Photography and Photomontage in Landscape and Visual Impact Assessment

Landscape Institute
Technical Guidance Note
Public Consultation Draft 2018-06-01

To the recipient of this draft guidance

The Landscape Institute is keen to hear the views of LI members and non-members alike. We are happy to receive your comments in any form (eg annotated PDF, email with paragraph references) via email to photography@landscapeinstitute.org which will be forwarded to the Chair of the working group. Alternatively, members may make comments on Talking Landscape: Topic "Photography and Photomontage Update".

You may provide any comments you consider would be useful, but may wish to use the following as a guide.

1) Do you expect to be able to use this guidance? If not, why not?

2) Please identify anything you consider to be unclear, or needing further explanation or justification.

3) Please identify anything you disagree with and state why.

4) Could the information be better-organised? If so, how?

5) Are there any important points that should be added?

6) Is there anything in the guidance which is not required?

7) Is there any unnecessary duplication?

8) Any other suggestions?

Responses to be returned by 29 June 2018.

Incidentally, the ##'s are to aid a final check of cross-references before publication.

Contents

1 Introduction

1.1 The purpose of photographs and photomontages

1.1.1 Photographs and photomontages are often included in support of a planning application, which may or may not include an Environmental Impact Assessment (EIA) or Landscape and Visual Impact Assessment (LVIA). The preparation and presentation of appropriate visual information is integral to the communication of landscape and visual effects. Photographs and photomontages are technical information in this context, and should be produced and used in a technically appropriate manner.

1.1.2 These images should show baseline conditions (the existing view), and the "as-built situation". Depending upon the nature/type of the development, the image may need to show the development during construction, and also the development during specific years of operation. Images should provide the viewer with a fair representation of what will be likely to be seen if the proposed development is implemented. Images should not be misleading.

1.1.3 This Guidance Note replaces LI Advice Note 01/11. The guidance has been updated in order to:-

- reflect other sources of guidance and additional research on the topic (see Further Reading);
- accord with the principles of GLVIA3 (2013) - (especially GLVIA3 paras 8.15-8.34);
- respond to instances of poor quality visualisations being produced in support of LVIAs and planning applications.

1.2 Scope of this Guidance

1.2.1 This Guidance recommends certain combinations of equipment and methodology, which are required to provide consistently professional and reliable results.

1.2.2 It provides advice to landscape professionals (who are members of the LI) on photography and photography-related visualisation, such as photomontages, as they relate to:

- Landscape and Visual Impact Assessment (LVIA);
- Landscape and Visual Appraisal (LVA) (sub-EIA);
- Planning applications and Pre-applications;
- Communication with client and stakeholder groups.

1.2.3 It may also be used by professionals within decision-making authorities and others outside the landscape profession.

1.2.4 It does not consider the use of photography or photomontage for other purposes, such as promoting or exhibiting a scheme, although the principles of clear communication and fitness for purpose may be useful.

1.2.5 The guidance is structured around its target users and stages in the process, specifically:

- photography;
- photomontage or visualisation production.

1.2.6 Technical Appendices follow, including methodology and presentation templates, detailed aspects of photography and a glossary of terms.

- Appendices 01-05## amplify aspects of methodology which should be followed.
- Appendices 06-15## provide supporting information.

1.3 Objectives of photography and photomontage

1.3.1 Technical landscape photography and photomontage production is carried out for the purpose of communication, typically to assist in landscape and visual assessment of a development proposal. It can also inform siting, design and mitigation.

1.3.2 Photography should capture the landscape and visual context under consideration in its present state, in clear visibility. The photographs provide the baseline position for any subsequent photomontages. Photomontages should simulate the likely changes, to the landscape and visual resource, which would result from a proposed development or management process.

1.3.3 For the purposes of this guidance, photomontage is: "A visualisation which superimposes an image of a proposed development upon a photograph or series of photographs." (GLVIA3).

1.3.4 The term photomontage is used in this guidance to indicate any such visualisation, although it should be noted that varying graphic techniques, from outlines, through photowires, to massing models and rendered photomontages, may be appropriate.

1.3.5 It should be borne in mind that two-dimensional photographic images and photomontages alone cannot capture or reflect the complexity and diversity of an actual visual experience one would have on site. They should, therefore, be considered an approximation of the three-dimensional visual experiences that an observer might receive in the field.

1.3.6 Such visuals will typically inform decision-making, in terms of design, planning, or land management processes. Importantly they will also inform the general public about what they might expect to see if the development should gain approval. However, such images can only be an aid to decision making, and are not a substitute for site-based assessment. Further, site-based assessment will be informed by photomontage in clarifying the likely extent and nature of visibility.

1.3.7 It is recognised that other technologies (PDF, panoramic viewers, and augmented reality) are increasingly being used as methods of visual communication.

1.4 Review

1.4.1 The LI recommends that, at each stage, the landscape professional reviews compliance with this guidance to ensure that Statutory Authorities, Agencies and stakeholders can have confidence that the images are 'fit for purpose' and not misleading.

1.5 Key review pointers

1.5.1 The LI recommends that, for the purposes of informing the landscape and visual impact assessment process and the competent authority and stakeholders, photography and photomontage should:

- use appropriate cameras, equipment and settings (Section 3## and Appendices 01+02##);
- be based on agreed viewpoint locations (##Section 3.3)
- be based on good quality photographic images taken in good, clear weather conditions; (## Section 3.3)
- use visualisation techniques, with appropriate explanation, that, in the opinion of the landscape professional, best illustrate the proposed scheme and its setting as accurately as reasonably practicable; and be based on a replicable, transparent and structured processes; (##Section 4)
- be reproduced at a suitable size and level of geometric accuracy; (##Section 4.2 and Appendix 03##)
- be provided with suitable accompanying information, including a Technical Methodology and required information within page title blocks (Section ##4.3 and ##Appendices 04+05)
- where necessary, allow the accuracy of the photography and visualisation to be verified; (##Appendix 08)

2 Background

2.1 LI Guidance

2.1.1 The LI's position on related visualisation advice is here: https://www.landscapeinstitute.org/visualisation/

2.1.2 This document should be read in conjunction with the LI's Technical Guidance Note 02/17 'Visual representation of development proposals' (31 March 2017).

2.2 Guidance by Others

2.2.1 This guidance is appropriate for all forms of development. The Landscape Institute recommends its use to its members. In the case of wind farm developments, the LI supports Scottish Natural Heritage Guidance: Visual Representation of Wind Farms, Feb 2017 - which this guidance is intended to be consistent with. This is abbreviated to 'SNH 2017' throughout this guidance.

2.2.2 When regulatory authorities specify their own photographic and photomontage requirements, the landscape professional should consider what the implications would be of not following this 'authority specific' guidance. For example, there may be a risk to validation/registration of the visuals, or of the application. Early engagement with the statutory body will always be useful.

3 Photography - equipment and approaches needed to capture suitable quality images

3.1 Equipment

Cameras

3.1.1 A good-quality camera and lens are essential. The following are the main requirements for good-quality equipment, based upon the 50mm Focal Length lens and Full Frame Sensor Digital SLR Camera.

Lens Focal Length

3.1.2 A fixed 50mm Focal Length (FL) lens is considered the benchmark for landscape photography and should normally be used. A fixed focal length lens ensures that the image parameters of every photograph are the same, simplifies the construction of panoramas, and ensures compatibility of photography for all viewpoints. 50mm FL lenses minimise optical distortion and allow for verification, where required (See Appendix 08##). Zoom lenses should not be used (see Appendix 15##).

3.1.3 Lens/camera combinations result in images which capture a Field of View (FoV). The Horizontal Field of View (HFoV) is the angle between the left and right edges of the image. The Vertical Field of View (VFoV) is the angle between the top and bottom of the image.

3.1.4 Where a site or proposal would exceed the Vertical Field of View of a landscape-orientated photograph, the camera may be used in portrait mode. If this is not sufficient, the use of wider-angled prime lenses should be considered and, in these unusual situations, the reasoning and the approaches documented (see Appendix 04## Technical Methodology).

3.1.5 Tilt-Shift lenses should only be used when the standard range of lenses have been ruled out due to the verticality of the development. See Appendix 06##.

Lens quality

3.1.6 The optical quality of the lens is important. Despite high resolution sensors, it may be that the resolution of digital photographs is limited more by the quality of the lens than by the quoted megapixels. Digital sensors and memory chips are quite cheap components whereas good lenses are relatively expensive.

