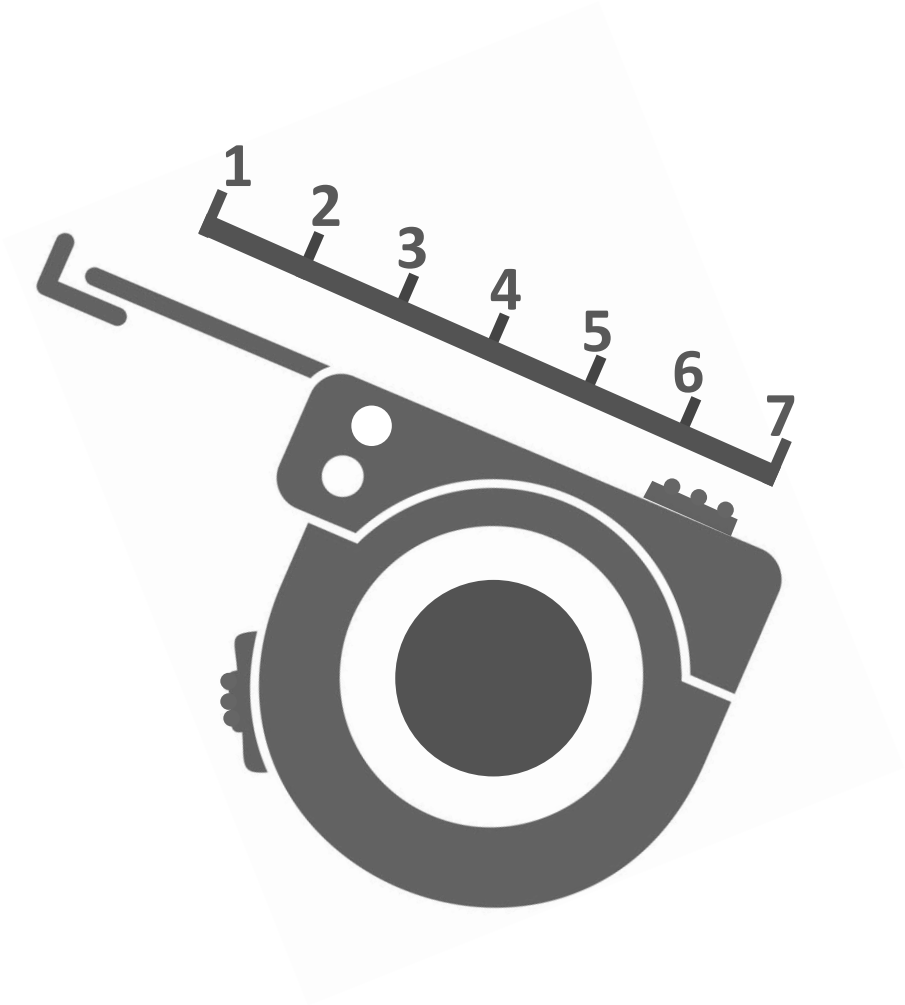
TECHNIQUES



MANCHESTER | URBAN DESIGN | LAB

MUD-Lab Toolkit
Technical Drawings

Technical drawings transfer your draft and sketch ideas into precise correct to scale drawings. In order to create technical drawings, you will need to be familiar with some tools to measure and draw objects, in addition to understanding scale, and to practice drawing. This short handbook is a brief introduction.

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'Manchester Urban Design LAB (2020) '***MUD-Lab Toolkit: Technical Drawings***' accessible at www.seed.manchester.ac.uk/mudlab

Disclaimer: This handbook does not replace the practical session

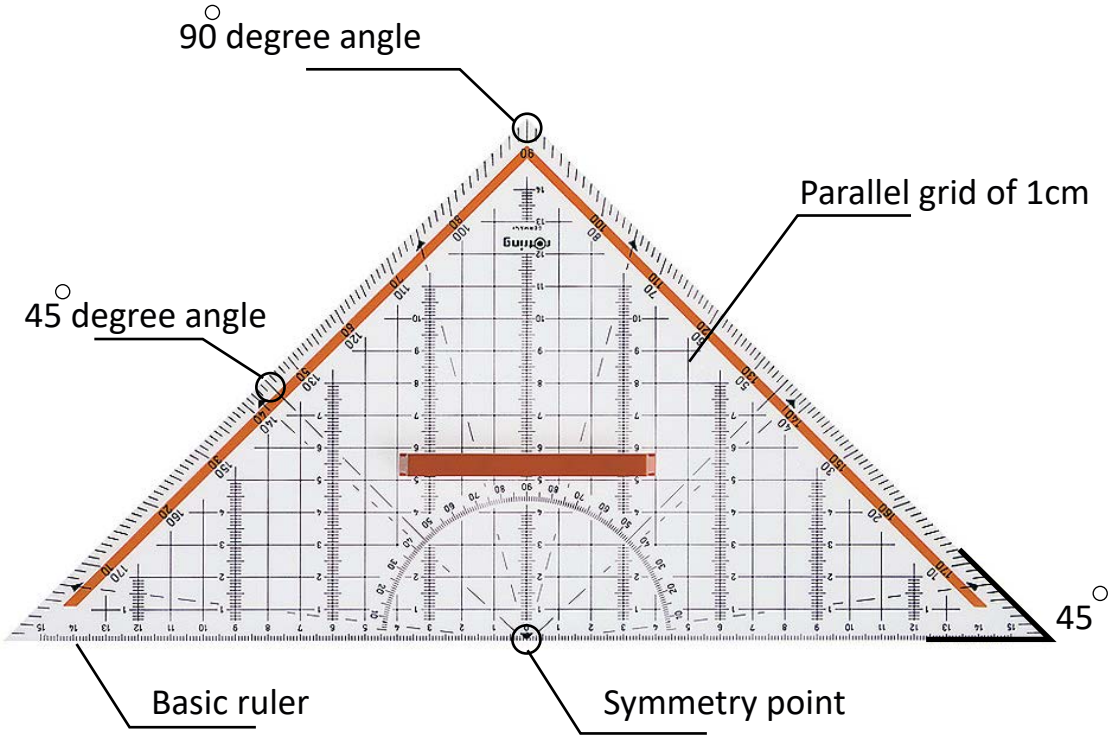
A Introduction

Developing the mature option in the urban design process is the critical process of transferring your ideas into a technical plan. In order to take your immature option to the next level in the urban design process, you will need to create a draft technical correct to scale plan by hand, or via CAD. This stage will ensure that your design is workable and that all the proposed elements are correct in terms of measurements and location. Whether you are creating technical drawings by hand or using software, you need constant practice in addition to some key information regarding scale and measurements. Three key skills will be the focus of this handbook:

