Appendix 8.6

Technical Methodology:
Photography, 3D Modelling and Verified Visualisations

ALDERHOLT MEADOWS

November 2022

End Barn . 58 Shaw Lane . Oxenhope . West Yorkshire . UK . BD22 9QL . www.msenvironmental.co.uk

Landscape Institute Registered Practice

Appendix 8.5

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Contents

Introduction

Michael Spence BA (Hons), MLD, CMLI, REIA, FRGS is one of the UK's leading independent exponents of technical photography, verified photomontages and visualisations. Since 2013 Mike has been a technical advisor to the Landscape Institute on 'photography and photomontage in landscape and visual impact assessment', and has been undertaking this technical work for over 25 years. He is one of the main authors of the Landscape Institute's TGN 06/19 and provided technical support to Scottish Natural Heritage(NatureScot) on their windfarm visualisation guidance. His background as a Chartered Landscape Architect, Registered EIA Practitioner and Fellow of the Royal Geographical Society working on strategic infrastructure projects has meant that the accuracy of the visualisation work is paramount, and technical photography, together with extensive surveying experience, use of GIS and detailed 3D modelling using real world co-ordinates ensures that the visualisations produced follow a clear and transparent methodology to ensure they are as accurate as possible.

Recent projects include the UNESCO World Heritage Sites at Valletta (Malta), Royal Botanic Gardens at Kew, Fountains Abbey for The National Trust, and West Cumbria Coal Mine for Friends of the Earth. Mike has also been working closely with Bath City Council on proposed development in the UNESCO World Heritage City of Bath. Mike's work and objective technical checks have been used at numerous Public Inquiries and Planning Hearings, on behalf of both local authorities and developers.

In April 2022 UIS contacted MSE to request Technical Photography, GNSS/RTK Surveying, 3D Modelling and Visualisation review and support for the proposed LVIA for Alderholt Meadows.

Verified Photography and 3D Modelling

The photographs were taken with a full frame camera (Canon EOS 5D Mark IV) and 50mm lens combination consistent with Landscape Institute's TGN 06/19, GLVIA3 and the emerging understanding of the requirement for technical photography for visualisation work. As part of the work 15 viewpoints were identified providing views of the site and in accordance with best practice visited in April and July2022. The weather was good with clear visibility.

Technical Photography

The camera was mounted on a Manfrotto 303 SPH panoramic tripod head, levelled using a Manfrotto Leveller, supported on a Manfrotto Tripod. The tripod head was levelled using a spirit level, to avoid pitch and roll. The camera was set with the centre of the lens 1.60m above ground level. Photographs were taken in Manual mode with an aperture of f/8 or f/11 and a fixed focal length throughout. Photographs were taken in landscape orientation. A Sigma 50mm f/1.4 lens was used for all viewpoint photographs.

A Single Frame 50mm photograph is insufficient to capture the extents of a wide, linear development. Each view was taken with a series of overlapping 50mm images, as shown above.

To ensure consistent geometry each image was cylindrically re-projected, as above. This ensures that a full 360 degree panorama can be created to match the 3D model view, as shown below:

From the 360 degree panorama a 90 (or 180 degree) degree portion can be extracted to present the visualisations as shown below:

Surveying

The position of each camera location was surveyed using Spectra Precision GNSS equipment with Real Time Kinematic Correction (RTK) which achieves an accuracy down to 1cm in eastings, northings and height (metres Above Ordnance Datum). The equipment included Spectra Precision SP85 GNSS smart antennae with Panasonic Toughpad data recorder. Points were saved using Origin Geospatial software. A photograph of the camera location was taken.

3D Modelling

MSEnvironmental (MSE) constructed a 3D model using the planning applications drawings, OS MasterMap for geo-referencing and site topographic survey. 3D point data was used for checking horizontal and vertical alignment.

Camera locations surveyed on site were added to the geo-referenced 3D model.

Target points were taken from the existing features in the view and built into the 3D model. This allowed the horizontal and vertical alignment of the photograph and 3D model to be checked, cross-referenced and verified.

Cylindrical renders generated using VRay for Rhino were exported from the 3D modelling software and used to overlay the cylindrical images. Target points from both the photograph and the model view were aligned to ensure a precise fit between the two images.

Visualisations are presented as either AVR 0, 1, 2 or 3. The differences are explained in the Landscape Institute's Technical Guidance Note 06/19: Visualisation of Development Proposals.

The results are presented as a sequence of visualisations as follows:

The topography of the site has been generated from a combination of a site Topographic survey and LIDAR 1m DTM data, with triangulated surfaces generated using Rhinoterrain.

The 3D Model was built and geo-referenced in Rhino 3D by MSE, using 2D CAD layouts supplied by the Scott Worsfield Associates, project architects, and landscaping proposals supplied by Urban Initiatives Studios.

A cumulative site has been added using lanning application drawings supplied by UIS.

The model is fully geo-referenced and positioned to correspond with the site layout and elevations supplied in the planning application drawings.

The resultant visualisations are considered to fairly demonstrate the correct scale and massing of the development.

Cameras have been added to the model and the field of view rendered out to precisely match the panoramic cylindrical images using highly precise camera co-ordinates.

3D Model (Year 1 Landscaping)

3D Model (Year 15 Landscaping)

50mm lens on Full Frame Sensor Camera

For decades it has been accepted that a 50mm lens on a full frame sensor camera provides the optimum image to replicate what is seen by the human eye. there are important differences between the human eye (binocular) and the camera lens (monocular). These have been explored in research by The Highland Council & the University of Stirling, as well as by myself through the Landscape Institute. We know that a single frame 50mm image on an A3 sheet of paper provides the same view as that gained in the field by someone with one eye closed. As we are binocular, and normally use both eyes, a different size of image is required, and the reason why we have presented the images as effectively a 75mm image on A2 paper. This gives what The Highland Council, University of Stirling, Scottish Natural Heritage (NatureScot) and the Landscape Institute agree is the most representative size of image to understand the nature and scale of a development on a photograph.

Planar or Cylindrical Projection

All photographs are taken as single frame planar images. Each single frame image has a single point of perspective lying at the centre of the image.To correctly match and align with the 3D modelling software the camera must be mounted on a levelled tripod, and directed towards the proposed development.

When a viewpoint is close to the development, or a development is wide such as this development, it is not always possible to fit the development on a single frame image. The alternative is to use a series of overlapping 50mm images and generate a ‘cylindrical’ perspective view,.

The 3D model renders have been rendered out in cylindrical (multiple frame images) projection to allow the precise image re-mapping to match the photography.

3D Modelling software

The work has largely been undertaken using Rhino 3D. All 3D modelling has been undertaken in metres and geo-referenced to align with OSGB36. RESOFT Windfarm was also used which is a 3D modelling package which we use to check on vertical and horizontal alignment of the 3D model against the precise image geometry. This is also set up to OSGB36. RESOFT Windfarm has been used to generate the geometric grid from LIDAR DTM data present in all 3D model visualisations.

Viewing Printed Images

The visualisations have been prepared to be printed in the Technical Methodology at at A3 (420 x 297mm) and in the separate ‘Verified Visualisations’ document at A1 (841mm x 297mm), to show the scale of the proposed development.

The image size is considered to give a fair representation of the view for everyone, and the scale of the development in that view.

Summary

This work has been undertaken in accordance with the the Landscape Institute TGN 06/19 and the developing understanding of visualisation work. The accuracy of camera locations and 3D modelling conforms with the Landscape Institute’s Type 4 (the highest level of accuracy). The 3D modelling has been produced to AVR 2 (simple architectural form with no detail).

The photography has been undertaken in an extremely robust manner, using professional full frame sensor DSLR and 50mm lens with levelled tripod. The camera position has been surveyed using highly accurate GNSS equipment, giving high levels of accuracy of camera location. The 3D model has been built in Rhino 3D using detailed information contained in the planning application drawings. An additional check on the vertical scaling has been undertaken using RESOFT Windfarm.

The resultant visualisations are highly accurate.

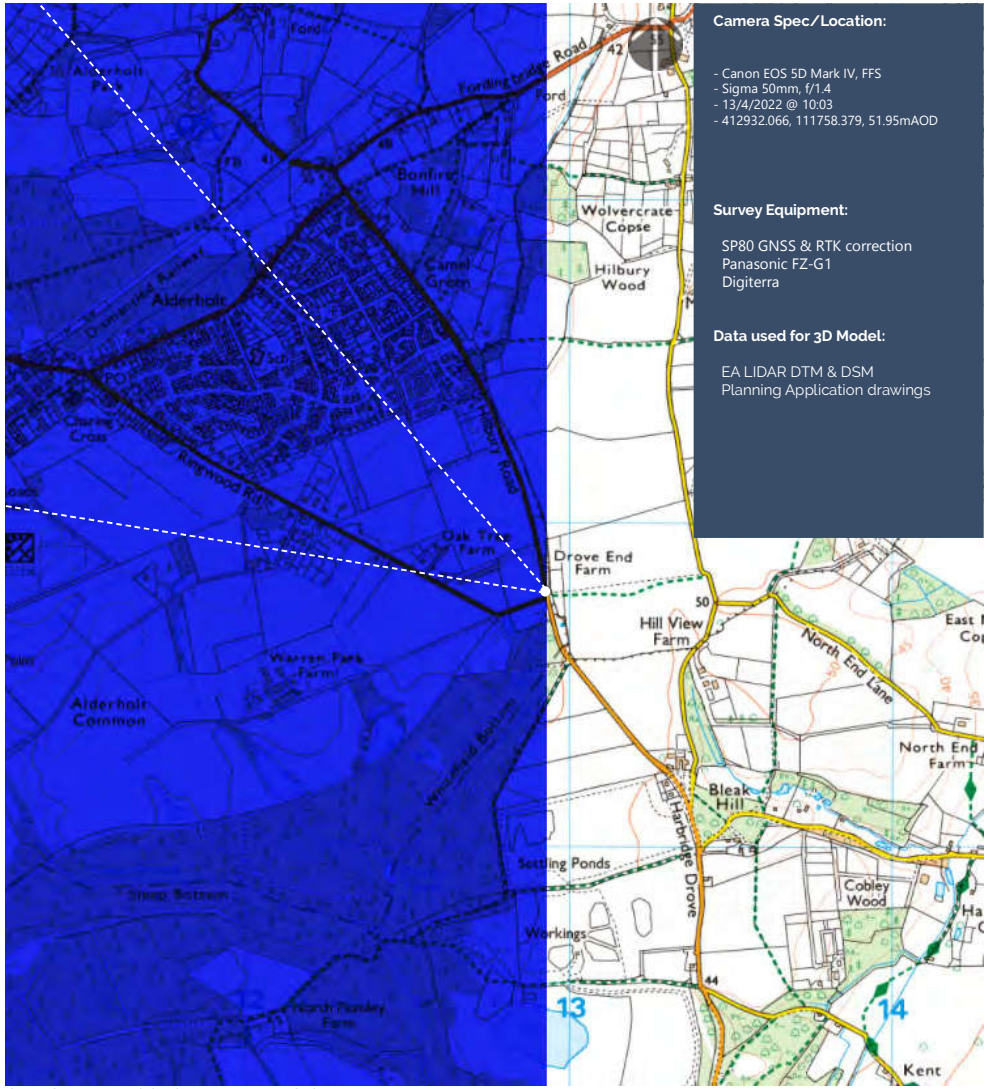
The photography, surveying and 3D modelling have followed a transparent methodology, and the resultant visualisations and the size at which they are presented are considered robust and fit for purpose to illustrate the positioning, and scale and massing of the proposed scheme in its local and wider context.

M.A.Spence BA(Hons), MLD, CMLI, REIA, FRGS 19 November 2022
Principal, MSEnvironmental

APPENDIX 1.1: VIEWPOINT SEQUENCES

Viewpoint 1
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 10:03
- 412932.066, 111758.379, 51.95mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 1 Winter Single Frame 50mm image

Viewpoint 1
Summer Photography

Camera Location:

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

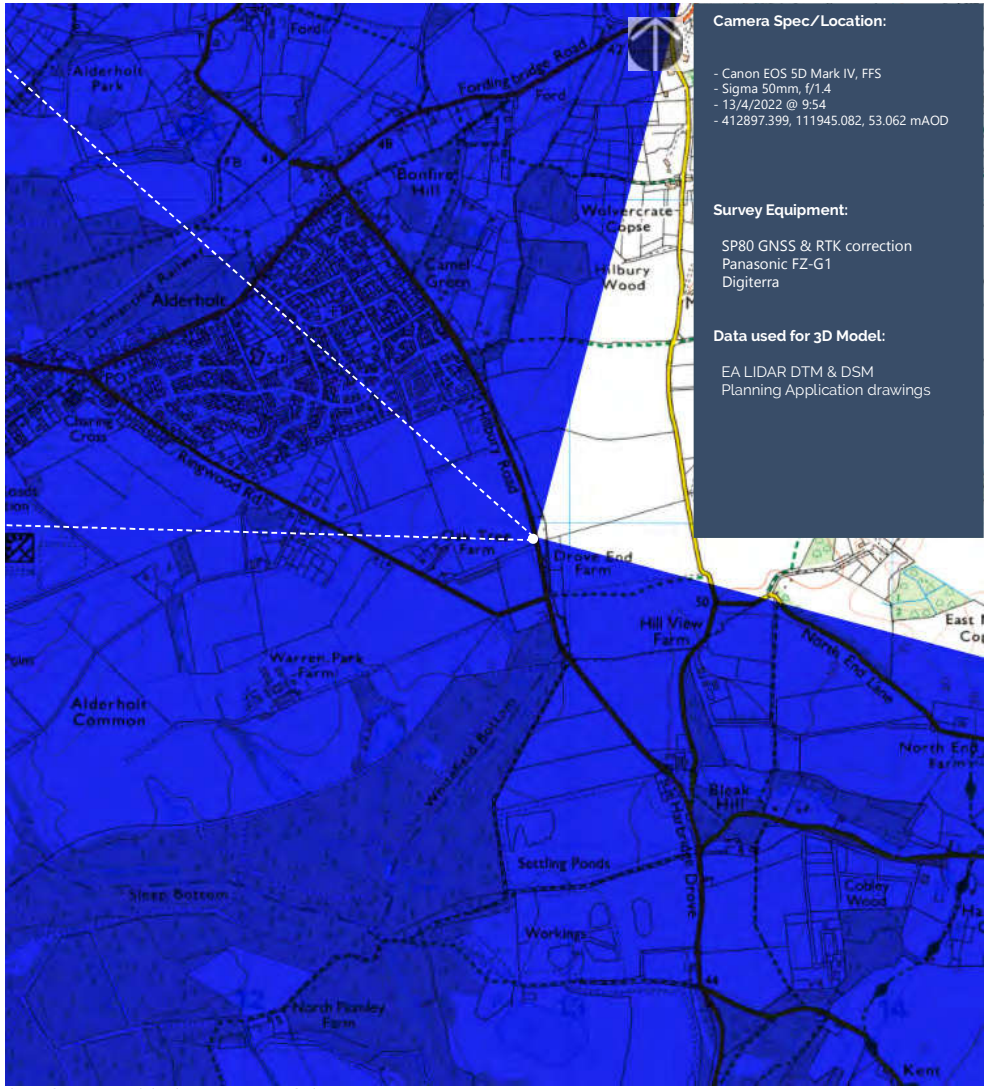
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 1 Summer Single Frame 50mm image

Viewpoint 2
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 9:54
- 412897.399, 111945.082, 53.062 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

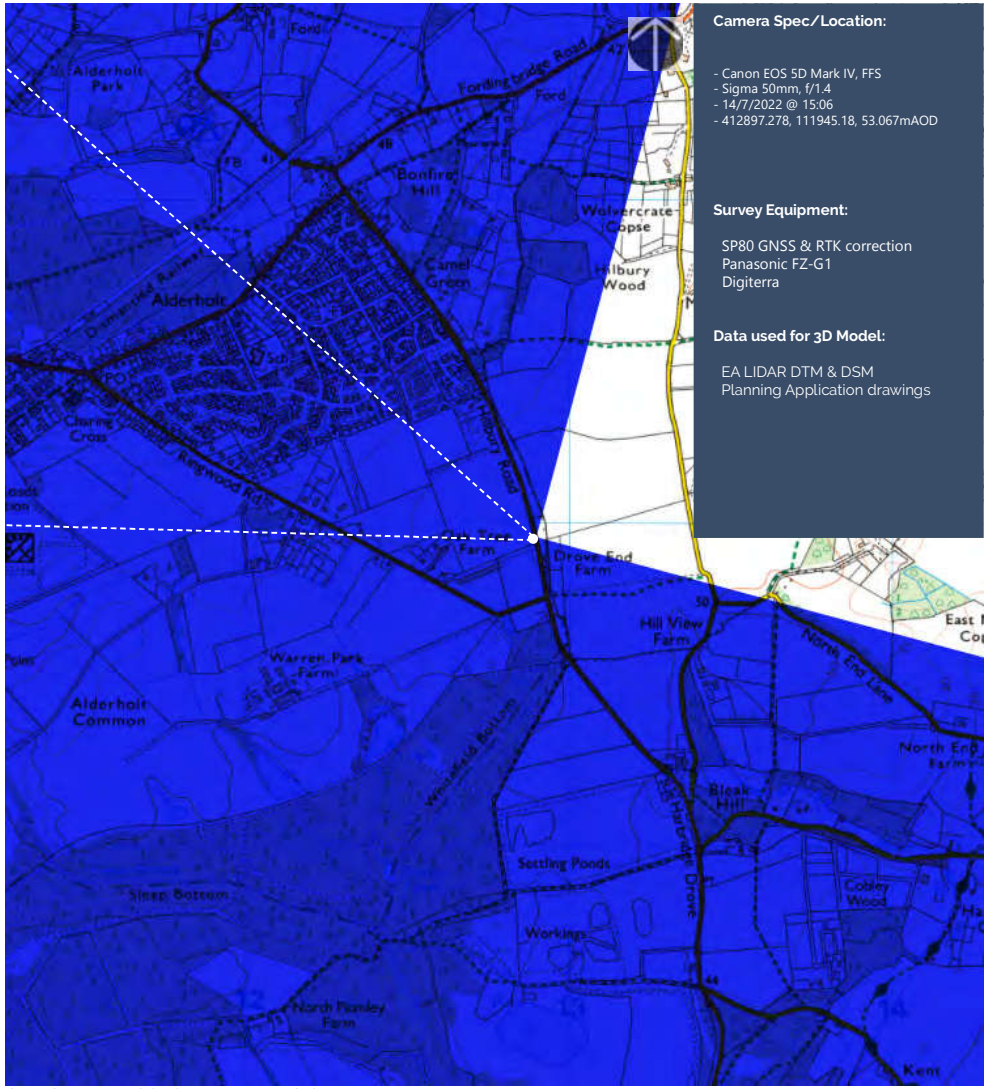
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 2 Winter Single Frame 50mm image