3.1.7 A simple check is on the speed/aperture of the lens. A lens with a large maximum aperture (e.g. f/1.8 or 'faster' - see Glossary), combined with good build quality, is generally a suitable lens.

Sensor type (FFS)

3.1.8 Full Frame Sensor (FFS) Digital Single Lens Reflex (DSLR) cameras set a photographic standard which is reliable, well-understood and consistent with professional requirements.

3.1.9 The use of the 50mm FL/FFS combination, and the avoidance of cropped-frame sensors, is recommended for technical photography. Cropped-frame sensors, such as APS-C, introduce technical limitations, which are discussed in Appendix 14##.

Sensor resolution

3.1.10 The Pixel count of a photo will have a direct mathematical relationship to the Dots Per Inch (DPI) count of the resulting image, for example when placed into an A3 sheet in vector drawing software.

3.1.11 A camera with a fairly high resolution will be required to produce sufficiently good-quality images to be reproduced at the required size: a 20+ megapixel sensor is the current standard (2018) and is considered sufficient. The essential requirement is that the camera should be capable of producing a sharp image when printed at the required page size. and this is predominantly down to the quality of the lens being used.

3.2 Camera settings

Camera settings

3.2.1 Technical photography should be undertaken using manual controls to avoid the camera creating unwanted differences (focus, exposure, white balance, ISO) between adjacent shots. Appendix 02## outlines appropriate manual settings, whilst Appendix 13## explains the issues with Auto settings.

Night-time and low-light photography considerations

3.2.2 If agreed as a specific project requirement with the competent authority, night-time photography will require particular consideration and approaches. These are outlined in Appendix 12##.

3.3 In the field

Viewpoint selection and timing

3.3.1 Photographic viewpoints will have been selected in advance to be representative of the range of likely effects on the landscape and visual resource ensuring that none are under- or over-represented. Viewpoint selection approaches and criteria, for purposes of LVIA/LVA, are set out in GLVIA3 paras 6.16 - 6.28.

3.3.2 Viewpoints should be agreed between the applicant, statutory authority and stakeholders. Considerations might include a need for evening/night photography or, in the case of Seascape effects, for morning, daytime or evening images. The illustration of seasonal variations may be a requirement of the relevant authority (see para 6.28 of GLVIA3). The role of the photographer is to microsite the camera to a location free from foreground screening.

3.3.3 Views should include the full extent of the development site and its setting, and show the effect it has upon the receptor location. Additional photographs may illustrate relevant characteristics, such as degree and nature of intervening cover along a highway or footpath, without showing the site.

3.3.4 Consideration of private residential viewpoints is relevant to Residential Visual Amenity Assessment (RVAA) but generally LVIA will use public viewpoints (ref GLVIA3 paras 6.16 - 6.17). See also LI guidance on RVAA (2018). Viewpoints on private land which is publicly accessible may be relevant, eg open gardens, monuments, communal access points, National Trust land etc.

3.3.5 Plan and time site visits such that the sun is behind, rather than in front of, the camera. This is particularly important in the winter, when the sun is lower in the sky, and especially in views from the north.

Capturing the View

3.3.6 The proposal under consideration and its relevant landscape context will determine the horizontal (and vertical) field of view required for photography and photomontage from any given viewpoint. This will, in turn, determine whether a single-frame image will suffice or whether a panorama will be required.

3.3.7 A 'standard' lens (50mm Focal Length (FL) on a Full-Frame Sensor (FFS)) typically captures a horizontal field of view of just under 40 degrees. This may be suitable for some purposes, but a single-frame photograph based on this field of view may not convey the breadth of visual information required to represent a proposed development and relevant context. Where it is greater than 40 degrees, a panoramic image produced by the careful ‘stitching’ together of single-frame images, can provide a more informative representation of the effect of a development in the landscape.

3.3.8 The general requirement is to capture enough of the scene to represent the landscape setting and the likely effects of the proposal. Consideration should be given to capturing 360°at each viewpoint, to avoid issues of errors in estimating the site's location, to assist in establishing the viewpoint's location and potentially assist in illustrating cumulative effects, if applicable.

Recording image data

3.3.9 Data to be recorded will include: Camera model, Lens focal length, Date, Time. Note that these parameters will be automatically recorded in the EXIF data on most DSLR cameras. Date and time need to be set accurately on the camera.

3.3.10 Items which should be recorded in the field include weather, lighting conditions and direction of view - although these may be apparent from the photographs themselves and the location of the camera. The viewpoint location should be captured by a GPS and a photograph of the tripod.

3.3.11 A full set of details, to be recorded and presented with the project photography overall, and for each viewpoint, is set out on Appendix 04## Technical Methodology.

Tripods and panoramic heads

3.3.12 Tripods should be used for all photography, unless impractical. Appendix 01## sets out:

- why they are required;
- methods for using them correctly;
- camera mounts to obtain level shots without parallax errors;
- taking panoramas;
- recording camera position.

4 Photomontage production - from captured image to photomontage

4.1 Preparing photomontages

Requirements of Photomontage

4.1.1 A digital photomontage consists of a base photograph composited digitally with a computer-rendered image of the proposal under consideration. This compositing process will typically include digitally blending the base photography with the computer-rendered image, whilst taking into account any masking by foreground features. Compositing necessarily requires digital manipulation, carried out with visual skill, judgement and objectivity.

4.1.2 Incorrect image production and presentation can render otherwise correctly photographed images unfit for purpose. It is crucial that the scale of the proposal and its location within the scene depicted in the photograph are accurately represented. In order to achieve this, it is necessary to match the perspective parameters of the photograph accurately, to record viewpoint location and camera settings, and to use rendering software correctly.

4.1.3 It may be necessary to illustrate different time periods associated with the proposal, such as during construction, at completion and post-completion, and with different stages of establishment of mitigation. This should be agreed with the competent authority.

4.1.4 Techniques for matching photography and 3D modelling are set out in Appendix 09##.

4.2 Technical considerations

Page size

4.2.1 When considering the printed page, page size is a compromise between displaying a sufficient extent of the site, available print technologies and manageability of paper.

4.2.2 A3 paper in landscape format (420mm x 297mm) generally allows an image size of 390mm x 260mm, subject to page title, notes etc. This is suitable for single-frame images. It is not uncommon for computer monitors to have a width of around 500mm. Whilst there are scaling and resolution issues with viewing photomontages on a monitor, in reality such use will not be uncommon. The A3 landscape format is therefore well-suited to this use, whilst allowing printing of images at technically correct scales.

4.2.3 For panoramic images to maintain a sense of scale, the page width must necessarily be increased. A1 width (841mm) by A4 portrait / A3 landscape (297mm) height is a practical solution. A2 size may be effective in some contexts.

Viewing Distance and Focal Length

4.2.4 Photographic images have a theoretical viewing distance at which the scale of the view is reconstructed (the mathematically correct "principal distance") although this assumes that cameras and humans have similar optical systems, which they do not. The essential difference is that cameras (for this purpose) are monocular, and humans are generally binocular. In addition, the fact that reality is viewed as a 3D space, and photographs are viewed as 2D planes, combine to alter perceptions of scale between reality and photography.

4.2.5 Experience and research has shown that images printed larger than 'mathematically correct' give a better impression of scale under many circumstances, especially when taking visuals to site (see 'Further Reading').

4.2.6 Images taken with a 50mm FL lens/FFS combination, may be enlarged on the presentation page to give a greater "equivalent focal length" for printing. This can be calculated as an enlargement factor relative to 50mm Focal Length, with 75mm equivalent being 150% larger than 'mathematically correct'.

4.2.7 The SNH Visual Representation of Wind Farms Guidance 2017 requires photographs to be presented with this degree of enlargement. This approach is also being used successfully to represent forms of development other than wind farms.

Presenting Photographs and Panoramas

4.2.8 The LI recommends an approach, consistent with SNH 2017, for the presentation and scaling of photomontages. See Appendix 03## for an explanation of planar and cylindrical projection.

4.2.9 Briefly, if a view fits within 27° Horizontal Field of View, use an A3 landscape page, but consider that this may not provide sufficient context; if it fits within 53.5° Horizontal Field of View, use A1 landscape width x A4 portrait height. If the image has a wider Horizontal Field of View, use overlapping sheets, and if it has a greater Vertical Field of View, use whatever larger page size captures the scene, but explain why it was necessary to do so.