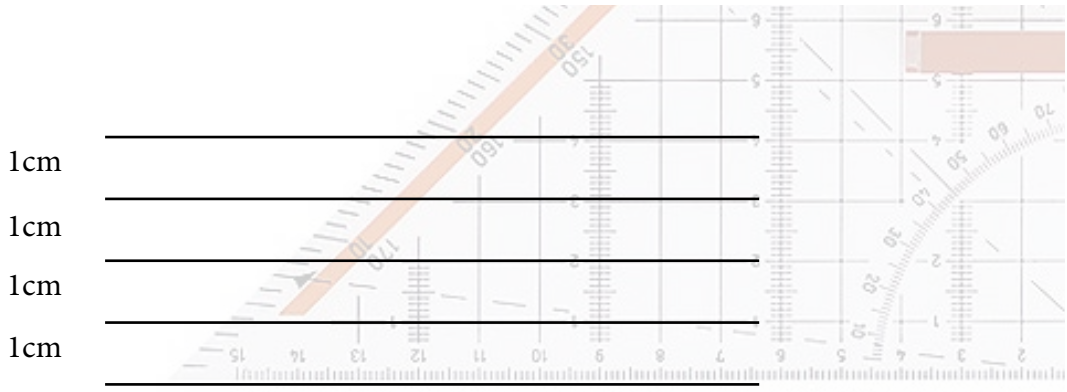
1- Some basic exercises on using the Aristo triangle to create shapes by hand. This will be expanded further in the technical session.
2- Developing your perception of dimensions,
3- Understanding scale in general and in CAD.

B A basic exercise to start with

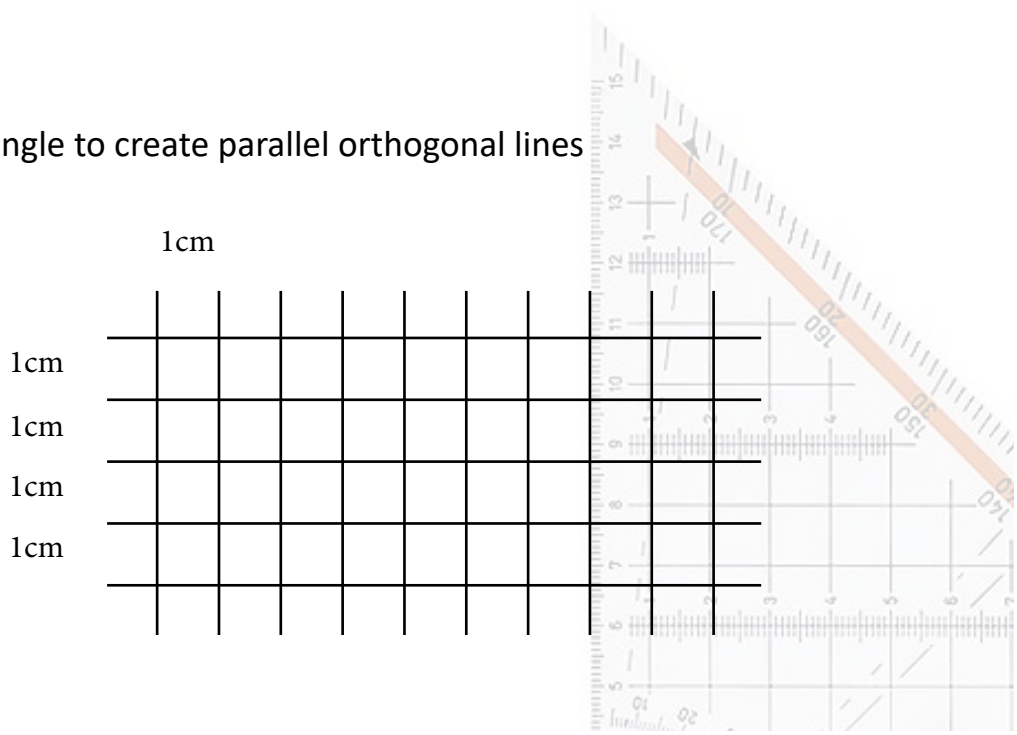
We will start by doing some basic exercises on a blank page using the Aristo Triangle. This triangle is an extremely useful tool to create parallel line, orthogonal lines, 45 degree angles, and symmetry by hand. Please refer to the pre-record Technical Drawings 1 to see how we can use it effectively in more details. Keep practicing the below exercise.



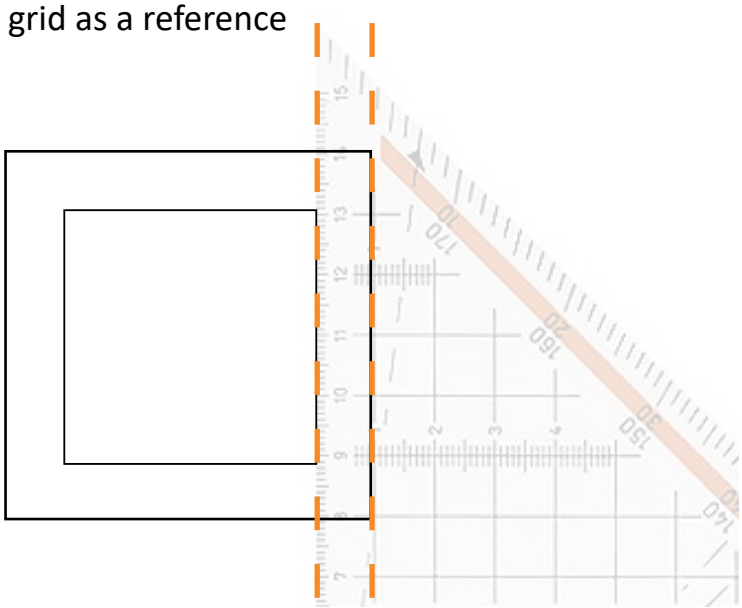
- Draw parallel lines with 1cm gap using the triangle grid by sliding the triangle.



