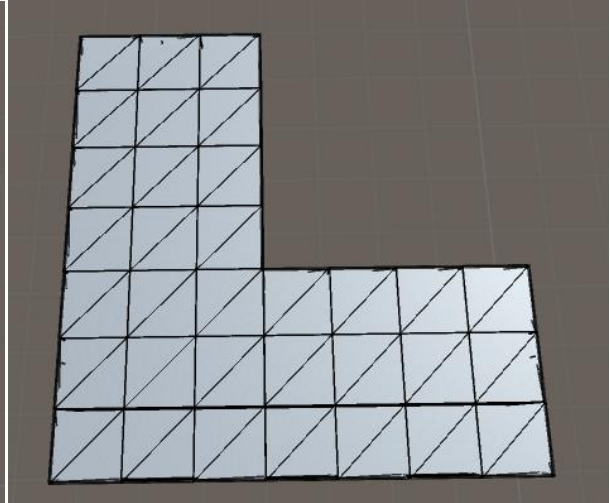
[M_SHAPE]



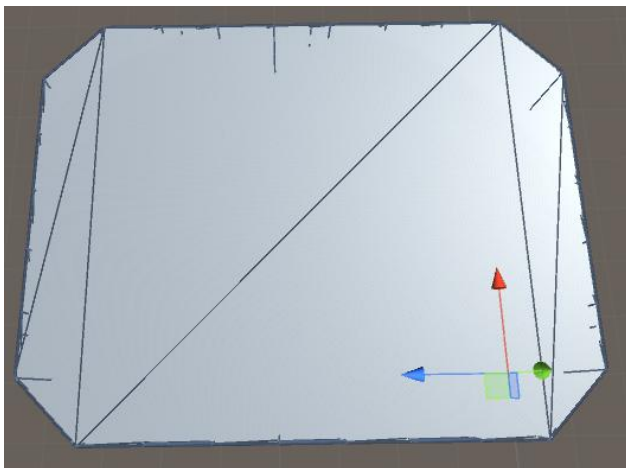
[T_SHAPE]



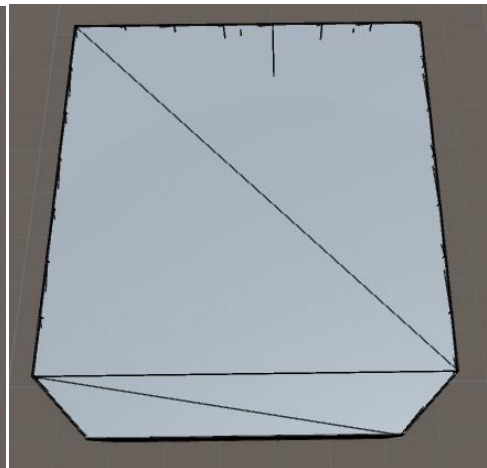
[L_SHAPE]



[RECT_ROUNDED]

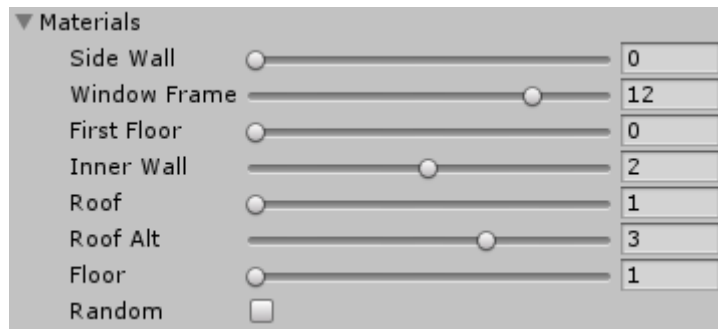


[RECT_ROUNDED_FRONT]



Inspector Panel. Expanded configuration of materials

Let's consider advanced settings for materials (Settings-> of Advanced-> Materials):



For change of materials move sliders. Value 0 means that this type of material will not be used. Below, the description for each type of materials is given.

Side Wall

This type of material will be used only for side walls of the building.

Window Frame

This type of material will be used only for walls with windows.

First Floor

This type of material will be applied only to walls on the first floor of the building.

Inner Wall

This type of material will be applied only to inner walls in the building.

Roof - This type of material will be applied only to an upper part of a roof of the building. (**RoofAlt** – for a side part of a roof)

Floor - This type of material will be applied only to building floors.

Random – if a flag is active, when clicking the Random button above-mentioned types of materials will be assigned randomly.

Expanded configuration of a roof

Let's consider advanced settings for a building roof (Settings-> of Advanced-> Roof):



Height – roof height on a y axis.

Tiling - regulates a UV-mapping.

Use Planks – if is active, then on borders of a roof additional planks will be located.

Plank Bold – thickness of additional planks.

Note: For use of the above described settings it is necessary to activate Settings-> Build-> Roof Gabled.

Additional information. Contacts

Send information on the found errors, and also your wishes for improvement of application to e-mail:

blackstepgames@gmail.com

Video records list:

Overview of main features: <https://youtu.be/fC8IBUTYV1E>

Resources Upload Tutorial: <https://youtu.be/2cefZ12Xnmc>

Settings for a gabled roof of building: <https://youtu.be/TZEuagaiS5c>