4.2.10 The SNH 2017 guidance can be summarised as follows:

- **Baseline (context) panoramas - if required**

  Present view angles of 90°H x 14.2°V with an image size of 820mm x 130mm, with matching wireline below, in cylindrical projection. Produce as many as required to cover the required angle (up to 360°) to show the setting. Note that *"This image provides landscape and visual context only".*

  Baseline photos may be annotated with placenames, key features etc. Photomontages should not be annotated.

- **For Photomontages + Wirelines**

  Present view angles of 53.5°H x 18.2°V with an image size of 820mm x 260mm. Both photomontage and wireline can be generated and matched to the photo in cylindrical projection, then re-projected to planar projection for submission.

- **A3 Viewpoint pack for taking out on site**

  This is optional and does not form part of an EIA/LVIA. It is presented at 27°H x 18.2 °V with an image size of 390mm x 260mm. The image can be extracted from the centre of 53°panorama.

4.2.11 Note that the above is a partial extract and a précis - refer directly to the SNH 2017 guidance for full details.

4.2.12 Because the SNH 2017 guidance is concerned with wind farms, a page format such as A3 is rarely suitable for showing the wider context, which is critical to such developments. Thus the use of the A3 sheet is proposed in SNH2017 only as part of the 'viewpoint pack', where the context will be apparent on site. For non-wind projects, the landscape professional should determine the extent to which context can be shown within 27° on an A3 sheet. Where this is in doubt, the wider 53.5° format should be used.

4.2.13 Examples of site and context widths in relation to 27° and 53.5° HFoV are shown in Figure 1 on the following page.

Wirelines. 3D Models and Photowires

4.2.14 The accuracy of a photomontage may usefully be illustrated by means of a wireline image or 3D model view, incorporating sufficient topographic or other features to allow a comparison to be made between the wireline/model and the photograph. The wireline should be presented as a separate image at the same scale as the main photograph/photomontage.

4.2.15 A visual presentation which is an overlay of wireline or 3D model upon the photograph is known as a photowire or 3D model photo overlay. A photowire does not replace a photomontage where rendered texture and detail is required, but is sufficient to indicate scale and placement. Where the site cannot be seen from a viewpoint, a photowire could indicate the site's relative size and location within the view (for example, to confirm that it would be hidden from view).

Wider Vertical Field of View

4.2.16 The proposed development, viewed at close quarters, may not fit comfortably within the above dimensions - for example, a tall building or high-voltage overhead line. In such instances, alternatives such as increasing the vertical height of the page (to A1 landscape width with A3 landscape or even A1 landscape height) may be appropriate. The same degree of enlargement (150% or "75mm equivalent focal length") should be maintained unless the subject will not fit on the above-sized formats, in which case the effective focal length may be reduced to a minimum of 50mm. Reasons for adopting such dimensions or approaches should be set out in the Technical Methodology.

Wider Horizontal Field of View

4.2.17 Where the required Horizontal Field of View exceeds 53.5°, planar panoramas of 53.5°may be overlapped by 50% to provide a wider total Horizontal Field of View.

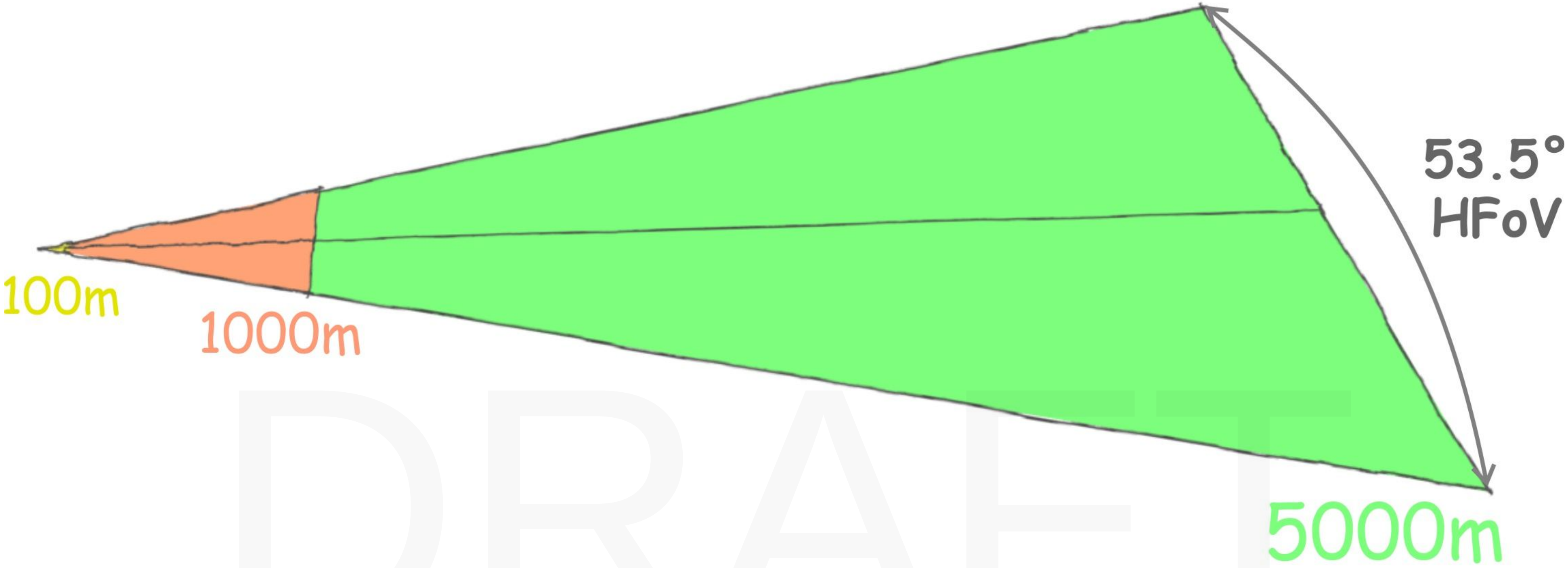

Fig 1: 53.5° Horizontal Field of View and Width of Site

This table gives examples of how wide a site or context could be captured within a 27° planar photograph and a 53.5° planar panorama, subject to distance from the viewpoint.

HFoV		100m from viewpoint	1000m from viewpoint	5000m from viewpoint
27°	calculation: w = 2d tan (A/2)	2 x 100 x tan (27 / 2) =	2 x 1000 x tan (27 / 2) =	2 x 5000 x tan (27 / 2) =
	site / width visible >	48m	480m	2401m
53.5°	calculation: w = 2d tan (A/2)	2 x 100 x tan (53.5 / 2) =	2 x 1000 x tan (53.5 / 2) =	2 x 5000 x tan (53.5 / 2) =
	site / width visible >	101m	1008m	5040m

Printed outputs

4.2.18 Inkjet printing, laser printing and digital press technologies all have different colour rendition and resolution issues. A minimum resolution of 300 pixels per inch will generally be required for high-quality printing.

4.2.19 In most cases, given suitable photographic paper, inkjet printing will provide the highest resolution, colour depth and dynamic range of any print technology. Inkjet prints are also likely to smear/run if wet, but could be laminated/encapsulated to allow multiple use for site viewpoint visits. Where the highest quality of printing is appropriate, consideration should be given to the use of inkjet technology, although commercial laser prints may be of very good quality and perfectly acceptable if photographic paper is used.

4.2.20 Critically, when producing documents for print, it is important to check that a print proof shows what you expect it to, that the image is sharp and that there is enough clarity and colour faithfulness to convey what is intended.

4.2.21 At the request of the competent authority, and particularly for more sensitive sites, the photomontage producer should provide high-quality printed outputs which match the criteria specified above.

4.3 Accompanying information

4.3.1 The following information should accompany photographs and photomontages:

- **Technical Methodology**

  A Technical Methodology should be provided as an Appendix to visualisations accompanying an LVIA (etc) using photomontage. This will assist recipients with understanding the level of technical approach and also to explain reasoning for any departures from standards. This should be proportionate to the requirements of the assessment and the required images. See Template at Appendix 04 ##.

- **In the report text**

  Viewpoints should be listed and the reasoning behind choice of viewpoints should be explained in writing. Where the images are accompanying an assessment, the choices may be explained in advance of the individual viewpoint assessments, as this helps to explain why the set of viewpoints has been selected and presented (and possibly why some visited or assessed viewpoints are not visually represented).

- **Viewpoint Locations**

  Viewpoints should be clearly located on a map-based figure. Location coordinates (eastings / northings) should be provided. It is helpful to provide small location maps as an inset to site photographs / photomontages, provided they take up a small amount of the page and do not dominate or obscure any of the photograph/photomontage content. See Template at Appendix 05## and SNH 2017 Guidance for suitable examples.