Viewpoint 2
Summer Photography

Camera Location:



Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

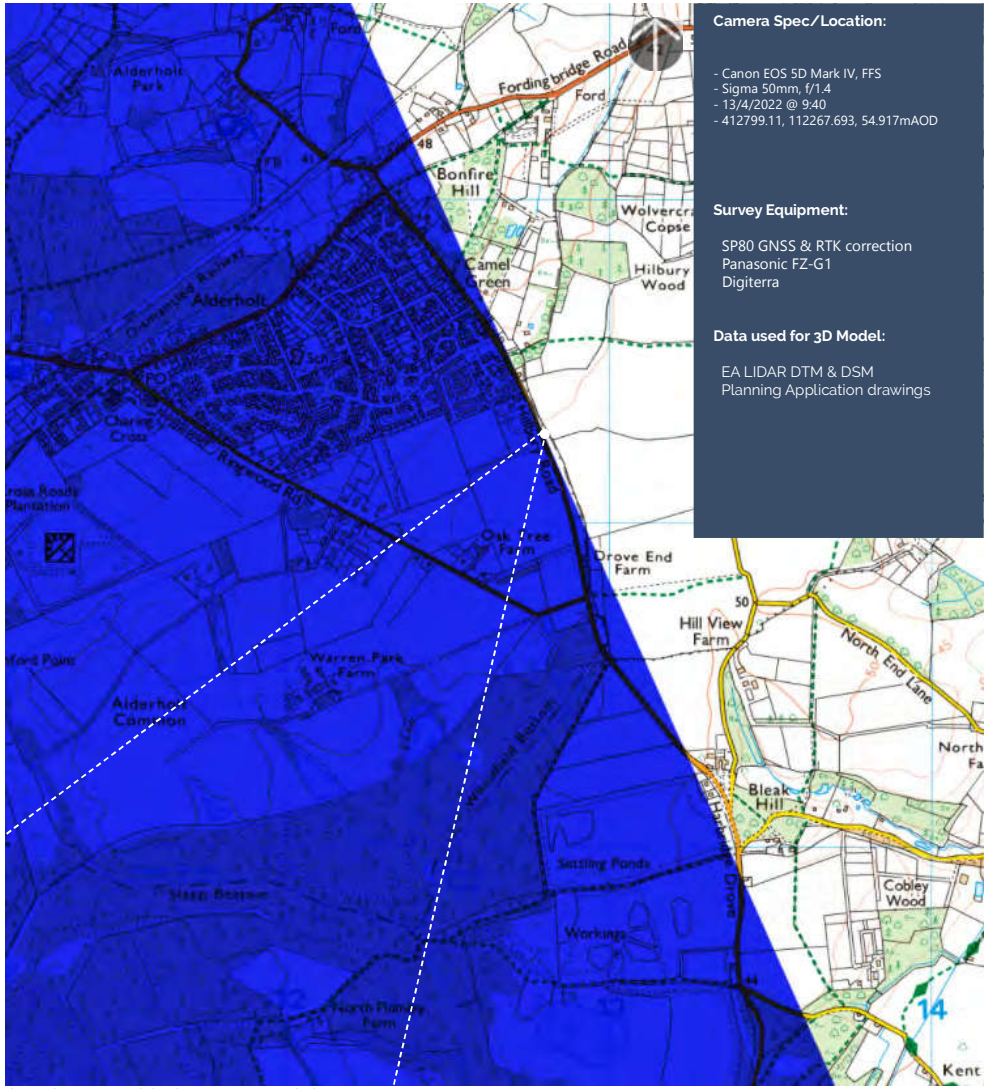
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 2 Summer Single Frame 50mm image

Viewpoint 3
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 9:40
- 412799.11, 112267.693, 54.917mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

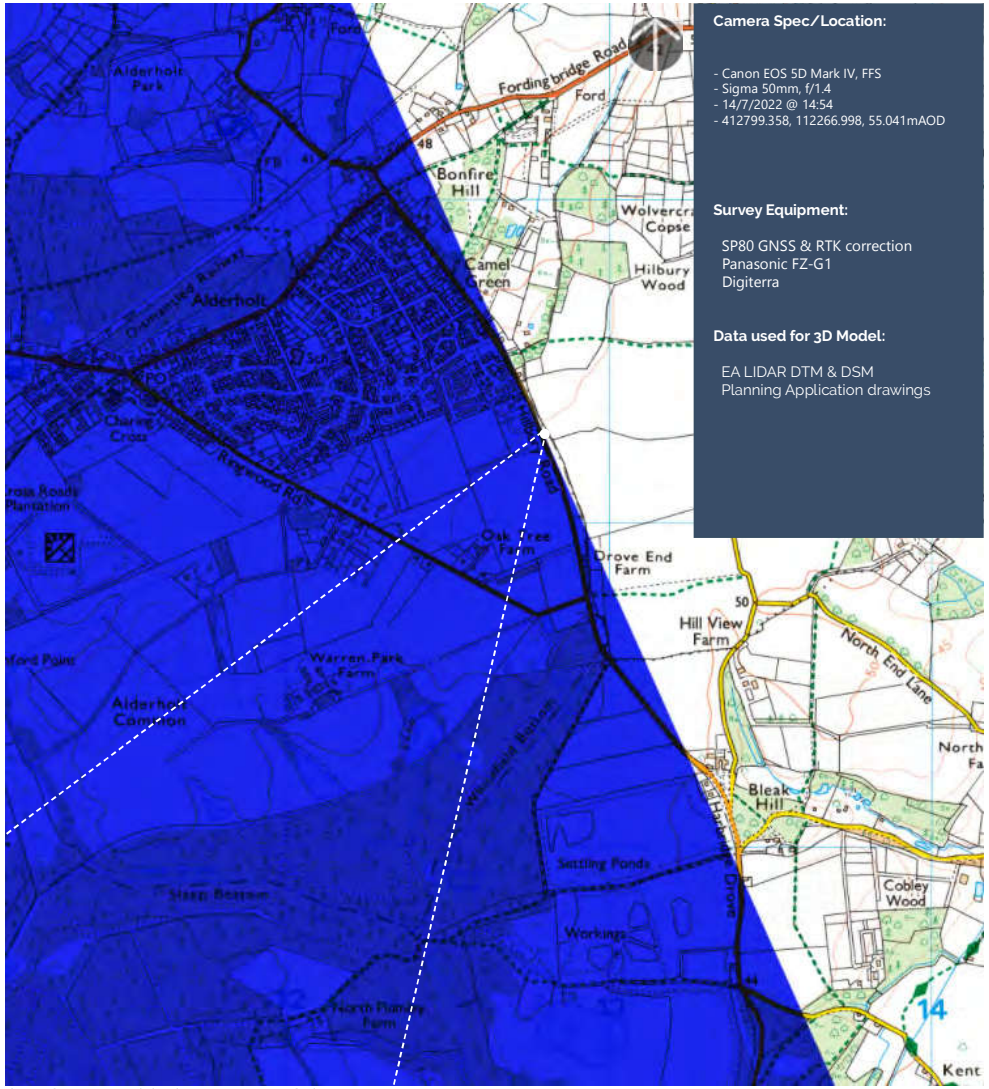
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 3 Winter Single Frame 50mm image

Viewpoint 3
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 14:54
- 412799.358, 112266.998, 55.041mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

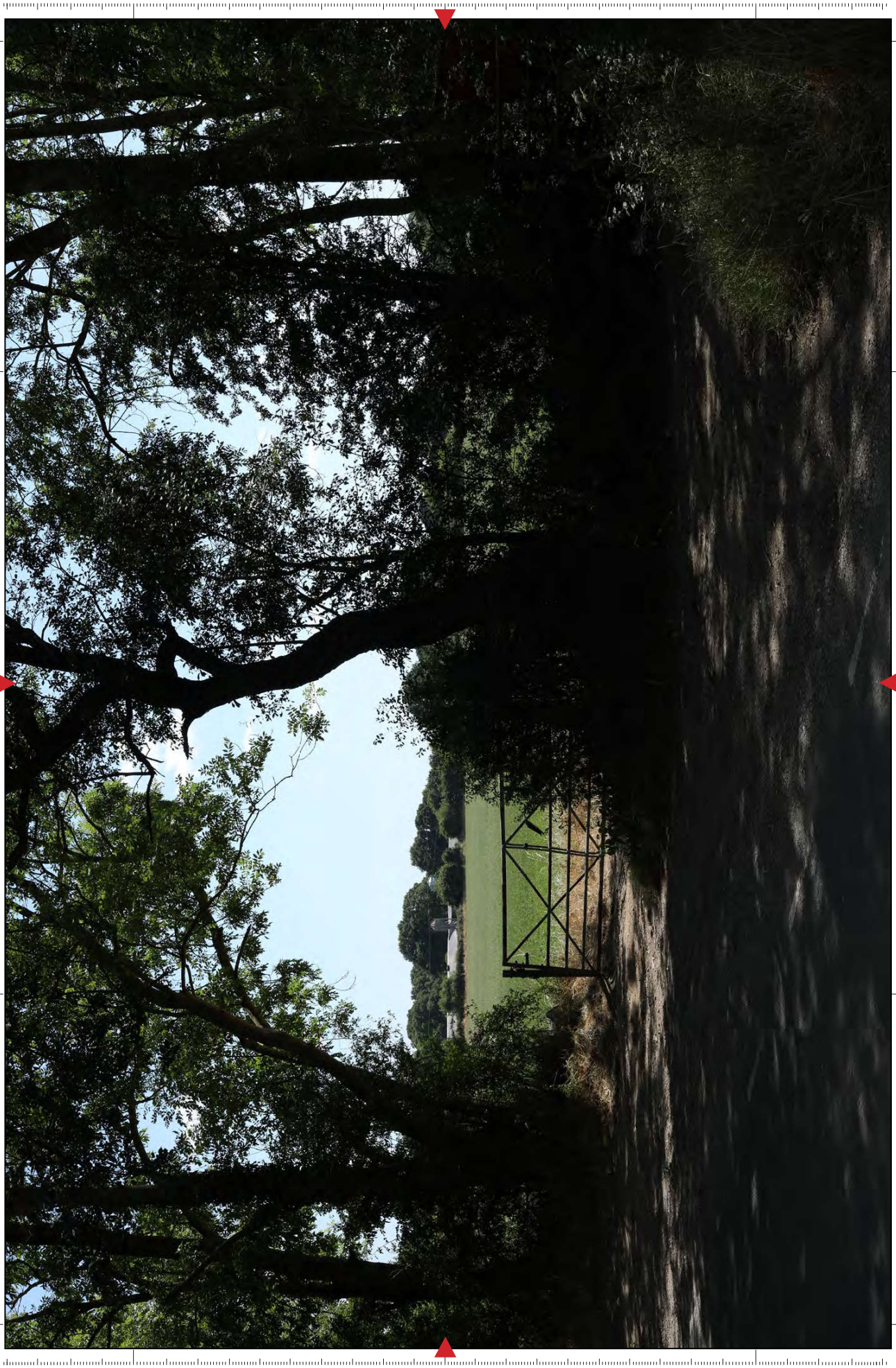
Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Point of Perspective



Point of Perspective

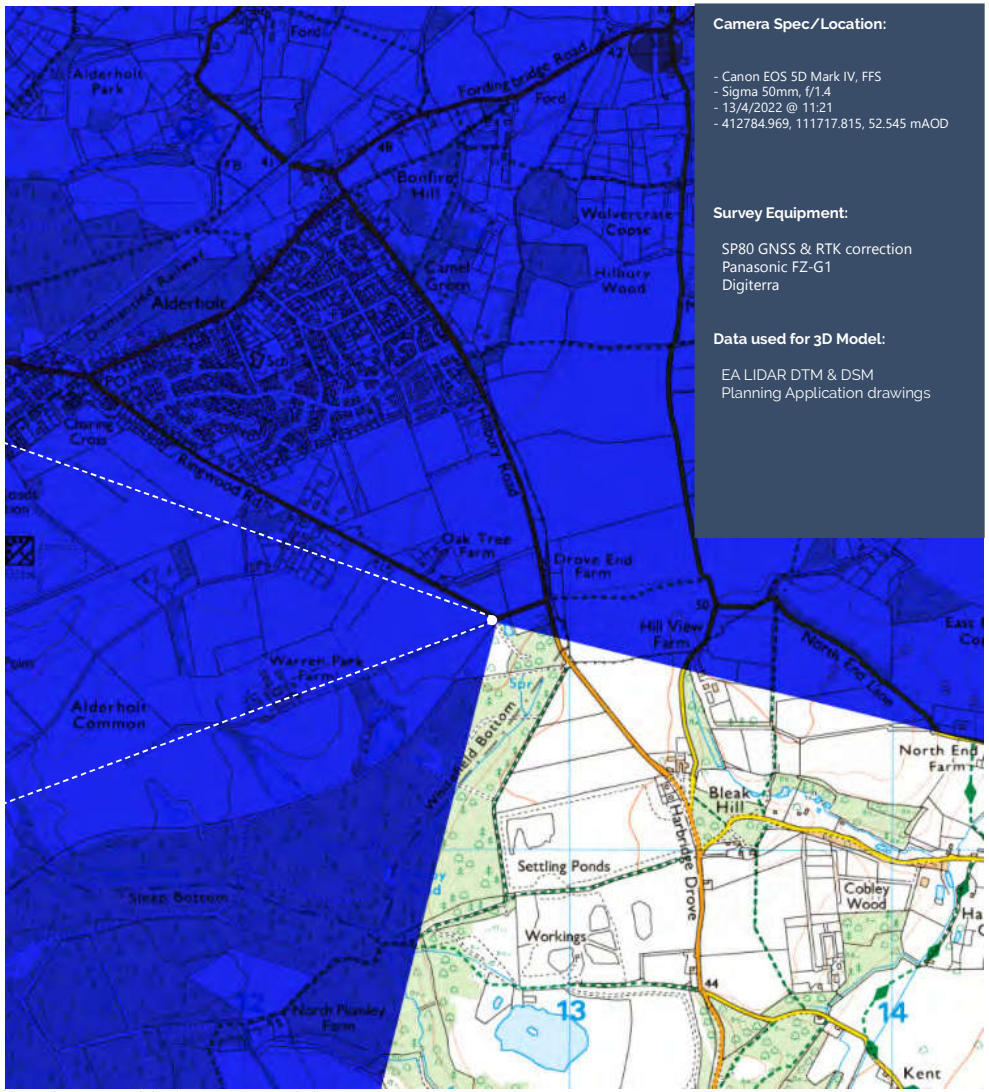
Point of Perspective

Point of Perspective

Viewpoint 3 Summer Single Frame 50mm image

Viewpoint 4
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 11:21
- 412784.969, 111717.815, 52.545 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

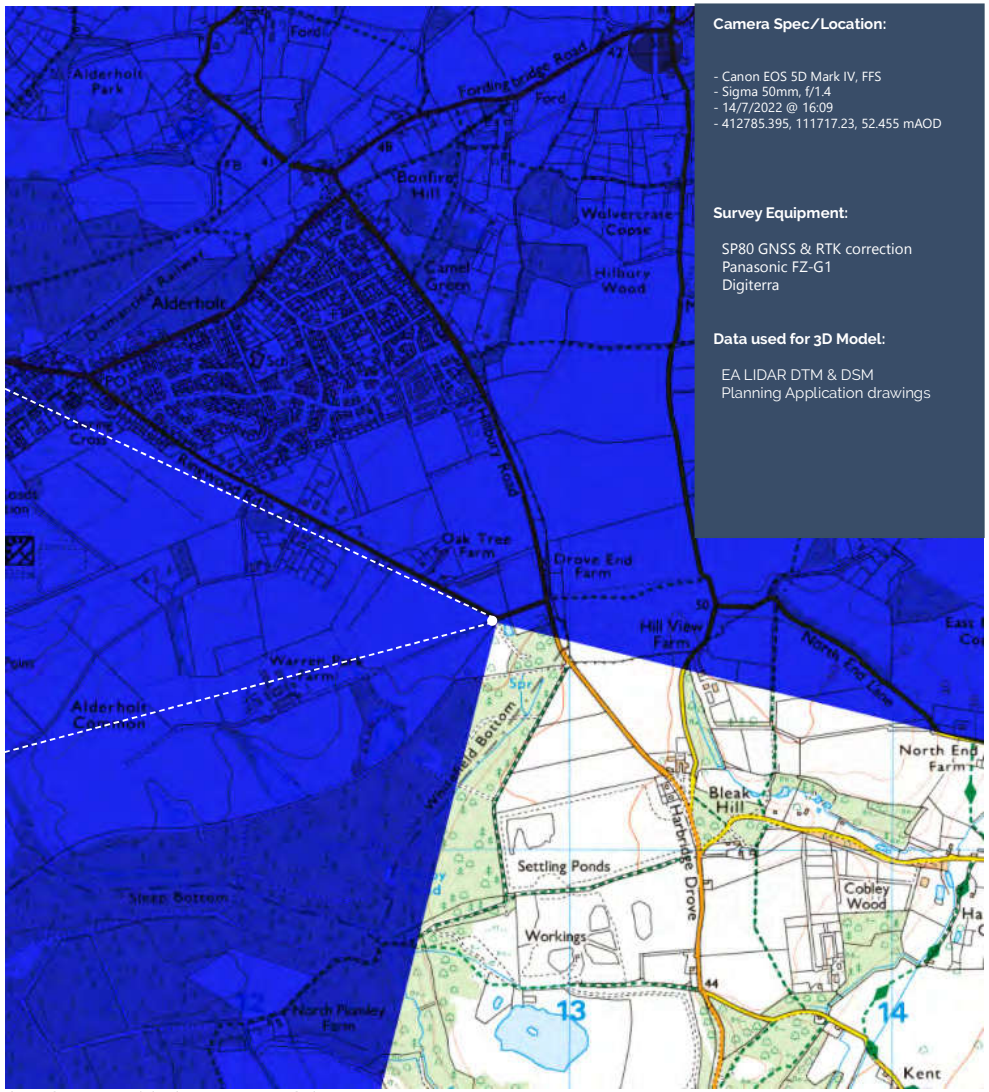
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 4 Winter Single Frame 50mm image

Viewpoint 4
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 16:09
- 412785.395, 111717.23, 52.455 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

