

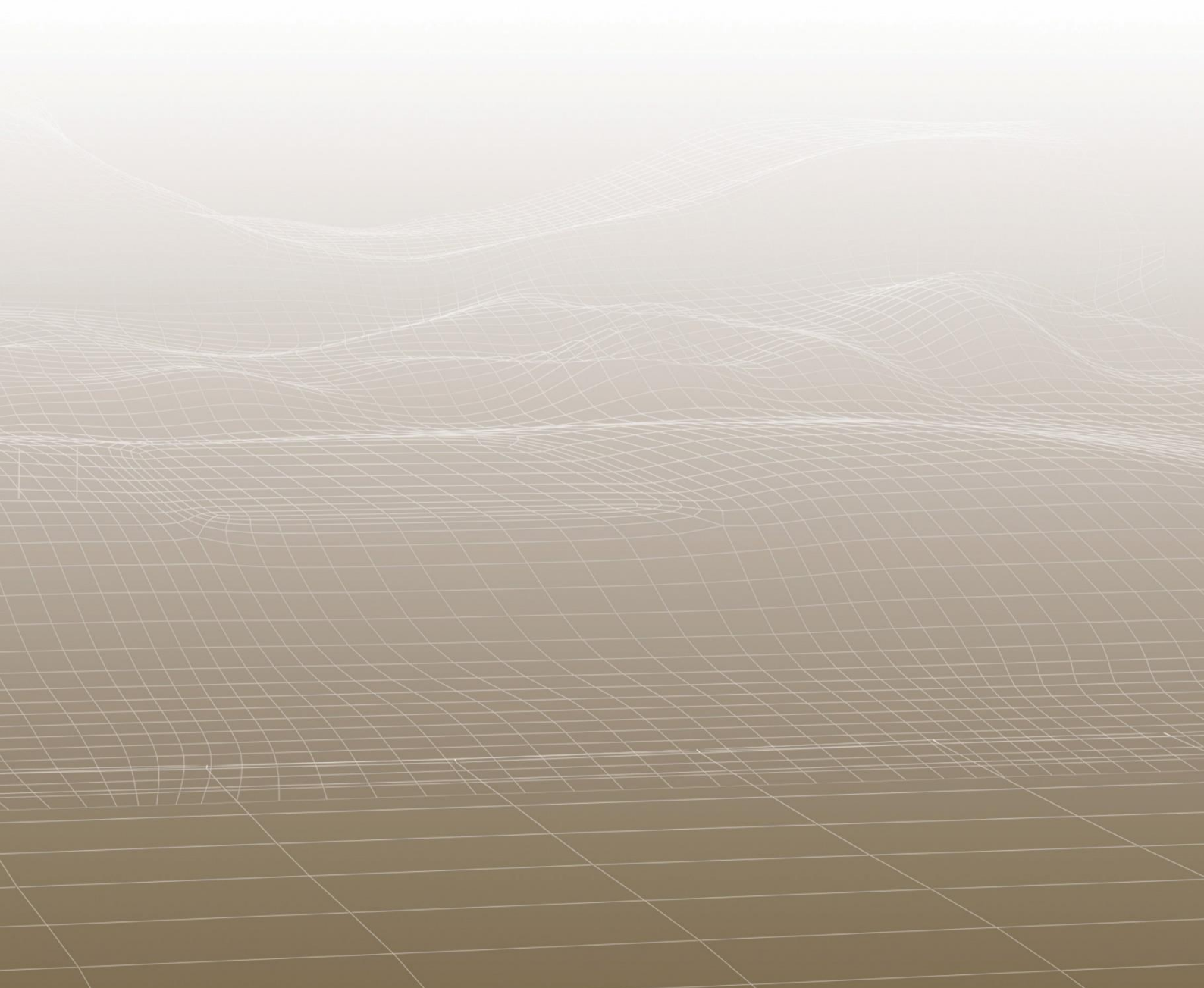


**BLOM**  
IMAGING THE WORLD

# **3489 DUBLIN AREA**

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## **PROJECT REPORT**



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# 1 Project Description

## 1.1 Background

This is a report of a helicopter airborne survey made by BLOM in order to produce data for digital elevation model Full-waveform airborne LiDAR data and orthomosaic.

