

## Note on LIDAR

1. LIDAR - Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.
2. LIDAR data is available in two sources. These are; DSM – Digital Surface Model (which includes all features) and DTM – Digital Terrain Model (removing the trees, bridges and buildings). The latter flags vertical objects which differ from the surroundings and uses the surface levels around to flatten the model to an expected ground level where that vertical difference occurs.
3. We have used DTMs as the standard preferred data set where available.
4. The scope of the Level Crossing Closure scheme at present is feasibility and detailed topographical surveys were not part of the scheme remit at the GRIP Stage 1 and GRIP Stage 2-4 stages of the works. It was considered that the details obtained from LIDAR information would be sufficiently accurate to present and consider at this feasibility stage.
5. In order to ascertain the existing ground gradients where appropriate LIDAR information has been obtained and longitudinal sections generated to determine an approximate slope of the land or road.
6. The horizontal spacing of the lidar file (effectively the size a pixel represents on the ground) is the way it is normally what's stated when data is ordered. So for a 1m resolution lidar dataset the size on the ground is 1m x 1m.
7. Mott MacDonald have used a mixture of Environment Agency which can be obtained free from <https://data.gov.uk/dataset/lidar-composite-dtm-1m1>. Mott MacDonald also purchased data from other sources where no free data existed. We have used lidar from 0.25m to 2m horizontal resolution depending on what data is available as not all sites are covered by the same resolutions.
8. A query was raised as to the accuracy of the LIDAR information in the determining of gradients and technical information from the EA download page is copied below to address this:

### **Vertical (height) accuracy**

- a) Our specifications require the absolute height error to be less than  $\pm 15\text{cm}$ . This is the root mean squared error or RMSE. It quantifies the error or difference between the Ground Truth Survey and the LIDAR data. With our more recent surveys we see this fall to about  $\pm 5\text{cm}$ . We expect the relative height error (random error) to be no more than  $\pm 5\text{cm}$ .

### **Horizontal (planar) accuracy**

- b) The absolute spatial error in our LIDAR data is  $\pm 40\text{cm}$ . For our datasets at 2m, 1m and 50cm resolution, this error is effectively absorbed in the pixels of the raster image. The relative horizontal accuracy of the LIDAR sensors we have been using over the past decade, as stated by the Instrument manufacturer, is  $1/5500 \times \text{altitude}$  (m Above Ground Level). For example, if the average survey height is 1000m AGL relative horizontal accuracy is 0.1818m.

### **Spatial Resolution**

- c) The spatial resolution of our LIDAR derived raster surface models are survey specific and vary from between 2 metres to 25cm.