Further Reading

Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment 3rd edition (GLVIA3).

Landscape Institute (2017) Technical Guidance Note 02/17 'Visual representation of development proposals'

Scottish Natural Heritage (2017) Visual representation of wind farms: good practice guidance. ('SNH 2017')

The Highland Council (2016) Visualisation Standards for Wind Energy Developments.

London View Management Framework supplementary planning guidance (2012).

Appendices

Methodology

App 01 Site Equipment
App 02 Camera Settings
App 03 Dealing with Panoramas
App 04 Technical Methodology Template
App 05 Photograph/photomontage information template

Supporting Information

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App 07 Glossary
App 08 Verified Photomontages
App 09 Matching photography and 3D modelling
App 10 Earth curvature
App 11 Locational accuracy
App 12 Night time photography
App 13 Camera Auto Settings to avoid
App 14 Limitations of Cropped-Frame Sensors (eg APS-C)
App 15 Why not Zoom Lenses?

Appendix 01 Site Equipment

1 Tripods

1.1 Tripods are used to assist with camera stability (to avoid camera-shake) and to provide levelling in the horizontal and vertical axes. When taking photographs with a view to creating stitched panoramic images, tripods are essential to provide adjacent images of consistent level and overlap.

1.2 It may be necessary for the camera to be mounted in portrait orientation or to 'look up' or 'look down', especially in hilly terrain or close to tall existing or proposed objects. Such photography can only accommodate a single image. Otherwise the camera will be assumed to be level in the vertical axis.

1.3 Camera height is fixed at 1.5m in SNH/THC wind-turbine guidance and this should be adhered to where that guidance is regarded as applying. For other project types, camera height should be set comfortably for the photographer and recorded/stated as noted at Appendix 04##. Additional height may be required to look over foreground hedges, or represent a proposed change to a viewpoint's finished level eg a raised highway.

2 Camera mounts

2.1 A Panoramic ('Pano') head, mounted on top of a tripod, will provide control of the angle between adjacent photographs. With a 50mm lens of approx 39.6° view angle, setting a 20° interval between shots will give a 50% overlap between adjacent shots. Such an overlap will be useful when stitching photographs later, will minimise edge distortion, and will provide confidence in the field of view captured within the panorama sequence (eg a panorama of 4 shots would give 3 x 20° = 60°, between the centre of the first and the centre of the last photograph).

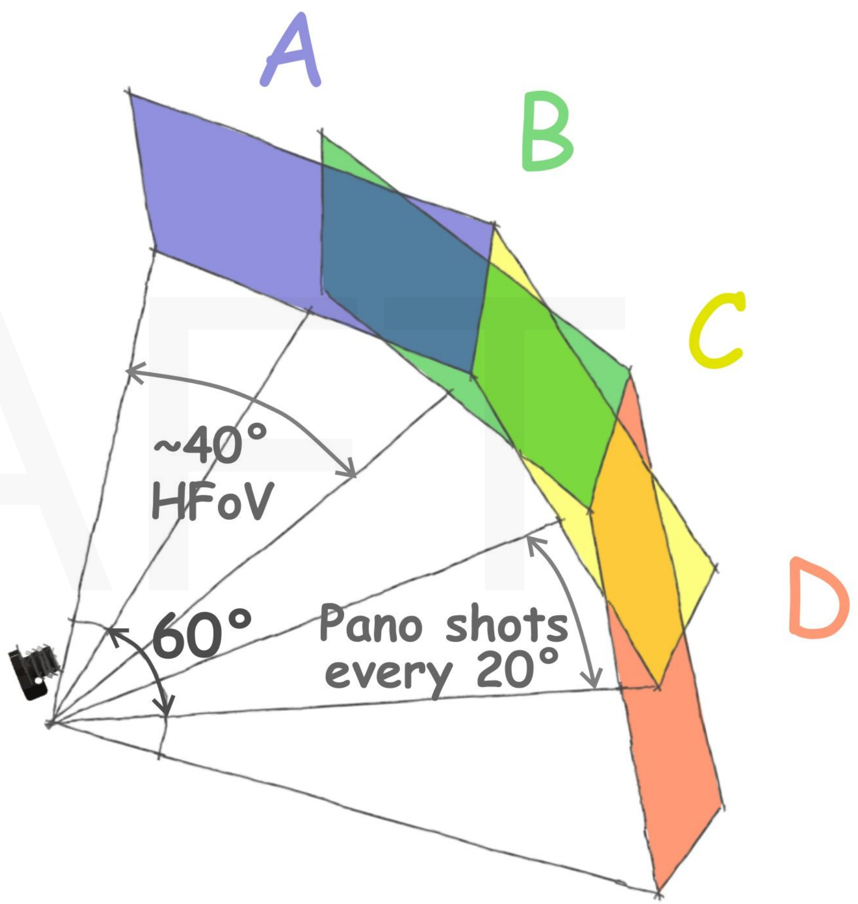


Figure 2: Example of a panorama of 4 shots with 20° overlap

2.2 When taking panoramas with a standard tripod and camera mount parallax errors will occur (where foreground objects appear to move, left or right, relative to background objects). A correctly set-up panoramic head eliminates parallax errors by ensuring that the nodal point of the lens is centred on the same point, as the camera is turned to capture the panorama. Parallax errors will be particularly apparent on foreground features such as fences, but will also affect the overall geometry of the image. Where a 360° image is being captured (for example to extract cylindrical baseline and planar shots later - see Appendix03##) removal of parallax will provide the correct geometry for subsequent processing.

2.3 A 'leveller' (or tribach) is separate to the panoramic head and allows the camera to be levelled in the horizontal and vertical planes. Levelling should be carried out using a small spirit level on the mounting plate, rather than bubble levels, which are not as accurate and can be difficult to read.

3 Taking panoramas

3.1 Set the exposure to be correct for the subject/site area, as this is the most important area of the panorama to have in good light. If there is no one subject, set the exposure for a point at 90°to the sun's direction (this is an average light level for a panorama).

3.2 Taking a photograph of your hand, before taking the first proper frame, will identify the starting point of the panorama. The same can be done after the last photograph of the panorama is taken.

3.3 Take photographs in a clockwise direction (left-to-right) for consistency and to avoid the panoramic tripod head unscrewing. A further benefit is that they will appear 'correct' when viewed side-by-side as thumbnails in image management software.

3.4 Use of the detents on the panoramic head will provide constant angles and overlaps between the photographs, such as the 20°with 50% overlap, suggested above.

3.5 As far as possible, avoid movement in the scene between adjacent images, such as pedestrian or vehicle movement.

4 Recording camera position

4.1 GPS-equipped cameras (with GPS function turned on) will record the location of the shot in the EXIF data, but typically with only around 5-10m accuracy. Hand-held GPS and most Smartphones will provide a similar level of positional accuracy. This is useful and acceptable in areas with no other visible references (eg mountain sides) and when the subject is some distance away. Where visible fixed references are close to the camera location (eg trig points, gates, surface features) reference to aerial photography within a GIS system (or Google Earth) may provide greater positional accuracy for the photograph viewpoint than GPS.

4.2 OS grid coordinates should be recorded where known, or extrapolated from other (latitude/longitude) positional data (for example by using UK gridreferencefinder.com website).

4.3 The tripod should be photographed (by another camera or smartphone) in a way which assists future confirmation or verification of the viewpoint location.

4.4 Where there are no visible references and standard GPS would not be of sufficient accuracy, enhanced GPS (eg GNSS RTK) may be hired or provided by a surveyor. High levels of locational accuracy may be required when viewpoints are near to the subject (eg close urban photomontage) and a close match is required between 3D model and existing features; and when photographs/ photomontages are required to be survey verified (see Appendix08##).

4.5 See Appendix 11## for comparisons of locational accuracy.

Appendix 02 Camera Settings

The following fixed (manual) settings will provide consistent results.

1 ISO

ISO measures the sensitivity of the image sensor. The lower the number, the less sensitive the camera is to light, and the finer the grain of the image. Typically ISO 100 will be appropriate on a clear bright day, perhaps dropping to 200 if light levels are low.

2 Aperture

Aperture is the hole within the lens, through which light travels into the camera body. You can shrink or enlarge the size of the aperture to allow more or less light to reach your camera sensor. In most cases, aperture should be set around f/5.6 - f/8 (roughly the middle of most lenses' range) to produce the sharpest image, although in wide open landscape an aperture of f/11 - f/16 will provide a better depth of field.

