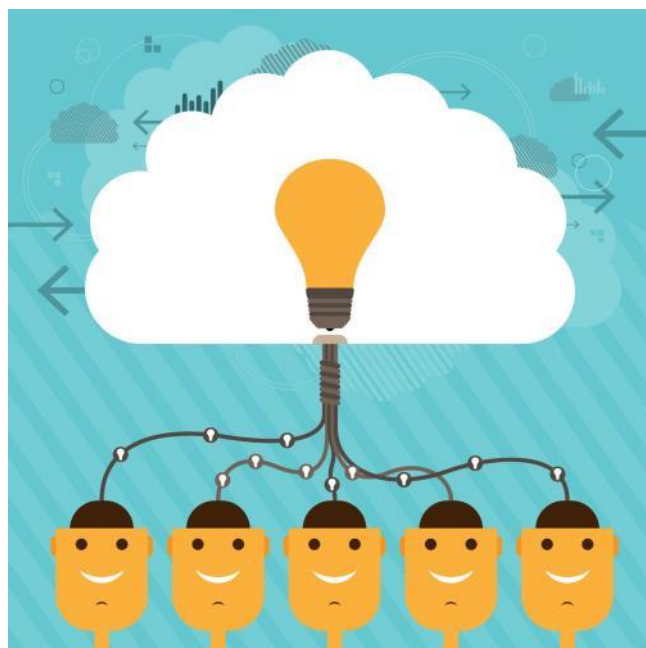




Building Sketching

Guideline

*Project "THE4BEES
– Transnational
Holistic Ecosystem
4 Better Energy
Efficiency Through
Social Innovation"*

DRAFT VERSION

APRIL 2017
iSPACE

INTRODUCTION

The goal of THE4BEES is to change the behaviour of users in public buildings. To make the energy consumption visible and experienceable, several sensors will be used to measure temperature, humidity and CO₂-levels as well as controlling devices for the heaters. The measured values cannot only be shown using tables, but also in a better understandable manner using maps. Today, maps can be drawn in 2D and in 3D to show current values.

To create such maps, the first step is to draw the building and its interior. Components that are needed are:

- Structural Elements: e.g. walls, stairs
- Opening Elements: e.g. doors, windows
- Spaces: e.g. rooms with their corresponding values
- Energy-relevant elements: e.g. heaters/radiators
- Sensors: e.g. humidity-sensor, temperature-sensor
- Furniture: e.g. tables, chalkboard

The building will be drawn using the extensible editor for OpenStreetMap “JOSM”.

Contents

PART 1: PREPARATION	4
PREPARE THE SENSORS AND THE DATA.....	4
A • SENSORS.....	4
B • GET A PLAN OF THE BUILDING.....	6
1. Send the plan for georeferencing.....	7
2. Check the layout.....	8
3. Measurements.....	9
4. More detail for the project room (sensors & furniture)	10
PART 2: JOSM 11	
PREPARE BUILDING USING JOSM	11
A • DOWNLOAD AND INSTALL JOSM AND SET THE LANGUAGE.....	11
B • INSTALL THE FREE PDF PLUGIN	15
C • INSTALL TWO MORE PLUGINS	17
D • IMPORT THE 4BEES-PRESET	18
E • ZOOM TO YOUR SCHOOL	20
F • IMPORT YOUR BUILDING PLAN	23
G • DRAW YOUR BUILDING	25
H • SAVE YOUR FINISHED BUILDING MODEL.....	38

PART 1: PREPARATION

PREPARE THE SENSORS AND THE DATA

A • SENSORS

The very first step here is to place the sensors. Available ones are

- HomeMatic Wireless Temperature/Humidity Sensor, indoor (Funk-Temperatur-/Luftfeuchtesensor, innen)
- HomeMatic Wireless Radiator Thermostat (Funk-Heizkörperthermostat)
- HomeMatic Wireless Sensor for carbon dioxide (Funk-Kohlendioxid-Sensor)
- HomeMatic Wireless Shutter Contact (Funk-Fensterkontakt)
- HomeMatic Wireless Rain Sensor (Funk-Regensensor)
- Bluetooth Beacon as “wireless QR-code”

All of the sensors, except of the rain sensor, will be used indoors. Additionally, one small device (Bluetooth Low Energy Beacon) will be **placed near the door of the room**. Depending on the vendor, a beacon comes in many shapes and colors. The image below shows some examples with a 1-Euro-Coin as reference for their size.



Figure 1 : Beacon shapes and size

The beacon will work as “**wireless QR-code**” or “central for display”. It has no display itself, but it communicates using Bluetooth Low Energy (BLE). BLE uses less battery than the classic Bluetooth, therefore, the beacon’s battery doesn’t need to be changed very often. Using the beacon, a smartphone with Bluetooth turned on can display the room data, such as the temperature or humidity. The following images show what information might be shown:

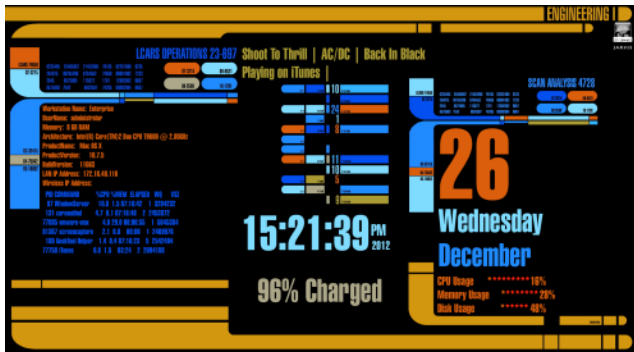


Figure 2 : Examples for the information a beacon might display (Sources: <http://www.macosxtips.co.uk/geeklets/modules/upload/attachments/Star%20Trek%20LCARS.png>, <http://image.rakuten.co.jp/mikiya-gift/cabinet/f61/f6089m04.jpg>)

The temperature/humidity sensor should be placed somewhere, where it will **not be moved anymore**. It might be good to use some glue or sticky tape to glue it somewhere.

The radiator thermostat can only be **placed at a heater**, thus its position is forced by the layout of the room.

The same applies to the sensor for carbon dioxide, this sensor does not use a battery, and therefore, it needs to be **placed in a socket**.

The shutter contact should be mounted at the **window that is mostly used** for ventilation, so that its status can be checked.

B • GET A PLAN OF THE BUILDING

Once the sensors are in place, the building can be mapped/drawn. If available, use a PDF-Plan of the building that shows the layout of the building. This plan might be more detailed than necessary and, contrariwise, might miss some important elements.

As a general rule, building plans only contain the walls and spaces and their measures, such as length, width and height. Doors might be contained in the plan, but windows might not be included. These need to be drawn into the PDF-Plan. It might be easier to draw them by hand before starting to map the building using the computer program.

The plan should be updated so that it now should include all walls, stairs, spaces, doors, windows, heaters, placed sensors as well as the furniture.

An example of a plan might look like this:

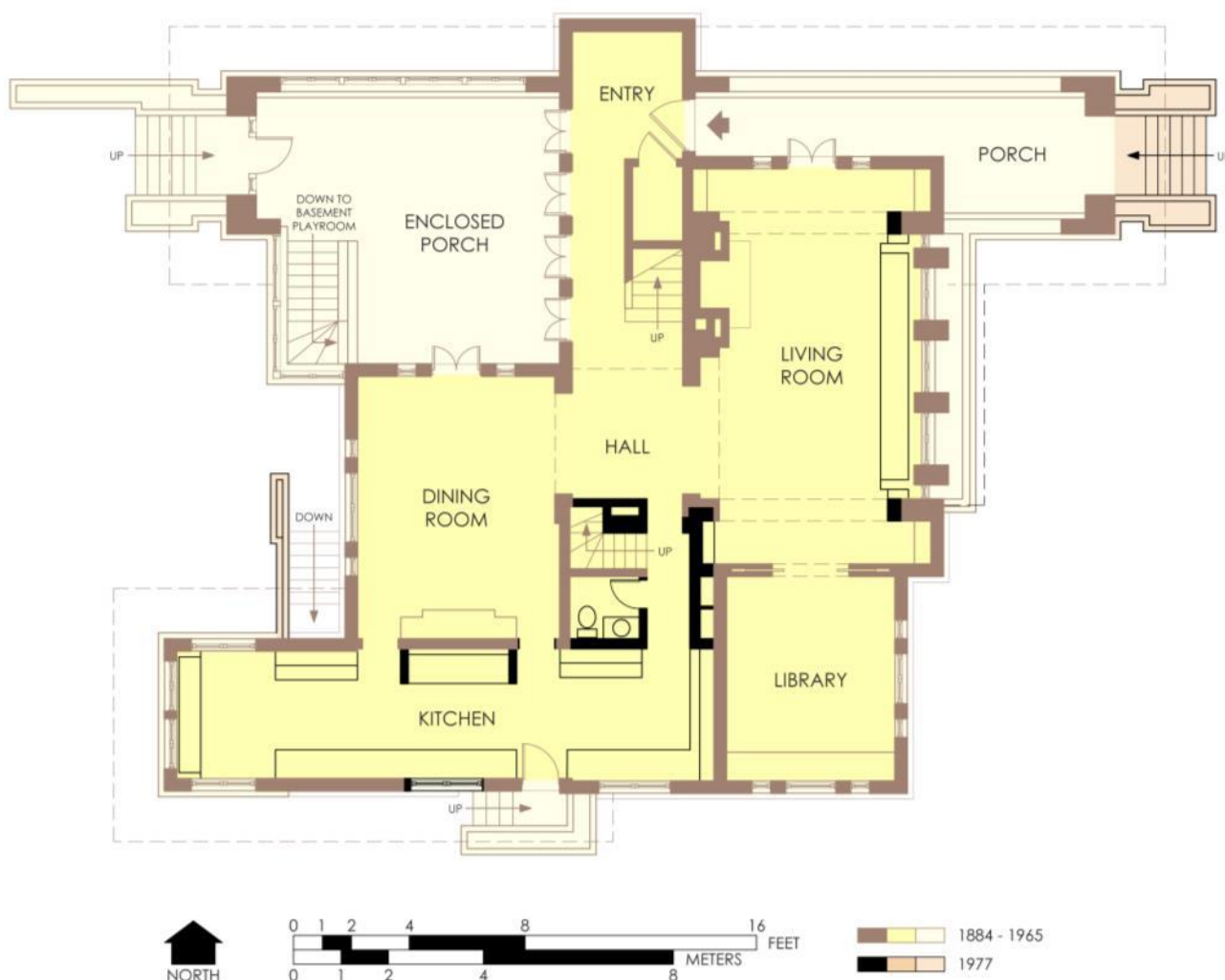


Figure 3 : Exemplary building plan (Source : https://upload.wikimedia.org/wikipedia/commons/1/14/Hills-DeCaro_House_First_Floor_Plan_Post-Fire.jpg)

The plan is mainly self-explaining. Walls, windows, doors, stairs, rooms and some furniture are drawn in there. The example is for a building with only one floor. If your building has several floors, one plan for each floor needs to be done.

1. Send the plan for georeferencing

To have the plan at the correct position, we need to reference it. This requires skills in geoinformation and a GIS-software.

The basic principle is that the local coordinate system gets translated into a Cartesian coordinate system. To keep it easy, most buildings have a positive coordinate system with the origin of 0,0 in the lower left corner. The image of the building does not know its position on the map or globe. That's what we "tell" the building during the georeferencing. Georeferencing includes different tasks, such as shifting, rotating, scaling and others.

To keep it simple, we assume, only those three were needed. When you load the image, it will be placed at 0,0 on the globe/map. That point is somewhere in the atlantic ocean near the westafrican coast (google maps cannot do georeferencing, but this is an example).



The first step is to shift the image at the right position. So, in this case, away from the African westcoast and to the correct city and site.

The image might be too big, so it needs to be scaled to the correct size.

Another step is to rotate it according to its real rotation.

These steps are not performed manually, the user defines points on the image and their corresponding points on the map, thus, the user tells the software, where the real location of each point is. The software does the rest. The result is a "georeferenced image". Doing it automated instead of manually gets more precise outcomes.



This part will be done by iSPACE, therefore, please **send us the building plan as soon as possible** per email!

2. Check the layout

The following steps should be performed for every room (at least the rooms you are allowed to enter):

1. Check the walls if they correspond to the plan. If a wall is missing, mark it on your plan. If a new wall was built, draw it.
2. Do the same for windows and doors.
3. Check the stairs, too!
4. Number the rooms in your drawing and write a list of the room attributes, such as: Room name, room number, room type, etc.