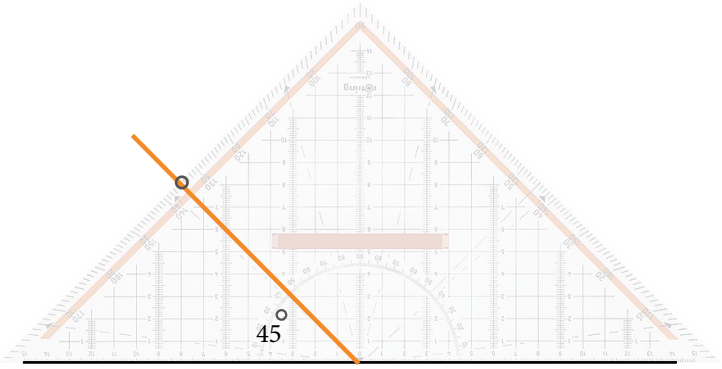
- Rotate the triangle to create parallel orthogonal lines



- Draw a 6cm x 6cm square and then create another inner square with 1cm offset to the inside, again using the tool grid as a reference

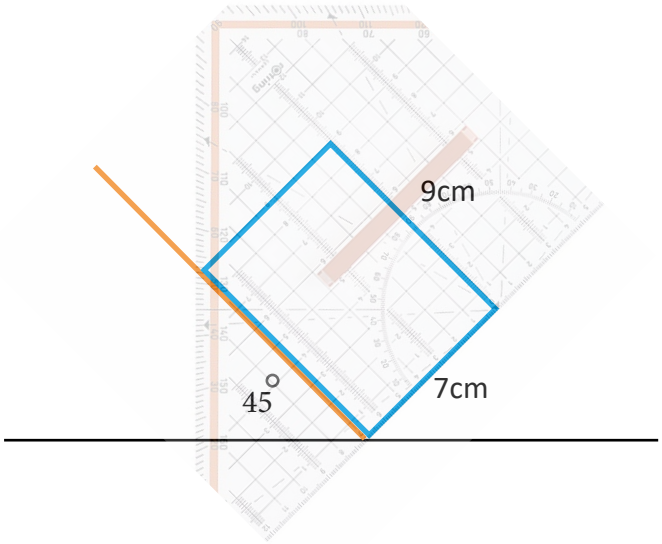


- Draw a line at 45 degree

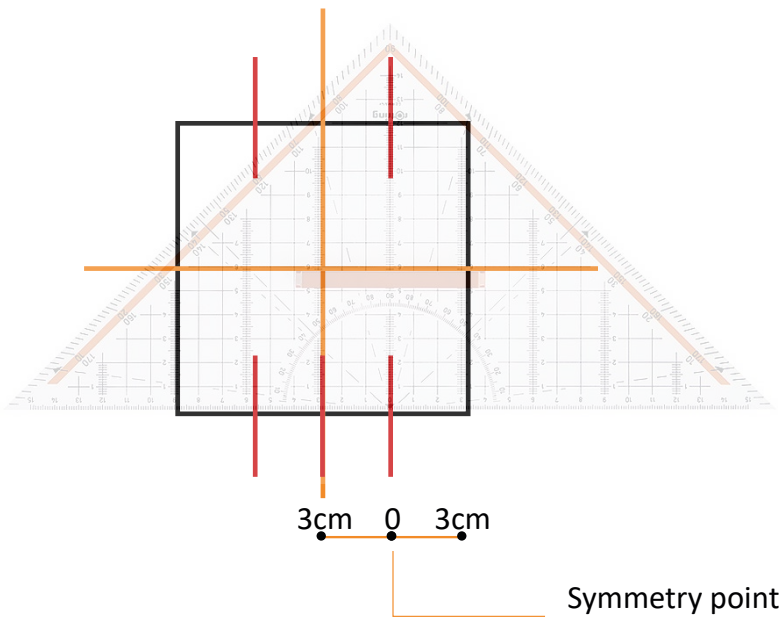


You can also draw any angle you want using the reference points on the triangle edge.

- Align the triangle grid with the 45 degree line and draw a 4cm*6cm rectangle.



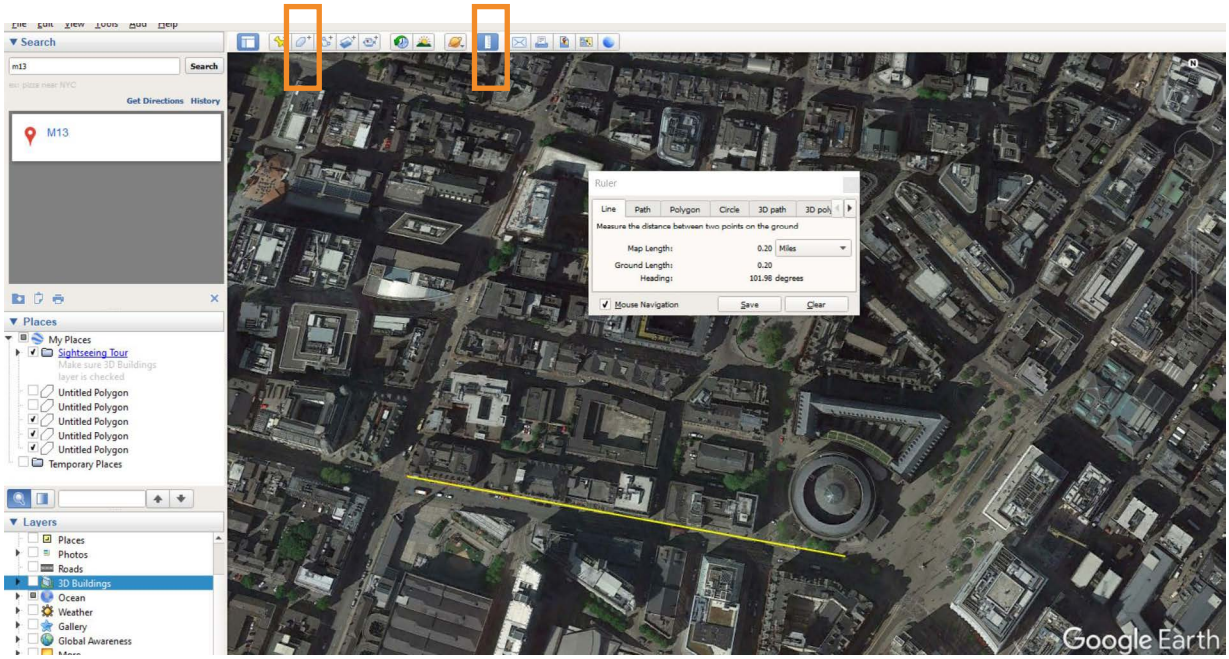
- Draw a 12cm x 12cm square and use the symmetry feature to find mid-points