3 Shutter speed

As a simple rule of thumb, you should aim for a speed (in fractions of second) well in excess of the focal length of the lens. For example, with a 50mm FL lens, aim for speeds of greater than 60th of a second.

If using zoom lenses (only appropriate to capture fine detail around the site for reference) an 85mm lens should exceed 100th of a second, 300mm lens should exceed 300th of a second etc.

This is less important when cameras are tripod-mounted, but camera shake (from the internal mirror lifting during exposure) can still occur, and its effects be minimised by suitably high shutter speeds.

Use of a shutter release cable will eliminate camera movement which might otherwise occur when the camera shutter button is pressed.

4 White Balance

Select an appropriate daylight setting eg Sun/Cloud/Shade (review at each viewpoint in case conditions change). Do not use 'auto' as it is likely to vary the white balance from shot to shot (see Appendix 13##).

5 Focus

Manual focus should be used to avoid incorrect geometry . For distant sites, the lens should be manually focussed on infinity. For closer sites, the focus should be close to the site's/subject's distance. This will ensure that the sharpest focus occurs where it is most needed. This will assist if the intention is to insert a 3D image of a proposed development, which will also be sharply in focus.

6 Image format: JPG/RAW

All digital cameras offer a range of formats in which the image will be stored on the camera’s memory card. Typically these will be JPEG at a variety of quality (resolution and compression) settings, camera ‘RAW’ and, on some cameras, Adobe DNG digital negative format. RAW and DNG both serve the same function of storing the contents of the sensor unaltered (hence 'raw') together with a series of parameters recording the camera’s current settings. Thus post-processing stages, such as white balance and sharpening are recorded as parameters but not actually applied to the image. RAW and DNG provide the user with the maximum possible opportunity to get the best quality out of the image.

The disadvantage of RAW over JPG is that the file sizes will be 2-6 times larger, requiring more storage space on memory cards and computers and also requiring more time and effort to post-process. Unless there is a compelling reason to use RAW or DNG (for example if specified by the planning authority), the highest-quality JPEG format usually provides sufficient image quality. Some cameras provide the option of automatically storing both RAW and JPG, which allows the choice of format to be made on an image by image basis, but of course requires even more storage space than raw alone.

To take advantage of its maximum available resolution, the camera must be set to its highest resolution and minimum compression settings.

Appendix 03 Dealing with Panoramas

1 Cylindrical Panoramas

1.1 Panoramic images are often required to capture wide fields of view appropriate to certain types of more linear or widespread development (eg power lines, transport corridors, solar farms etc). However, they do come with difficulties in respect of viewing printed images. Cylindrical images need to be curved around the viewer to represent real-world viewing angles. Alternatively they could be viewed flat by moving the head at a constant distance across the panorama. Both of these options are unlikely to be followed by viewers. They are more likely to be viewed flat from a single, central position. It is for this reason that planar projection has been adopted by SNH and the LI.

2 Planar Panoramas

2.1 A panorama which is projected into a planar image will represent a more accurate image overall, but only of a view from the central point of perspective of the image. Increasing distortion (or stretching) occurs towards the edges of the panorama in order to maintain the correct impression when it is viewed flat. All parties should recognise that printed panoramic images are an imperfect way of attempting to recreate the experience of viewing a wide-angle scene. Nonetheless, where it is important to communicate the context of the view, a panorama will be required.

3 Reprojecting panoramas

3.1 The default projection for most panoramic software will be cylindrical. Within SNH guidance 2017, this is the required format for Baseline photography. It may be helpful to work in cylindrical projection whilst creating wirelines and renders, to correctly overlay the cylindrical panorama, and then to re-project to planar (rectilinear) for submission.

3.2 Cylindrical to planar projection may be achieved by a variety of software, for example: Hugin (open-source), Photoshop (with or without the Flexify plugin), The GIMP (with G'MIC (open-source) or Flexify plugins). An internet search will reveal other options which will suit specific platforms and workflows.

4 Calculating view angles

4.1 For a panorama created from overlapping frames, each of just under 40° HFoV, the view angle can be determined mathematically, based on the stops set on a panoramic head (see Appendix 01 ## above).

4.2 Alternatively the total view angle may be determined from map or aerial data corresponding with what is visible within the panorama frame. For example, the Google Earth measurement tool shows the angle of any line relative to geographic north. Draw a line from the camera position to an object at the left side of the frame, note the angle (say 210°), repeat for the right side of the frame (say 290°)and deduct the first angle from the second angle (290 - 210 = 80° HFoV).

Appendix 04 Technical Methodology Template

Indicative Template – adapt to your own page format

For the project:

1	**For all photography**	**Example responses**
	Make and model of camera, and its sensor format (assumed 35mm FFS)	Canon 6D, FFS
	If panoramas used: make and type of panoramic head and equipment used to level head	Manfrotto pano head and leveller
	Method to establish the camera location (eg handheld GPS/GNSS, GPS/RTK GPS, survey point, visual reference)	Aerial photography in GIS system
	Likely level of accuracy of location (#m, #cm etc)	better than 1m
	If working outside the UK, geographic co-ordinate system (GCS) used (e.g. WGS-84)	N/A
2	**For the 3D Model**	
	3D Modelling and Rendering Software	#########
	Source of topographic height data and its resolution	Combination LiDAR + OS Terrain 5m
	How have the model and the camera locations been placed in the software?	Model based on architect's coordinates, camera locations ref GPS plus ground features in aerial photography
3	**Generally**	
	Any limitations in the overall methodology for preparation of the photomontage and visualisations?	No

Per Viewpoint: (you may opt to provide some of this information in the photograph/visualisation figure notes – see Appendix 05##):

1	**Photographic equipment**	**Example responses**
	Date and Time of captured photography	
	A photograph of the tripod location, to allow the viewer to understand where the camera/tripod was located.	
	Make, maximum aperture and focal length of the camera lens(es) used.	Canon / Nikon / Sigma etc 50mm f/1.4
	If lenses other than 50mm have been used, explain why a different lens is appropriate (e.g. wide-angle view required to capture the width or height of the development)	N/A
	Camera location grid coordinates: eastings & northings to 1m accuracy; height of ground in mAOD	
	Height of the camera lens above ground level. If above 1.65m or below 1.5m, why?	1.5m
	Distance (in m) to the nearest boundary or key feature(s) of site, as most appropriate.	1200m to south boundary
2	**3D Model**	
	What elements in the view have been used as target points to check the horizontal alignment?	Existing buildings, telegraph poles, LiDAR DSM
	What elements in the view have been used to check the vertical alignment of the model in the view?	Topography, existing buildings

Appendix 05 Sample Photograph/photomontage template - data to include per view

Appendix 05 - indicative page layout and information template - layout not prescriptive

Resize to A3

20 cm

DRAFT

10 cm

Location plan

0

Distance to ######:	###km	Revision:	-	Sheet Size: A3 Landscape
Bearing to ######:	###° from north	Scale:	-	Checked: -
Viewpoint grid reference:	E######, N######- see Figure ##	Drawn:	##	
Viewpoint ground height:	### m	Date:	##	
Date & time of photo(s):	##/##/20## 10:00			
Camera:	Make	File Name: ####		
Lens, FL, max aperture:	Make, 50mm, F1.8			

Project: Proposed ########

Client: #

Drawing title: Viewpoint ## - Existing

Fig: ##

Appendix 06 Tilt Shift Lens

The tilt shift lens is increasingly being used in architectural photography in urban locations. It can also be employed for taking photographs up or down slope. The lens comes in a range of focal lengths including 17mm, 24mm, 45mm and 90mm. The 24mm tilt shift is typically used for visualisation work where viewpoints are located close to a development and the normal range of prime lenses will not capture the proposed site.

The **tilt** function allows the lens to be swung about either a vertical or horizontal axis so that the axis of the lens is not perpendicular to the picture plane of the sensor.

The **shift** function allows the lens to be offset vertically or horizontally so that the axis of the lens remains perpendicular to the plane of the sensor but no longer passes through it centre point.

It is only the shift function which is relevant to photography and visualisations.

The tilt shift lens should be considered a ‘lens of last resort’ because the results can be used to direct the eye upwards or downwards, depending on the selected portion of the overall view used. This can be used to (wrongly) accentuate the extent of sky or the extent of foreground in the view, resulting in an over-emphasis on the amount of sky or foreground in the printed image/visualisation, creating an unbalanced view towards a development which doesn’t reflect what the camera, or the human eye, would see under normal circumstances.

Prime lenses have a single point or perspective in the middle of the single frame image. With the tilt-shift this point of perspective will vary depending on where the lens is positioned.