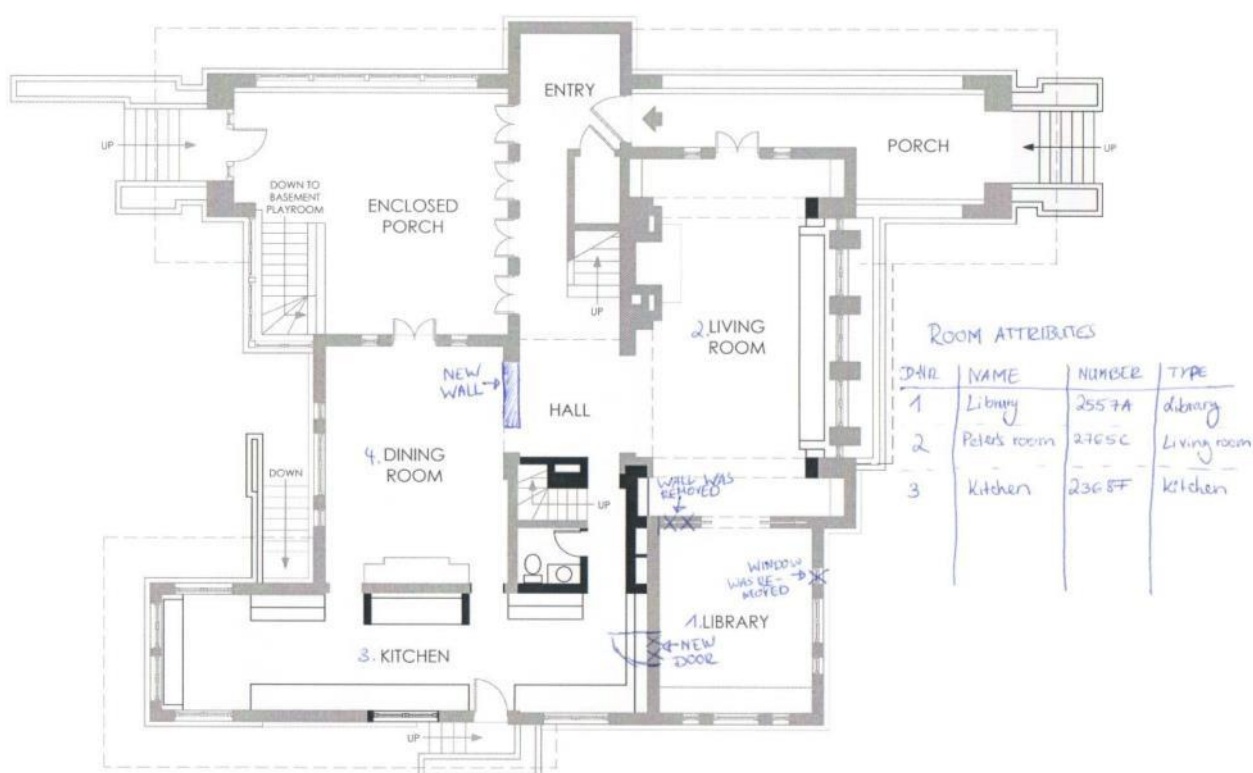


Figure 4 : How a layout check might look. The attributes can be written in a table.

3. Measurements

1. Additionally, measure (or estimate) the following values:
 - 1.1. Room height (RH): For every room if the room has just one height, otherwise, do in the example in the kitchen (one part has a height of 3 meters, one has just 2.5m)
 - 1.2. Window upper height (WU)
 - 1.3. Window lower height (WL)
 - 1.4. Door upper height (DU)

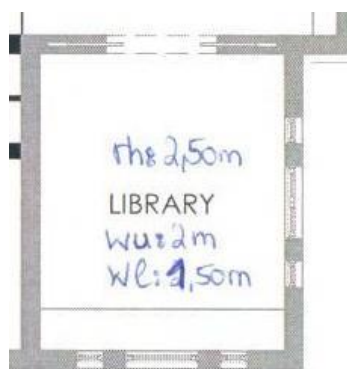


Figure 5 : Room height, window upper height and window lower height for one room

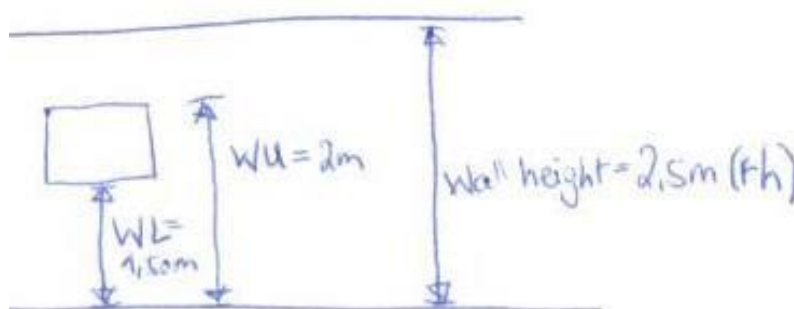


Figure 6 : Definition of the window heights

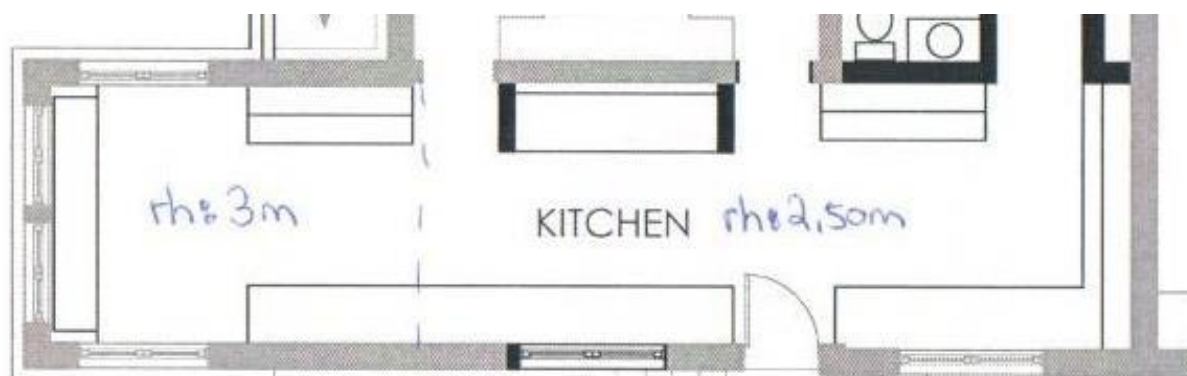


Figure 7 : Example of a room with differing heights

4. More detail for the project room (sensors & furniture)

If this was done for every room, then the project rooms should get more detailed information:

First, use a plan to map the sensor-locations. In the example, some of the sensors are written with the whole name, some are abbreviated. Do it your way, but make sure you know what symbol represents which sensor.

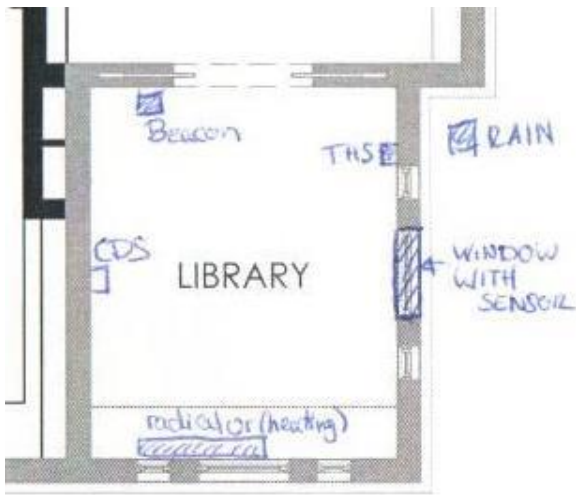


Figure 8 : Sensors

Abbreviations:

THS: Temperature/humidity sensor

CDS: Carbon dioxide sensor

Afterwards, the furniture needs to be mapped, too. Don't add too many details, the chalkboard and the tables should be enough.

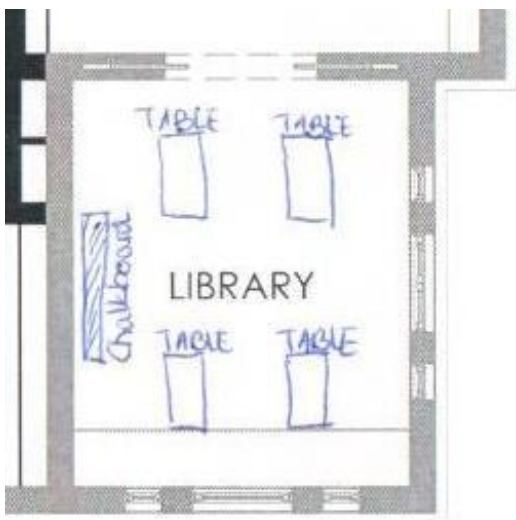


Figure 9 : Mapping of furniture

Once you collected all this information, you are prepared for the next steps.

PART 2: JOSM

PREPARE BUILDING USING JOSM

A • DOWNLOAD AND INSTALL JOSM AND SET THE LANGUAGE

OpenStreetMap is an open project that enables users to collect geographic data as a map. We will use its editor to draw the building map.



Download the JOSM (Java OpenStreetMap) Editor:

<http://josm.openstreetmap.de/download/windows/josm-setup.exe>



The installer suggests an installation in your computer's language. However, in this project, several countries are taking part and therefore, this tutorial is prepared in English. You might use the installer in German, Italian or any other language, but then, the names and menus in the tutorial might look different. **Therefore, we suggest to install JOSM in English!** The installer language has nothing to do with the installation language. The installation language needs to be changed after the installation in the next step.

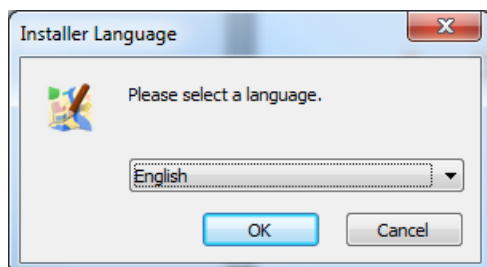


Figure 10 : Choose English as language

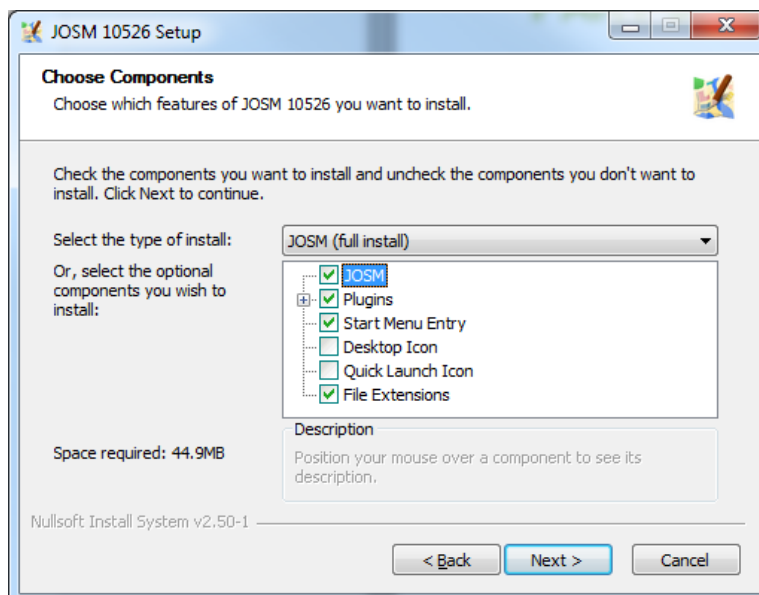
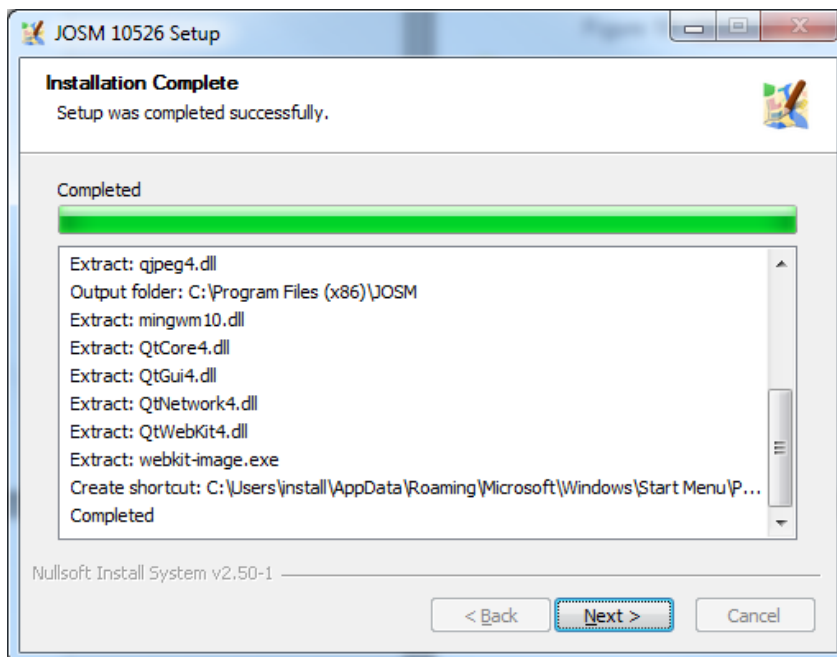
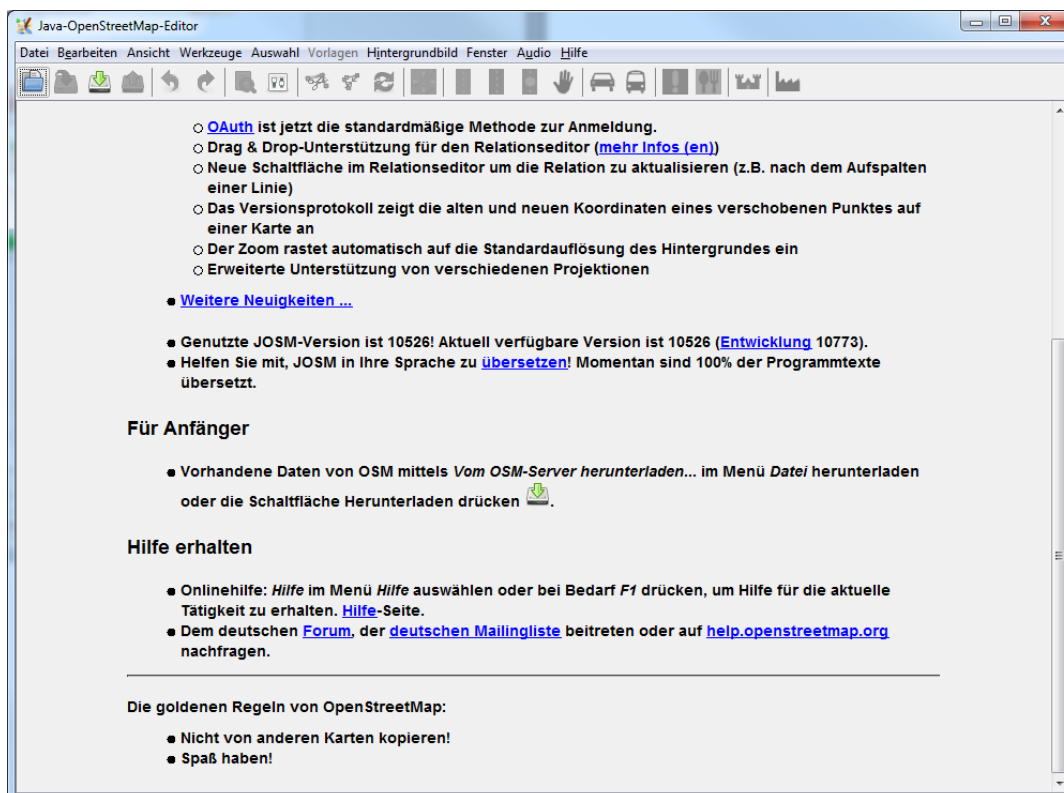