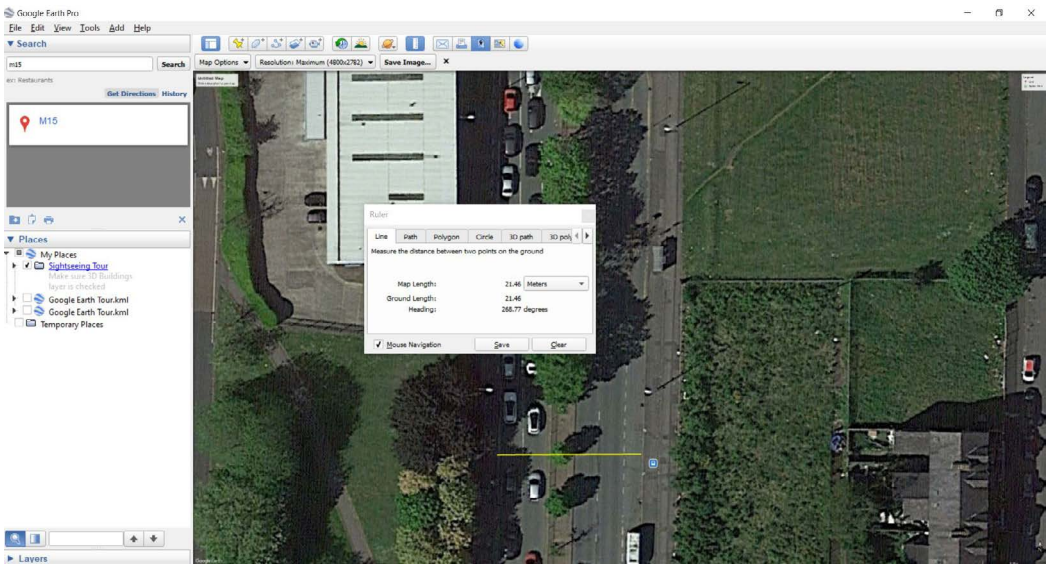
C Developing your perception of dimensions

One of the key skills you need to obtain in order to create technical drawings is estimating measurements around you. How wide is your local street? How big is the large shopping centre in your area? How long is an urban block you are interested in? What is the height of a certain building? How large is a green space that you enjoy? These are some simple questions that you should explore in order to make the essential connection between spaces and their dimensions. A very useful tool for doing this is Google Earth.

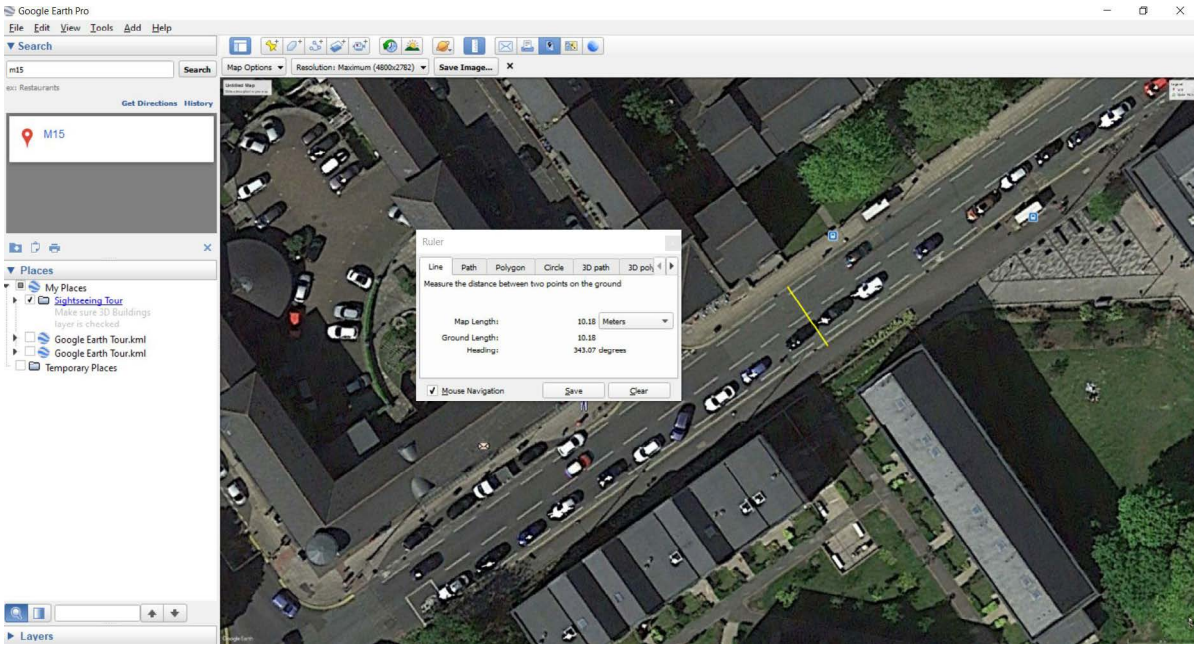
Use the Ruler tool to get rough idea about the dimensions of the spaces we are exploring. Select the appropriate units from the drop down menu. You can also estimate areas using the polygon tool.



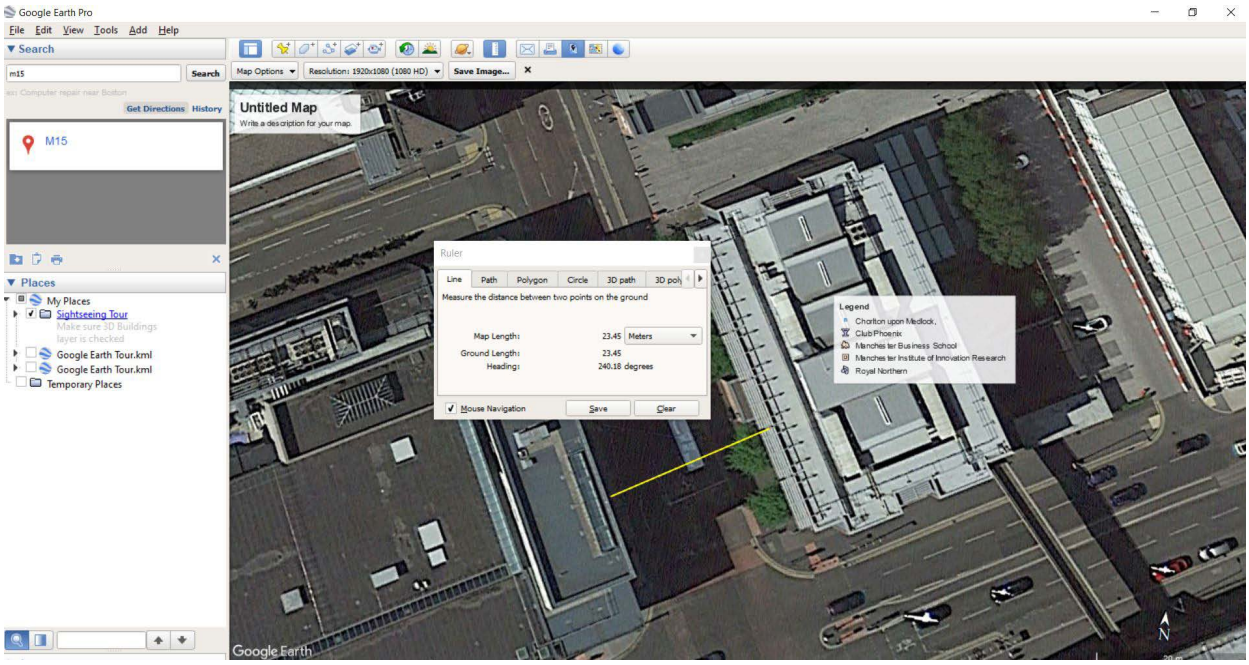
A very quick test shows that Princess Road, the key arterial road in Manchester, is about 21m wide without pavements.