This delivery includes a quality assured LiDAR point cloud, full waveform data, developed images RGB and NIR, oblique images, and 20 cm raw orthomosaic.

## 1.2 Aerial Survey Information

The aerial survey was performed 2015-03-26 at an altitude of 300 m with TopEye system S/N 443. The survey was completed in 2 sessions.

The survey includes LiDAR data and aerial digital images over Dublin. The area defined by the customer can be found in a Google Earth file in the folder /planning/kml.



FIGURE 1-1 SURVEYING AREA OUTLINED IN GOOGLE EARTH

### 1.2.1 LiDAR Data

Total number of points is approximately 616391736 and the average point density inside the project area is 348.43 points/m<sup>2</sup>.

### 1.2.2 Aerial Photography

The photography was performed with a **Phase One** camera. The surveying altitude and the camera of choice give the following ground sampling distance:

| Camera type | Resolution (pixels) | Altitude (m) | GSD (cm) |
|-------------|---------------------|--------------|----------|
| RCD30       | 9000x6732           | 300 m        | 3.4 cm   |

Total number of images: **4553**

Camera calibration file: **leica\_sys443\_150326\_LA\_OK.cal**

#### **FW oblique camera:**

Number of images: 4210

CamCal\_FW\_SLR\_D800E\_50mm\_150326\_no\_lever\_arm.cal

#### **BW oblique camera:**

Number of images: 4178

CamCal\_BW\_SLR\_D800E\_50mm\_150326\_no\_lever\_arm.cal

## 1.3 Coverage and Point Density Verification

Coverage check for digital images has been made without remarks. Image footprints are plotted in the design file at level PRJ footprints.

Coverage check for LiDAR data has been checked with BLOM's software for point density control, TPDS (TopEye Point Density and Statistics). The area is fully covered by LiDAR data. Complete reports are located in the folder */reports/lidar/coverage\_check*.