Figure 11 : Select the full installation

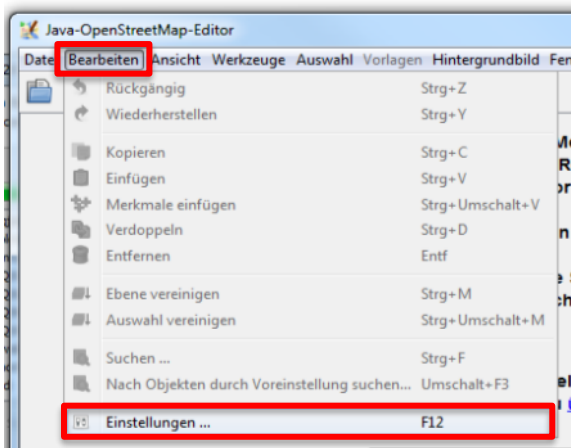


Start JOSM.

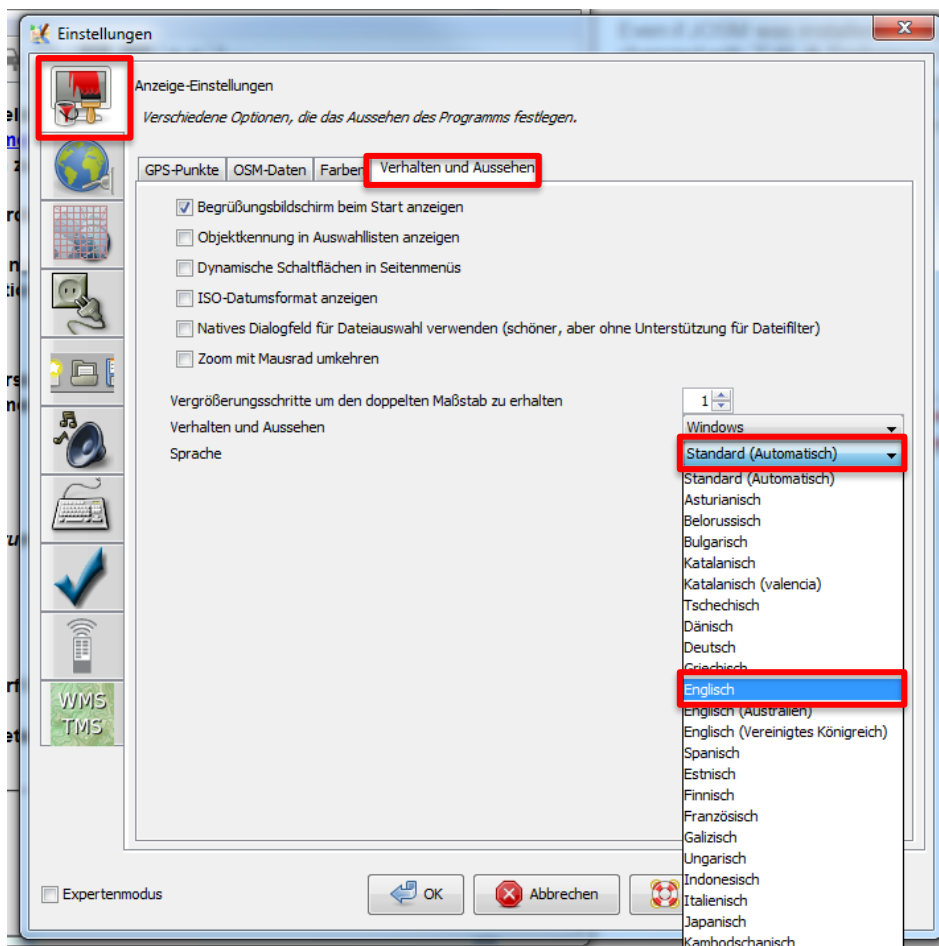
JOSM will look like this at startup:



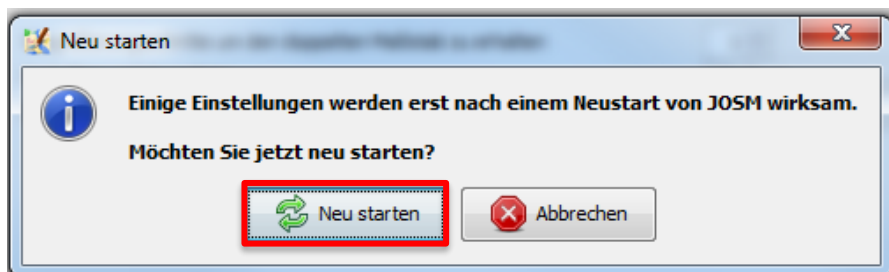
Even if JOSM was installed in English, it might start up in your standard language. This should be changed (the tutorial will be easier to follow) with “Edit → Preferences” (or Key “F12”):



Then go to “Display Settings” → “Look and Feel” → language. Choose “English” and press “Ok”:



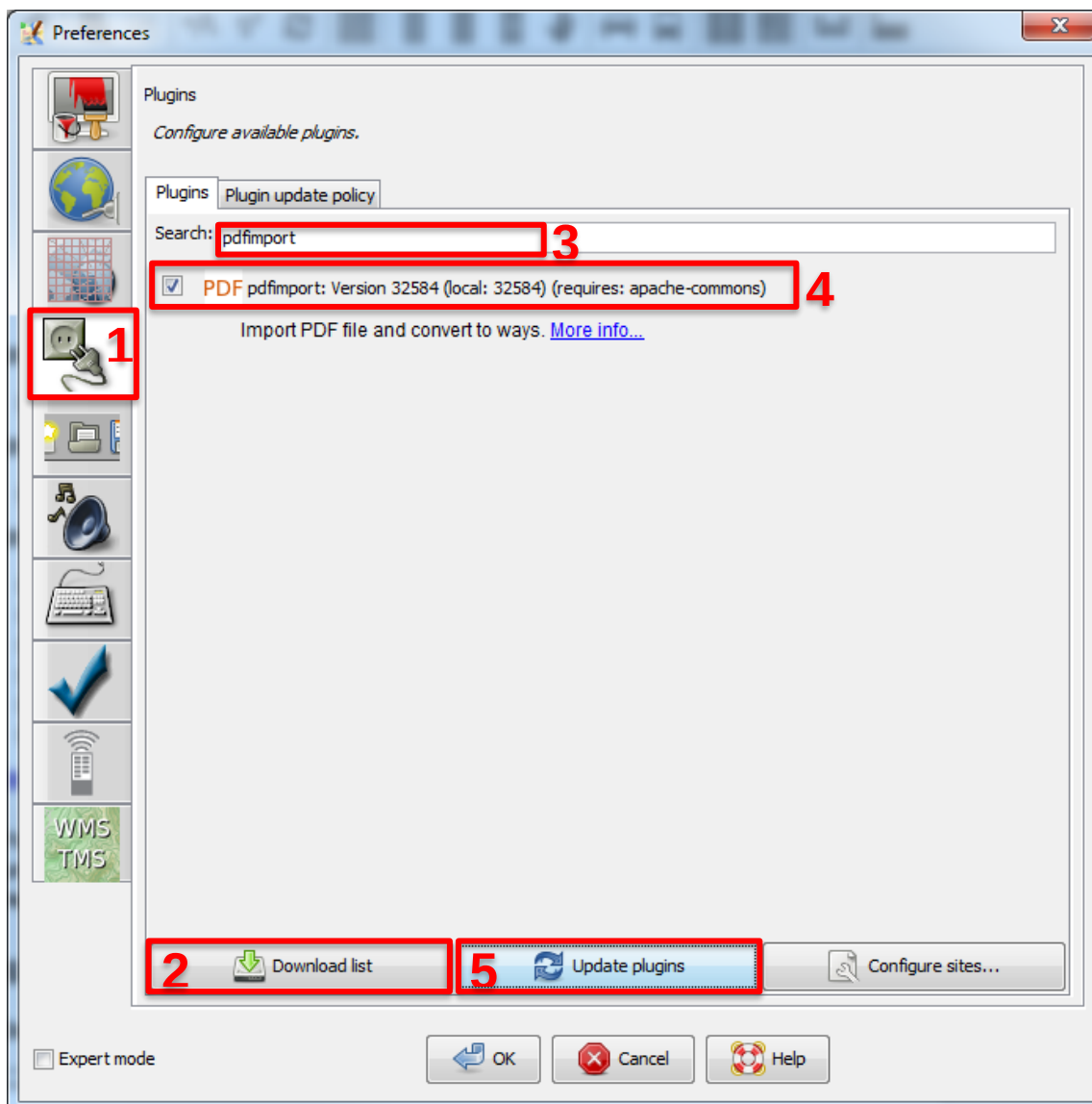
JOSM will tell you that it needs to restart. Press “Restart” and wait for it to shut down and start again.



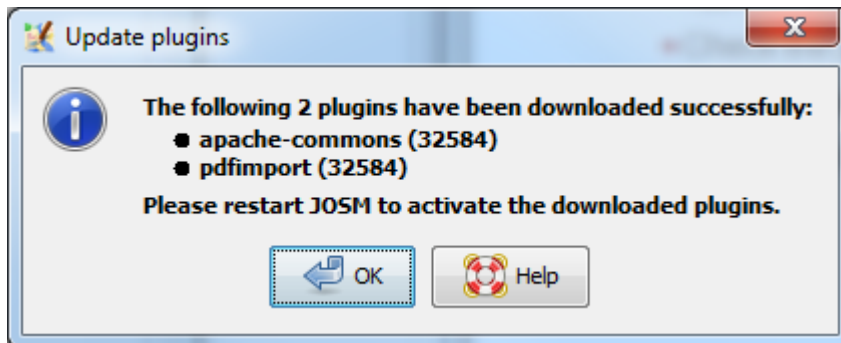
Once it was restarted, it should be in English.

B • INSTALL THE FREE PDF PLUGIN

- Start JOSM
- Open the preferences (“Edit → Preferences” or “F12”)
 - (1) Open the plugin-section
 - (2) Click on “Download list” (bottom-left)
 - (3) Type in “pdfimport” within the search-field
 - (4) Check the plugin
 - (5) Click “Update plugins”
- Restart JOSM



Once installed, the following message will be displayed:



Press ok, then again ok. JOSM will ask again for a restart. Press "Restart".