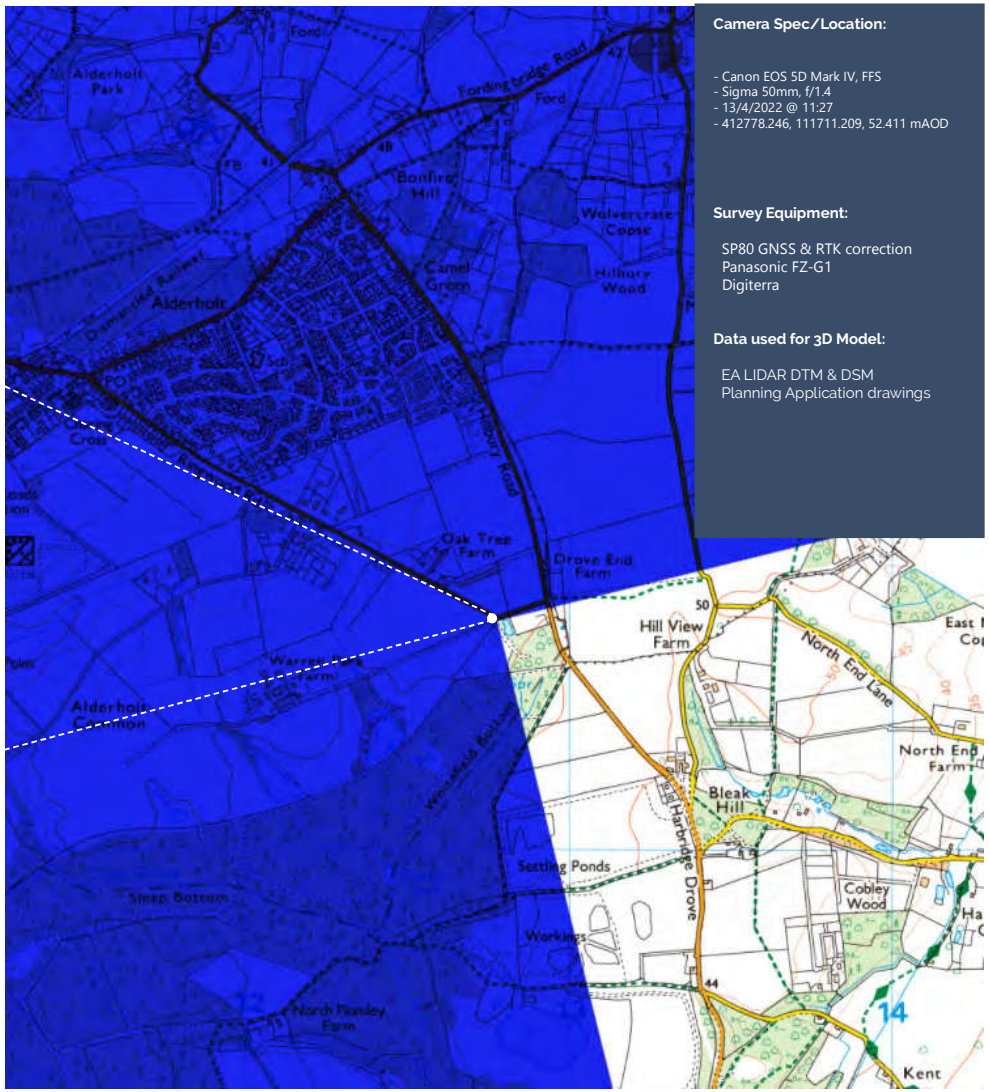
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 4 Summer Single Frame 50mm image

Viewpoint 5
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 11:27
- 412778.246, 111711.209, 52.411 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

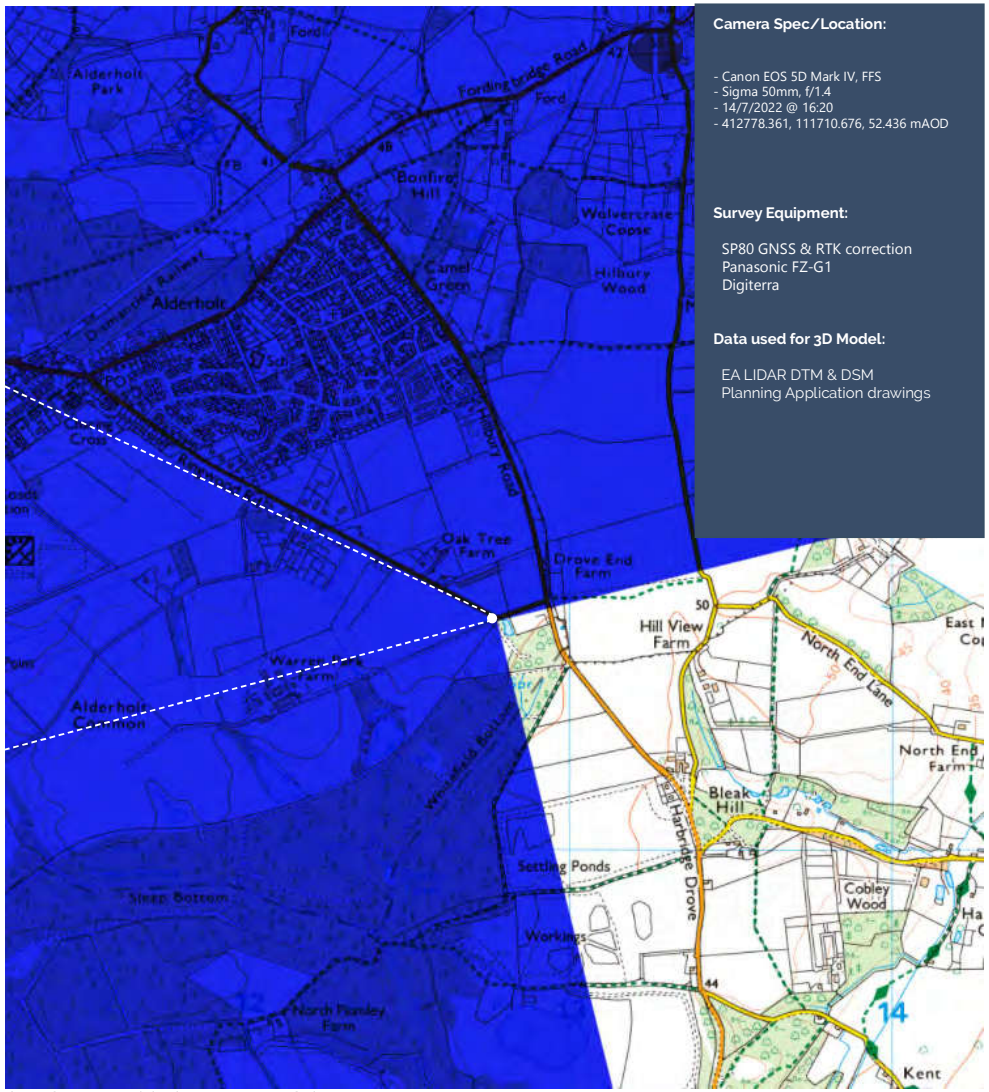
Tripod:

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 5 Winter Single Frame 50mm image

Viewpoint 5
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 16:20
- 412778.361, 111710.676, 52.436 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

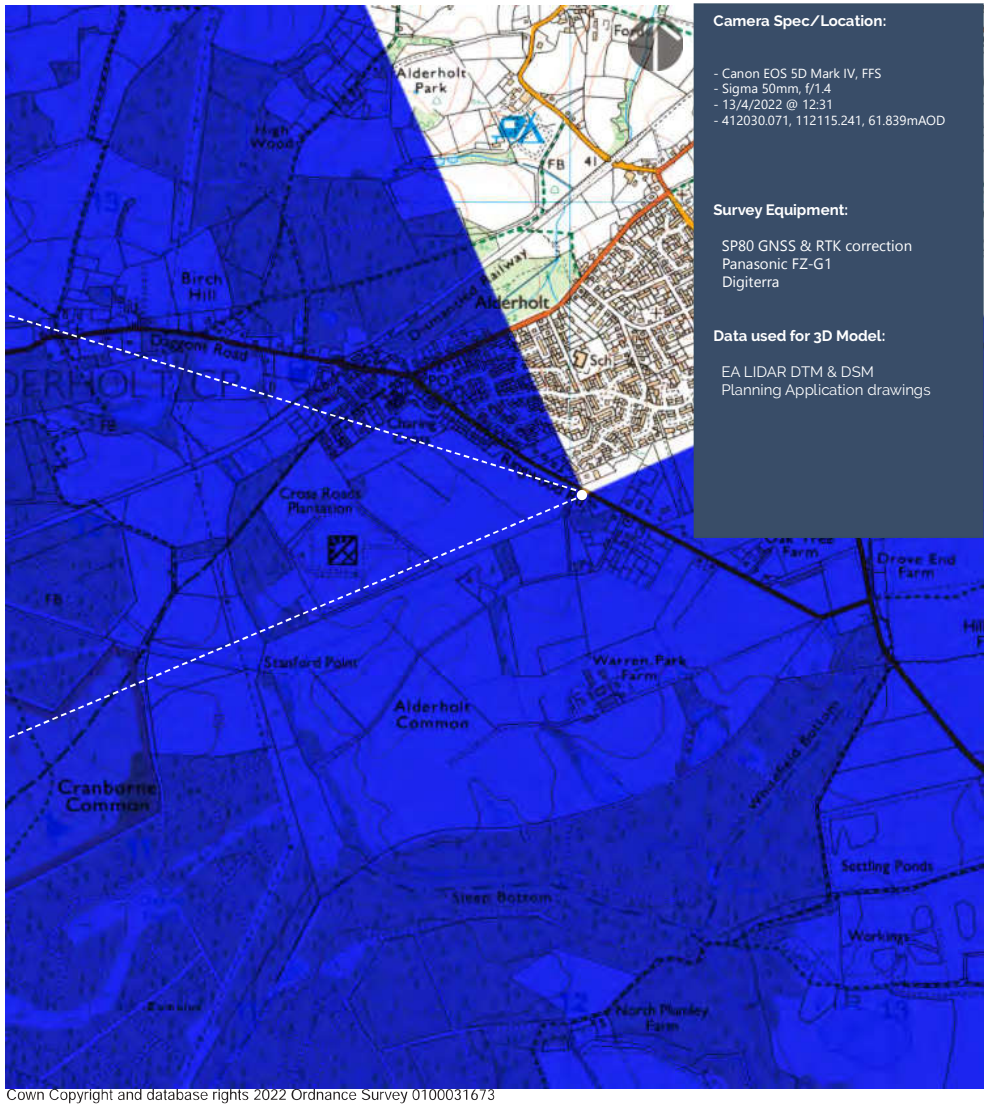
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 5 Summer Single Frame 50mm image

Viewpoint 6
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 12:31
- 412030.071, 112115.241, 61.839mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

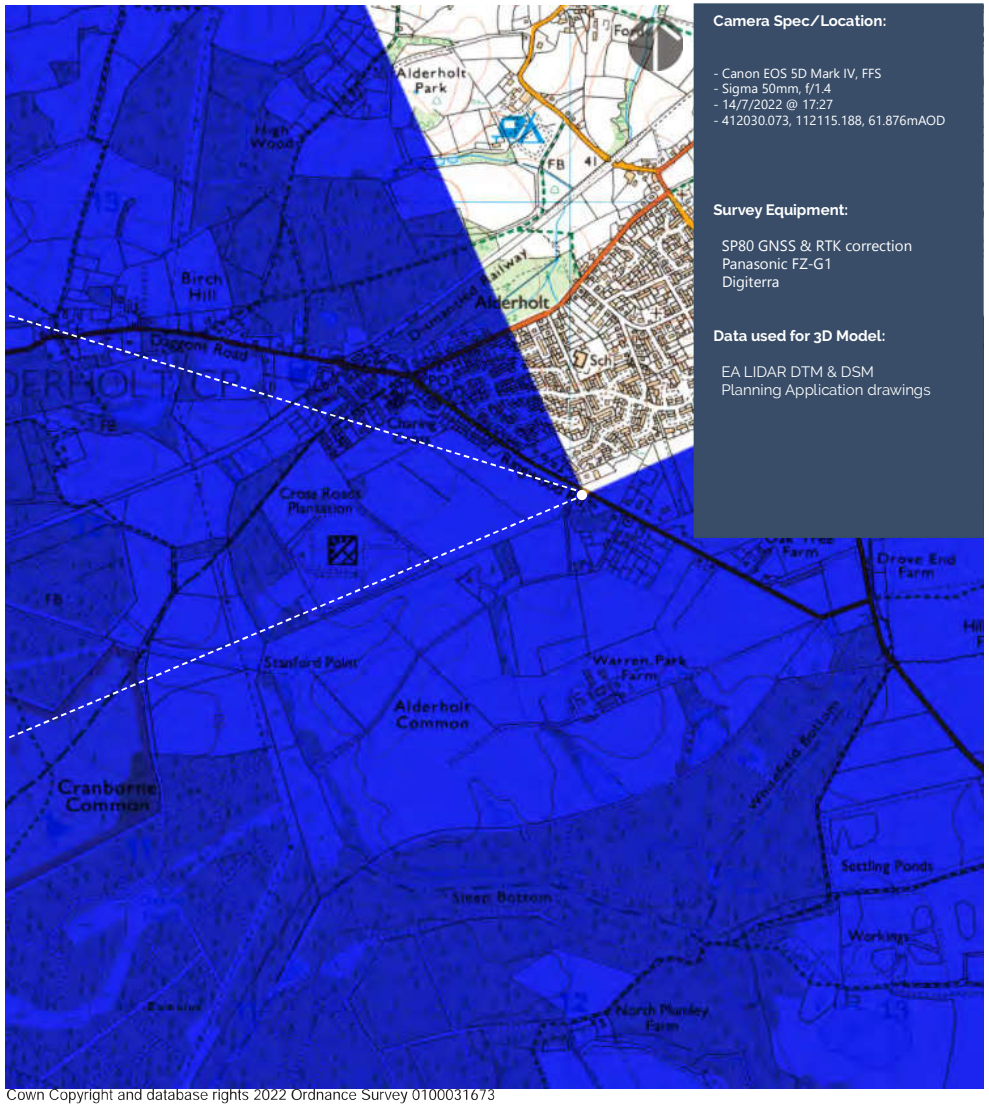
50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFoV)

Point of Perspective

Viewpoint 6 Winter Single Frame 50mm image

Viewpoint 6
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 17:27
- 412030.073, 112115.188, 61.876mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

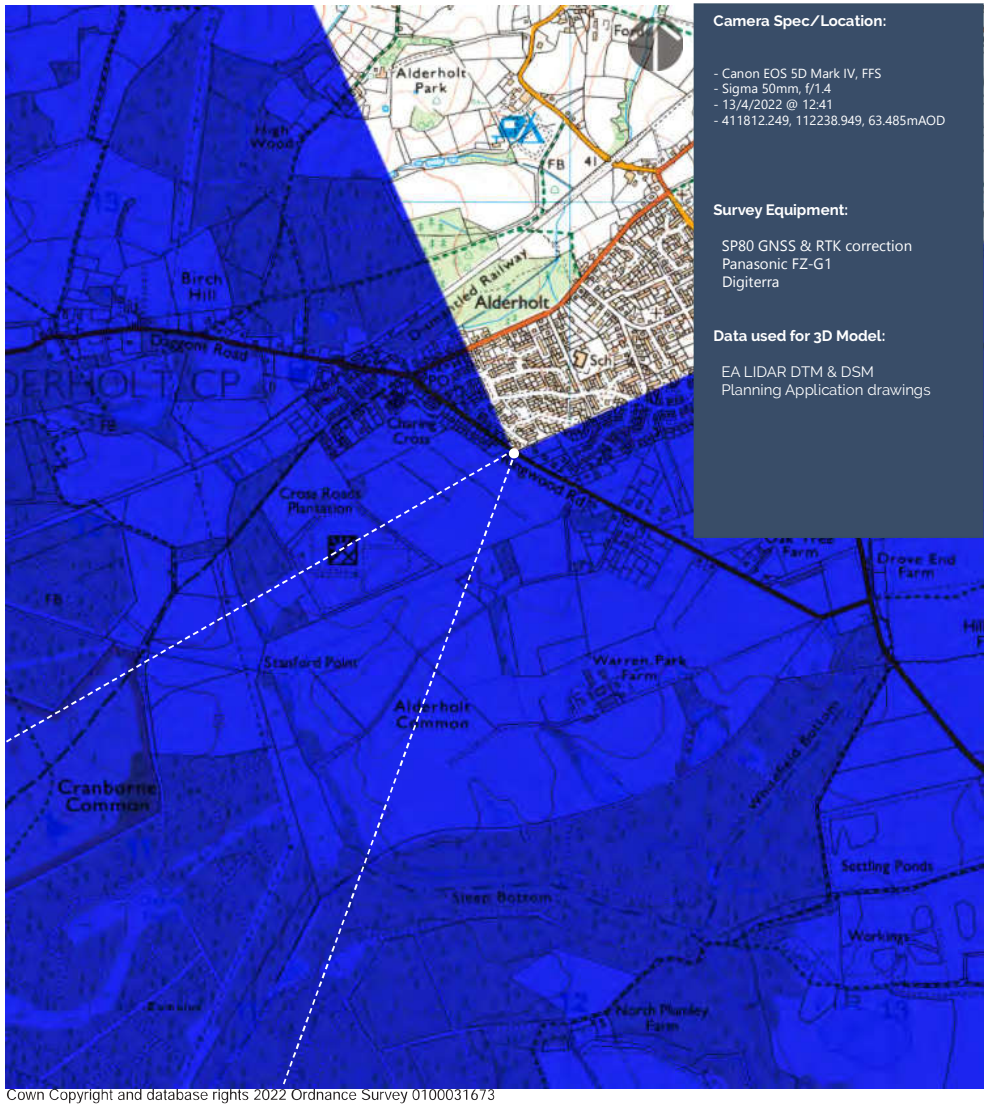
50mm Lens Planar Projection (actual 49.7mm; 39.9 deg HFoV)

Point of Perspective

Viewpoint 6 Summer Single Frame 50mm image

Viewpoint 7
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 12:41
- 411812.249, 112238.949, 63.485mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

