M20 Junction 10a

TR010006

Appendix 7.5 Photomontage Methodology

APFP Regulation 5(2)(q)

Revision A

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6.3

July 2016

M20 Junction 10a

TR010006

Appendix 7.5 Photomontage Methodology

Volume 6.3

Date: July 2016

Date: July 2016

Content

1. Methodology for the Production of Photomontages

1.1.1 The methodology for undertaking the Photomontages for the junction 10a Scheme are given below. Reference is made to photography and field surveying techniques, followed by the methodology used for the photomontage production itself.

1.2 Photography Equipment

1.2.1 Refer to ARCMINUTE Methodology 2015 in Appendix A.

1.3 Photography Procedures

1.3.1 Refer to ARCMINUTE Methodology 2015 in Appendix A.

1.4 Procedure Adopted for Field Surveying

1.4.1 Refer to ARCMINUTE Methodology 2015 in Appendix A.

1.5 Procedure Adopted for Photomontage Production

Software

1.5.1 AutoCAD, 3DS Max and Photoshop are used to model the proposed scheme to generate perspective overlays for each photograph.

Drawings

1.5.2 DWG files (plans, elevations and details) for the scheme as well as X-Y-Z data from GPS system.

3D Model

1.5.3 Photomontages are produced by placing a computer generated camera at the surveyed camera position within the 3D model. The photograph taken from the actual camera position is used as a backdrop to the 3D model. A view of the 3D model within the photographic context is rendered.

Artwork

1.5.4 Photoshop is used to merge the perspective taken from the 3D model and the photograph to illustrate the visual appearance of the proposals.

Appendices

Appendix A. ARCMINUTE Methodology 2015

METHODOLOGY2015

ARCMINUTE
john@arcminute.co.uk
07774 857627

Overview

The Arcminute methodology uses a hybrid survey and photographc system to create geometrically accurate photographs and verifiable data for all associated parameters. It is fully compliant with all guidelines covering images required to be aligned with survey data for use in planning applications.

System capabilities

XYX positioning and recording of the camera in relation to a marked survey point to <2mm
Orientation of the camera in elevation and roll to <0.02degrees
Identification of intrinsic camera paramters for focal length <0.005mm optical axis position on image < 0.005mm
Removal of all optical distortion to enable precise registration in all parts of the image with survey and 3d render elements.
Full camera orientation and positioning using a camera resection process to give the end user all the data for a full camera alignment

Camera

Sensor size in mm - 36x24
Sensor size in pixels - 7360 x 4912 pixels
Sensor size in mega-pixels - 36

Lenses

17mm, 24mm, 35mm, 52mm and 80mm with shift capability. Specially selected for best in class resolution and customised to conform to the high precision focal length and optical axis settings required in the process.

Camera mounts

Custom made designs for both single frame and panoramic capture which enable the high precision camera positioning and orientation tolerances.

Photography

The camera is set up at eye level (1.55-1.75m) and positioned and orientated to within the stated tollerances using standard survey instrument setup procedures. The scene is then captured in a RAW format using high quality architectural photographic practice.
For Panoramic images the camera is setup in portrait orientation and rotated around the camera coordinate capturing sequential frames with a 50% overlap. Each frame has the same orientation tolerance as a single frame capture. A photographic record is made of the tripod location, the survey mark and the height reading of the camera above it.