C • INSTALL TWO MORE PLUGINS

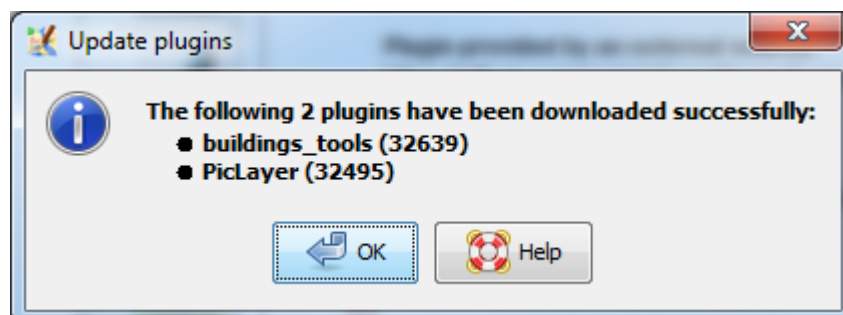
Two more plugins are needed. One is called “piclayer”, the other one is named “buildings_tools”.

PicLayer: This plugin is needed to import your building-picture.

Buildings_tools: This tool makes it easier to draw buildings with right angles.

To install both:

- Open the preferences (“Edit → Preferences” or “F12”)
 - (1) Open the plugin-section
 - (2) Type in “piclayer” within the search-field
 - (3) Check the plugin
 - (4) Type in “buildings_tools” within the search-field
 - (5) Check the plugin
 - (6) Click “Update plugins”
- The following message appears:

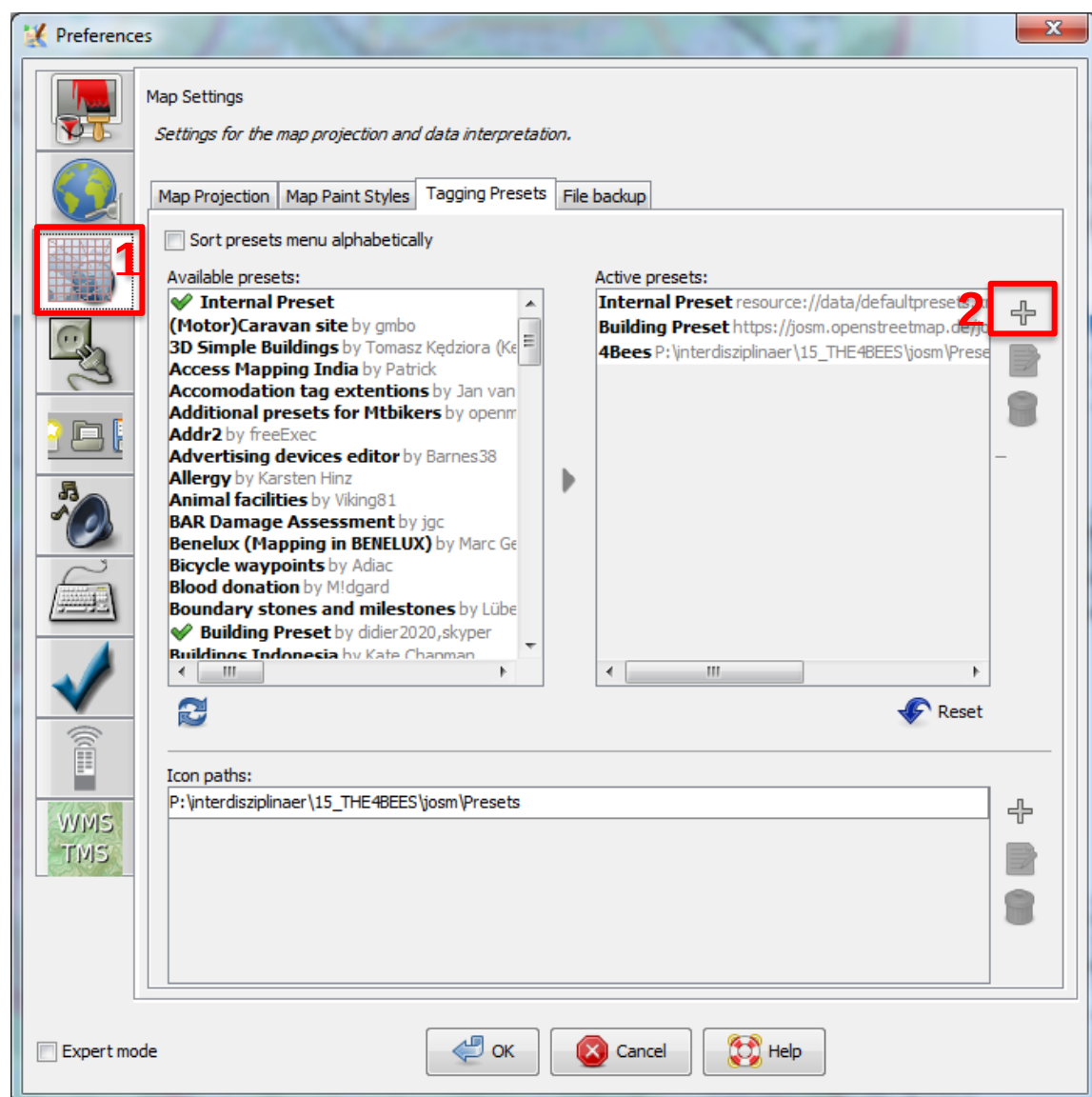


JOSM does not tell you to restart, but do it anyway (File → Restart).

D • IMPORT THE 4BEES-PRESET

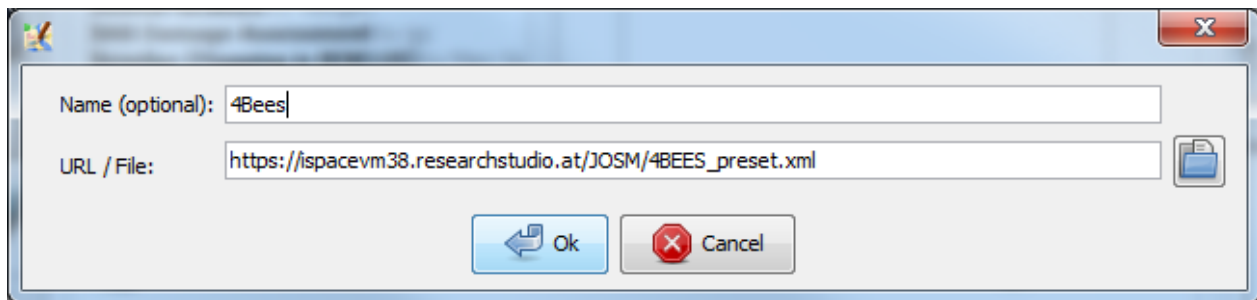
To make the drawing easier, a preset was defined. This includes all the elements that you need to draw. All elements should be mapped using closed areas. There are no lines and points defined in this preset. To import the preset:

- Open the preferences (“Edit → Preferences” or “F12”)
 - (1) Open the Map Settings-section
 - (2) Press on the “Plus”-sign on the right



- (3) For name, type “4Bees”
- (4) For URL/File, type in:

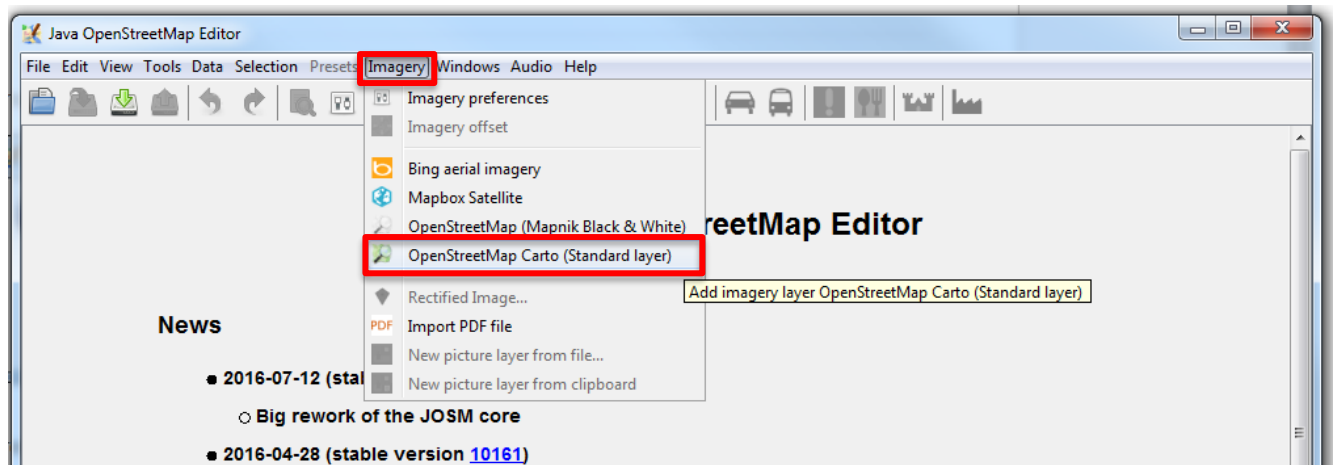
https://ispacevm38.researchstudio.at/JOSM/4BEES_preset.xml



- (5) Press “Ok”.
- (6) Press “Ok” again and restart JOSM.

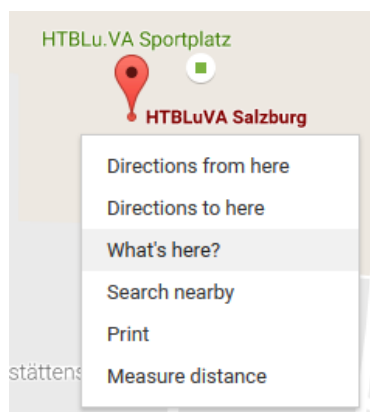
E • ZOOM TO YOUR SCHOOL

Now, add the OpenStreetMap layer (Imagery → OpenStreetMap Carto (Standard layer))

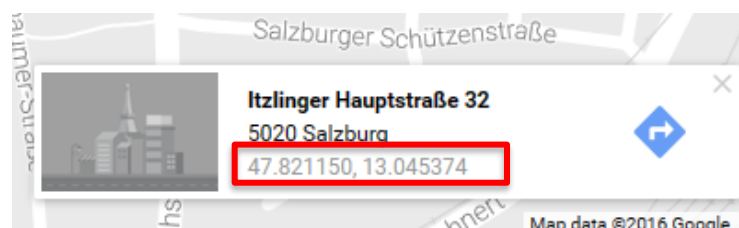


Jump to the place where your school building is located. For this step, you need the coordinates of your school building:

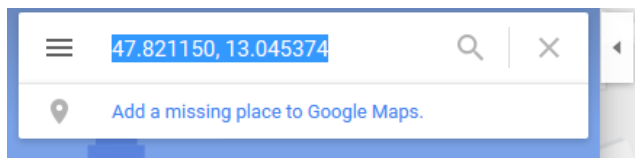
- Open Google Maps
 - (1) Find your school via search or just zoom to it
 - (2) Right click on the building and select “What’s here?”



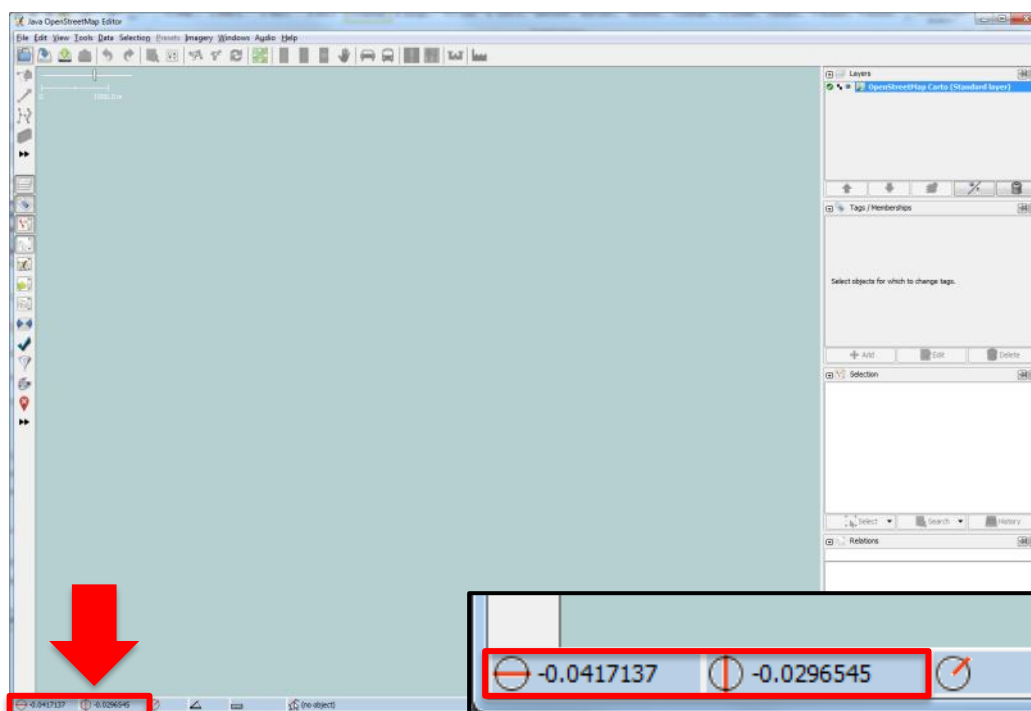
- (3) A small window opens in the bottom of the window
- (4) Click on the coordinates



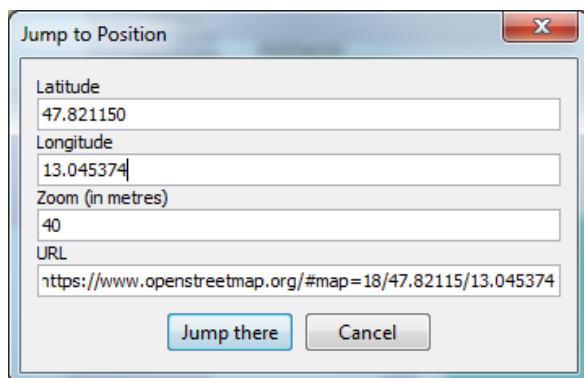
- (5) These are the coordinates you need in JOSM. Save them somewhere or leave Google Maps open:



To jump to your position, click on the coordinates on the bottom left of the page:



The first part until the comma is the latitude, the second part the longitude. Make sure to have a point as decimal marker in the coordinates, not a comma. For Zoom, write “40”.