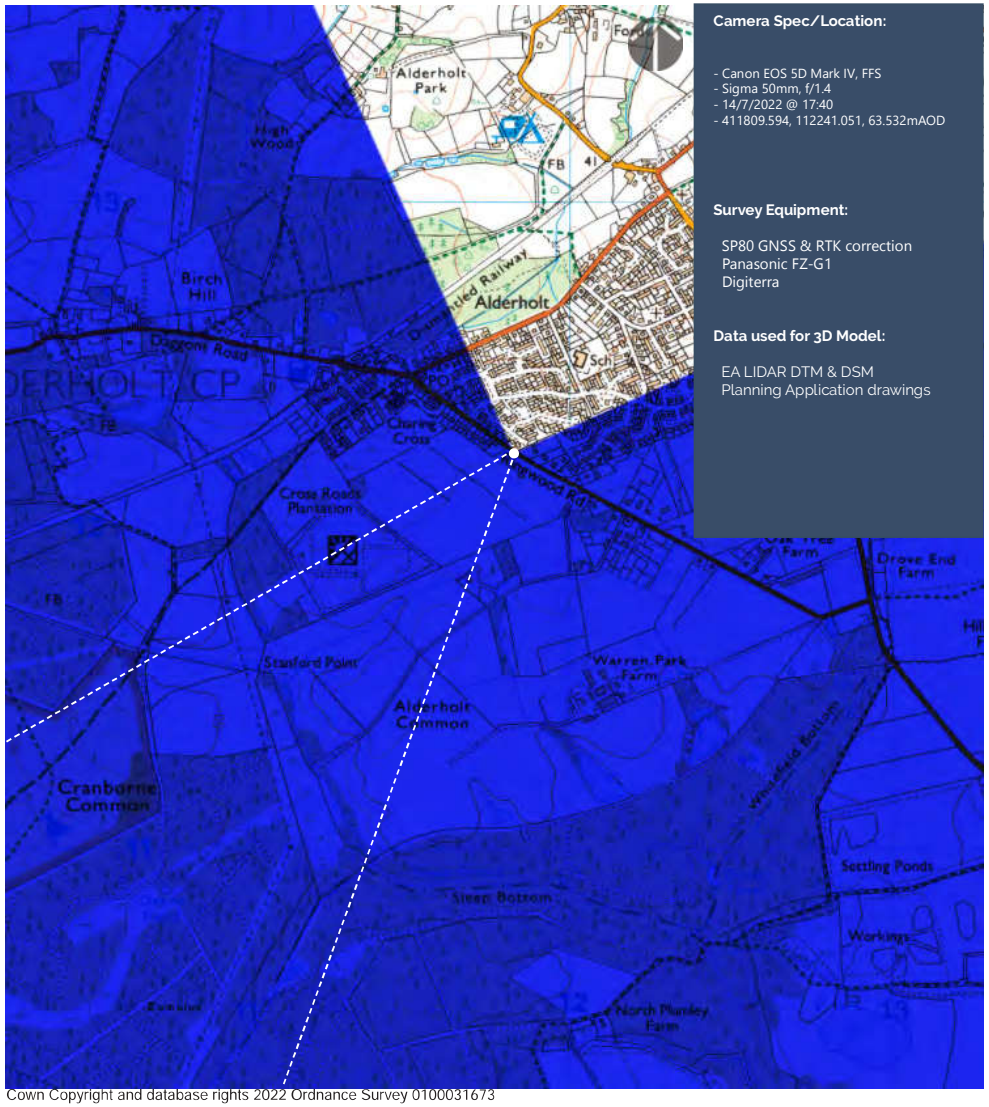
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 7 Winter Single Frame 50mm image

Viewpoint 7
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 17:40
- 411809.594, 112241.051, 63.532mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

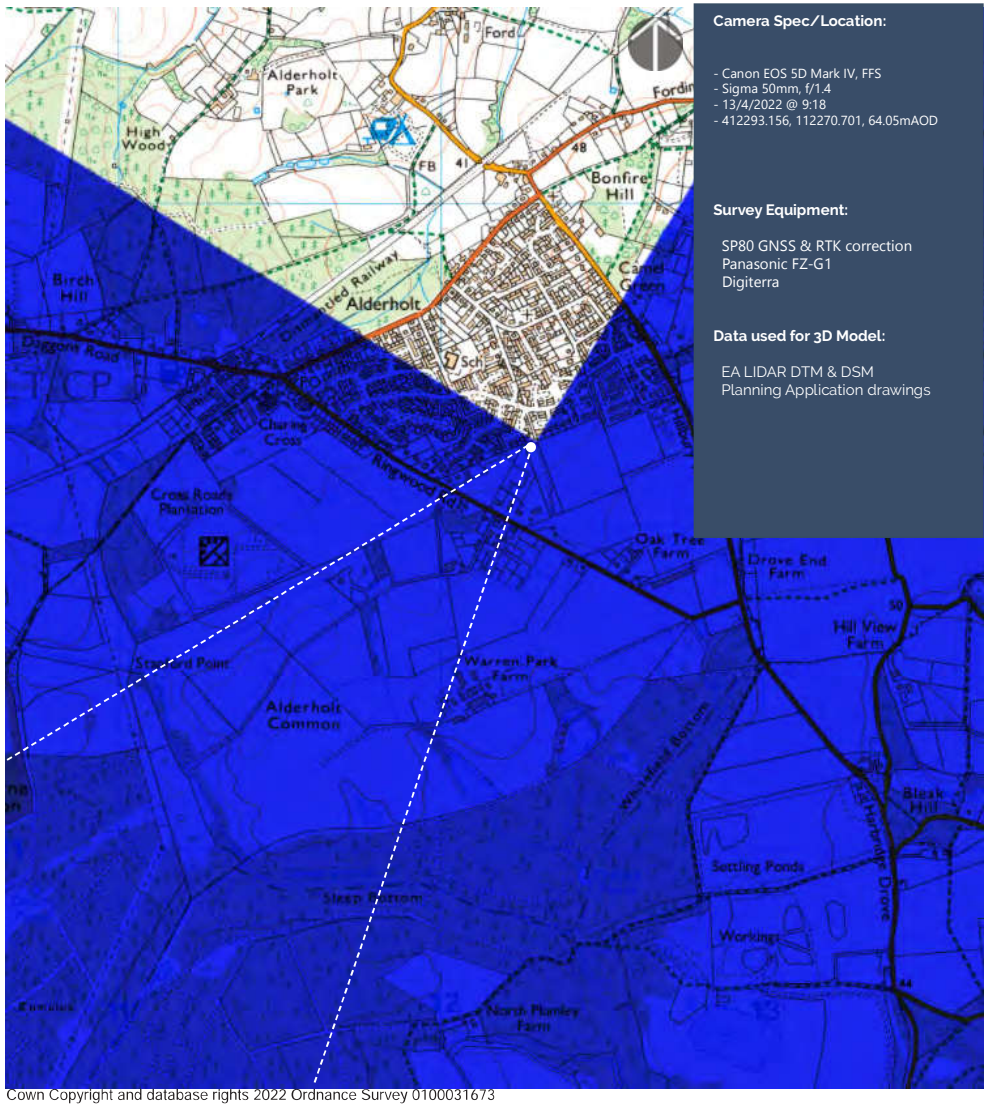
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 7 Summer Single Frame 50mm image

Viewpoint 8
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 9:18
- 412293.156, 112270.701, 64.05mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

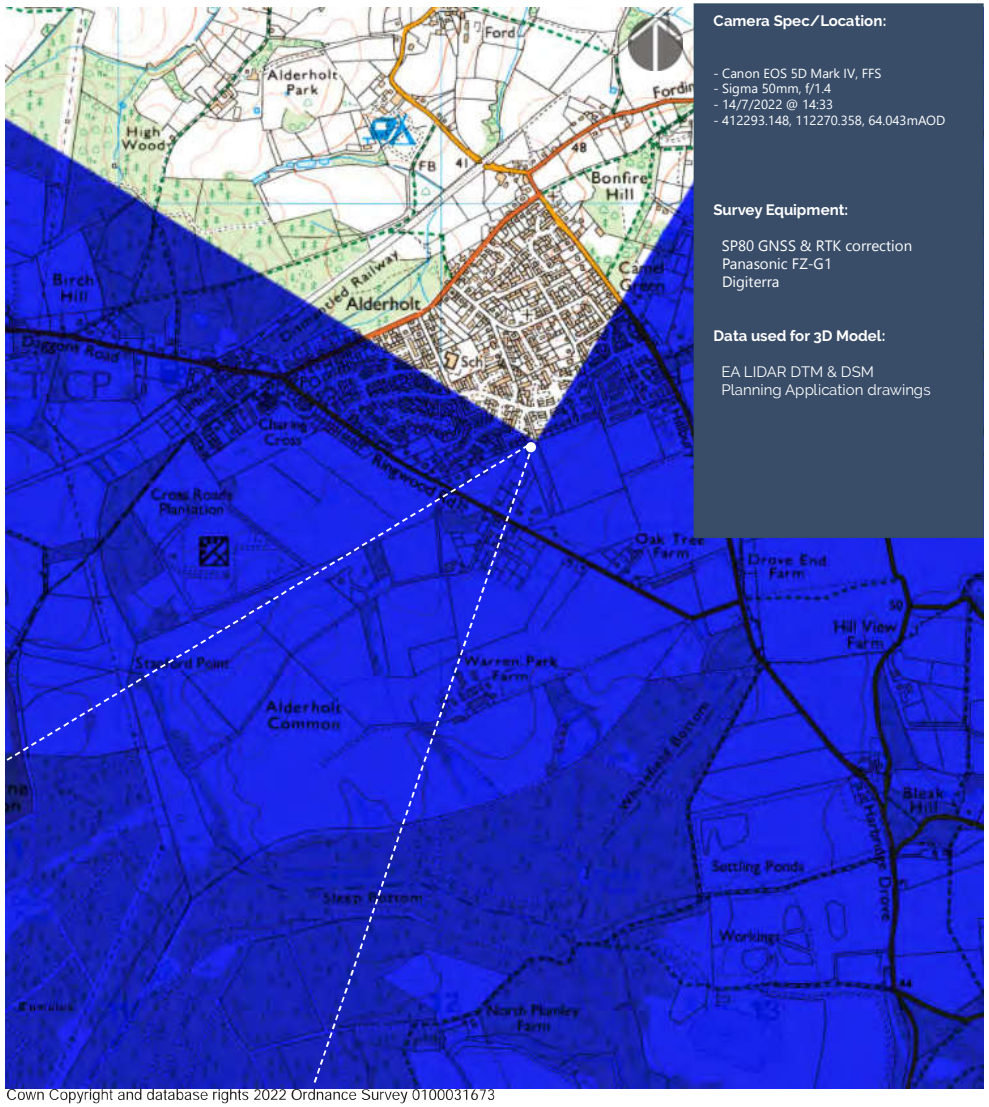
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 8 Winter Single Frame 50mm image

Viewpoint 8
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 14:33
- 412293.148, 112270.358, 64.043mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

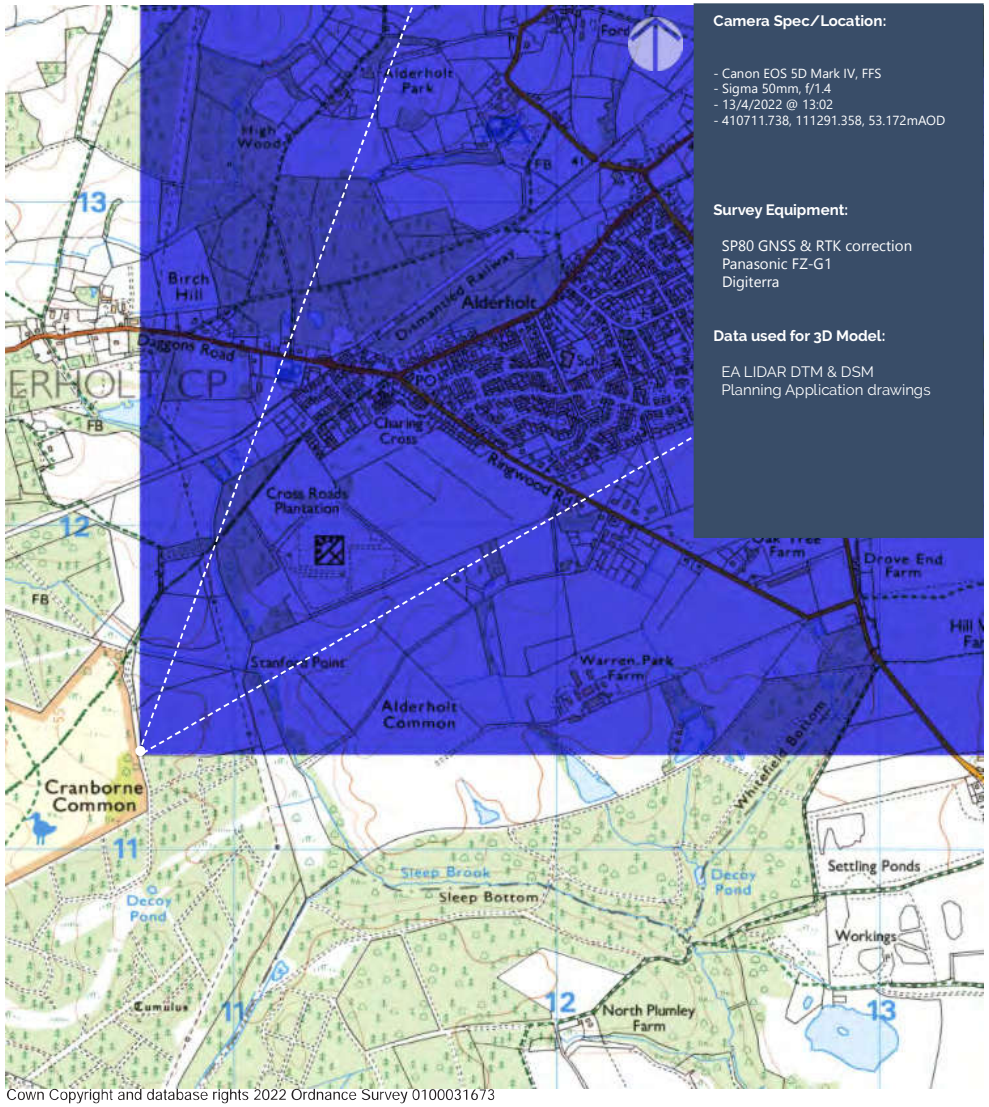
50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Point of Perspective

Viewpoint 8 Summer Single Frame 50mm image

Viewpoint 9
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 13:02
- 410711.738, 111291.358, 53.172mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

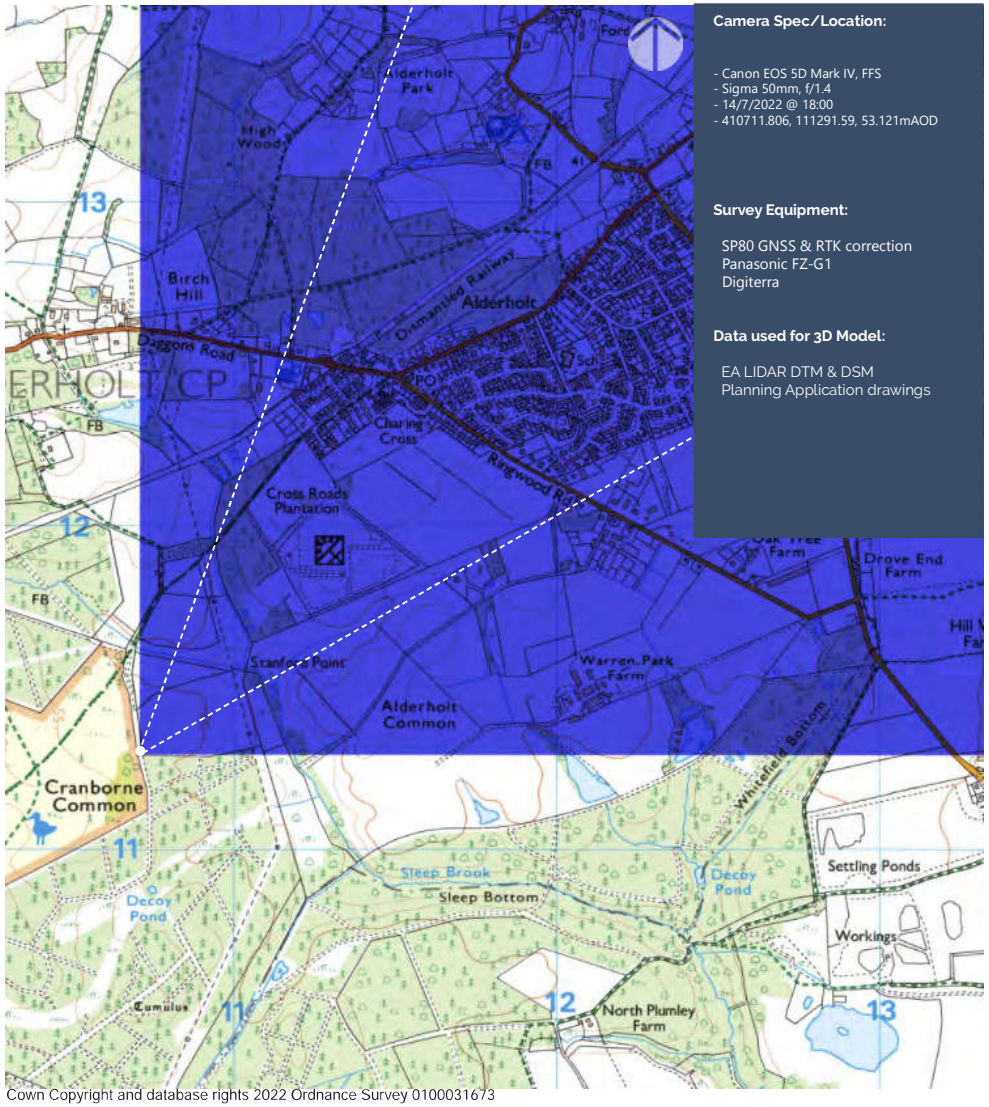
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 9 Winter Single Frame 50mm image

Viewpoint 9
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 18:00
- 410711.806, 111291.59, 53.121mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

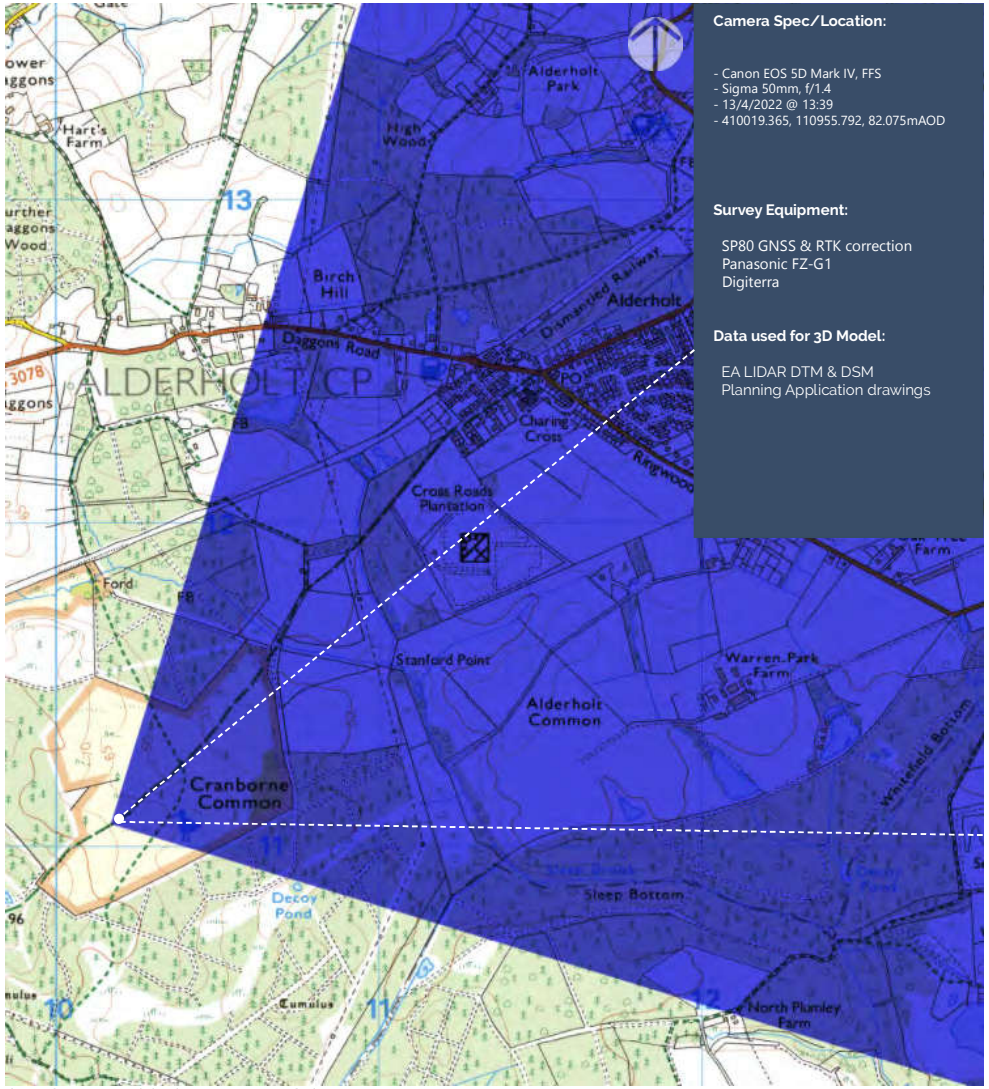
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 9 Summer Single Frame 50mm image