Post Production

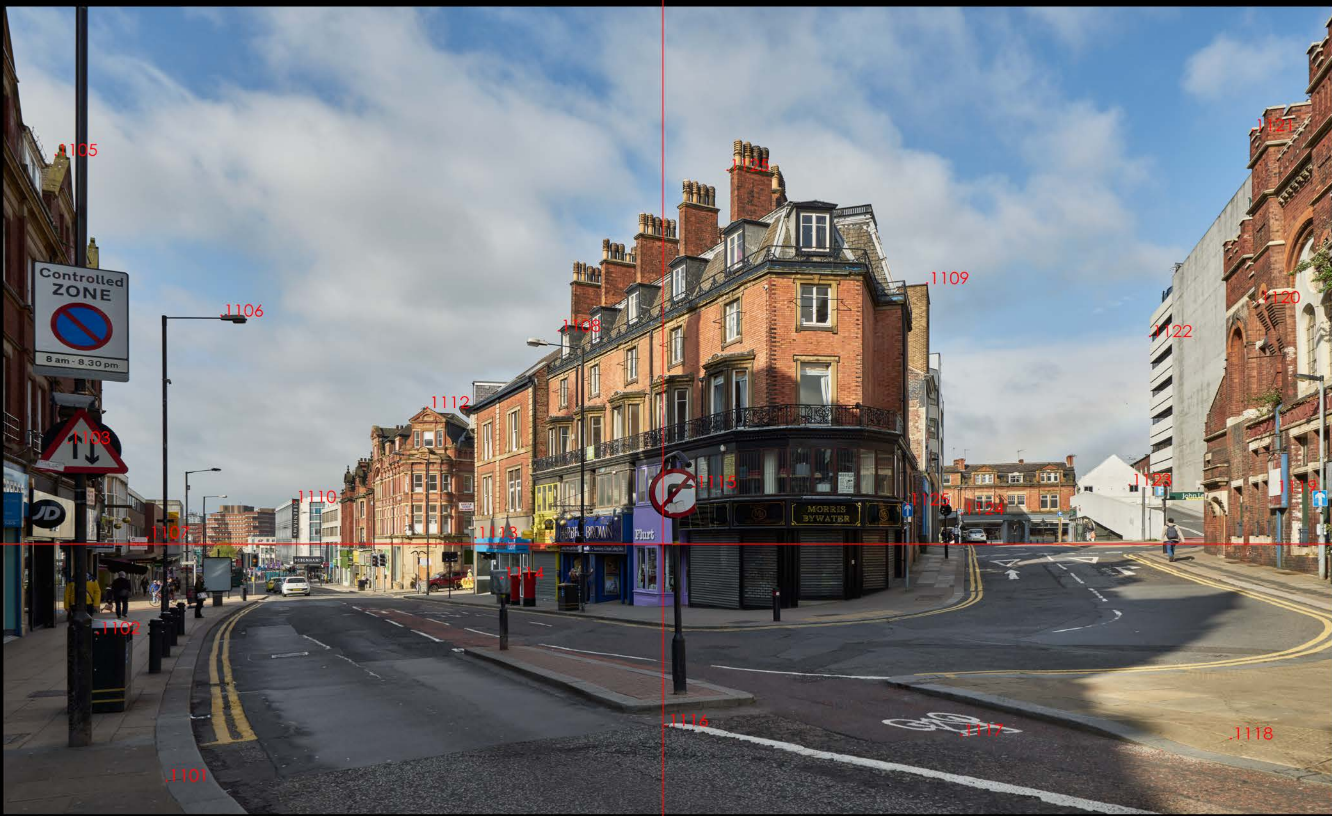
Standard image processing for dealing with RAW files is undertaken to create a tiff image that honestly represents the scene in terms of tonality and colour.
This image is then processed to remove lens distortion and identify the XY position on the image of the optical axis. For panoramic images the sequence of tiff images are assembled into a seamless and accurate equirectangular projection using specialist panoramic software. Due to the large size of any image created this way the final image is down sampled to a more manageable size based on 100pixels per degree. For example a 120degx40deg panorama has a pixel size of 12000x4000 or 48mp.
The image is then placed in a larger background where the optical axis (horizon only in the case of panoramic images)is aligned with it's center in order to present the end users rendering application with a 'non shifted' image. The survey points are also marked up on a separate layer ether by myself or by the survey team. This layer can be set in a blending mode so that the precise point on the image below the marked dot can be seen.

Issued files

A layered tiff file containing the image and data.
A flattened jpeg showing the survey points for use in the alignment process
A picture of the tripod setup
Any other supporting evidence deemed relevant to the end user such as a KMZ file of camera locations and other supplementary photography.