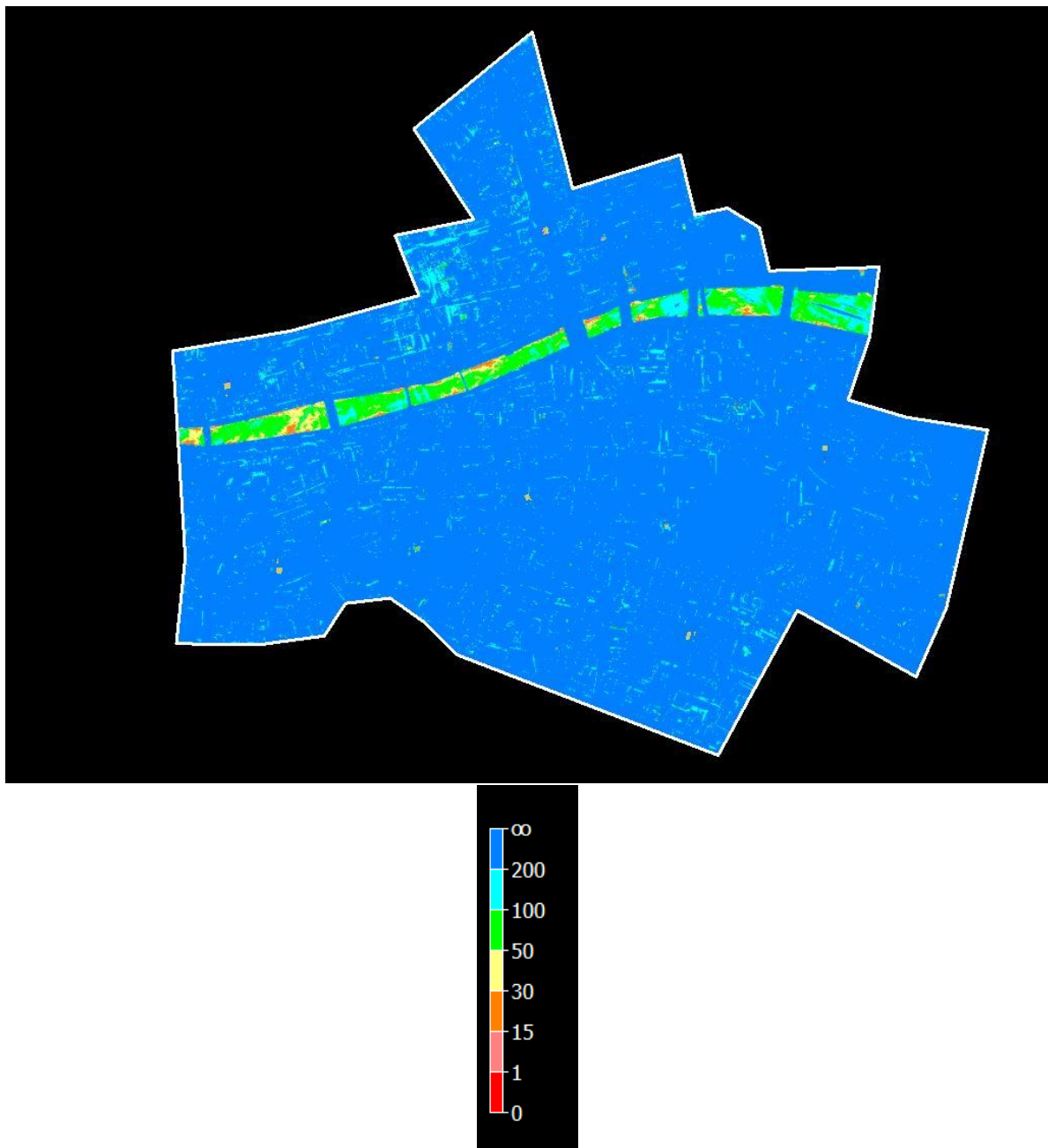


FIGURE 1-2 DENSITY RASTER

## 2 Primary Data Processing

### 2.1 Survey and Processing

The GPS processing and GPS/IMU integration is done using Applanix PosPac. The GPS is processed using data from fixed reference station(s)

The GPS processing is made separately to achieve a forward and reverse solution. An ideal solution would have a separation of zero as this indicates that the carrier phase ambiguities have been determined to be exactly the same in both processing directions. Full statistics are located in folder */reports/trajectory*.

### 2.2 LIDAR processing

#### 2.2.1 Calculation of point cloud

GPS/INS and LRF (Laser Range Finder) measurements were integrated in RiProcess to generate a 3D point cloud.

#### 2.2.2 Verification of flight line alignment and adjustment (matching)

The relative accuracy between individual flight lines has been verified with the following procedure:

- Ground and buildings is classified in each flight. The system bore sight calibration is verified by calculating systematic pitch, roll and heading misalignment parameters using data from the project and the RiProcess and TerraMatch software.
- BLOM's software TASQ (TopEye Area Statistics and Quality, *see section 2.2.3*) is used to calculate statistics for the alignment between flight lines.
- TerraMatch is then used to search for individual corrections for each flight line in XYZ, Roll and mirror scale. TerraMatch reports can be found in *reports/lidar/terramatch*.  
The precision improvement in the dataset is then verified with TASQ. If the statistics show improved precision, the correction will be applied to the whole dataset.