Viewpoint 10
Winter Photography

Camera Location:



Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

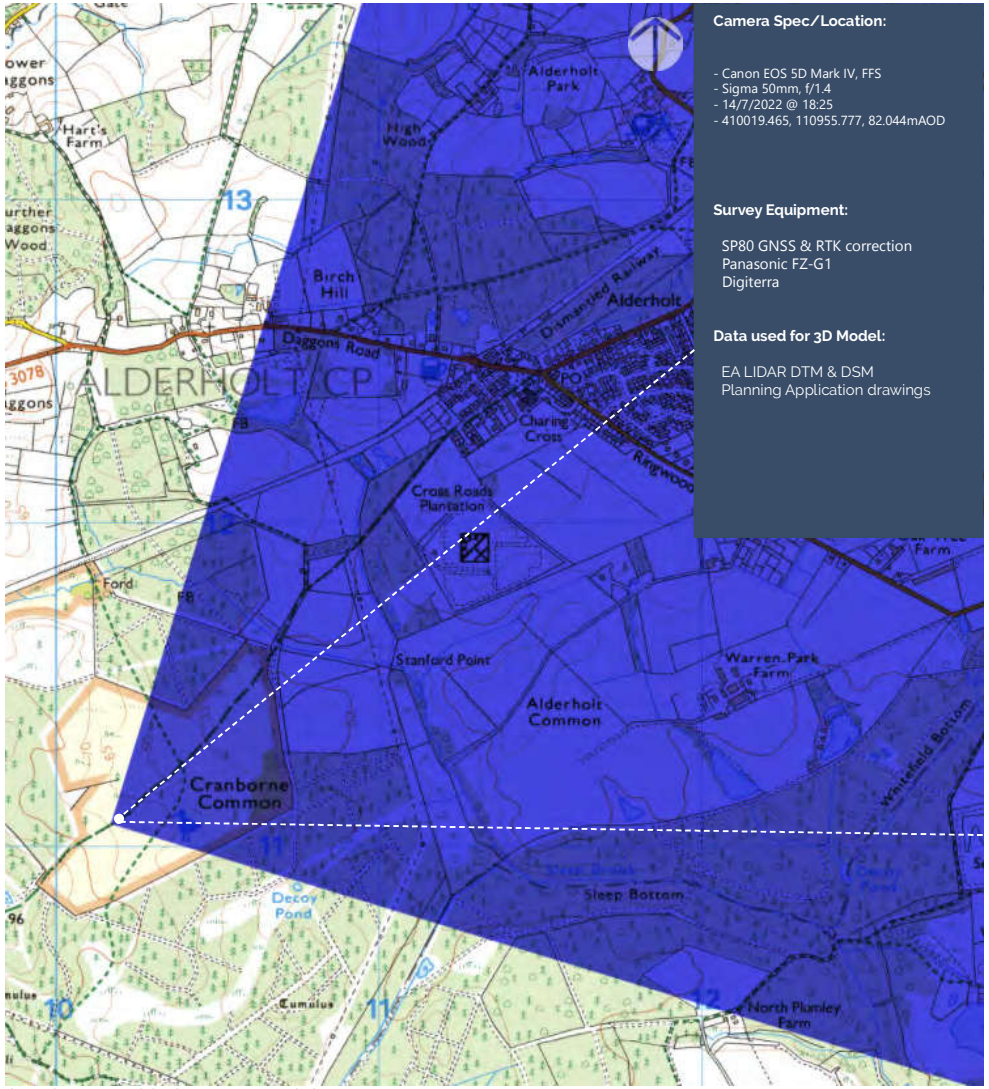
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 10 Winter Single Frame 50mm image

Viewpoint 10
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 18:25
- 410019.465, 110955.777, 82.044mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

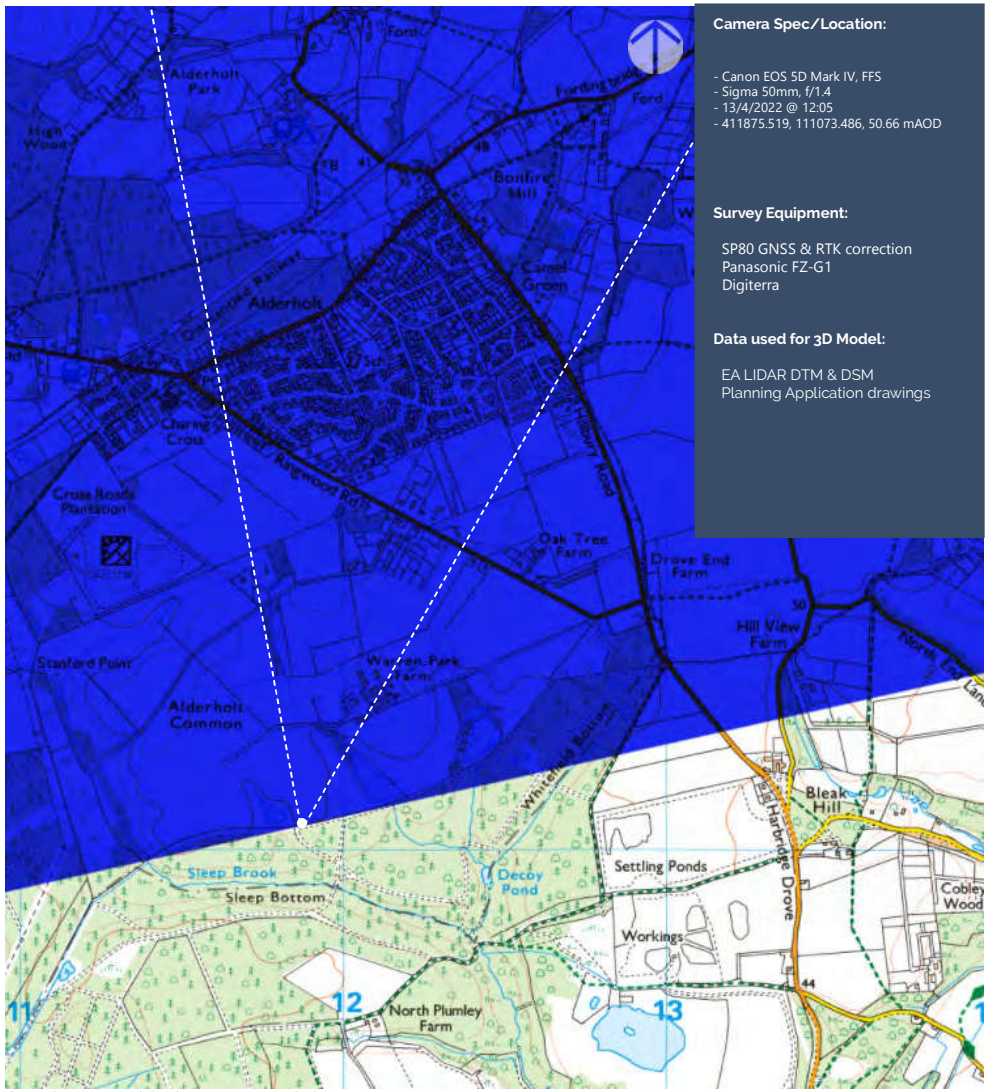
50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Point of Perspective

Viewpoint 10 Summer Single Frame 50mm image

Viewpoint 11
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 12:05
- 411875.519, 111073.486, 50.66 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

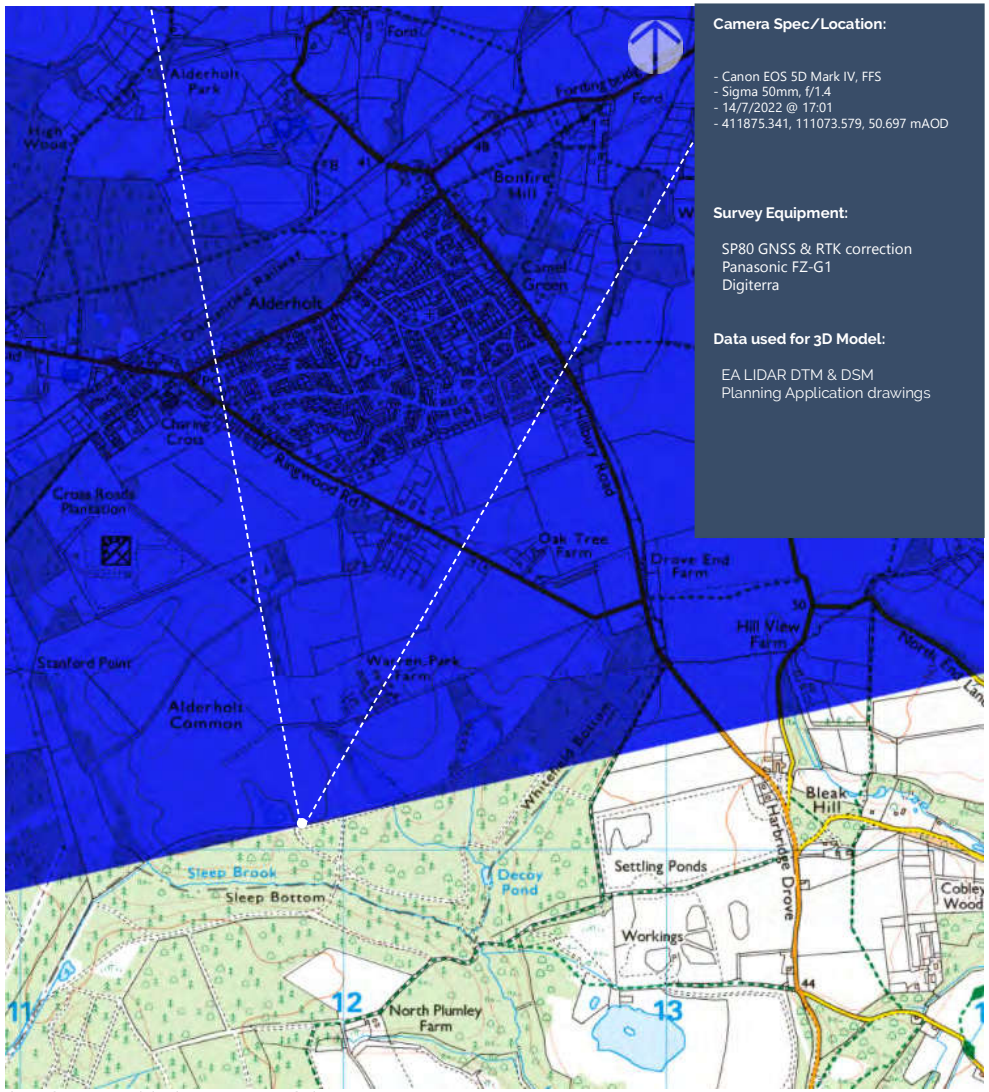
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 11 Winter Single Frame 50mm image

Viewpoint 11
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 17:01
- 411875.341, 111073.579, 50.697 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

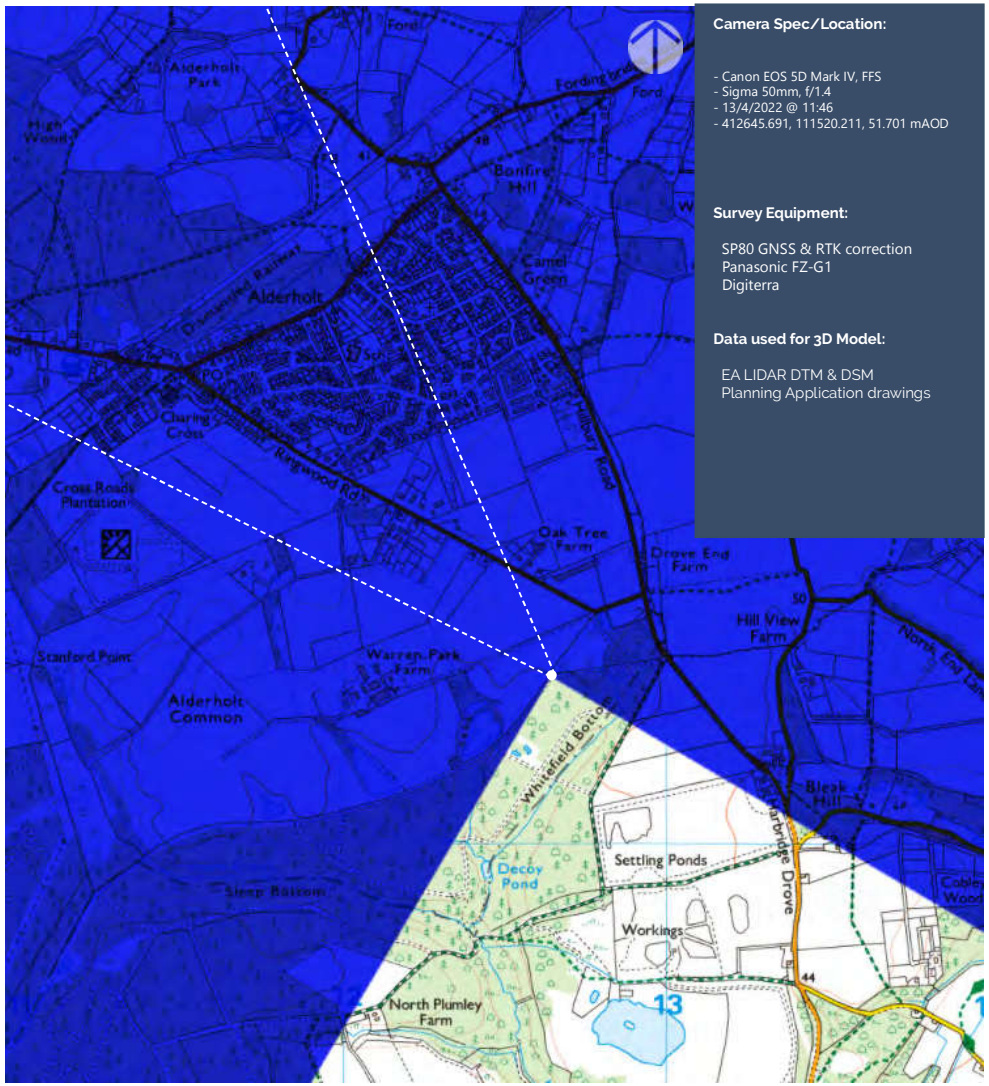
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 11 Summer Single Frame 50mm image

Viewpoint 12
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 11:46
- 412645.691, 111520.211, 51.701 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

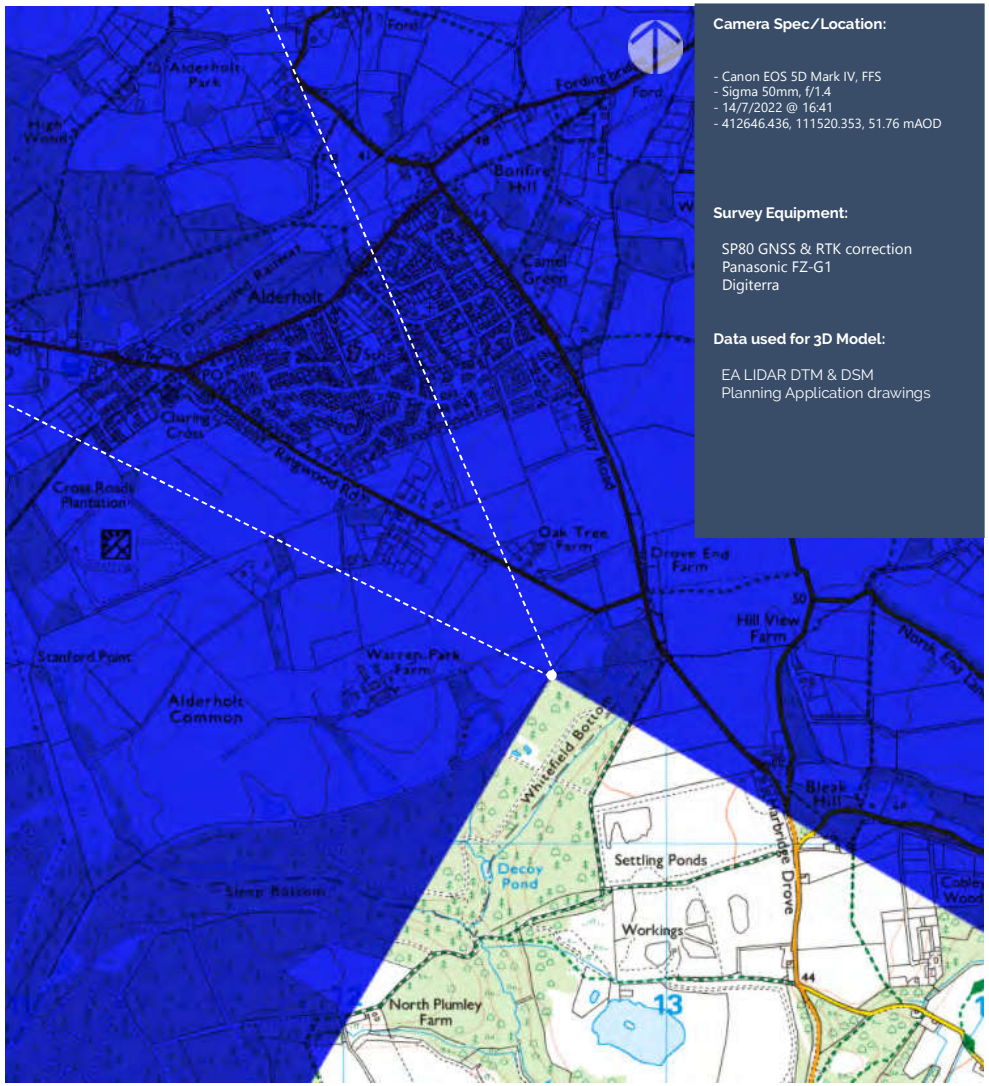
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 12 Winter Single Frame 50mm image