Arcminute Ltd Registered Address 62 Grove Park Terrace London W4 3QE Registration No 07544732 VAT Registration 925157914

ARCMINUTE
john@arcminute.co.uk
07774 857627



Calibrated focal length	24.292mm
Film gate width	39.12mm
Canvas size	8000 x 7200 pixels
Pixel size	0.00489mm
Height above survey point	1652mm
Shift	4mm
Date	11.05.15
Time	08.45 BST

E: 435415.582
N: 387345.426
AOD: 79.394
Direction :212.669 degrees
Elevation: -0.013 degrees
Roll: 0.015degrees

ARCMINUTE
john@arcminute.co.uk
07774 857627

Alignment to survey data

This identifies all the data for the 3d rendering application's virtual camera controls in order to achieve a highly accurate alignment to the survey without need for further adjustment by the end user. The key value available from his system is the camera direction and it further optimises all other parameters to higher tollerances than stated in the standard system. It is fully compliant with any existing users alignment methodology as it simply eliminates the sometimes lengthy camera matching process but does not replace the final evidence showing rendered survey points matched to their corresponding features on the image. The exact process is commercially confidential but can be described as a 'single image camera resection using forensic image analysis software'. The data is supplied in the form of the green text on the preceding image.

The above image is illustrative of the concept of camera matching to a survey where lines converge on the camera position from the survey points. Each 'ray' has an angular value, length and point of origin which forms the input data for calculating camera position, orientation, focal length and position of the optical axis. This system can be used on 3rd party images and survey data but it cannot be verified in the same way as only when combined with my capture system can the data it creates be checked against known control parameters.

The working tolerance for this system ensures that no rendered survey point on the image is more than 2 pixels away from the surveyed feature (less than 1 pixel for points near the scheme).

If the data is deemed to be unsatisfactory at this stage or required to be 'verified' at a later date a multi camera photogrammetry network can be created using the additional images obtained at the time of the main image capture.This will check the parameters of the single image resection data and also identify any errors in the survey or other parts of the process. When combined with the end users existing camera matching check of rendering out the survey points on the image a view can have 3 different alignment methods associated with it. In addition to this a 2nd photogrammetry survey can be carried out using an alternative software package by an independent photogrammetry service to further verify the results.