Before using a tilt shift, the normal suite of 50mm, 35mm, 28mm and 24mm prime lenses should be explored in both landscape and portrait orientation. Assuming the 24mm lens in portrait will not pick up the verticality of a proposed building, then the tilt shift can be employed.

Images produced with the tilt shift should be stated as such and be presented with clear makings on the image to identify the point of perspective.

The reasons for using tilt shift should be clearly explained in the Technical Methodology.

Appendix 07 Abbreviations and Glossary (to be completed)

Aperture

APS-C ...see also Full Frame Sensor

Cylindrical ...see also Planar

DNG ...see also JPG and RAW

DTM

Effective Focal Length

EIA ...see also LVIA/LVA

EXIF ...see also Metadata

Exposure

FoV / Field of View (FoV)
of a given image is measured in degrees, and generally refers to the Horizontal Field of View (HFoV), from the left to the right edge of the image. For close viewpoints to a development the Vertical Field of View (VFoV) will also be an important consideration.

FFS / Full Frame Sensor ...see also APS-C

Focal Length

Focus

GIS

GNSS

GPS

ISO

JPG ...see also DNG and RAW

LiDAR

LVA

LVIA

mAOD

Megapixel

MetaData ...see also EXIF

Nodal point

Panoramic head

Parallax

Photomontage
"A visualisation which superimposes an image of a proposed development upon a photograph or series of photographs." (GLVIA3)

Pixel

Pixel per inch

Planar ...see also Cylindrical

Principal distance

RAW ...see also JPG and DNG

RTK

Shutter speed

SLR

Verified photomontage - see Appendix 08##

White balance

Appendix 08 Verified Photomontages

There is no industry-standard definition as to what constitutes 'a verified photomontage' and when it is required. The LI's understanding is as follows.

1 Survey-verified photography

1.1 When working on close-range, urban projects, a high level of consistency may be required between photograph viewpoints, identifiable objects within the scene and the 3D model which aims to replicate and add to the scene. This can be achieved through survey-verified photography.

1.2 Survey-verified photography involves using a surveyor, or survey equipment, to capture camera locations and relevant target points within the scene, which are then recreated in the 3D-model.

1.3 The position of a camera and fixed points in a view are recorded using precision surveying equipment, for example GNSS (Global Navigation Satellite System) with RTK correction and laser rangefinders, allowing camera location and fixed points in the view to be calculated to down to cm accuracy. A clear understanding of camera geometry and the scaling requirements of the 3D model renders ensures highly accurate visualisations can be produced. The combination of survey-verified photography, accurate 3D modelling and overlaying of proposal images effectively allows survey-verified photomontage to be created.

2 SNH: Verification of Visuals

2.1 SNH, in its Visual Representation of Wind Farms Guidance (2017) allows for verification that the process described in its guidance has been correctly followed. It states (para 117):

“In some cases the determining authority may wish to verify the accuracy of the image produced. This is possible using the original image data recorded by the camera (to check camera format and lens used) and a simple template (to check that the image dimensions have been correctly adjusted (by cropping and then enlarging)). This process is described in Annex E. Camera metadata should be provided by the applicant on request.”

2.2 The LI concurs with this approach, where verification is required.

3 Accurate Visual Representation (AVR)

3.1 Other guidance, such as the London View Management Framework Supplementary Planning Guidance (2012) states (para 463):

“An AVR must be prepared following a well-defined and verifiable procedure so that it can be relied upon by assessors to represent fairly the selected visual properties of a proposed development. AVRs are produced by accurately combining images of the proposed building (typically created from a three-dimensional computer model) with a representation of its context; this usually being a photograph, a video sequence, or an image created from a second computer model built from survey data.”

3.2 The guidance goes on to require a methodology and information about each AVR including location and coordinates of the camera.

4 Summary

4.1 The LI takes the view that a proportionate approach is required. Where high levels of positional accuracy are essential to the validity and purpose of the photomontages being produced, for example in sensitive urban contexts with close subjects, survey-verified photomontage may be appropriate, and should be determined by the practitioner in consultation with the relevant authority.

4.2 In most situations, sub-metre accuracy, which may be achieved using aerial photography (as described in Appendix 11 ##) is sufficient.

4.3 Where the subjects of the photomontage are at distances beyond a few kilometres, the level of accuracy of standard GPS (at around 5m horizontal) is sufficient, noting that ground/camera height can usually be derived more accurately from height data. It is noted that, as global positioning systems are enhanced, and the cost of equipment reduces, higher levels of positioning accuracy will become the norm.

4.4 In all cases, as stated at the beginning of this guidance, visuals should provide a fair and not misleading representation of what might be seen if the proposed development was built. The level of positional accuracy, and how it has been achieved, should be set out in the Technical Methodology (Appendix 04##) accompanying any visuals. Where the competent authority has particular expectations or requirements, these should be set out and agreed in advance of site work.

Appendix 09 Matching photography and 3D modelling

Software-based matching

1 The combination of 50mm FL lens and Full Frame Sensor, is usually quoted as having a HFoV of 39.6°. However, there are no precise 50mm lenses and all models will have a range of effective focal length depending on the point of focus. Therefore the HFoV cannot be assumed to be 39.6°and may range from 37-42°. The practitioner must understand how to calculate HFoV from the sensor/lens combination being used, if they wish to use this data to match software-generated 3D models to the photographic image.

2 Given accurate FoV data and orientation, some 3D software is able to output visuals which are perfectly matched, in terms of FoV and pixel size, to the reference photographs. If this mathematical model is relied upon to determine the size of the visualisation within the photograph, the FoV must be known to a high degree of accuracy. Making assumptions as to FoV may result in renders which are out of scale with the background photograph, either larger or smaller.

3 Using software to directly provide a render, based on accurate FoV data and target points, there should be no need for resizing or repositioning, relative to the background photograph.

4 Care should be taken, when using software or mathematical approaches to determine the size of the render within the photograph, that a 'sense-check' is applied to ensure that overall placement is correct. For example, if there were a low foreground rise in the view, but the development was placed in front of it, when it should be behind, not only will it be in the wrong place geographically, but it will also appear to be too small, because a more distant object appears to be 'closer' to the viewer than it should be.

Image matching

5 An alternative approach is to use key reference points which occur within the 3D model and the background photograph. These will allow alignment and sizing of a render to match the background image. It is important, however, if resizing renders within a photograph, to use the corner "grips" only, as this will prevent the distortion and loss of the correct (ie the original) aspect ratio of the visual. Using side or top grips will alter the aspect ratio and result in a visual which is either too tall or too short, compared to its background photograph.

6 Resizing any object or layer in photo-editing software is likely to lead to some loss of resolution and blurring. Resizing should, therefore, be kept to a minimum by, for example, re-sizing in one step rather than multiple 'goes'. If the background photograph and rendered image are sufficiently high resolution, this is unlikely to be an issue. However, the optimal solution is to generate the rendered image to match the resolution of the photograph without resizing, if the 3D software allows it.

7 When using targets within the photograph and targets in the 3D model, these should be accurately geo-referenced, and vertical heights of 3D elements confirmed from either survey or terrain model (eg LiDAR DSM).

Appendix 10 Earth curvature

With the exception of dedicated wind software, most 3D software depicts the earth (model space) as flat, and does not reproject distant parts of the model in response to earth curvature.

A photograph necessarily shows real-world curvature of the earth and the effect of refraction through the atmosphere. Whilst at distances of less than 1km this is barely perceptible, at distances above 1km these effects become more important.

The effects are notable on, for example, tall structures near or beyond the visual horizon, being particularly relevant for tall buildings, wind turbines and similar structures viewed at distance.

Earth curvature also affects situations where distant features are used as a reference for nearer subjects. For example, if a site was located in the middle-ground of an expansive view, but distant hills were used as a vertical reference, the distant hills would be lower in the photo (due to curvature) than in a 'flat' 3D model. Therefore, if the model was aligned to the hills, the nearer part of 3D model would be placed too low. In this instance, vertical alignment should reference objects close to the site.

Examples of the visual effects of earth curvature:

- When stood at sea level on the beach the maximum distance to the horizon would be less than 4km

- The Shard Tower in London would not be visible, from a point near sea level, 68 km away.

It should also be noted that, for elevated viewing positions (for example, standing on the cliffs at Dover) it is possible to see greater distances than at sea level. Therefore, the visualisation methodology should be aware of and demonstrate that it takes account of earth curvature, where relevant.