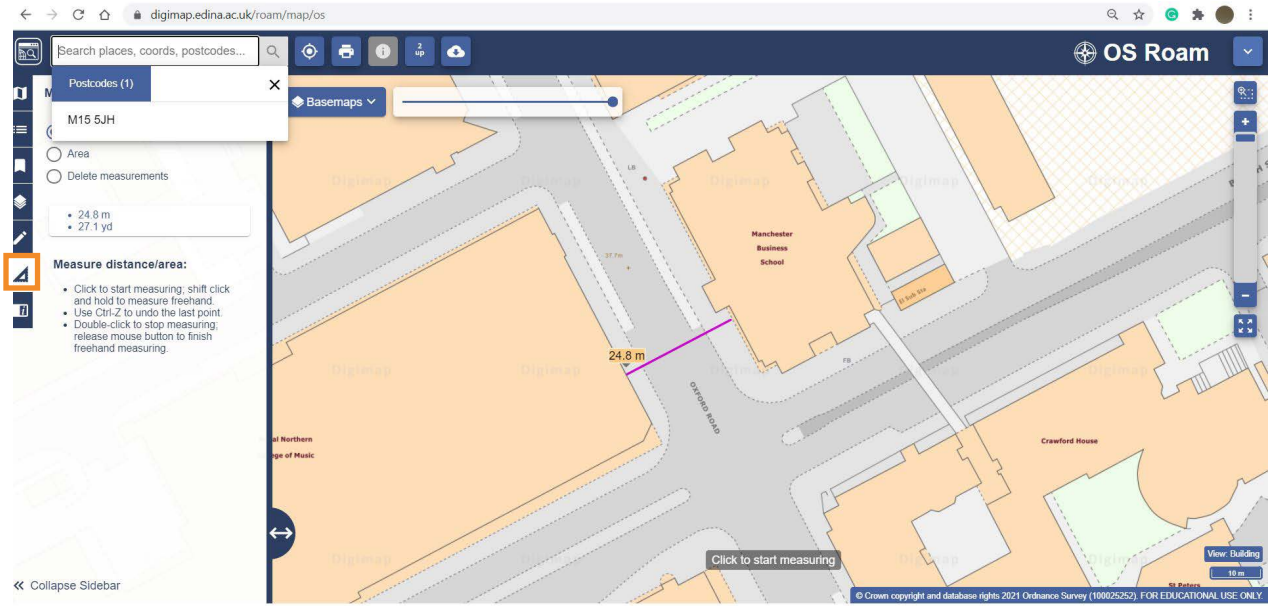
Stretford Road that connects Hulme with the rest of the city is about 10m wide without pavements



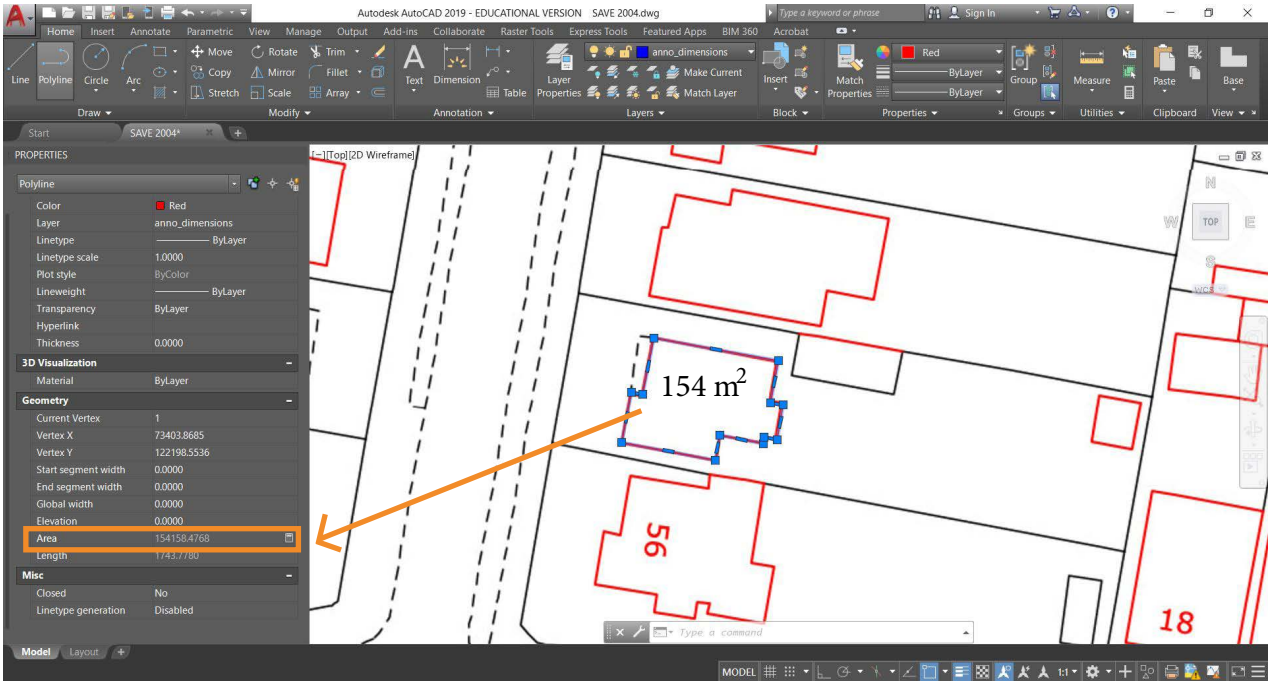
A typical distance between two buildings along Oxford Road is about 23.5m.