#### 2.2.3 TASQ Reports

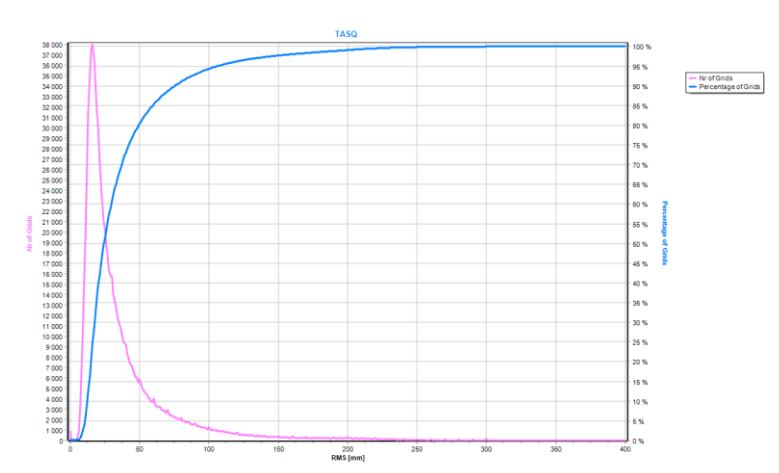
TASQ performs estimation of internal quality in a LiDAR data set through statistical evaluation of deviation between overlapping flight lines. The dataset is gridded in 2 m grids. For each grid a RMS(dZ) value calculated. TASQ presents the RMS statistics between flight lines with a histogram, a plot, and a report. The report presents mean RMS values for the whole area (*see Table 1*) and per individual flight line.

| Global Statistics  | Before matching | After matching |
|--------------------|-----------------|----------------|
| Total RMS (dZ)     | 0.035 m         | 0.030 m        |
| No of Observations | 945250353       | 966109108      |
| Maximum Deviation  | 0.300 m         | 0.300 m        |

**TABLE 1** STATISTICS ON DISCREPANCIES BETWEEN FLIGHT LINES, CALCULATED ON SUBAREAS OF 2 M

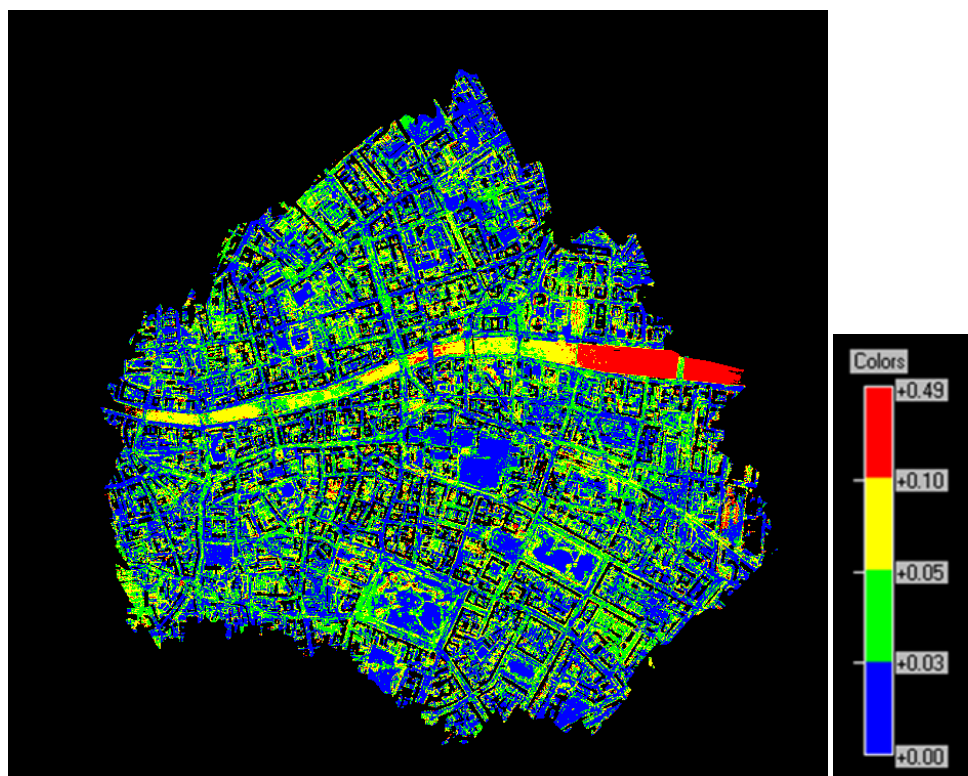


The histogram plot have two histogram curves. The purple curve represents the number of subareas with a certain RMS(dZ)-value. The blue line represents the percentage of subareas having a lower RMS(dZ) than a certain value.