Press “Jump there”. If the zoom level does not fit, you can use the mouse wheel to zoom in or out and the right mouse button to pan the map.

Depending on where you jumped, there might be additional basemap-sources available. For Austria, basemap.at should be used. To use it, go to “Imagery” and choose “basemap.at”.

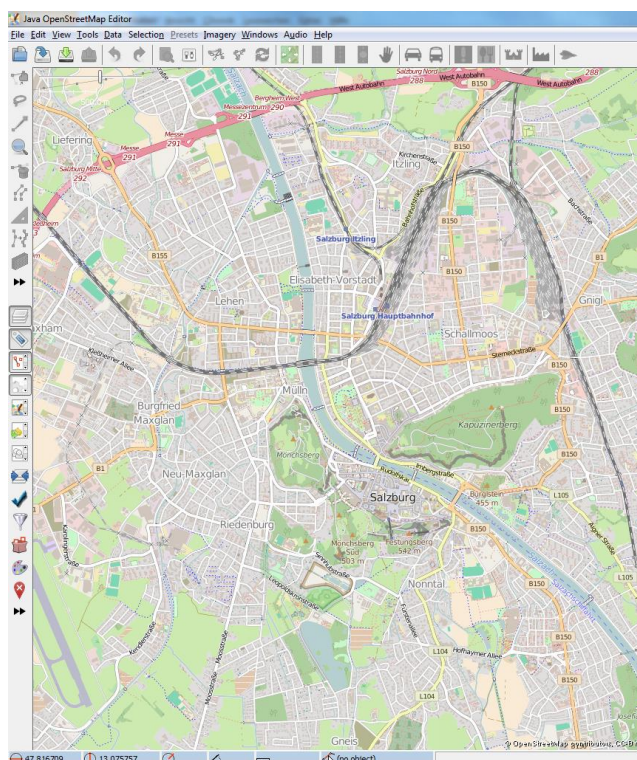


Figure 12: OpenStreetMap Carto

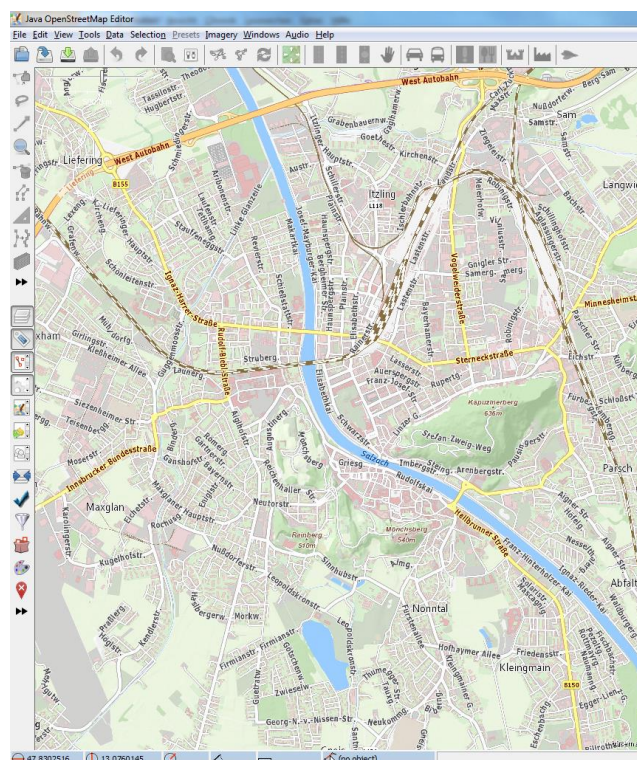
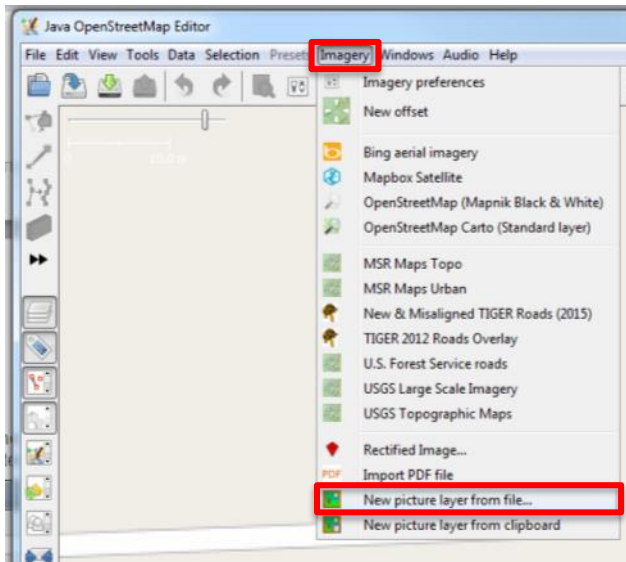


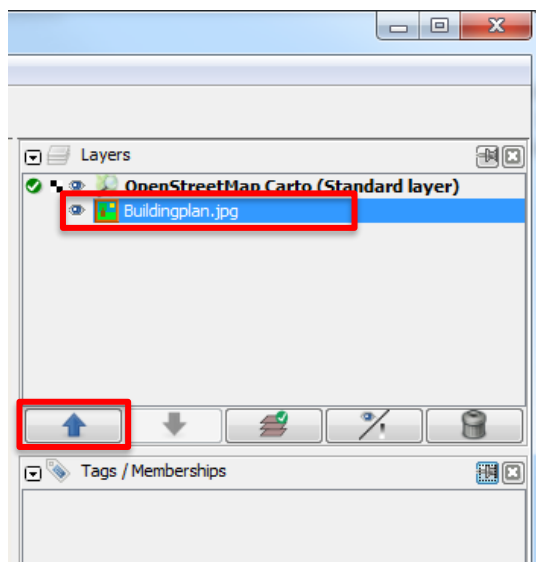
Figure 13 : Basemap.at

F • IMPORT YOUR BUILDING PLAN

Now, you can add the georeferenced building plan (Imagery → New picture layer from file...), browse to your image and click “open”.



The building plan is now available on the right in the “layers-tab”. As the plan is below the OpenStreetMap layer, it is not visible. To make it visible, click on the new layer (however you layer is named) and then on the arrow below. Now, your layer should be visible.



Because of the georeferencing that was done beforehand, the building plan is located directly on top of the building outline on the map.



G • DRAW YOUR BUILDING

To start the drawing, add a new layer. This will be the layer you draw on. To do so, click “File → New Layer”. A new layer is added on the right. This layer must be active to draw on it. It is active, when there is a small green arrow in front of the name. To activate the layer, click on its name and the “Activate the selected layer on the bottom”:

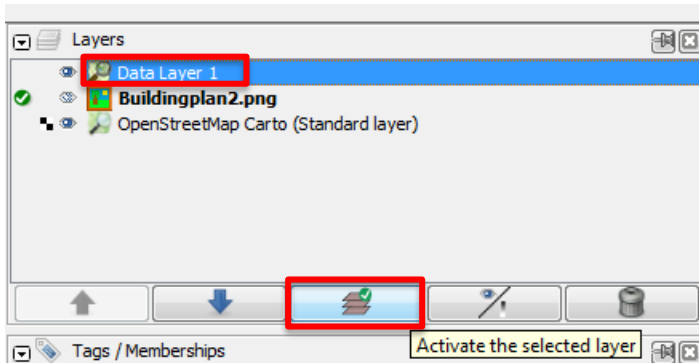


Figure 14 : Make an inactive layer active

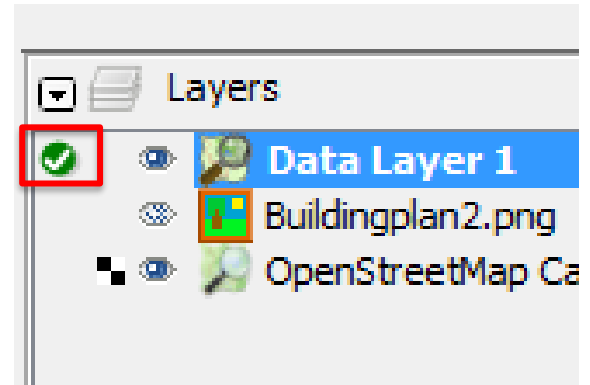
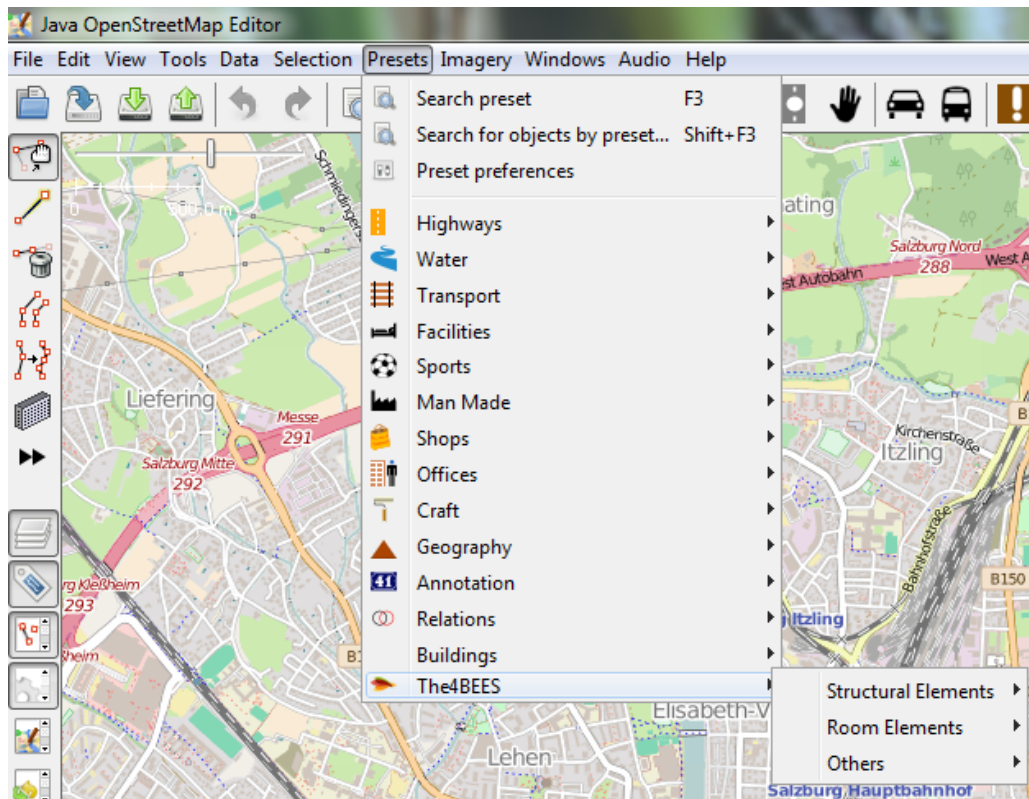


Figure 15 : Green symbol shows active layer

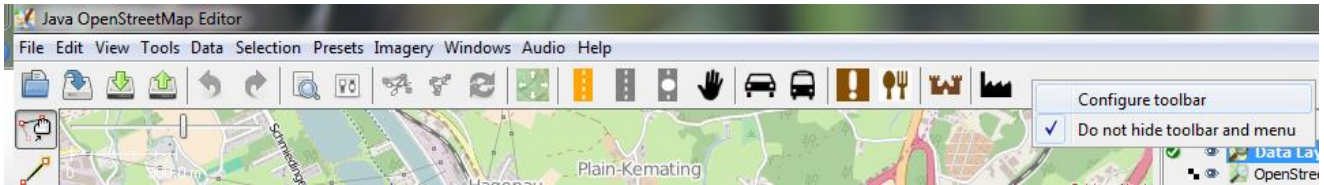
To pan around on the map, press the right mouse button and drag the image (alternatively: Press CTRL and use the arrow keys).



