Using QGIS to produce base material for use with OCAD 11

John Moody, April 2021

What is QGIS?

QGIS is an example of a geographical information system or GIS. A GIS is used to organise and analyse geographical information in relation to spatial location, usually in the form of maps. Because they are tools for drawing maps, OCAD and OOM can also be regarded as geographical information systems, albeit mainly focussed on producing orienteering maps. QGIS is a free, open-source GIS developed by academics. The latest version is 3.18 'Zürich'. I am currently using version 2.18 'Las Palmas'. There has been a major change in the user interface between versions 2 and 3.

Uses of QGIS in relation to orienteering maps

You can directly visualise LiDAR data downloaded from sources such as the Environment Agency, or the Tellus SW Project (covers Cornwall and Devon as far east as Exeter). LiDAR data downloaded from these sources is **raster** data, i.e. a grid of regularly sized pixels; the files have either a .asc or .tif file extension. Visualising the data in this form is of limited value, but once loaded the data can be analysed in QGIS to produce information of more use as base material for orienteering maps.

1. The first thing you may want to use QGIS for is to crop (**clip**) the LiDAR file you are working on. Depending on the performance of your computer, e.g. whether you have a dedicated graphics card, processing LiDAR files may take quite a while. The files downloaded from the Tellus SW Project cover 5 × 5 km areas, so there is a large amount of data. To speed things up, it may be worth using QGIS to clip out a small section covering the area you are interested in.
2. The next thing you might want to do is to extract contours from the raw LiDAR raster data. In doing this you are converting raster data to **vector** data, **objects** defined by **nodes** connected by **lines**, just like OCAD uses. It is worth extracting contours with a smaller interval than needed in your final map. This helps with deciding if form lines are needed, and if wobbles in the contours represent real features or just noise in the LiDAR data. I use **DTM**, digital terrain model, LiDAR data to produce the primary contours. LiDAR DTM data attempts to show the terrain underlying the vegetation, but also to remove man-made features such as buildings and walls. Occasionally this means that features that you would want to represent on an orienteering map using contours, e.g. quarry 'finger' dumps, are missing. For this reason, if you are working on a largely open area, it is also worth extracting contours from the matching **DSM**, digital surface model, LiDAR data, as a check. LiDAR DSM data attempts for show the surface including vegetation and any man-made features. Once you have extracted your contours using QGIS you need to export them in the form a **.dxf** file. This .dxf file can be imported into OCAD and, after checking that the **coordinate system** is correct, e.g. British National Grid, the result should be georeferenced. After assigning an OCAD symbol, e.g. the contour symbol, to the contours imported from the .dxf file you can save them as an OCAD file. I usually load this file as a background map in OCAD and use it as a template to draw the contours by hand. This allows you to iron out some of the noise in the

contours; although OCAD 11 has a smoothing function, this does not work well because some of what is apparently noise in the contours may be real.

3. A final thing you may want to do using QGIS is produce **hill shade** images from the LiDAR data. I usually use DSM data for this since this works well for the open areas with scattered gorse and trees that I have been working on. Hill shade images are the result of analysis of the LiDAR data in which an imaginary light source is placed above the terrain. In QGIS you can change the height and direction (azimuth angle) from which the light is coming. You may need to experiment with this to produce the best results. In areas of open moorland hill shade images can reveal pits and knolls, gullies, walls and earth banks, as well as isolated trees and clumps of trees. Once you have generated a hill shade image using QGIS you need to save it in a form that can be opened as a background map in OCAD 11. If you save the hill shade images in **geoTIFF** format they will be georeferenced when you open them as background maps (templates) in OCAD 11, provided that the correct coordinate system has been selected.

A few of additional points

Once you have your georeferenced base material, e.g. aerial photos from Google Earth (see https://freegeographytools.com/2007/importing-google-earth-imagery-into-a-gis for how to downloaded georeferenced photos from Google Earth), LiDAR-derived contours or LiDAR-derived hill shade images opened as background maps in OCAD 11, you can check that the georeferencing is correct by exporting the data in a form that can opened in Google Earth. If you are just working with contours then you can export in a vector format to produce a .kml file. On opening this in Google Earth your contours will be superimposed on the aerial image. If you check the Terrain box in the Layers on the left-hand side, the contours will be 'wrapped' round the 3D representation of the terrain. If you are working with hill shade images then you can export in raster format to produce a .kmz file. When this is opened in Google Earth the image will obscure the underlying aerial image.

It is potentially possible to georeference an old orienteering map using the '**rubber sheeting**' function in OCAD (under Transform in the Map menu in OCAD 11) and georeferenced hill shade images generated using QGIS. The old map needs to of good quality, e.g. based on photogrammetry, and you need lots of points that can be identified with certainty on both the old map and on the hill shade image. Clearly this is more likely to be possible with a largely open area. The rubber sheeting function attempts to align and stretch the old map over the template image so that the points you have chosen match. The assumption is that other points on the old map should now align better with the template. How well this works depends on the number and quality of the points that you have selected.

You can use the British Geological Survey grid magnetic angle calculator to find out where magnetic north currently is for the area you are working on.