While using Google Earth is very handy and generally enough to get rough ideas about distances, the "Measure Distance" tool in Digimap is a more accurate tool for measuring distances as it shows flat 2D plan rather than the 3D images that Google Earth show. Repeating the same exercise above, we notice that the same distance according to Digimap is 24.8m, while it is 23.5m in Google Earth.



Digimap drawings are exported to Ai and then to CAD in which they are rescaled to be the basis of measuring distances and calculating areas. Simply select the polygon you want in CAD and the floor area will be calculated automatically and shown in the Geometry panel:



Estimating building heights

Building heights estimation is a useful technique to create 3D models of the existing space, draw cross sections and evaluate space enclosure. This can be done by simply counting the floors of each building and multiplying the result by floor height. However, floors height is different from building to building, but as a general rule we can rely on 3 main categories to estimate heights:

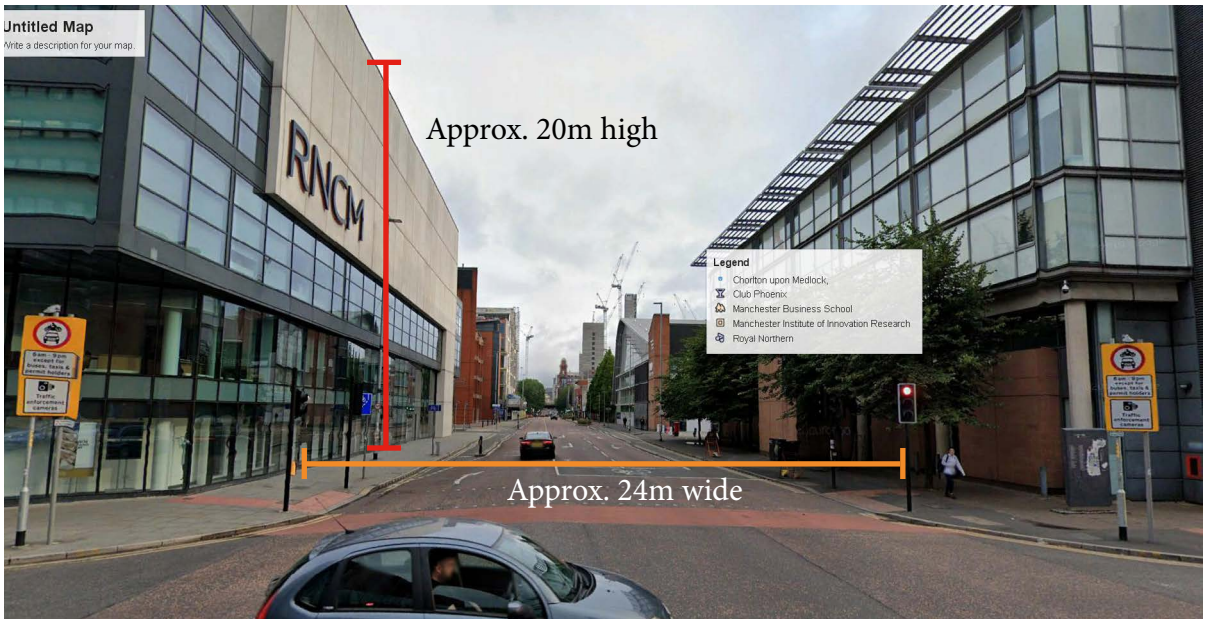
1- Residential Buildings: Each floor is roughly 3m high

2- Commercial buildings: Each floor is roughly 4m high

3- Retail: Each floor is roughly 5m high

You should use certain objects as reference for height though. A person height is on average 170cm for example.

Apply this method on the Oxford Road example above, we can estimate that the 5 floors RNCM building to the left is about 20m high. This means that the enclosure in a little more than 1:1 in this example. Refer to thinking 3D toolkit for more information regarding enclosure.



Note:

More accurate results can be achieved by using laser measure tools. These are relatively cheap and easy to use, and they are available to buy online or from local hardware stores.

D Understanding Scale

Maps are usually printed to scale. A scale is an important element of the map that makes it accurate and measurable. Information about scale is usually located at the bottom of the map in a shape of **scale bar** and a **numeric scale**.

Scale bars are graphical means of depicting measurements on a map, and especially to estimate distance. They stay correct even if you print the same map at different sizes as they shrink and extend with the map. Numeric scales are different. We often get printed maps at specific scales such as 1:1000, 1:500 or 1:200. This means that these maps are scaled down 1000 times, 500 times and 200 times respectively. A map done at 1:500 on A3, and then printed at A1 will no longer be at 1:500. But the **scale bar** will still be valid.

In order to measure distances on a correct to scale printed map, we use either a simple ruler and do the conversions ourselves, or we can use the scale ruler.

Scale rulers are important tools that allow us to convert maps measurements to meters/feet without doing any complex calculations. Simply select the appropriate side of the ruler (which matches the map scale) and do measurements.

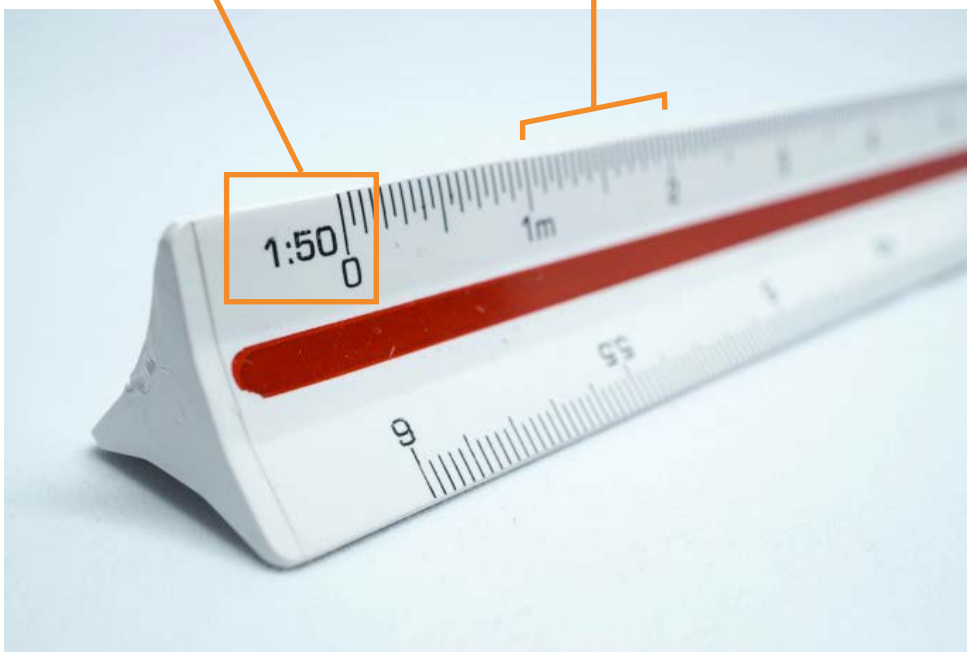
This face work for 1:50, 1:500 and 1:5000