If you succeeded with the import of the Preset earlier, you can now find the new preset at “Presets”
→ “4Bees”

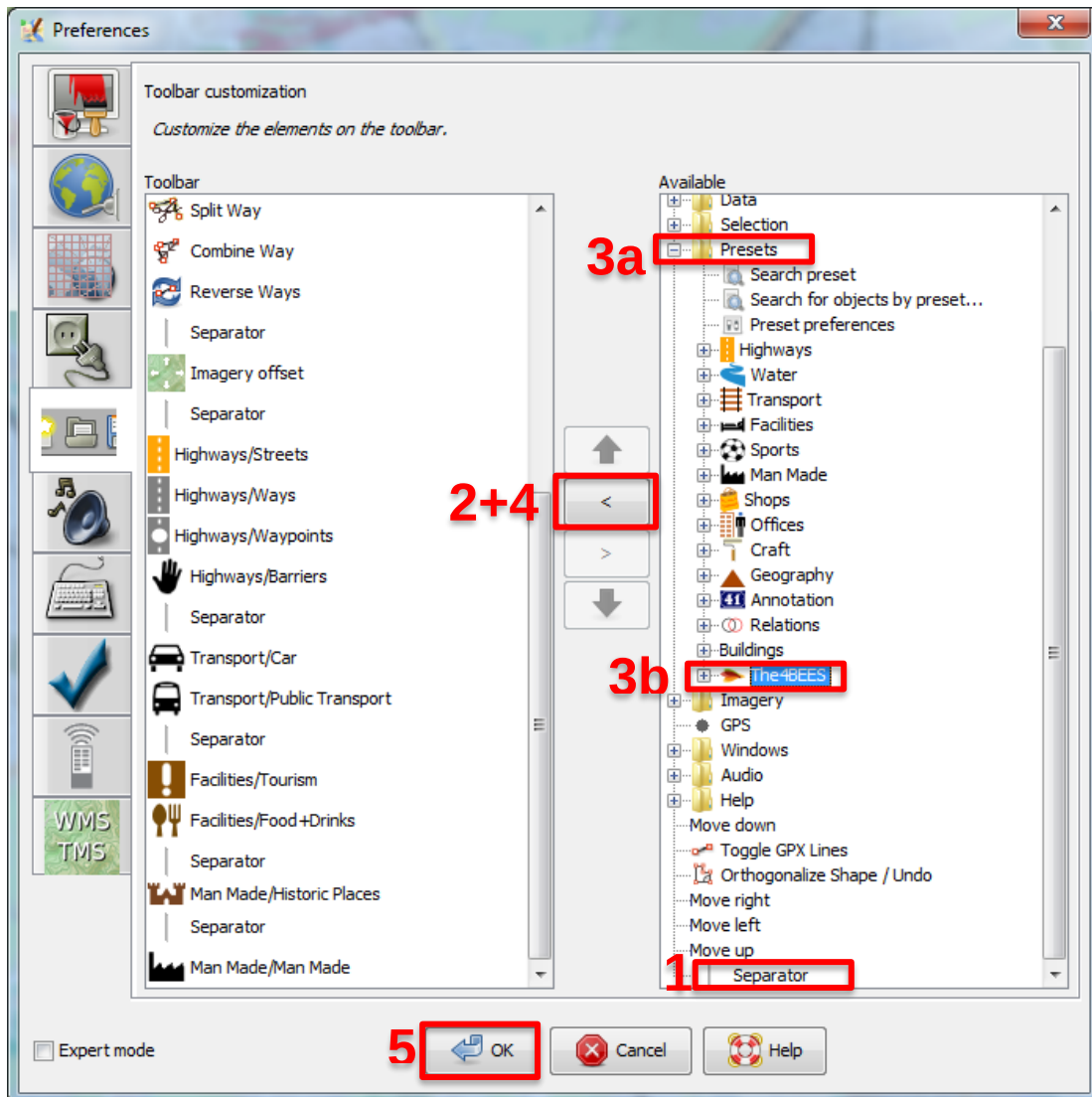


Because you will need these elements very often, it is useful to put them in the toolbar on top of the map. To do so, **right click** on the grey edge and press “Configure toolbar”:

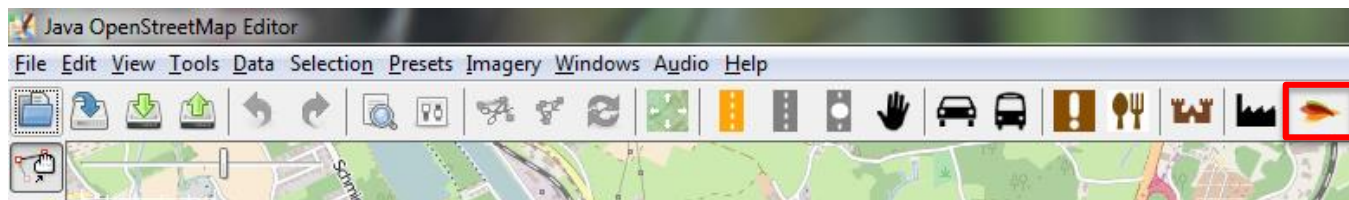


Follow these steps:

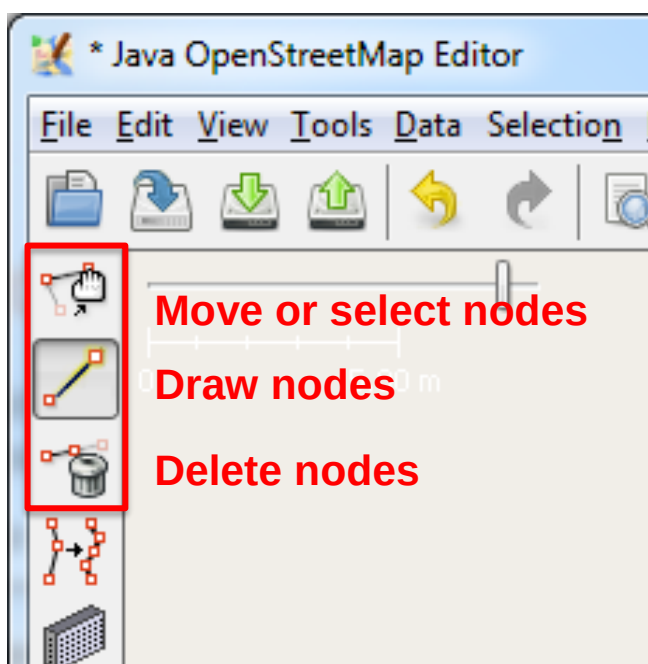
- (1) Scroll down and click on “Separator”.
- (2) Click on the “Arrow”.
- (3) Click on “Presets” and “4Bees”.
- (4) Click on the “Arrow”.
- (5) Press “Ok”.



- The 4Bees menu is now available in the toolbar:

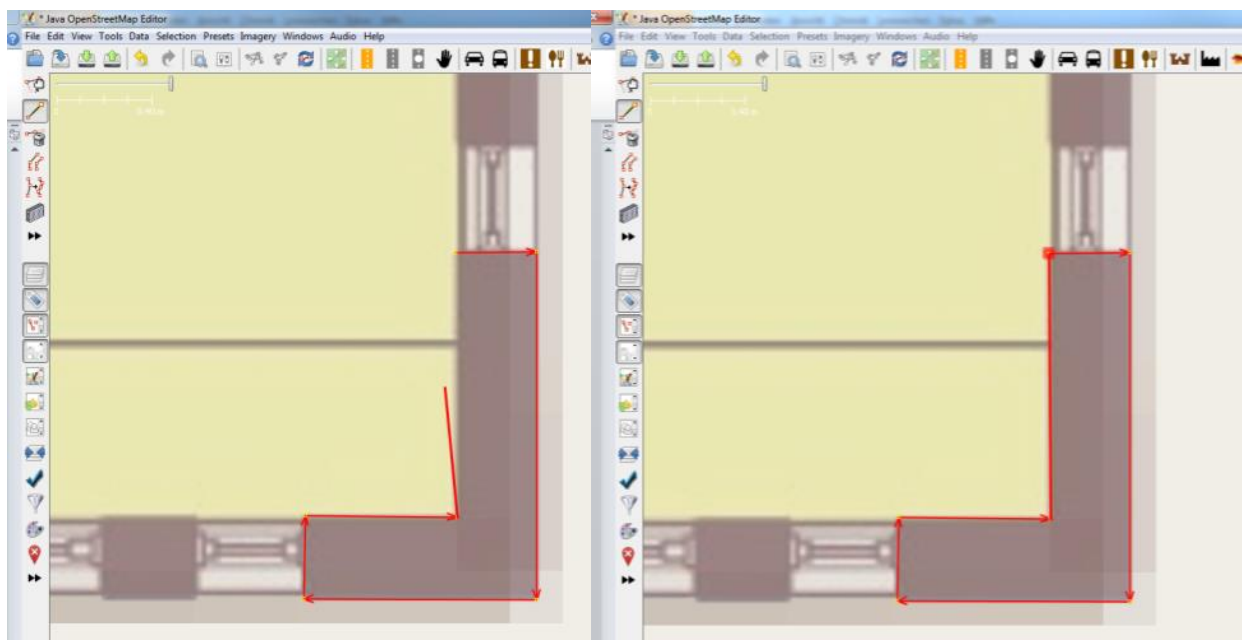


These are the tools you will be using the most in combination with the preset:



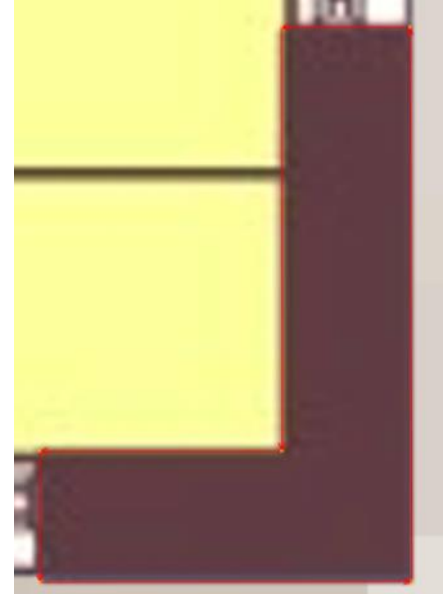
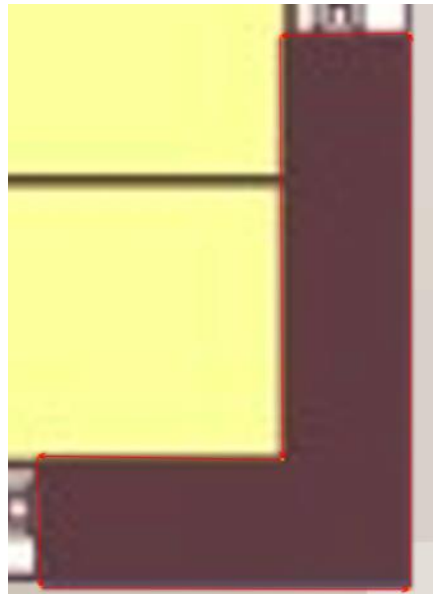
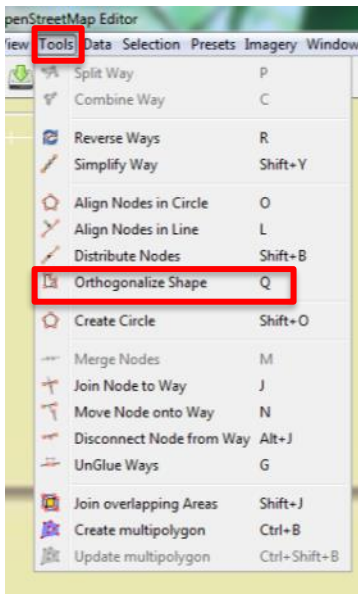
With “Draw nodes”, you can draw the outline of an element. “Move or select nodes” lets you edit a drawn element. Or select it to add attributes. With “delete nodes”, you can delete elements.

To draw your first element, select the “draw nodes”-tool and start with some part of a wall or some window as shown below. Go around that one element and draw as accurate as you can. You can also zoom and out and pan while drawing. When you come back to the first point, a red dot is shown. This red dot means, that you can close the object. Make sure to draw only properly closed objects.