Viewpoint 12
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 16:41
- 412646.436, 111520.353, 51.76 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

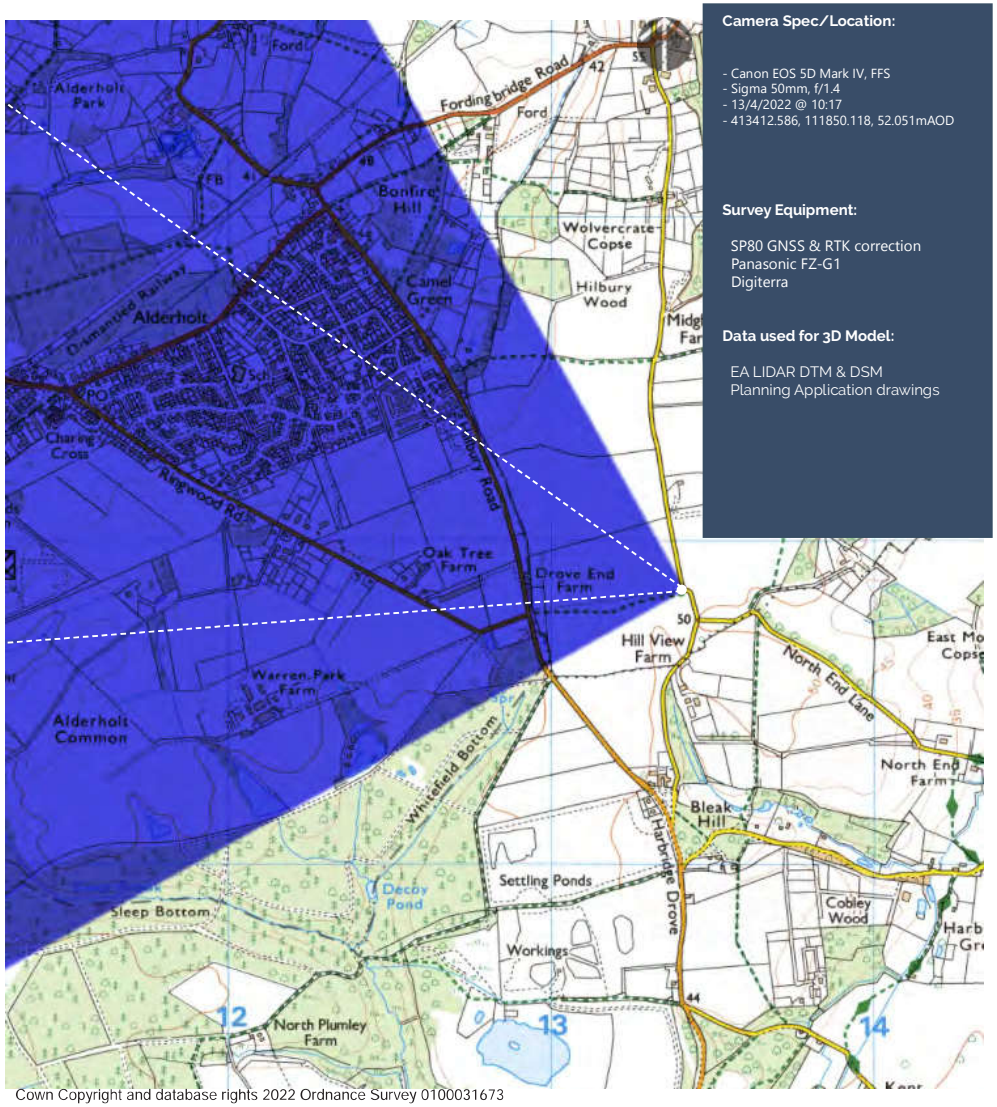
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 12 Summer Single Frame 50mm image

Viewpoint 13
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 10:17
- 413412.586, 111850.118, 52.051mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

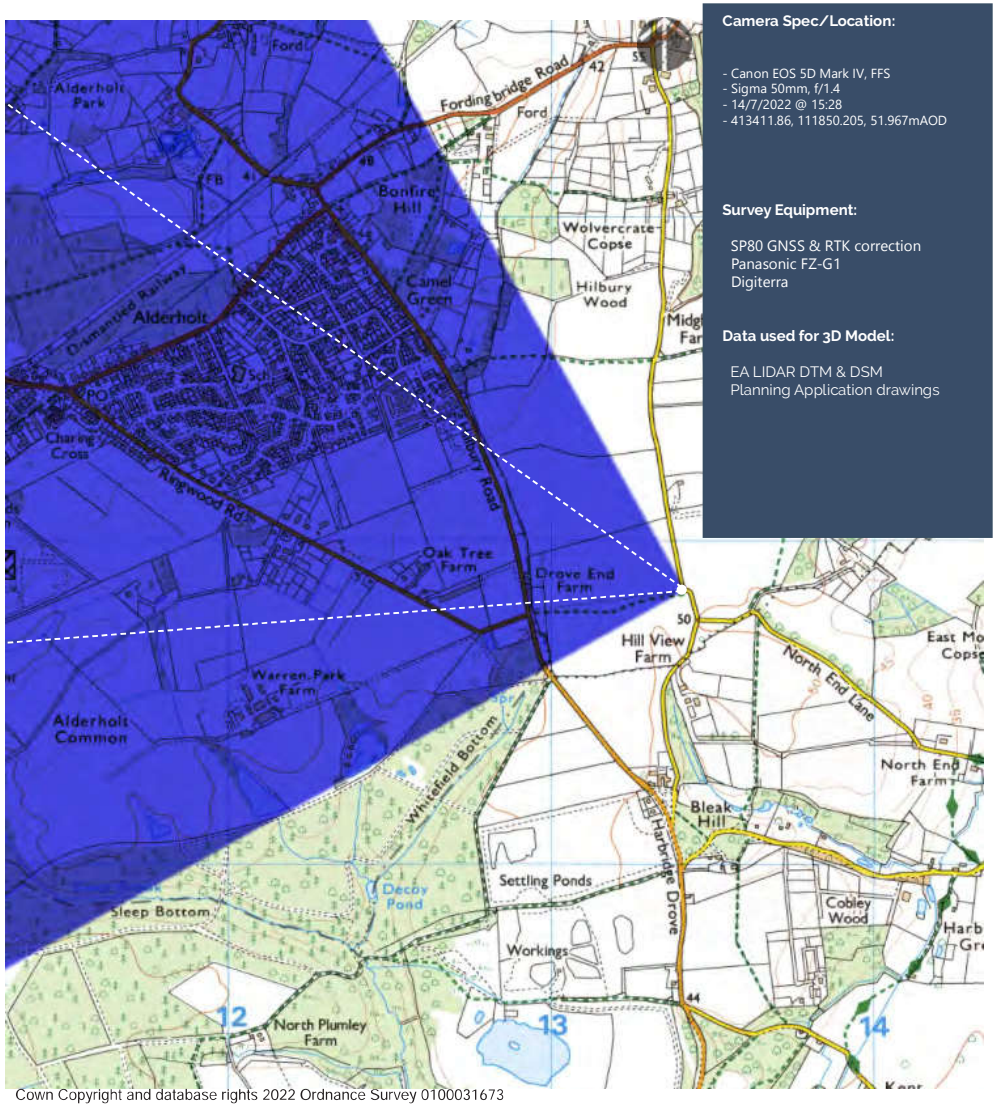
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 13 Winter Single Frame 50mm image

Viewpoint 13
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 15:28
- 413411.86, 111850.205, 51.967mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

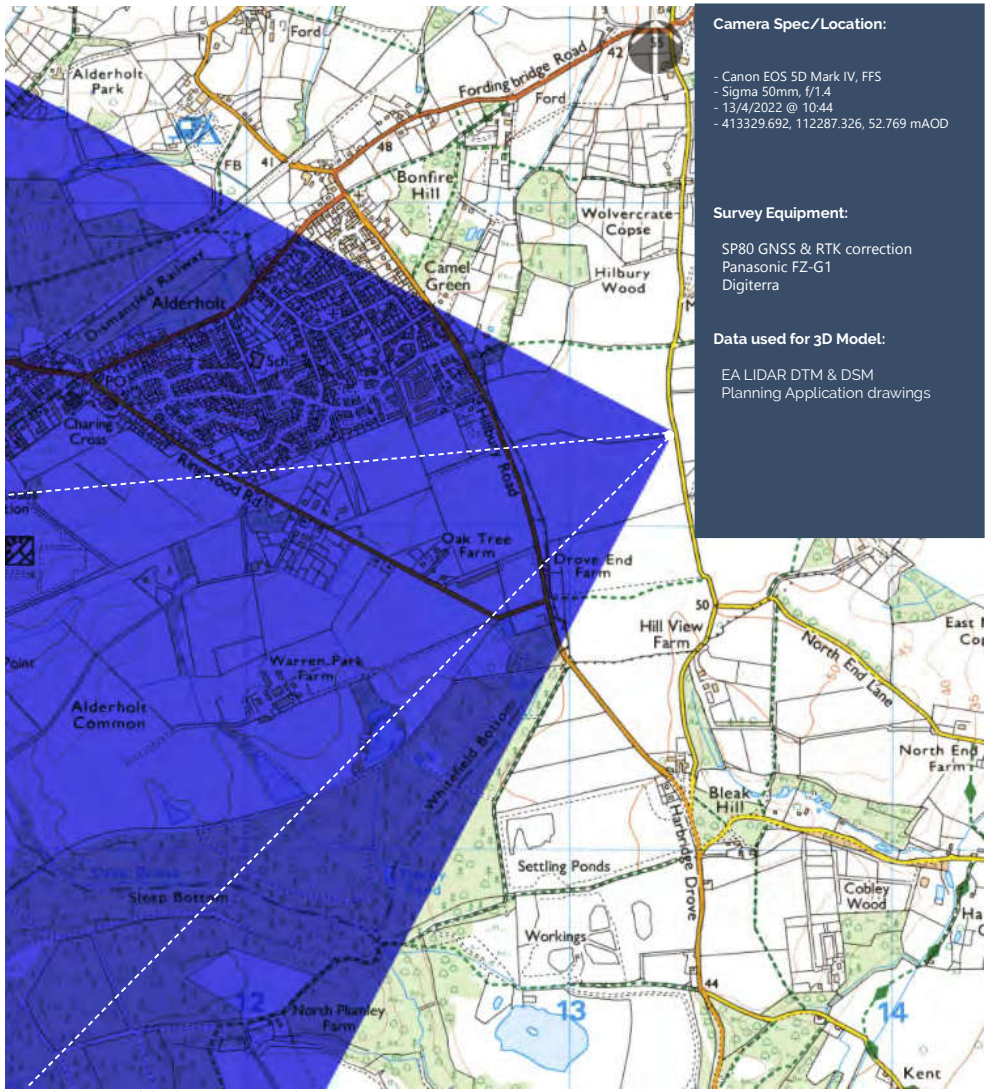
50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Point of Perspective

Viewpoint 13 Summer Single Frame 50mm image

Viewpoint 14
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 10:44
- 413329.692, 112287.326, 52.769 mAOD

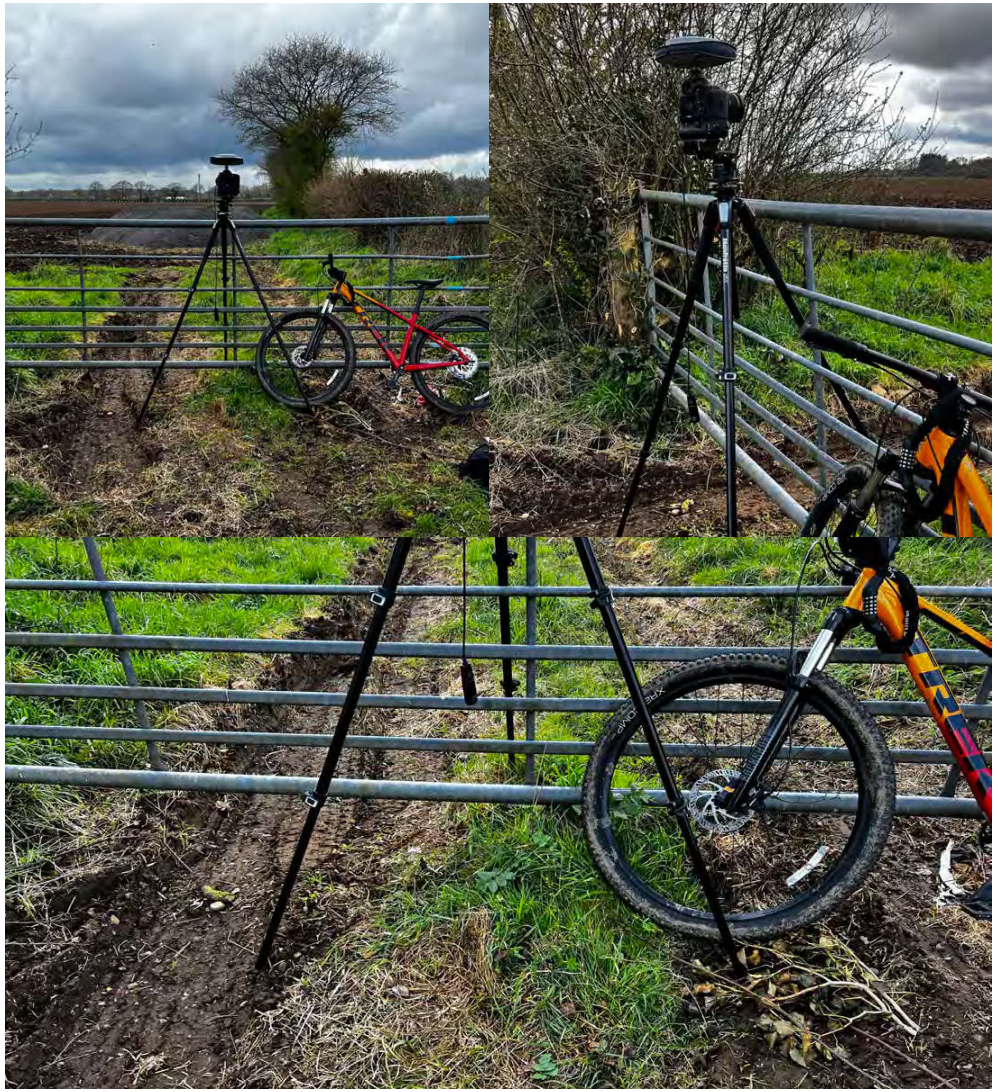
Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:



Point of Perspective

Point of Perspective

Point of Perspective

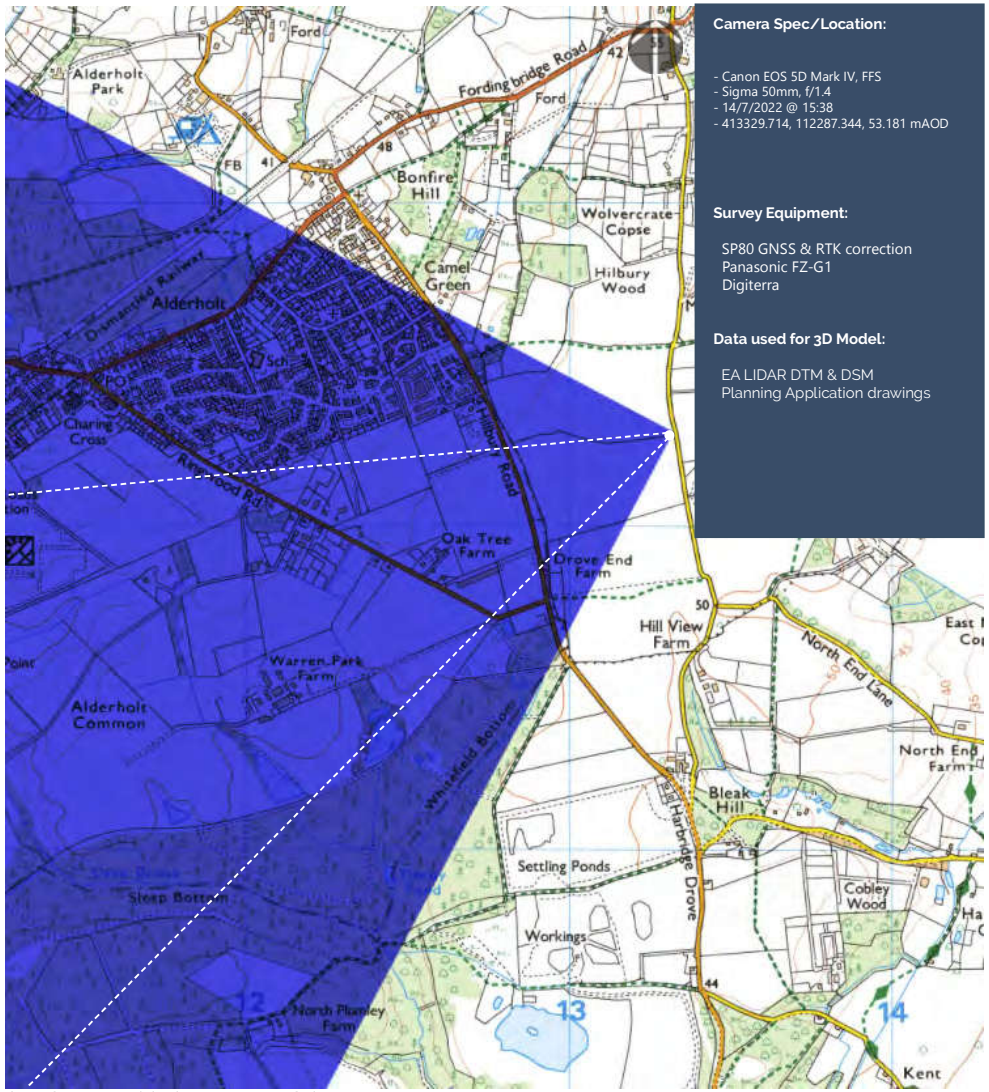
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 14 Winter Single Frame 50mm image

Viewpoint 14
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 15:38
- 413329.714, 112287.344, 53.181 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