**FIGURE 2-1** TASQ HISTOGRAM. RMS (dZ) STATISTICS FOR EACH SUBAREA PLOTTED IN A HISTOGRAM

In the plot (see Figure 2-2) the RMS(dZ) statistics for each subarea is presented by color in a raster image. Full report can be found in *reports/lidar/tasq*.



**FIGURE 2-2** TASQ PLOT

## 3 LiDAR data classification

### 3.1 General

A standard macro has been used for ground classification. No manual editing has been performed.  
The data has the following classes:

- 1 Default
- 2 Ground
- 4 Medium Vegetation
- 7 Low points
- 12 Overlap points

### 3.2 Elevation control

Control points were provided and checked against the Lidar data.  
No adjustment were applied to the data.  
Full reports can be found in the folder *reports/lidar/GCP\_report*.

|                     |        |
|---------------------|--------|
| Average dZ:         | -0.006 |
| Average Magnitude:  | 0.031  |
| Root Mean Square:   | 0.037  |
| Standard Deviation: | 0.037  |

TABLE 2 CONTROL POINT STATISTICS

### 3.3 Plane metric control

The lidar data were checked visually against the plane control points.



The image shows the intensity of the lidar data and the image position against the control points.



### 3.4 Model key points (MKP)

A thinned out ground model is classified called Model Key Points (MKP). MKP is classified from the original ground model by thinning the data while minimizing the loss of quality. Limits at the MKP classification were set to  $\pm 0.15\text{m}$ .

The model key points is produced from an unedited ground model and should only be used as DEM for orthophoto production and not delivered to the final customer.

## 4 Image orientation

The image orientation has been verified through a series of tie points measured in a small area. The deviation between the tie points can be found in the folder *reports/images/tiepoint\_report*.

### 4.1 Plane control for images.

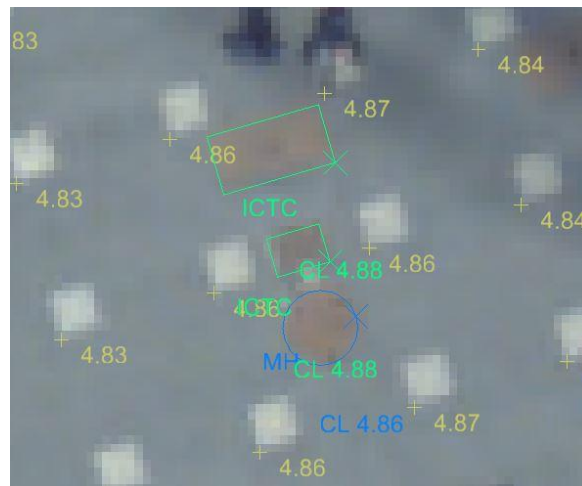


FIGURE 4-1 IMAGE POSITIONS AGAINST CONTROL POINTS.

To ensure that the orientation is of good quality all over the area, a 20 cm raw orthomosaic has been created. The mosaic and the files for TerraPhoto are located in */image\_data/mosaic*.



FIGURE 4-2 20 CM ORTHOMOSAIC.

## 5 Delivery information

### 5.1 Coordinate system in plane and height

Irish National Grid (ING) / Above Ordnance Datum (AOD) - Ordnance Survey Malin Head datum

### 5.2 File formats

Laserdata full waveform: Las 1.3

Laserdata: LAS 1.2

Orthomosaic: .ECW

Developed Images: TIFF (\*.tiff)

Oblique images: .JPG

### 5.3 Additional information

All data were delivered by FTP.