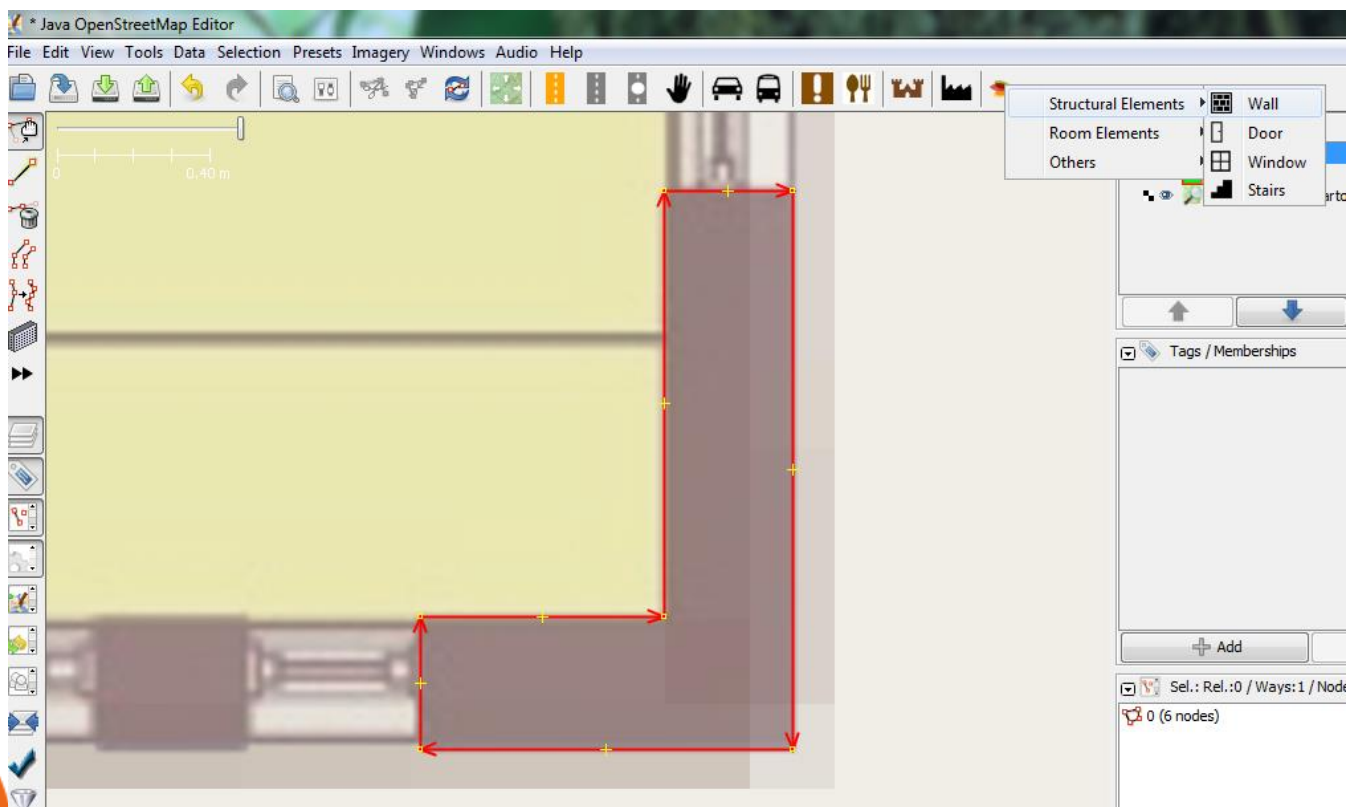


When your element was finished, you can use the “mode or select nodes”-tool to adjust your drawing.

The lines might not have right angles. To get right angles, use “Tools → Orthogonalize Shape” (Or “Q”):



Now, you have to tell the element, what it is. Right now, it is only an area, you have to tell it, if it is a wall, a window, etc. To do so, select the element (activate the select-tool, then click on the 4BEES-preset in the toolbar and select the correct element):

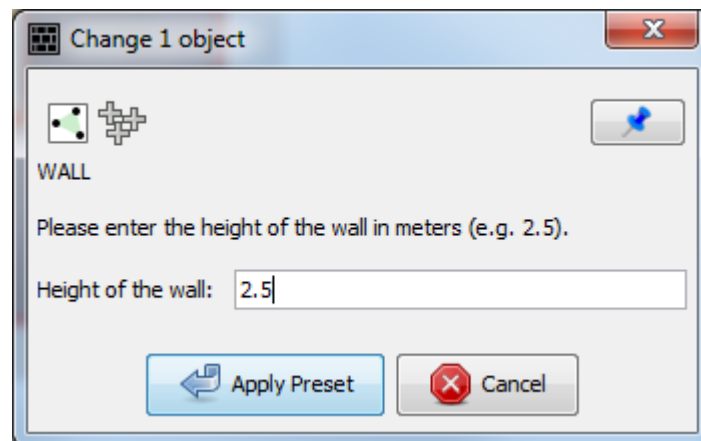


A new window appears. In this window, you have to enter the fields. It should be self-explaining.



Decimal marker is a point, not a comma: 2,5 → 2.5

Do **only write the values** in the field, not the units: “2.5 m”, “2.5 meters” → 2.5

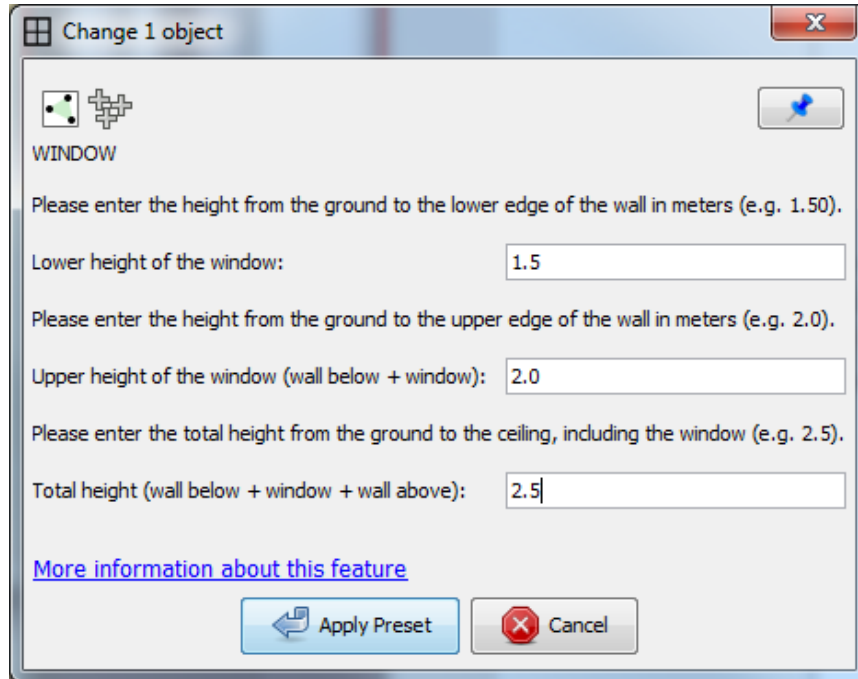


When finished entering the values, click “Apply Preset”.

Now you can draw the next element. Draw an element that shares a border with your first element. When drawing, make sure that the points turn red like when closing an area (and an arrow appears). This is called snapping. Snapping makes sure that there is no empty space between e.g. a wall and a window:



For some elements, there is a clickable link (“More information about this feature”) that provides help for the entry of the values:



The dialog box is titled "Change 1 object" and contains a "WINDOW" icon. It has a pin icon in the top right corner. The text inside reads: "Please enter the height from the ground to the lower edge of the wall in meters (e.g. 1.50).", "Lower height of the window:" followed by a text box containing "1.5". Then: "Please enter the height from the ground to the upper edge of the wall in meters (e.g. 2.0).", "Upper height of the window (wall below + window):" followed by a text box containing "2.0". Then: "Please enter the total height from the ground to the ceiling, including the window (e.g. 2.5).", "Total height (wall below + window + wall above):" followed by a text box containing "2.5". At the bottom, there is a blue link: [More information about this feature](#). At the very bottom are two buttons: "Apply Preset" and "Cancel".

It is good practice to draw element by element and directly assign the correct preset. Otherwise, there is a high chance that you might forget to attribute an element.

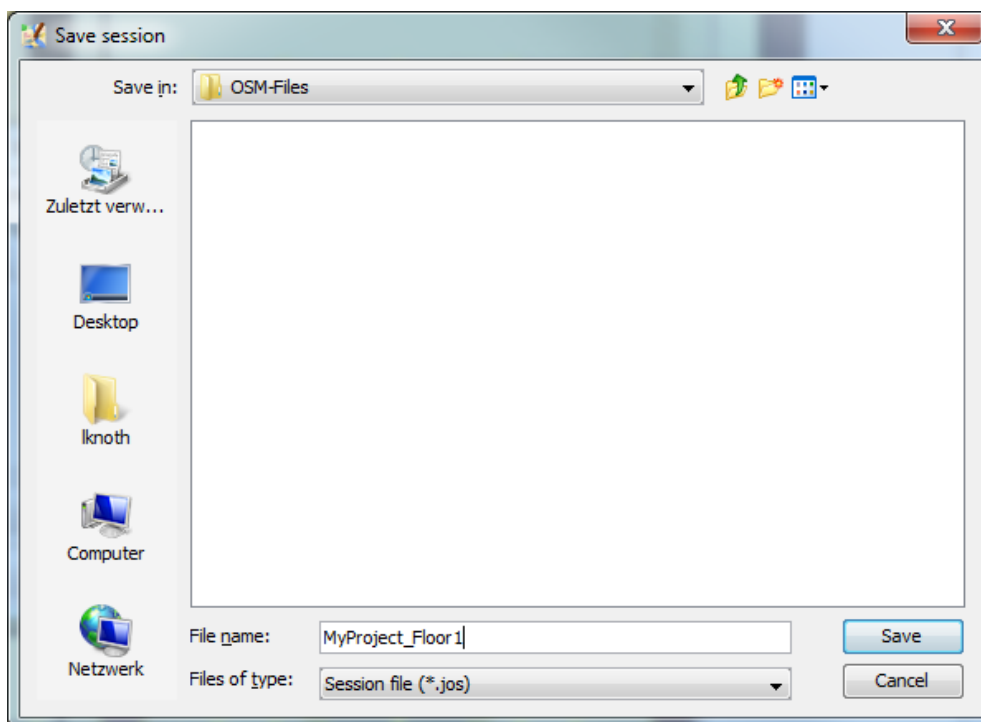
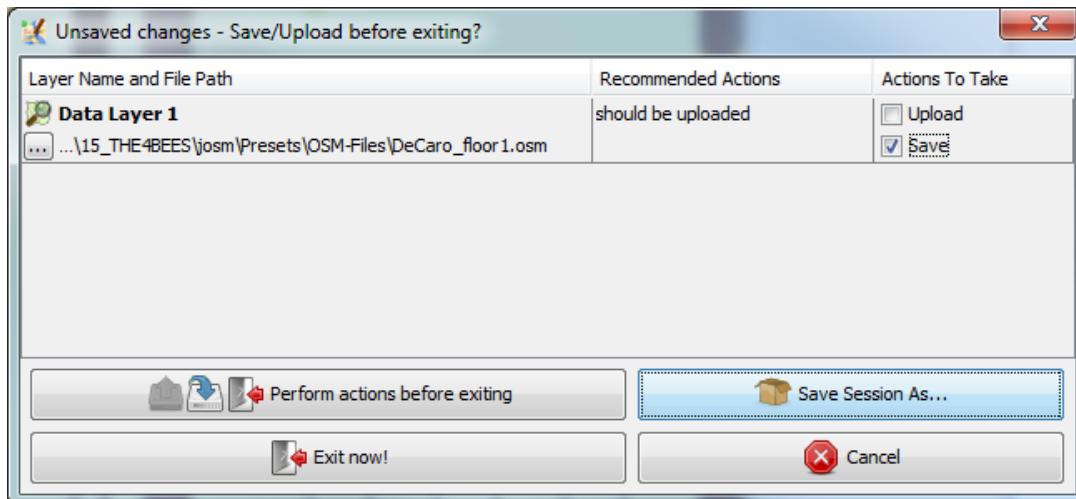
Make sure to save your edits frequently, in case the program crashes or something goes wrong. You can save your drawing with File → Save as...

Name your file like this:

NameOfSchool_FloorNumber.osm → e.g. HTBLuVA_floor1.osm

For “Files of type”, choose “OSM Server Files (*.osm)” and click save.

If you want to interrupt your drawing session and continue later, click on “File → Exit”, uncheck the “upload”-action and check “Save”. Then, click on “Save Session As...”, leave the next window as it is and click “save as”. Give your project a name and choose a location to save and save your *.jos Session-file.



Next time you start JOSM, go to “File → Open Recent” and choose your file.