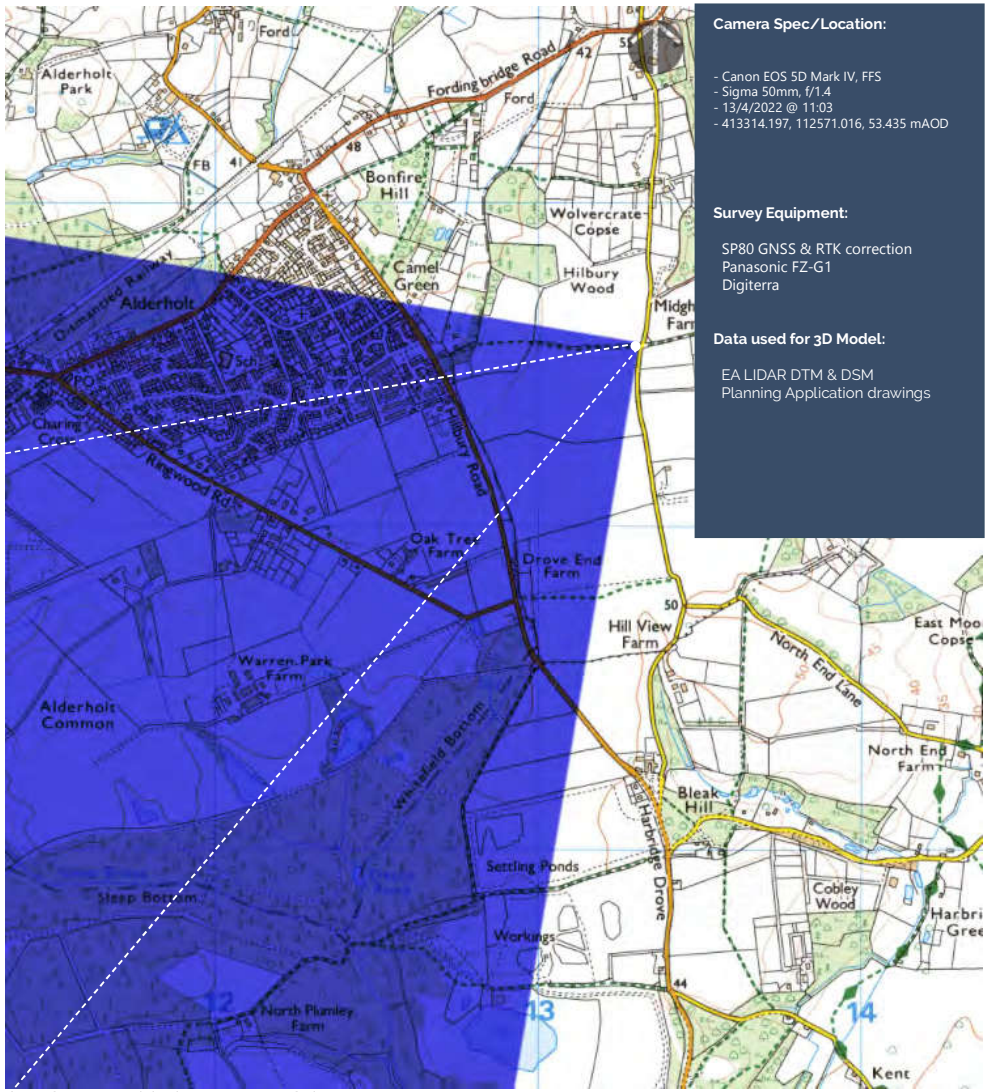
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 14 Summer Single Frame 50mm image

Viewpoint 15
Winter Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 13/4/2022 @ 11:03
- 413314.197, 112571.016, 53.435 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

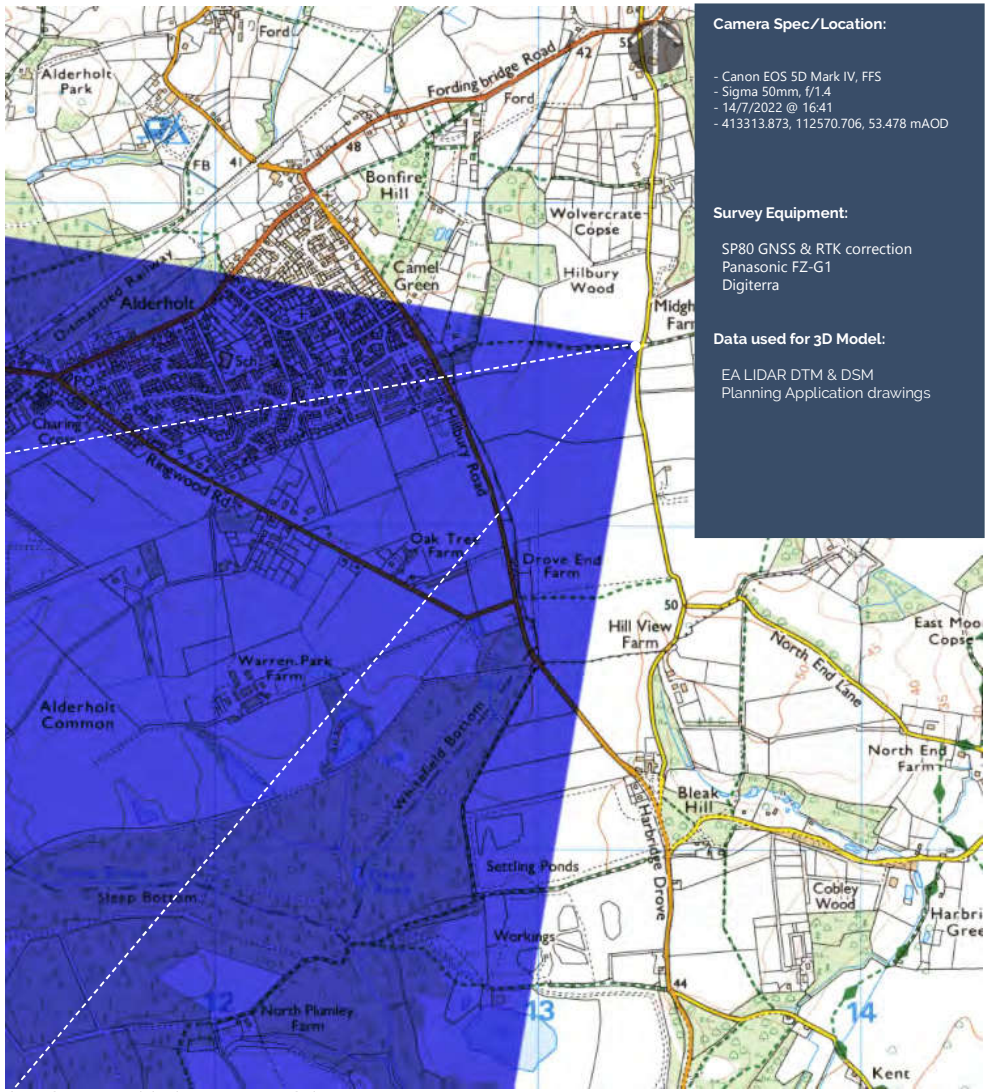
Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 15 Winter Single Frame 50mm image

Viewpoint 15
Summer Photography

Camera Location:



Camera Spec/Location:

- Canon EOS 5D Mark IV, FFS
- Sigma 50mm, f/1.4
- 14/7/2022 @ 16:41
- 413313.873, 112570.706, 53.478 mAOD

Survey Equipment:

SP80 GNSS & RTK correction
Panasonic FZ-G1
Digiterra

Data used for 3D Model:

EA LIDAR DTM & DSM
Planning Application drawings

Tripod:

Point of Perspective

Point of Perspective

Point of Perspective

Point of Perspective

50mm Lens Planar Projection (actual 49.6mm; 39.9 deg HFoV)

Viewpoint 15 Summer Single Frame 50mm image

APPENDIX 1.2: LAYOUT INFORMATION USED FOR 3D MODEL CONSTRUCTION

Indicative Site Layout
Alderholt Park, Dorset

APPENDIX 1.2: LAYOUT INFORMATION USED FOR 3D MODEL CONSTRUCTION

SPECTRA GEOSPATIAL

SP80

GNSS CHARACTERISTICS
- 240 GNSS channels
  - GPS L1C/A, L1P(Y), L2C, L2P(Y), L5
  - GLONASS L1C/A, L1P, L2C/A, L2P, L3
  - Beidou (Phase II) B1, B2
  - Galileo E1, E5a, E5b
  - QZSS L1C/A, L1-SAIF, L1C, L2C, L5
  - SBAS L1C/A, L5 (WAAS, EGNOS, MSAS, GAGAN, SDCM)
  - IRNSS L5
- Support for Trimble RTX™ real-time correction services
- Patented Z-Blade technology for optimal GNSS performance
  - Full utilization of signals from all 6 GNSS systems (GPS, GLONASS, BeiDou, Galileo, QZSS and SBAS)
  - Enhanced GNSS centric algorithms: fully independent GNSS signal tracking and optimal data processing, including GPS-only, GLONASS-only or BeiDou-only solution (Autonomous to full RTK)
  - Fast Search engine for quick acquisition and re-acquisition of GNSS signals
- Patented SBAS ranging for using SBAS code & carrier observations and orbits in RTK processing
- Patented Strobe™ Correlator for reduced GNSS multi-path
- Up to 20 Hz real-time raw data (code & carrier and position output)
- Supported data formats: ATOM, CMR, CMR+, RTCM 2.1, 2.2, 2.3, 3.0, 3.1 and 3.2 (including MSM), CMRx and sCMRx (rover only)
- NMEA 0183 messages output

REAL-TIME ACCURACY (RMS) [1][2][3]

SBAS (WAAS/EGNOS/MSAS/GAGAN)
- Horizontal: < 50 cm
- Vertical: < 85 cm

Real-Time DGPS position
- Horizontal: 25 cm + 1 ppm
- Vertical: 50 cm + 1 ppm

Real-Time Kinematic Position (RTK)
- Horizontal: 8 mm + 1 ppm
- Vertical: 15 mm + 1 ppm

Network RTK (i)
- Horizontal: 8 mm + 0.5 ppm
- Vertical: 15 mm + 0.5 ppm

REAL-TIME PERFORMANCE
- Instant-RTK® Initialization
  - Typically 2 sec for baselines < 20 km
  - Up to 99.9% reliability
- RTK Initialization range: over 40 km

POST-PROCESSING ACCURACY (RMS) [1][2][3]

Static & Fast Static
- Horizontal: 3 mm + 0.5 ppm
- Vertical: 5 mm + 0.5 ppm

High-Precision Static [4]
- Horizontal: 3 mm + 0.1 ppm
- Vertical: 3.5 mm + 0.4 ppm

DATA LOGGING CHARACTERISTICS

Recording Interval
- 0.05 - 999 seconds

PHYSICAL CHARACTERISTICS

Size
- 22.2 x 19.4 x 7.5 cm (8.7 x 7.6 x 3.0 in)

Weight
- 1.17 kg (2.57 lb)

User Interface
- Graphical PHOLED display
- WEB UI (accessible via WiFi) for easy configuration, operation, status, and data transfer

I/O Interface
- RS232 serial link
- USB 2.0 (HOST)
- Bluetooth 2.1 + EDR
- WiFi (802.11 b/g/n)
- 3.5G quad-band GSM (850/900/1800/1900 MHz) / penta-band UMTS module (800/850/900/1800/2100 MHz)

Memory
- 2 GB internal memory NAND Flash (1.5 GB user data)
- Over a year of 15 sec. raw GNSS data from 14 satellites
- SD/SDHC internal memory card (up to 32GB)

Operation
- RTK rover & base
- RTK network rover: VRS, FKP, MAC
- NTRIP, Direct IP
- GSM mode
- Post-processing
- RTK bridge
- UHF repeater
- UHF networking
- Trimble RTX (cellular/IP)

Environmental Characteristics
- Operating temperature: -40° to +65°C (-40° to +149°F) [5]
- Storage temperature: -40° to +85°C (-40° to +185°F) [6]
- Humidity: 100% condensing
- IP67 waterproof, sealed against sand and dust
- Drop: 2m pole drop on concrete
- Shock: ETS300 019
- Vibration : MIL-STD-810F

Power Characteristics
- 2 Li-Ion hot-swappable batteries, 33.5 Wh (2 x 7.4 V, 2820 mAh)
- Battery life time (two batteries): 10 hrs (GNSS On, and GSM or UHF Rx On)
- External DC power: 9-28 V

Standard System Components
- SP80 receiver
- 2 Li-Ion batteries
- Dual battery charger, power supply and international power cord kit
- Tape measure (3.6 m / 12 ft)
- 7 cm pole extension
- USB to mini-USB cable
- Hard case
- 2 year warranty

Optional System Components
- SP80 UHF Kit (410-470 MHz 2W TRx)
- SP80 Field Power Kit
- SP80 Office Power Kit
- Data collectors
  - Ranger 3
  - T41
  - MobileMapper 50
  - Nomad 1050
- Field software
  - Survey Pro
  - FAST Survey
  - Survey Mobile (Android)
  - SPace control app for 3rd party devices (Android)

1. Accuracy and TTFF specifications may be affected by atmospheric conditions, signal multipath, satellite geometry and corrections availability and quality.
2. Performance values assume minimum of five satellites, following the procedures recommended in the product manual. High multi-path areas, high PDOP values and periods of severe atmospheric conditions may degrade performance.
3. Long baselines, long occupations, precise ephemeris used.
4. At very low temperatures UHF module should not be used in the transmitter mode.
5. Without battery. Batteries can be stored up to +70°C.
6. Network RTK RMS values are referenced to the closest physical base station.
7. Receiver initialization time varies based on GNSS constellation health, level of multipath, and proximity to obstructions such as large trees and buildings.

TRIMBLE RTX INITIALIZATION [RTX10]

	Horizontal (RMS)	Initialization	GNSS
CENTERPOINT® RTX	<4 cm	<30 mins; <5 mins	L1 + L2

CONTACT INFORMATION:

Americas
10368 Westmoor Drive
Westminster, CO 80021 • USA
+1-720-587-4700 Phone
888-477-7516 (Toll Free in USA)

Europe, Middle East and Africa
Rue Thomas Edison
ZAC de la Fleuriaye - CS 60433
44474 Carquefou (Nantes) • FRANCE
+33-(0)2-28-09-38-00 Phone

Asia-Pacific
80 Marine Parade Road
#22-06, Parkway Parade
Singapore 449269 • SINGAPORE
+65-6348-2212 Phone

Please visit spectrageospatial.com for the latest product information and to locate your nearest distributor. Specifications and descriptions are subject to change without notice.

SP80
GNSS RECEIVER

The Spectra Geospatial SP80 is a next generation GNSS receiver that combines decades of GNSS RTK technology with revolutionary new GNSS processing. Featuring the new 240-channel "6G" chipset combined with the patented Z-Blade technology, the SP80 system is optimized for tracking and processing signals from all GNSS constellations in challenging environments.

As the most connected GNSS receiver in the industry, the SP80 offers a unique combination of integrated 3.5G cellular, Wi-Fi and UHF communications with SMS, email and anti-theft technology.

These powerful capabilities, packaged in an ultra-rugged housing and patented antenna design with unlimited operation time (hot-swappable batteries), make SP80 an extremely versatile turnkey solution.

KEY FEATURES

- Patented Z-Blade technology
- 240-channel 6G ASIC
- Hot-swappable batteries
- Internal TRx UHF radio
- 3.5G cellular modem
- Built-in WiFi communication
- SMS and e-mail alerts
- Anti-theft technology
- Backup RTK
- RTK Bridge
- eLevel technology
- Trimble RTX correction services

Patented inside-the-rod mounted UHF antenna design

UNIQUE 6G GNSS-CENTRIC TECHNOLOGY

Patented Z-Blade processing technology running on a next generation Spectra Geospatial 240-channel 6G ASIC fully utilizes all 8 GNSS systems: GPS, GLONASS, BeiDou, Galileo, QZSS and SBAS. Unlike GPS-centric technology which requires a minimum number of GPS satellites for GNSS processing, Z-Blades unique GNSS-centric capability optimally combines GNSS signals without dependency on any specific GNSS system: this allows SP80 to operate in GPS-only, GLONASS-only or BeiDou-only mode if needed. In addition, SP80 supports the recently approved RTCM 3.2 Multiple Signal Messages (MSM), a standardized definition for broadcasting all GNSS signals from space, regardless of their constellation. This protects the surveyor's investment well into the future by providing superior performance and improved productivity as new signals become available.

SMS AND EMAIL MESSAGING

SP80 has a unique combination of communication technologies including an integrated 3.5G GSM/UMTS modem, Bluetooth and Wi-Fi connectivity, and optional internal UHF transmit radio. The cellular modem may be used for SMS (text message) and e-mail alerts as well as regular Internet or VRS connectivity. SMS (text messages) can be used to monitor and configure the receiver. Likewise, SP80 can use all available RTK correction sources and connect to the Internet from the field using WiFi hotspots, where available. The internal UHF transmit/receive radio allows for quick and easy setup as a local base station. This saves time and increases the surveyor's efficiency.

ANTI-THEFT PROTECTION

A unique anti-theft technology secures SP80 when installed as a field base station in remote or public places and can detect if the product is disturbed, moved or stolen. This technology allows the surveyor to lock the device to a specific location and make it unusable if the device is moved elsewhere. In this case, SP80 will generate an audio alert and show an alert message on its display. Furthermore, a SMS or e-mail will be sent to the surveyor's mobile phone or computer and provides the receiver's current coordinates allowing tracking of its position and facilitating recovery of the receiver. SP80's anti-theft technology provides surveyors with remote security and peace of mind.

TRIMBLE RTX CAPABLE

Trimble RTX correction services offer a wide range of accuracy requirements ranging from better than 4 cm accuracies, up to sub-meter accuracies, without the need of an RTK base station. Trimble RTX is available for the SP80 GNSS receiver via cellular/IP delivery. The premium service, CenterPoint® RTX is the most accurate satellite-delivered correction service available today. With the SP80 GNSS receiver and a Trimble RTX correction, achieve high-accuracy positioning nearly anywhere in the world.

THE MOST POWERFUL TOOL FOR RELIABLE FIELD USE

The SP80's rugged housing, created by Spectra Geospatial's engineering design lab in Germany, incorporates a host of practical innovations. Dual hot-swappable batteries can be easily exchanged in the field as a one hand operation for an interruption-free working day, ensuring surveyors remain productive until the job is done. The impact-resistant glass-fiber reinforced casing, designed to withstand 2m pole drops and waterproof to IP67, ensures that SP80 can handle the toughest outdoor conditions. The patented UHF antenna, set inside the rugged carbon fiber rod, extends the range of RTK radio performance at the same time as armoring protection. The sunlight-readable display offers instant access to key information like the number of satellites, RTK status, battery charge and available memory. With eLevel technology, the user is able to focus in one place when leveling and measuring as well as automatically store measurements when the receiver is level. These powerful design features combine to make SP80 the most capable, most reliable GNSS receiver, backed by a comprehensive standard 2 year warranty.