This distance is:

1m if your map scale is 1:50

10 m if your map scale is 1:500

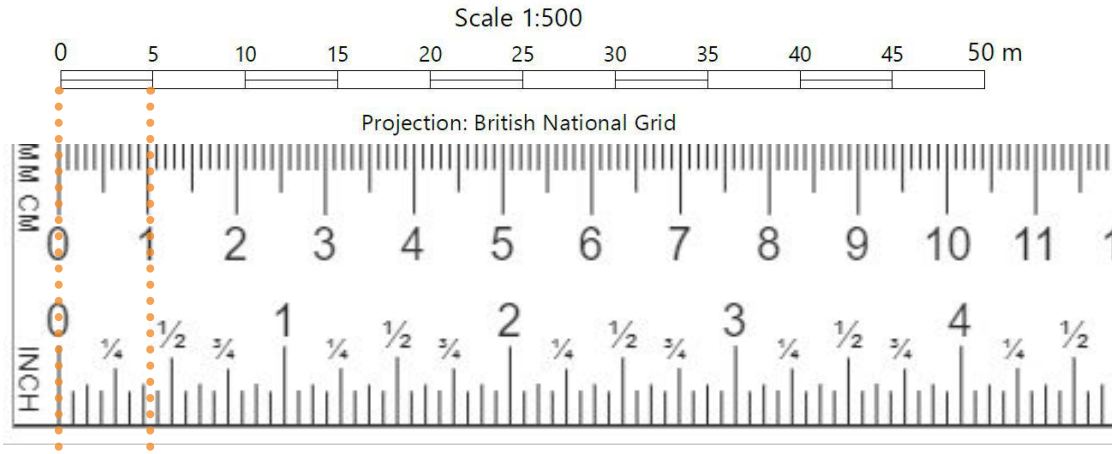
100 m if your map scale is 1:5000



However, understanding scale beyond the scale ruler is important to effectively draw by hand and to do scale conversions in AutoCAD. Let us have a look at the examples below:

A printed map at 1:500

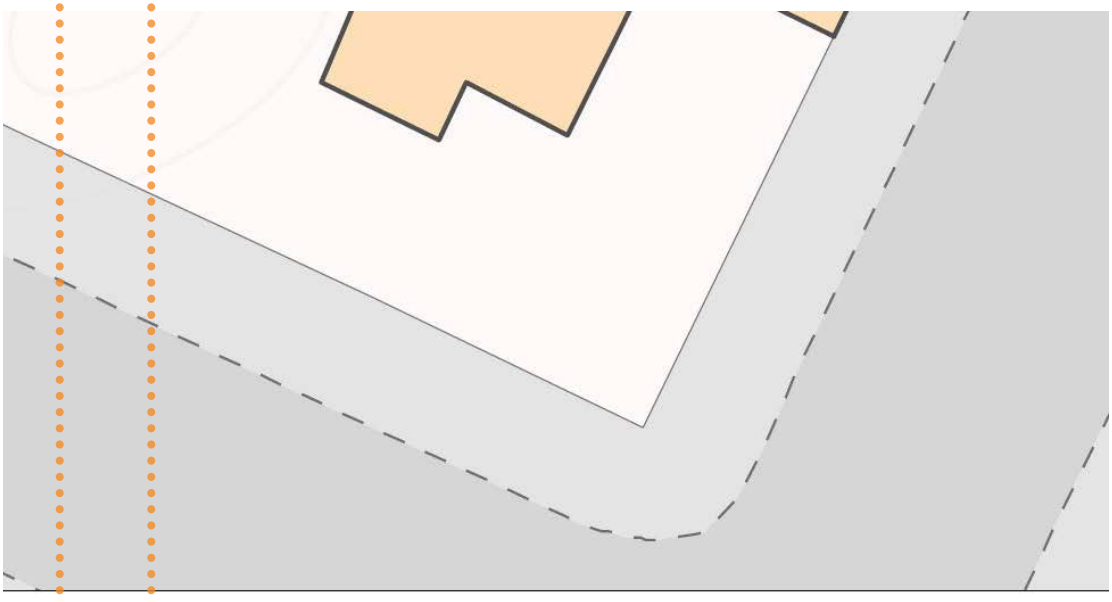
Scale bar



A ruler

At 1:500 scale, every **1cm** on the map is **5m** in reality

A printed map at 1:200



Scale bar

At 1:200 scale, every **1cm** on the map is **2m** in reality

Manual conversion is made simple and quick if you remember the following rules:

If you are measuring distances on printed maps:

At **1:200** maps: **multiply** simple ruler measurements by **2** to get the actual distance in meter.
At **1:500** maps: **multiply** simple ruler measurements by **5** to get the actual distance in meter.
At **1:1000** maps: **multiply** simple ruler measurements by **10** to get the actual distance in meter.

So if your map is **1:500** for example, and you want to measure distances using the simple ruler (i.e. rather than the scale ruler that would convert measurements for us): multiply the ruler reading by 5 to get the actual distance in meters. So if you measure a street width and it is 2cm, this means the street is actually 10m in reality.

If you are drawings on printed maps, you reverse the above operation:

At **1:200** maps: **divide** the real life measurements by **2** to draw in centimetres .
At **1:500** maps: **divide** the real life measurements by **5** to draw in centimetres.
At **1:1000** maps: **divide** the real life measurements by **10** to draw in centimetres.

So if your map is **1:500** for example, and you want to draw a rectangular 50m x 100m urban block, you will draw a 10cm x 20cm rectangle. If you are drawing at 1:1000, this will be 5cm x 10cm rectangle and so on.

If you are doing whole map rescaling

The easiest method is to use AutoCAD, but you can also do simple scaling up and down operations for simple tasks: from 1:1000 to 1:500 - Scale the map up 2x - From 1:1000 to 1:5000, scale the map down 5x. Remember to change the numeric scale on the map, the scale bar remains accurate.