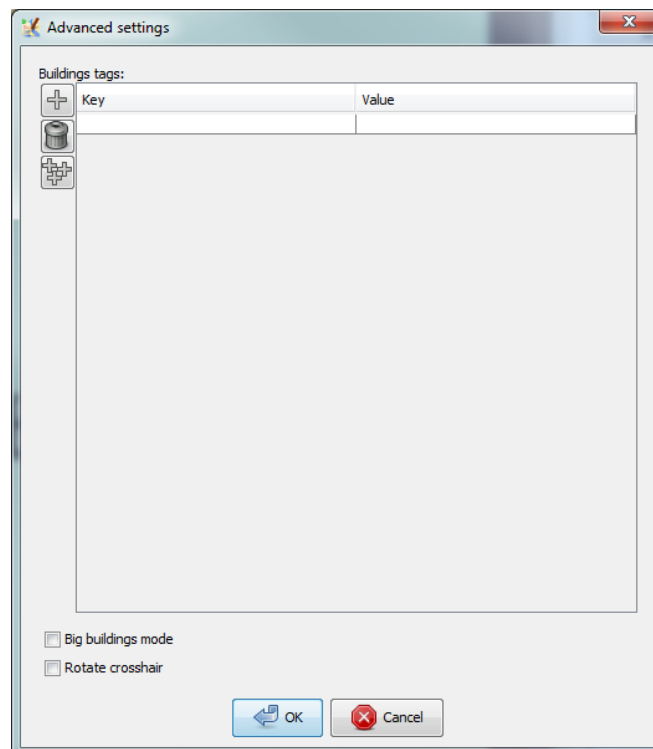


To make drawing of the tables easier, we use a little “workaround” as there currently is no other (easy) way to draw the tables.

To do so, go to “Data → Set buildings size” and click on “Advanced...”

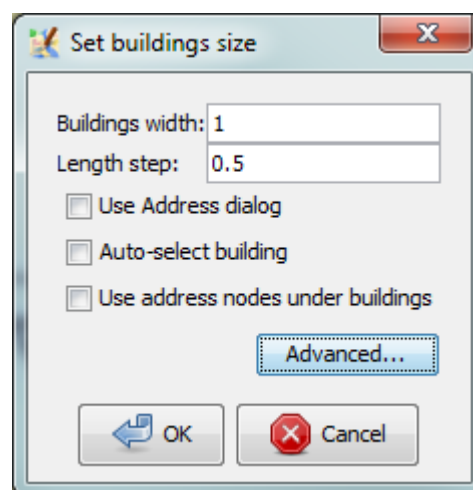
In the next window, there is one element in a table: Key: “building”, value: “yes”.

Click on “building” and delete it, then do the same with “yes”, so that the table is empty:

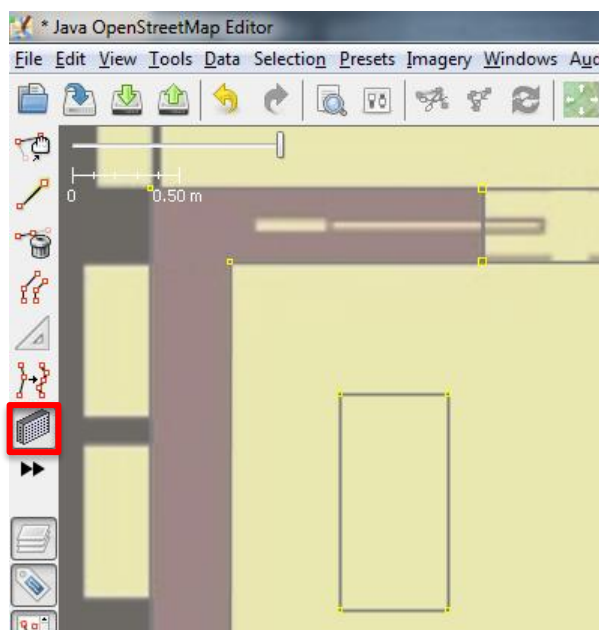


Then click “Ok”.

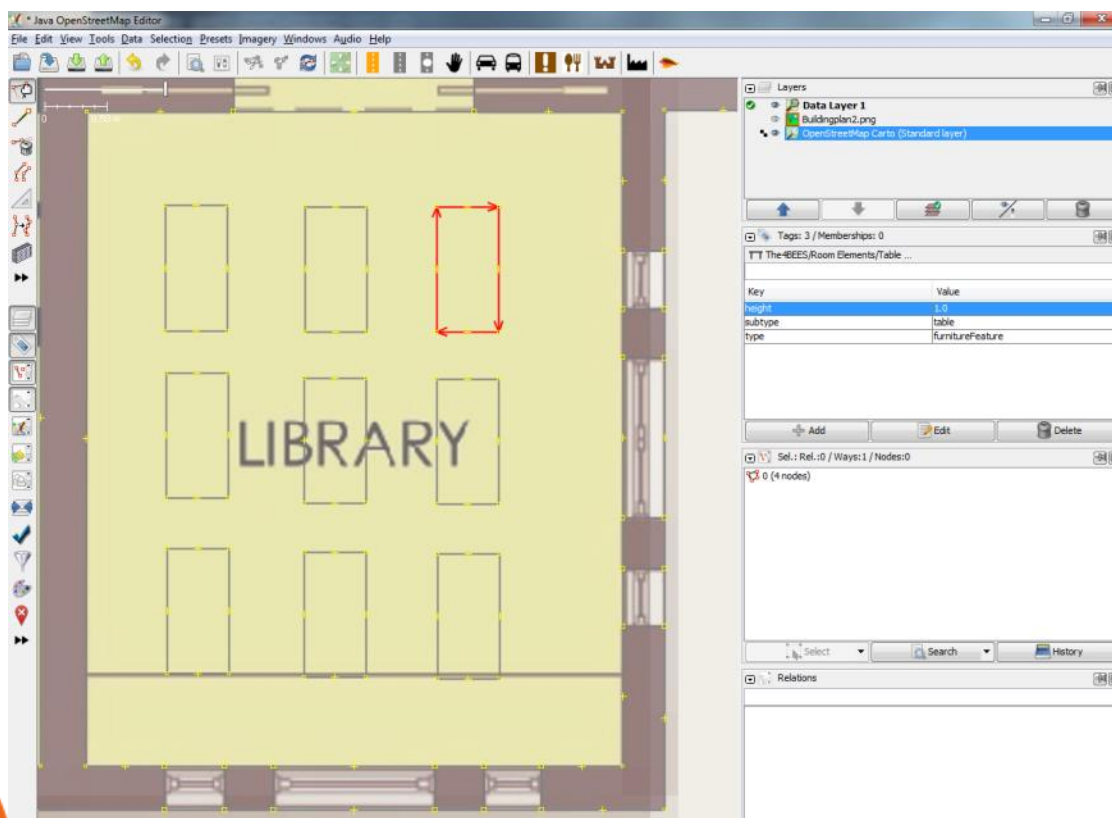
Now, you can use the tool to draw your tables. For “buildings width”, enter the length of the table, e.g. 1 m, for the length step, enter the width of the table, e.g. 0.5 m:



Use the “Draw Buildings”-Tool to draw your first table:



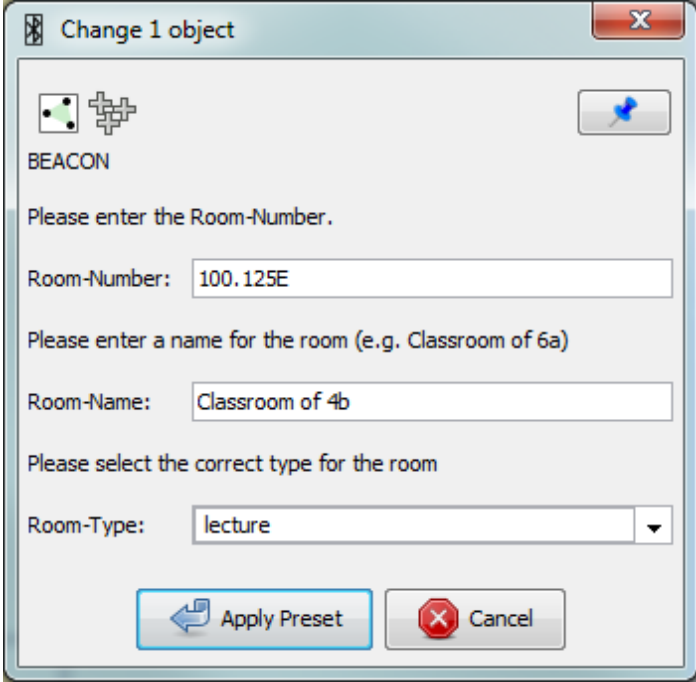
Select the table and use the preset for a table, enter the attributes. If you have more tables with the same size, select your table, press “CTRL + C” and “CTRL + V”. When you select the new table, you can drag and drop it to its correct position:



The same tool can also be used to draw the chalkboard and radiators (if available).

The beacon as “display element” should be located near the main door and have a size of 0.1 x 0.1 m.

 **For the Room-name, do not use any comma or semi-colon. Spaces are ok.**



Change 1 object

BEACON

Please enter the Room-Number.

Room-Number: 100.125E

Please enter a name for the room (e.g. Classroom of 6a)

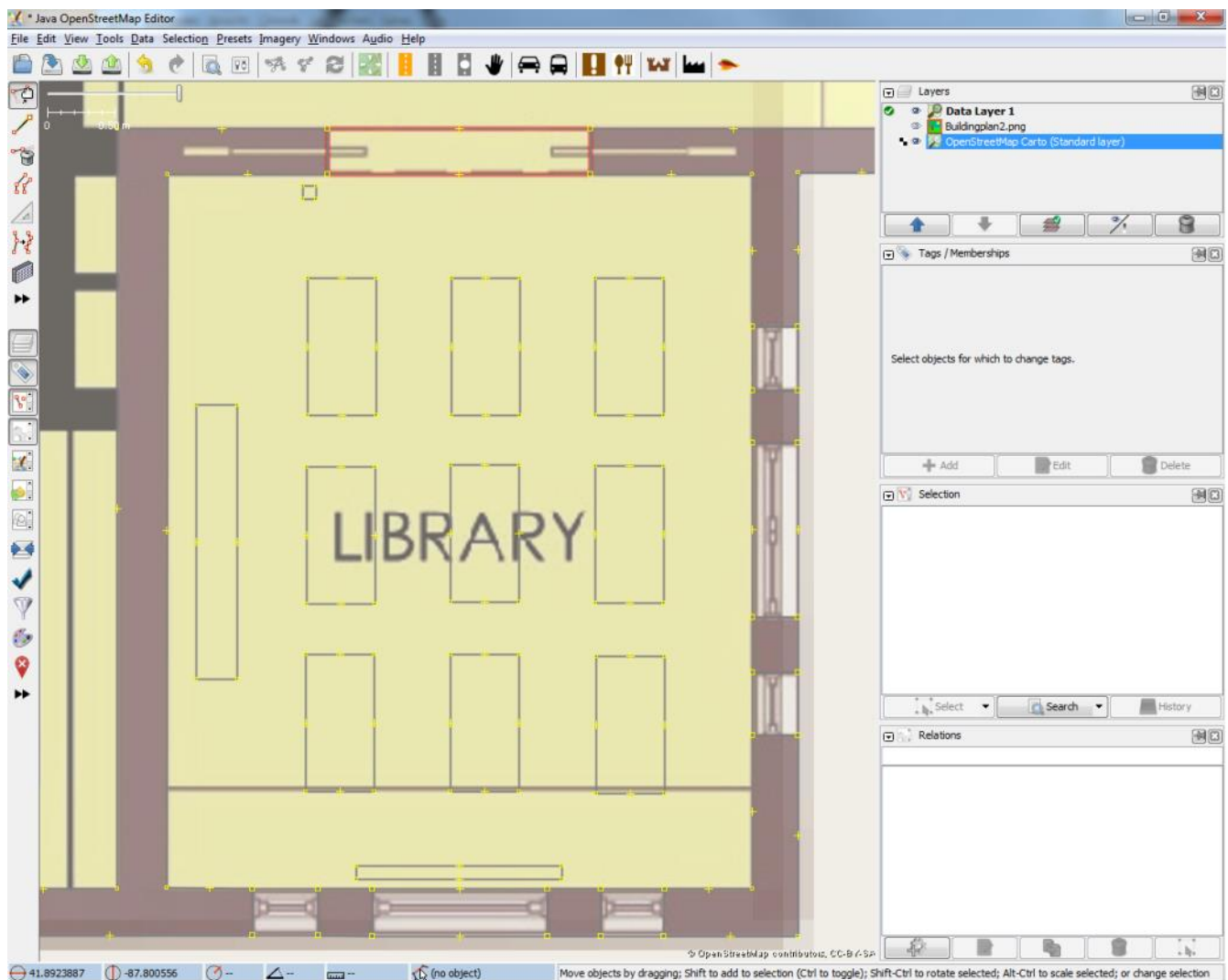
Room-Name: Classroom of 4b

Please select the correct type for the room

Room-Type: lecture

Apply Preset Cancel

The following image shows how a fully drawn room might look like:



This should be done for every room and every floor.



H • SAVE YOUR FINISHED BUILDING MODEL

When you finished drawing your building, please save it as *.osm with the same name as before in Chapter “G”. This file is your final file and should be provided to iSPACE for further processing.