SNH Visual Representation of Windfarms 2006 provided a useful reference table: "Annex F: Earth Curvature and Refraction of Light, Table 19: Height corrections for earth curvature and refraction". This is reproduced here (with the kind permission of SNH) purely to indicate the magnitude of the figures involved.

Distance	Vertical correction for Earth curvature and atmospheric refraction
5 km	1.7m
10 km	6.7m
15 km	15.0m
20 km	26.7m
25 km	41.7m
30 km	60.1m
35 km	81.8 m
40 km	106.8 m
45 km	135.2 m
50 km	166.9 m
55 km	201.9 m
60 km	240.3 m

Appendix 11 Locational accuracy

How much does locational accuracy matter?

if you are looking at an object 10m away, which is directly east of you (90° from north), and you move 1m north, the object will appear to shift by 5.7°, and will now be at an angle 95.7 degrees from north.

If the object is 100m away, it will appear to shift 0.57°, to 90.57° from north.

If the object is 1000m away, it will appear to shift 0.057°, to 90.057°.

If the object is 10,000m away, it will appear to shift 0.006°, to 90.006°.

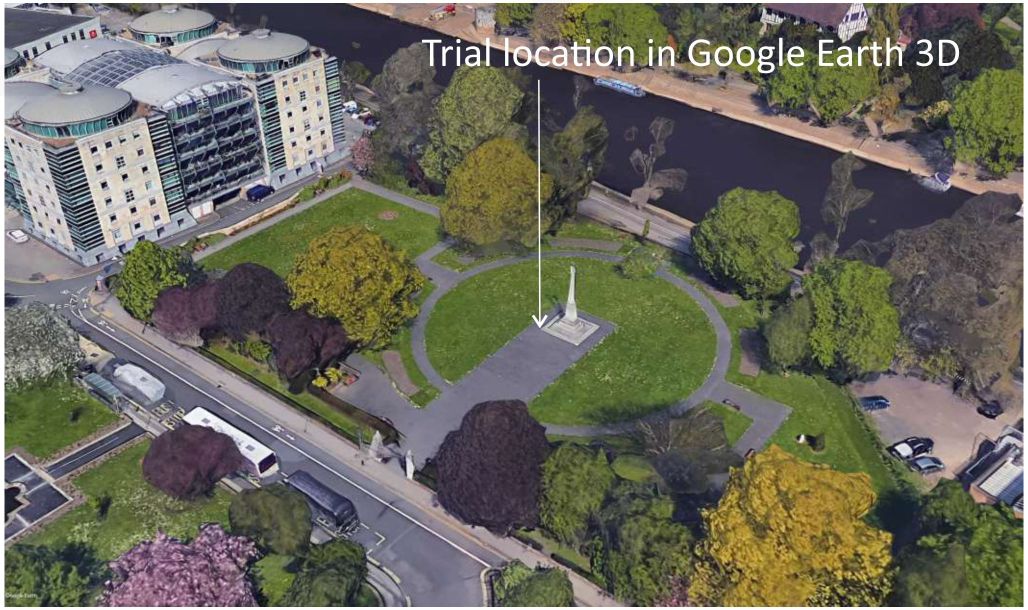
War Memorial in Memorial Gardens, York

Clearly, a small shift in location can make large difference to the apparent location of objects when they are close to you. This is especially important due to the effect of parallax, or the apparent shifting of objects' positions based on how near or far they are from you.

In the photo of the War Memorial in Memorial Gardens, York, if we faced the memorial and stepped 1m to our right, we would no longer be able to see the south tower of York Minster. This is because the war memorial is close to us and appears to shift substantially, relative to a more distant object such as the Minster.

So if we wanted to accurately 3D model the geometry of the war memorial and match a render to the photograph above, we would need a very accurate understanding of our camera position (x,y,z or easting, northing, height), relative to the memorial. However, if we were modelling an extension to York Minster south tower from this same view, it would not be as critical to know our exact camera position.

In summary, knowing the precise location of the camera, relative to the site, matters more when the subject (site) is closer to the viewpoint, than when it is further away.



Appendix 11/1
Locational accuracy

How accurately can a viewpoint be located?

When undertaking research photography for this guidance, one location used was the stepped south-west corner of the War Memorial in Memorial Gardens, York (see photo and Aerial view, previous page). This was selected, in part, because it would be clearly visible in aerial photography. The following images show the location within GIS software, with some of the available means of identifying the location of the corner of the monument.

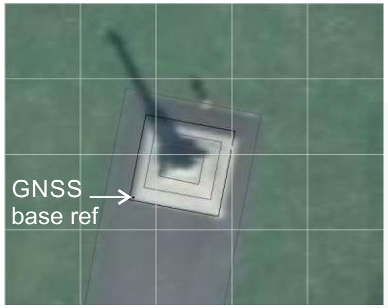
For each source of aerial photography, the corner position was visually estimated and compared to the base reference.

The images below are 1:500 scale when the page is printed at A4, with a 5m grid overlay. This exercise shows that dedicated survey equipment offers a high level of accuracy relative to mapped sources.

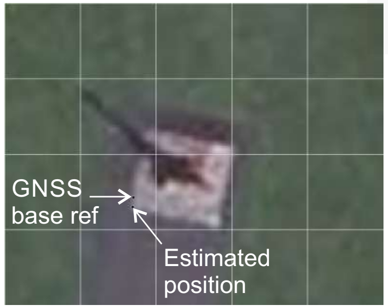
Hand-held GPS devices (all of which were allowed to 'settle') offered accuracy from around 8m to 2m.

Aerial photography varied subject to source: hi-res OS performing best in this instance (accuracy within tolerance of GNSS device) with other sources providing location within 1m from the base ref. Note that performance will vary by location and subject to date, accuracy and resolution of source - this exercise cannot establish the best source in all cases.

For this clearly-identifiable location, in an urban area with tall buildings and trees (which could compromise GPS signals) aerial photography proved to be more accurate than hand-held or camera GPS. However, the results might be reversed on an open mountainside with no distinguishing locational features.

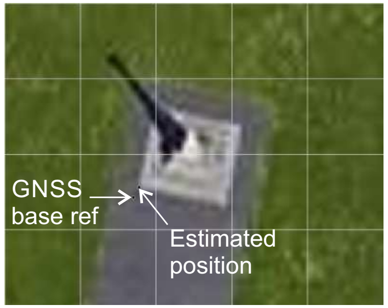


GNSS (without RTK), approx 0.18m accuracy. With RTK enhancement, this could have provided sub-cm accuracy.
Position reported as E459833.69, N451917.82.
Assumed as base reference (ref) for this exercise.
Vector outline is OS MasterMap, corner is 0.352m from base ref.
Aerial photography is OS Aerial hi-res (2007).
Estimated position is 0.073 from base ref.



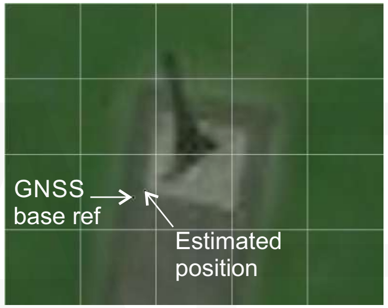
Aerial photography is Bing Imagery, accessed within GIS.

Estimated position is 0.634 from base ref.



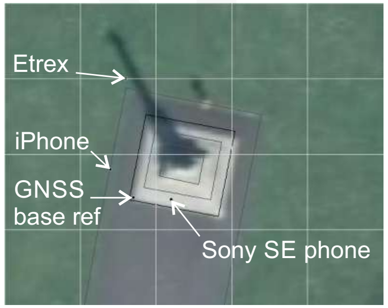
Aerial photography is Google Imagery, accessed within GIS.

Estimated position is 0.7854 from base ref.



Aerial photography is World Imagery, accessed within GIS.

Estimated position is 0.7854 from base ref.

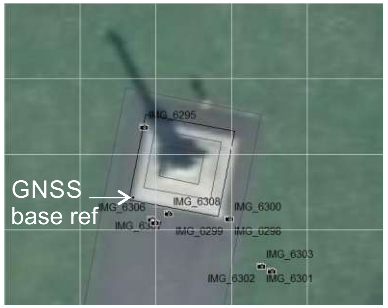


GPS sources plotted against OS background. Reported coordinates were to the nearest metre:

iPhone GPS 2.414m from base ref.

Sony SE phone 2.478m from base ref.

Garmin Etrex Vista HCx (GPS) 7.889m from base ref.