E Scale in AutoCAD

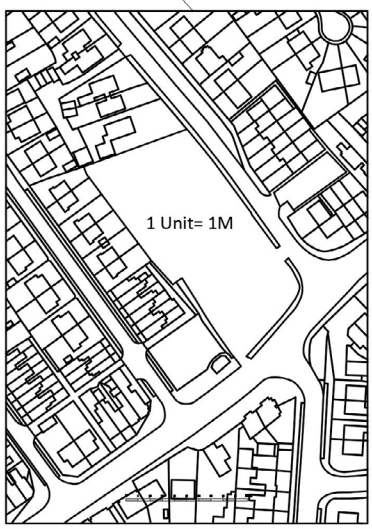
Technical drawing in AutoCAD are usually done at the 1:1 scale in units from your choice. So if you start by drawing a 10 x 10 square, you can assume that this means 10cm x 10cm or 10m x 10m, it is your choice. The key thing is to be consistent in your drawing. The issue of scale appears last, when you want to export your work. There are different methods to export your work at specific scale, on a specific sheet size. Here is a simple method considering that you are drawing in meters:

Draw the **sheet** you want manually at 1:1 scale (so if you want to print at A1, draw a 0.841 x 0.594 rectangle)

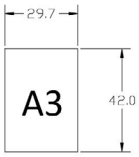
If the map is to be printed at 1:200, scale the **sheet** up 200x times
If the map is to be printed at 1:500, scale the **sheet** up 500x times
If the map is to be printed at 1:1000, scale the **sheet** up 100x times

You can also draw the sheet 100x times larger (i.e. 84.1 x 59.4 for the A1 sheet, or 29.7 x 42.0 for an A3 sheet) and then scale it up 2x times for 1:200, 5x times for 1:500 or 10x times for 1:1000 as the example below illustrates. This is often done to avoid creating very small rectangle that might be lost in the CAD drawing area, however, the first method is the easiest to remember.

The drawing we edited on Ai and exported to CAD. The original Digimap file is 1:500 on A3.



Draw an A3 size rectangle 29.7x42 (or A2, according to your site size and shape)



If the map to be printed as 1:200 on A3..... Scale the rectangle up X2
If the map to be printed as 1:500 on A3..... Scale the rectangle up X5 (this example)
If the map to be printed as 1:1000 on A3..... Scale the rectangle up X10
If the map to be printed as 1:2500 on A3..... Scale the rectangle up X25

To export your map:

- Ctrl+P, select AutoCAD PDF, A3 size,
- Window/ select the A3 boundary
- Check "fit to paper" option, select landscape/portrait
- Apply to layout

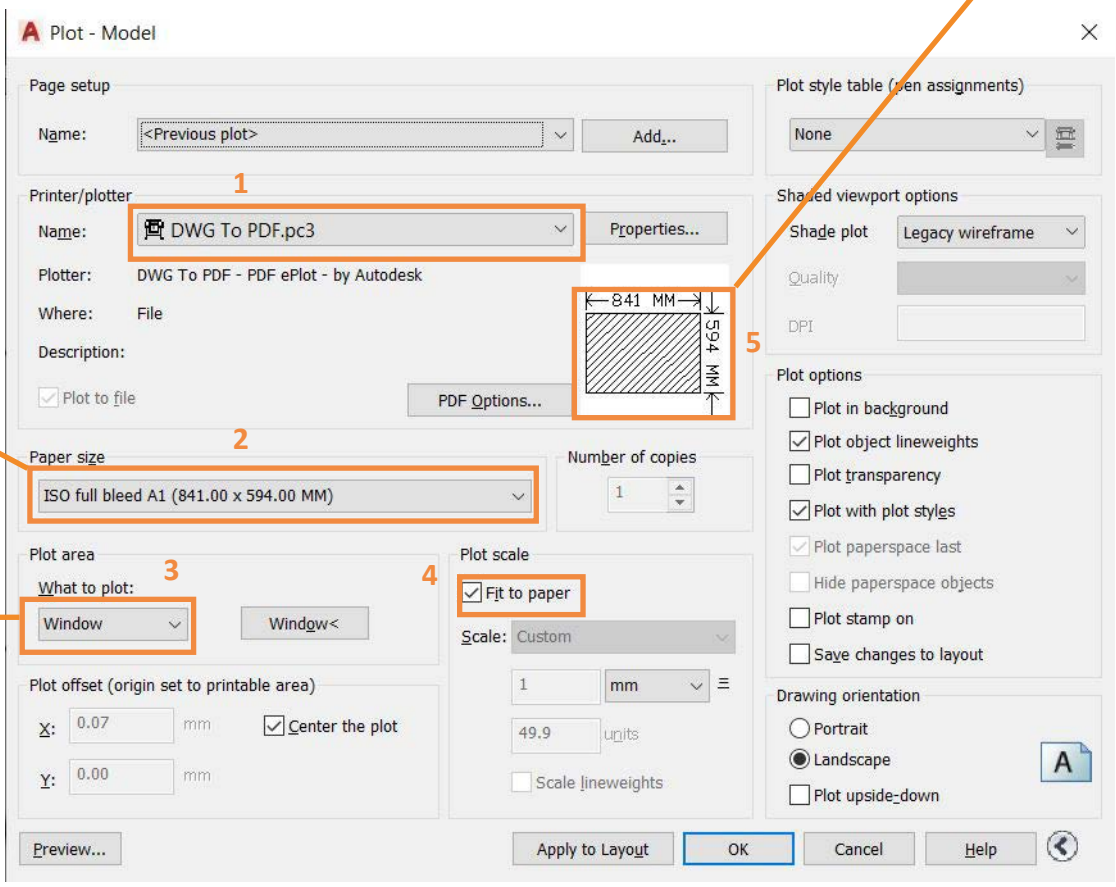
Note 1: The map should be downloaded at the desired scale and paper size from Digimap
Note 2: Do not scale the actual map drawing up or down in this method.

- Place the sheet around the site, this is your printing sheet boundary.
- Ctrl+P: Open the regular exporting window
- Select Printer: DWG to PDF.pc3
- Select page size: ISO Full Bleed A1
- Click on Window, and draw a window around the A1 (or A3) sheet you have created
- Click OK

Make sure the hatch fills the rectangle as in here

Select sheet size

a window around the sheet boundary you creat-ed



F Exerciser

Below are two urban blocks located in Hume (M15 5JH). Draw the two urban blocks with the surrounding streets and pavements by hand at 1:500 scale.

Tips:

1- Start by measuring the whole drawing width and length, and convert that to 1:500 so you know how big the drawing is going to be. Would this fit on A4? or do you need an A3?

2- Take all measurements you need from Digimap

3- To simplify the drawing process, rotate the drawing and align the key lines that define the blocks horizontally/vertically

4- Start by drawing the land plots and then do the inside offsets to create the blocks and the outside offsets to create the streets.

5- Add details last (roof lines, trees, parking spaces...etc.)