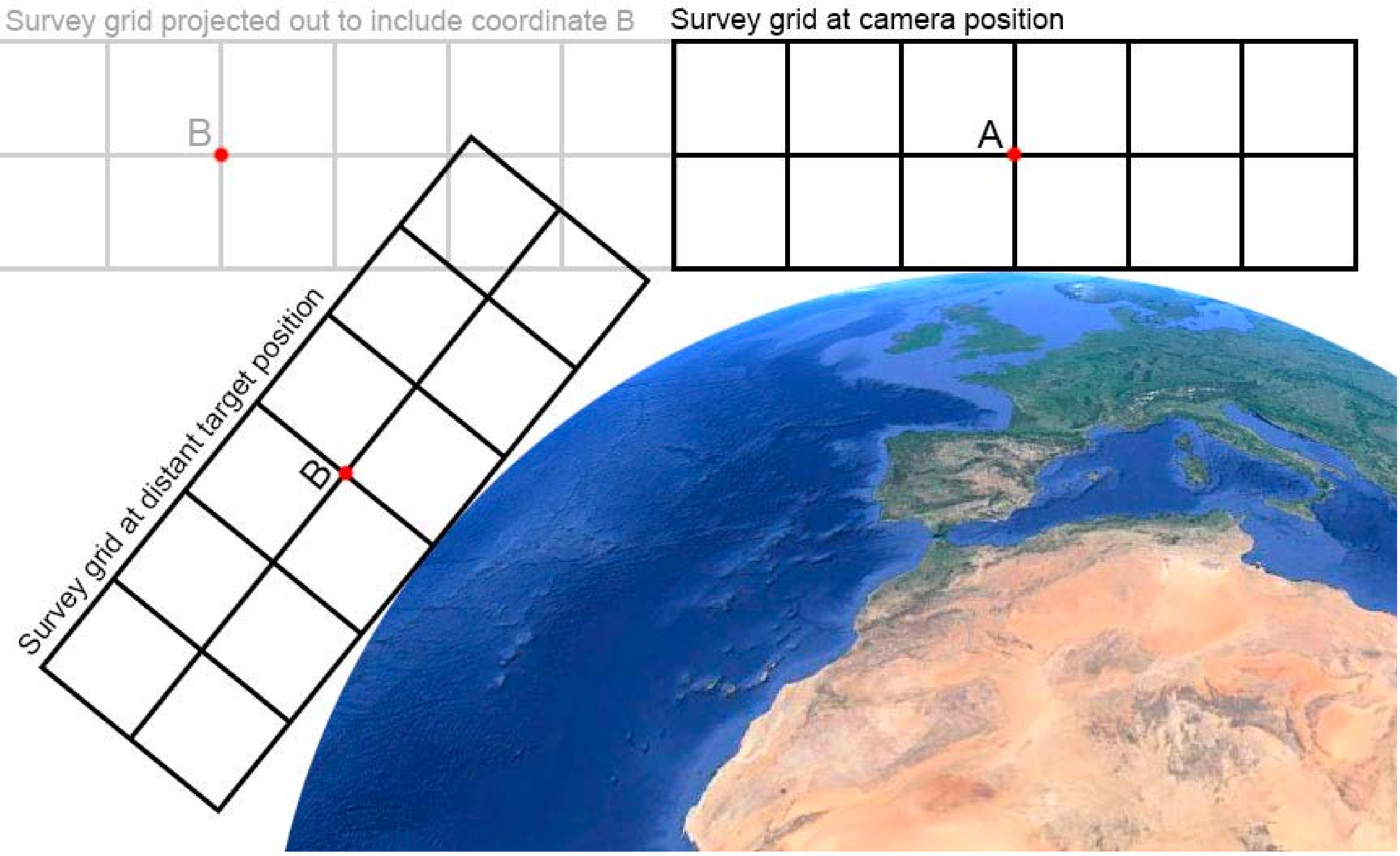
ARCMINUTE
john@arcminute.co.uk
07774 857627

Disclaimer

This methodology describes the processes involved but it does not constitute a prescriptive set of rules which must be followed in order to render the result as accurate or valid. Any test of the accuracy of the data and imagery must be judged by the alignment process where the current industry accepted concept is that there is only one visual 'solution' for a 3d point structure that projects each point to it's surveyed feature on the 2d background image from a single common point when the real world and virtual cameras are aligned.
While this system will accurately align the camera within the local OS coordinate space it is not a guarantee that any render will be correctly placed within the final image as this can be subject to other factors outside my control which can include;

GPS working tolerances (particularly height) which may be visible at close ranges.
Transform errors of the OS data to a render packages local coordinate system.
Alignment of the scheme's original design to OS coordinates.
Any errors in data entry or use of the rendering package
Failure to account for the effects of the OS system, earth's curvature and refraction for long distance views.

All alignment and survey data is in a purely rectangular XYZ or 'Cartesian' coordinate system local to the camera position which conforms to the render packages coordinate system and will therefore be accurate at near and medium distances from a scheme. At long distances the OS grid system deviates from a pure square grid as it follows the earth's curvature so that any survey coordinate established by a separate local survey close to the scheme but far away from the camera position cannot be imported into the camera alignment coordinate system without adjustment to it's height value. Without this adjustment it is not possible to reconcile near and far coordinates and it is the responsibility of the end user to make all relevant height adjustments in the final render alignment. Additionally as the correction values commonly used are a combination of curvature and refraction and the later value is variable it is highly advisable during the commissioning of long distance views to ensure that local (and visible from the camera position) survey points are acquired as close as possible to the scheme's location so the necessary height correction can be accurately made from the amount of offset on the image.



Above is a highly exaggerated illustration of the curvature issue. Points A and B both have the same AOD value according to their respective local cartesian OS survey grids which for this purpose are 5km apart. If the coordinate values of point B are transfered in the coordinate system of A and projected out to the distance on the grid in the grey and used for aligning the camera or placing an object there is an obvious error. According to standard formulas for curvature and refraction the height error at 5km is 1.7m.