GPS sources plotted against OS background:

Canon 6D internal GPS: multiple exposures at base location, recorded GPS coordinates variable, average 5m from base ref.

Appendix 12 Night-time photography

The following is an extract from a forthcoming LI publication: Landscape and Visual Assessment: Artificial Light and Lighting (with thanks to Karl Jones of the LI Technical Committee). It provides an outline of considerations specific to night-time photography for the purpose of LVIA.

Fieldwork

Fieldwork requires suitable weather conditions and consideration of the phase of the moon to get accurate sky darkness results and to accurately record views of the existing night time environment, noting that as the temperatures cool in the evening, mist or rain may form. Online weather forecasts targeted for astronomers can assist with predicting the appropriate time to undertake the fieldwork (e.g. (www.clearoutside.com) or by using smartphone apps (e.g. www.metoffice.gov.uk/datapoint/showcase/scope- nights).

Before undertaking the fieldwork, ensure you know:

- *The sunset time;*
- *Where, within the study area, potential viewpoints that need to be checked (for day time and night time effects) are located;*
- *How to identify the main types of lighting (for recording accurately those already present at the Site) and how existing lighting will appear in photographs;*
- *What potential existing night-time landscape features (e.g. prominent lit important architecture) maybe present;*
- *How long the night-time work is likely to take (factoring-in time for checking of photos and the time needed for each exposure (generally taking tens of seconds per photo);*
- *and*
- *The locations of likely sensitive night landscapes (e.g. dark-sky areas, existing light pollution, 'remote' policies).*

Additional equipment, beyond that normally required for daytime fieldwork may usefully include:

- *A tripod (to allow long exposure shots to be taken without incurring fuzzy photographs), ideally with luminous or high visibility*
- *reflective strips on legs to prevent trip hazards;*
- *A Camera lens hood (to avoid glare from lights of passing vehicles or other obliquely located sources of light);*
- *A Head torch (working at night requires additional lighting whilst keeping hands free to work the camera, record notes etc.);*
- *A Tablet (helpful to view photographs, on location, to ensure that the exposure and colour balance reflects the scene viewed with the naked eye, and to record differences);*
- *UV marker chalk or pegs and black light torch (useful to temporarily record and mark the exact location of daytime viewpoints, to reposition the camera to the same viewpoint in the dark – bearing in mind that the location can look very different in the daytime to the night time);*
- *Spare batteries or portable battery charger (as it is generally significantly colder at night, batteries may discharge more quickly, e.g. for mobile phone and camera);*
- *Warm clothing and appropriate safety equipment.*

Further detail will be provided within the LI publication "Landscape and Visual Assessment: Artificial Light and Lighting" on the topics of exposure, ISO settings etc. Such detail is beyond the scope of this guidance.

Any night-time photography should be accompanied by day-time photography from the same location and same direction to give a direct comparison. Photos taken at half-hour intervals, from dusk to deep night, may be useful in sensitive locations - noting that only one viewpoint sequence can be taken per day.

Note that SNH 2017, paras 174-177, provides useful guidance on illustration of lighting and night-time effects.

Appendix 13 Camera Auto Settings to avoid

1 Auto settings generally

Automatic camera or lens settings are designed to make the photographer’s task easier, but the loss of control can give unpredictable results and potentially reduce the quality of the photographic images. Most auto settings should be disabled or treated with caution. Photography should generally be undertaken using manual controls to avoid the camera creating unwanted differences (focus, exposure, white balance, ISO) between shots.

2 Autofocus

Many passive autofocus systems are sensitive to the presence of foreground objects. This can result in focus being determined by a foreground twig, leaving the majority of the frame out of focus. Importantly, the focus can be slightly different in successive frames of a panorama, potentially precluding a clean splice and preventing the capture of a useful panorama. Autofocus should be switched off and manual focus engaged (usually a switch on the lens of a DSLR).

3 Digital zoom

Many inexpensive digital cameras offer both 'optical zoom' and 'digital zoom'. 'Optical zoom', as the name implies, uses the optics of a zoom lens to enlarge the image projected onto the sensor. 'Digital zoom' is a simple enlargement of the digital image by cropping and reduces the resolution of the image to that of the crop. As it reduces image quality, 'Digital zoom' should not be used.

4 Automatic exposure

Automatic exposure greatly speeds opportunistic photography, but rarely results in optimum results for landscape and visual impact assessment work. Manual settings should be used - see Appendix 02##.

5 Automatic white balance

Many digital cameras have a facility to automatically compensate for ambient colour temperature, so that, for example, photographs taken under indoor lighting do not appear yellow compared with those taken in daylight. This facility can have unforeseen consequences when taking panoramas. For example, the presence of a red telephone box in the foreground of one frame may result in a cyan cast on the colour in that frame only. White balance should be set manually (see Typical settings below).

6 Image sharpening

Many digital cameras have a facility to sharpen the photographic image in the camera. This option should be switched off. Compositing a photomontage is much more difficult to do satisfactorily if the base image has already been sharpened, particularly if it is over-sharpened. Any image sharpening required for printing can be done in a more controlled manner in image processing software.

7 Image stabilisation

'IS' is designed principally to reduce the effects of camera vibrations (eg when pressing the shutter button) when the camera is hand-held. If the camera is tripod-mounted, IS should generally be turned off as, in this situation, it can worsen, not improve, image quality.

Appendix 14 Limitations of Cropped-Frame Sensors (eg APS-C)

1 Whilst 35mm film itself is largely outdated for technical applications, it is worth being aware of the origin of the term "Full Frame Sensor" (FFS). The point of reference for FFS as a term of specification is the frame size of pre-digital 35mm SLR film frames, which is 36mm x 24mm. The combination of 50mm Focal Length (FL) lens and 35mm equivalent FFS (giving a Horizontal Field of View (HFoV) of a little under 40 degrees) has become a standard for photography over many decades.

2 Whilst FFS is rightly regarded as the professional standard for digital photography, APS-C cameras have been developed as the 'pro-sumer' or entry level in Digital SLR (DSLR) for many years. The overall image quality (in normal lighting situations) is often regarded, for example in camera reviews, as comparable with, or only slightly inferior to, FFS.

3 The main difficulty arising with APS-C cameras is that the image sensor is some 1.5- (Nikon standard) to 1.6- (Canon standard) times smaller than a FFS. Whilst image resolution (pixel count) can be maintained with APS-C, the smaller sensor size effectively crops the image projected through the lens, with the overall result that it is based on a smaller part of the scene, so that, effectively, it is 'zoomed'. Thus a 50mm lens on a (1.5x smaller) APS-C lens will give an image equivalent to 1.5 x 50mm = 75mm (FFS). This (and the variations in cropped-sensor sizes) does not allow for the degree of control required for a verifiable process (see Appendix 08##).

4 APS-C will present greater difficulties, if wide-angle (28-35mm FFS equivalent) images are required. In these situations a much wider-angle fixed lens would be required, leading to increased levels of distortion.

5 The reduced size of cropped-frame, compared to a full-frame sensor results in lower sensitivity, especially in poor lighting conditions. This, in turn, can result in greater image noise at high ISO levels or in darker conditions. Smaller size is also likely to reduce the camera's capability to capture a high dynamic range (HDR) which is the range from light to dark areas of the image. Higher dynamic range can be especially useful in landscape photography, where the sky is often very bright, compared to the earth and vegetation.

6 Whilst most APS-C limitations can be overcome, doing so introduces more scope for error and demands a higher degree of technical competence than working with FFS cameras and 50mm prime lenses. For these reasons, the LI and regulators, such as SNH, recommend the use of Full-frame sensors.

Appendix 15 Why not Zoom Lenses?

1 Zoom lenses (with variable FL) present several difficulties for technical photography:

- It is usually impossible to set a zoom lens to a specific focal length, apart from the longest and shortest ends of its focal length range.
- FL can vary between shots, even in the same panoramic sequence, resulting in variations which make panoramas un-stitchable or individual shots subject to unnecessary variation.
- zoom lenses usually create more distortion than fixed lenses (barrel / pincushion) and although this can be fixed with software post-processing (lens correction) it introduces an additional step with potential for error and loss of image quality.

2 As a result of the above shortcomings, zoom lenses:

- should be avoided in favour of fixed prime lenses;
- will not satisfy more demanding applications which require fixed lenses for verification purposes;
- require higher levels of skill in shooting and post-processing than fixed lenses.

This Guidance Note was prepared by members of the Landscape Institute (LI) Technical Committee, in consultation with LI members and technical experts experienced in photography, photomontage and landscape and visual impact assessment.

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