THE SPECTRA GEOSPATIAL EXPERIENCE

With the most advanced and rugged field data collectors from Spectra Geospatial, surveyors get maximum productivity and reliability every day. Spectra Geospatial Survey Pro or FAST Survey software is specifically tailored for the SP80 GNSS receiver providing easy-to-use, yet powerful GNSS workflows, letting the surveyor concentrate on getting the job done. Spectra Geospatial Survey Office Software provides a complete office suite for post-processing GNSS data and adjusting survey data, as well as exporting the processed results directly back to the field or to engineering design software packages. Combined with Spectra Geospatial field and office software, SP80 is a very powerful and complete solution.

TOUGHPAD FZ-G1

Panasonic recommends Windows.

SOFTWARE
- Windows 10 Pro 64 bit
- Panasonic Utilities (including Dashboard), Recovery Partition

DURABILITY
- MIL-STD-810G certified (4' drop, shock, vibration, rain, dust, sand, altitude, freeze/thaw, high/low temperature, temperature shock, humidity, explosive atmosphere)
- IP65 certified sealed all-weather design
- Optional class I division 2, groups ABCD certified model
- Solid state drive heater
- Magnesium alloy chassis encased with ABS and elastomer corner guards
- Optional hand strap or rotating hand strap
- Port covers
- Raised bezel for LCD impact protection
- Pre-installed replaceable screen film for LCD protection

CPU
- Intel® Core™ i5-6300U vPro™ Processor
  - 2.4 GHz up to 3.0 GHz with Intel® Turbo Boost Technology
  - Intel Smart Cache 3MB

STORAGE & MEMORY
- 8GB DDR3L SDRAM[4,5]
- 256GB solid state drive (SSD) with heater[4,5]
- Optional 512GB
  - up to 64GB additional storage with optional microSDXC card slot

DISPLAY
- 10.1" WUXGA 1920 x 1200 with LED backlighting
- 10-point capacitive multi touch + Waterproof Digitizer pen daylight-readable screen
  - 2-800 nit
  - IPS display with direct bonding
  - Anti-reflective and anti-glare screen treatments
  - Ambient light sensor, digital compass, gyro and acceleration sensors
  - Automatic screen rotation
  - Intel® HD Graphics 520 (Built-in CPU) video controller
- Concealed mode (configurable)

AUDIO
- Integrated microphone
- Realtek high-definition audio
- Integrated speaker
- On-screen and button volume and mute controls

KEYBOARD & INPUT
- 10-point gloved multi touch + digitizer screen
  - Supports bare-hand touch and gestures and electronic waterproof stylus pen
  - Supports glove mode and wet-touch mode
- 7 tablet buttons (2 user-definable)
- Integrated stylus holder
- On-screen QWERTY keyboard

CAMERAS
- 720p webcam with mic
- 8MP rear camera with autofocus and LED light

EXPANSION
- Optional MicroSDXC3

INTERFACE

Docking connector	24-pin
HDMI	Type A
Headphones/speaker	Mini-jack stereo
Optional Serial Dongle[3]	D-sub 9-pin
USB 3.0 (x 1)[2]	4-pin
Optional second USB 2.0[3]	4-pin
Optional 10/100/1000 Ethernet[3]	RJ-45

WIRELESS
- Optional integrated 4G LTE multi carrier mobile broadband with satellite GPS
- Optional GPS (u-blox NEO M8N)[3]
- Intel® Dual Band Wireless-AC 8260 (IEEE802.11a/b/g/n/ac)
- Bluetooth v4.1, Classic mode/ Low Energy mode, Class 1 (Windows 10 pro 64-bit)
- Security
  - Authentication: LEAP, WPA, 802.1x, EAP-TLS, EAP-FAST, PEAP
  - Encryption: CKIP, TKIP, 128-bit and 64-bit WEP, Hardware AES
- Dual high-gain antenna pass-through

POWER SUPPLY
- Li-ion battery pack:
  - Standard battery: Li-ion 11.1 V, 4200 mAh (typ.), 4080 mAh (min.)
  - Optional long life battery[1]: Li-ion 10.8V, 9300mAh(typ.), 8700mAh (min.)
- Battery operation[1]:
  - Standard battery: 14 hours
  - Optional long life battery[1]: 28 hours
- Battery charging time[1]:
  - Standard battery: 2.5 hours off, 3 hours on
  - Optional long life battery[1]: 3 hours off, 4 hours on
- Optional bridge battery[2] (1 minute swap time)

POWER MANAGEMENT
- Suspend/Resume Function, Hibernation, Standby

SECURITY FEATURES
- Password Security: Supervisor, User, Hard Disk Lock
- Kensington cable lock slot
- Trusted platform module (TPM) security chip v.2.0[12]
- Computrace® theft protection agent in BIOS8
- Optional Insertable SmartCard reader[2]
- Optional Contactless SmartCard/HF RFID reader[2]
  - ISO 15693 and 14443 A/B compliant

WARRANTY
- 3-year limited warranty, parts and labor

DIMENSIONS & WEIGHT[9]
- 10.6"(L) x 7.4"(W) x 0.8"(H)
- 2.4 lbs. (standard battery)
- 3.0 lbs. (optional long life battery)[1]

INTEGRATED OPTIONS[10]
- 4G LTE multi carrier mobile broadband with satellite GPS
- Choice of 1D/2D barcode reader (EA11 or EA21), GPS, Serial Dongle, Ethernet, MicroSDXC or second USB 2.0 port[3]
- Choice of bridge battery, magstripe reader, insertable SmartCard reader, insertable SmartCard reader with bridge battery, contactless SmartCard/RFID HF reader or UHF 900MHz RFID reader (EPC Gen 2)[2,7]

ACCESSORIES[10]

AC Adapter (3-prong)	CF-AA6413CM
Standard Battery Pack	FZ-VZSU84A2U
Long Life Battery Pack[1]	FZ-VZSU88U
Long Life Battery Bundle (includes rotating hand strap and corner guard set)	FZ-BNDLG1LL1ST1CG4
Single Battery Charger Bundle	FZ-BNDLG1BATCHRG
LIND 3-Bay Battery Charger	FZ-LND3BAYSG1
LIND Car Adapter 120W	CF-LNDDC120
LIND Car/AC Adapter 90W (with USB port)	CF-LNDACDC90
LIND Car Adapter 90W MIL-STD	CF-LNDMLDC90
Tall Corner Guard Set	FZ-WCGG111
Rotating Hand Strap and Tall Corner Guard Set Bundle	FZ-BNDLG1ST1CG4
ToughMate G1 Always-On Case (with hand strap)	TBCG1AONL-P
ToughMate G1 Professional Portfolio	TBCG1PFLIO-BLK-P
ToughMate G1 "X" Hand Strap	TBCG1XSTP-P
Desktop Cradle	FZ-VEBG11AU
Vehicle Docks (no pass-through)	
– Gamber-Johnson	7160-0486-00-P
– Havis with LIND power supply	CF-H-PAN-702-P
Vehicle Docks (dual pass-through)	
– Gamber-Johnson	7160-0486-02-P
– Havis with LIND power supply	CF-H-PAN-702-2-P
Cradlepoint Router	
– Verizon	CP-IBR1100LPE-VZ
– AT&T	CP-IBR1100LPE-AT
Replacement Digitizer Pen Waterproof	FZ-VNPG11U-S
Tether	FZ-VNTG11U
10.1" LCD Protective Film	FZ-VPFG11U

Please consult your reseller or Panasonic representative before purchasing.

Caution: Do not expose bare skin to this product when handling this unit in extreme hot or cold environments.

[1] Approximate time. Battery operation and recharge times will vary based on many factors, including screen brightness, applications, features, power management, battery conditioning and other customer preferences. Battery testing results from MobileMark 2007.

[2] Bridge battery, magstripe reader, insertable SmartCard reader, insertable SmartCard reader with bridge battery, contactless SmartCard reader and UHF RFID reader are mutually exclusive. Please note, USB 3.0 port cannot be accessed when the unit is equipped with the magstripe reader, but optional USB 2.0 port can be accessed.

[3] GPS, Serial Dongle, Ethernet, MicroSDXC and second USB port are mutually exclusive options.

[4] 1GB = 1,000,000,000 bytes.

[5] Total usable memory will be less depending upon actual system configuration.

[6] The size of the VRAM cannot be set by the user and varies by operating system as well as the size of the RAM. Windows 7 max. VRAM is 1555MB.

[7] Magstripe reader, insertable SmartCard reader, insertable SmartCard reader with bridge battery and UHF RFID reader include tall corner guards and rotating hand strap. Bridge battery (without SmartCard reader) includes medium corner guards and rotating hand strap.

[8] Requires software and activation to enable theft protection.

[9] Length measurements do not include protrusions. Weight varies with options and digitizer pen.

[10] Accessories and Integrated Options may vary depending on your configuration. Visit the Panasonic website for more accessories and details.

[11] Hazardous location certifications may not apply to all configurations. Consult your Panasonic representative for availability.

[12] TPM 1.2 available upon request - please contact your reseller or Panasonic representative.

TOUGHPAD

1.800.662.3537
panasonic.com/toughpad/G1

Canon

EOS 5D Mark IV

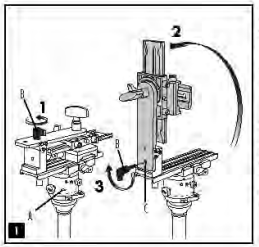
Design detail

Incredible resolution ideal for the high-megapixel era. Introducing the new benchmark large-aperture standard lens

In 2008, Sigma released a large diameter standard lens designed for digital SLRs, "SIGMA 50mm F1.4 EX DG HSM". At that time, products for film cameras were prevalent, yet we spent enormous effort to set a new benchmark for the 50mm lens that optimizes the characteristics of digital cameras, such as compensating peripheral brightness, controlling the point images in the corners, and improving the image drawing, not only around the focusing point, but also other areas in the image.

INSTRUCTIONS

303SPH
SPHERICAL "VR" HEAD



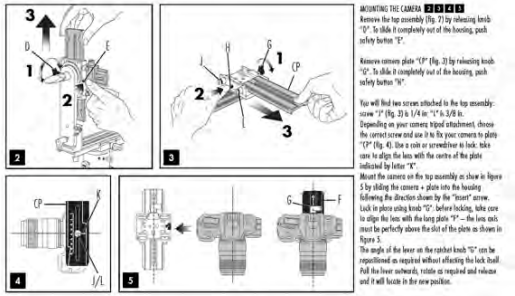
The spherical "VR" head is designed to allow virtual scenes to be created by Computer from a series panoramic sequences of digital or digitized photographs, taken at different horizontal angles.

There are 4 requirements to achieve good panoramic sequence this is:
1. Accurate levelling of the panoramic axis
2. A Panoramic head that enables you to choose the angle of rotation between one shot and the next.
3. The ability to position the camera so the "Nodal Point" of the lens (the front lens) is exactly above the panoramic rotational axis, to eliminate any parallax problems between the near and distant objects in the scene.
4. An additional rotating axis that assembles you to shoot several panoramic sequences at different vertical angles in order to achieve a complete spherical scene.

The spherical "VR" head incorporates three main modules that perform the functions mentioned above in points 2, 3 and 4.

Unless your tripod has a built-in levelling device (such as the Manfrotto 410 Bubble Tripod's 50mm half ball), you will need to use one of the levelling accessories available from the Manfrotto range to assure accurate levelling of the head (see point 1).

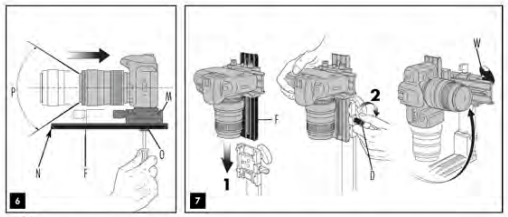
SET UP 1
Fix the levelling device (not supplied) to the tripod, then fit the "VR" head on the levelling device via female attachment "A".
Completely remove knob "B", rotate the bracket into the vertical position as shown in fig. 1 and lock it in place by screwing the knob "B" into hole "C".



MOUNTING THE CAMERA 2 3 4 5
Remove the top assembly (Fig. 2) by releasing knob "D". To slide it completely out of the housing, push safety button "E".

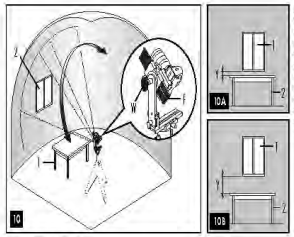
Remove camera plate "CP" (Fig. 2) by releasing knob "G". To slide it completely out of the housing, push safety button "H".

You will find two screws attached to the top assembly: screw "J" (Fig. 3) is 1/4 in "I" is 3/8 in.
Depending on your camera tripod attachment, choose the correct screw and use it to fix your camera to plate "CP" (Fig. 4). Use a coin or screwdriver to lock: take care to align the lens with the centre of the plate indicated by letter "K".
Mount the camera on the top assembly as show in figure 5 by sliding the camera + plate into the housing following the direction shown by the "insert" arrow.
Lock in place using knob "G". before locking, take care to align the lens with the long plate "F" – the lens axis must be perfectly above the slot of the plate as shown in figure 5.
The angle of the lever on the ratchet knob "G" can be repositioned as required without affecting the lock itself. Pull the lever outwards, rotate as required and release and it will locate in the new position.



NOTE 6
The position of the housing "M" relative to the long plate "F" will need to be adjusted: loosen screw "O" to slide the housing. The ideal position is with the camera body as far back on the plate as it can go before the front edge "N" of the long plate "F" becomes visible in the camera's field of view "P".

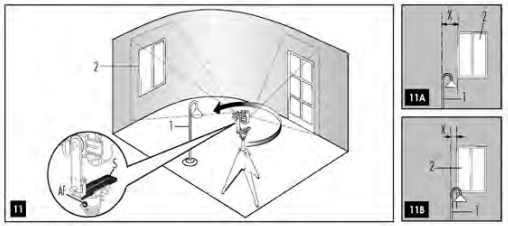
MOUNT THE CAMERA ON THE HEAD 7
Mount the whole top assembly + camera on the head as shown in figure 7 by sliding the long plate "F" into its housing and locking it by screwing knob "D", then unscrew knob "W" and move the camera on the vertical plane.



ADJUSTING POSITIONING OF THE "NODAL POINT" 10 11
If the scene being shot contains objects at varying distances from the point where the shot is being taken (close and distant objects), the "Nodal Point" needs to be more accurately positioned as follows: (this procedure is possible ONLY with tubular model 3)
Note
- FIRST DO ALTITUDINAL POSITIONING
- ADJUST LATERAL POSITIONING ONLY WHEN LONGITUDINAL POSITION HAS BEEN SET

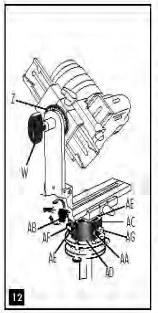
- LONGITUDINAL POSITIONING 10
(Ref. Figure 10) Choose a frame that contains both a near object "1" and a distant object "2" situated along the same horizontal line of vision.
1. (See figure 10A and 10B) unscrew knob "AB" and move the camera around the panoramic axis so that the two objects are first on the left hand side of the frame, then on the right. Check whether the horizontal gap "X" between the two objects varies in the two frames: the more constant the distance remains, the more accurately the "Nodal Point" has been positioned.
2. For optimum results, make minor adjustments by moving plate "F".

Once the right position is achieved it is VERY USEFUL to memorize it by noting the position of the plate "F" on the index on the graduated scale.



- LATERAL POSITIONING 11
(Ref. Figure 11) Choose a frame that contains both a near object "1" and a distant object "2" situated along the same horizontal line of vision.
1. (See figure 11A and 11B) unscrew knob "AB" and move the camera around the panoramic axis so that the two objects are first on the left hand side of the frame, then on the right. Check whether the horizontal gap "X" between the two objects varies in the two frames: the more constant the distance remains, the more accurately the "Nodal Point" has been positioned.
2. For optimum results, make minor adjustments by moving plate "F".

Once the right position is achieved it is VERY USEFUL to memorize it by noting the position of the plate "F" on the index on the graduated scale.



INSTRUCTIONS FOR SPHERICAL PANORAMIC SHOOTING 12
A spedal panoramic scene is obtained by adding together panoramic sequences taken at different angles from the horizontal. First you will need to choose the number of panoramic sequences you will need to complete the sphere depending on the angle of the lens you will be using.
Before starting with the panoramic sequence, choose the initial vertical angle using the round scale "Z" (Fig. 12)
Unscrew locking knob "AB" or remove it completely if you do not need it/ must be used to completely stop rotation when the head is used in non-vertical position, or to avoid any accidental movement of the head in any position).

Decide the number of shots or the angle of rotation between each shot for the first panoramic sequence (see the chart below):

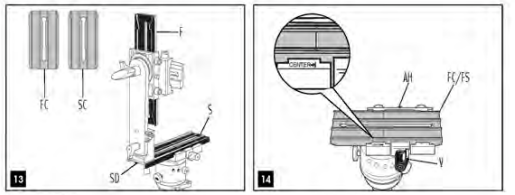
Angle	90°	60°	45°	36°	30°	24°	20°	15°	10°	5°
n. shots	4	6	8	10	12	15	18	24	36	72

- Screw knob "AG" into the selected setting holes "AH".
- Release locking lever "AD" and rotate the camera on top plate "AG" to the position of the first shot.
- Hold the camera in position and rotate the central barrel "AC" until the first "click stop" is reached, then lock lever "AD".
- Take the first shot and then rotate the camera to the next "click stop" without releasing "AD" and take the next shot.
  Continue this process until the start position is reached.

Once you have completed the first complete panoramic sequence, you can start on the other panoramic sequences needed to cover the sphere: change the vertical angle using knob "W" and round scale "Z", and repeat the operations described above for each full sequence.

The base of the head "AD" has graduated scale markings from 0 to 360° and a reference index "AE" on the central barrel "AC". Use it to be used to set angles not on the chart. To use the head in this way, unlock knob "AD" to disengage the "click stop" driving rotation of central barrel "AC" and use the locking knob "AB" to lock the position during shooting.

NOTE: The angle of the lever on the ratchet knob "AB" can be repositioned as required without affecting the lock itself. Pull the lever outwards, rotate as required and release and it will locate in the new position.



ADDITIONAL PLATES 13
If you have a very compact camera we suggest you to use the short plate "SC" (Fig. 13) and "FC" (supplied with the head) instead of the two long plates "F" and "S" in order to reduce space and weight of the system.
To replace the plate "S" unscrew screw "SD" (Fig. 13)
To replace the plate "F", please refer to fig. 6 and unscrew screw "O"

USE OF THE KIT AS AN OBJECT-PANORAMA TURNTABLE 14
The head can also be used as a turntable, useful for shooting object panoramas. For this use, loosen knob "H" and push button "AH" to slide the lower plate "S" out of the housing on the panoramic rotation base unit. In place of the long plate and top assembly, mount one of the two shorter plates supplied as a base for your object. The plate bearing has a "center" mark to help you position your object accurately above the center of panoramic rotation.