HIGHWAYS AGENCY

Safe roads, reliable journeys, informed travellers

A14 Cambridge to Huntingdon improvement scheme

Environmental Statement

Appendices

Appendix 10.7: Detailed methodology used for production of zone of theoretical visibility and photomontages

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1 Zone of theoretical visibility methodology

1.1.1 This appendix describes the technical methodologies used to produce the zone of theoretical visibility (ZTV) illustrated on *Figure 10.4* and photomontages illustrated on *Figure 10.6*.

1.1.2 The ZTV is the extent to which the scheme would be visible, as described within *Chapter 10 of the environmental statement (ES)*. The ZTV was produced using 3D computer modelling techniques to produce a broad scale area from which the scheme would theoretically be visible. This is shown on *Figure 10.4*.

1.1.3 Four ZTV scenarios were examined as follows:

- ZTV1: Heavy goods vehicles (HGV) traffic – no screening (bare earth) to a 5km extent.

  The 'bare earth' approach used for the assessment is in accordance with Section 6.6 - 6.12 of the *Guidelines for Landscape and Visual Impact Assessment (Third Edition) (GLVIA)* (Landscape Institute and Institute of Environment Management and Assessment, 2013).

- ZTV2: HGV traffic– with screening to a 3km extent.

  ZTV2 assumes HGV traffic as per ZTV1, but the screening effects of existing vegetation and buildings are included within the computer model.

- ZTV3: Proposed gantries– no screening (bare earth) to a 5km extent.

  As ZTV1 above but includes gantries along the scheme, excluding Huntingdon where gantries are not proposed.

- ZTV4: Proposed gantries– with screening to a 3km extent.

  As ZTV2 (screening from vegetation and buildings) but with gantries as ZTV3.

1.2 Ground modelling

1.2.1 This section describes the technical methods used to develop the ZTVs.

1.2.2 A suite of computer modelling software was used to combine and justify 3D survey and model data for the scheme into a single ground model for use in ZTV generation. The computer modelling software includes Autodesk Civil 3D, Key Terra Firma 2013 and AutoCAD 2013.

1.2.3 Digital data used to compile a 3D ground model for a 6km offset from the scheme included:

- Landform panorama contours (.dxf tiles from OS open data 2013) for a 6km offset from the full extent of the scheme;
- A remote sensing technology (lidar received July 2014) topographical survey for the full extent of the scheme (including contours); and

- 3D design models available in August 2014 (contours generated from 3D design string models).

1.3 Target points

1.3.1 Target points are points plotted above the level of the proposed carriageway to represent the height of HGV traffic and gantries above the road surface. Each of these points then generates 3D rays across the 3D model to a theoretical viewer height of 1.7m above local ground level.

1.3.2 ZTV1 and ZTV2 – HGV traffic 4m above the carriageway: 3D centrelines of the proposed main line, slip roads and junction roads were combined and raised 4m in height to represent HGV traffic on the proposed scheme. A chainage of 500m for each target point along the carriageway was used to enable a suitable resolution proportional to the scale and nature of the proposals.

1.3.3 ZTV3 and ZTV4 – Gantries 12m above carriageway level: Gantries were modelled as 3 point lines (to represent each end and a centre point of each gantry) and attached to the original 3D centrelines to fix the carriageway heights below, then raised to 12m above carriageway to reflect representative height for all gantries across the scheme as the likely worst case for assessment.

1.4 Screening elements (visual barriers)

1.4.1 All visual barrier information (relating to buildings only) within a 3km offset of the scheme was extracted from 2D OS vector mapping (vector-based collection of geographic information system data about earth at various levels of detail) and supplemented by traced OS raster mapping (image file made up of pixels i.e. points of colour). The larger urban areas were combined and additional barrier lines created internally every 40m to account for local changes in topography within these areas (e.g. housing located on a hillside). These areas were then inserted into the ZTV computer model and given a representative height of 8m.

1.4.2 All significant vegetation visual barrier information within 3km of the scheme was extracted from 2D information contained in topo-survey and GIS spatial data and combined where large areas of single trees were identified to reduce calculation time. These areas were then inserted into the ZTV computer model and given a representative height of 10m.

1.4.3 Once all target points and visual barriers were input, the ZTV model process then used each target point to generate rays out to the surrounding terrain in the 3D ground model, which stopped when encountering higher ground (bare earth), or visual barriers.

1.4.4 The resulting set of visible rays created the zones of visibility which were then traced in AutoCAD to complete the graphic output of the ZTV. This was then exported to GIS and overlaid over the OS base mapping to create the final figures.

Key assumptions and limitations

1.4.5 The extent of the ZTV (5km from the scheme for “bare earth” and 3km with screening), representative heights of target points and visual barriers are all deemed to be a reasonable approach for visibility modelling based on the proportional scale and nature of the scheme. This assumption is based upon the professional judgement of suitably qualified and experienced specialists, as listed in *Appendix 6.1 of the ES*.

1.4.6 Screening: The heights for screening are representative only. There would be areas within the ZTV where some visual barriers are taller and provide greater screening, while some visual barriers would be shorter.

2 Photomontage methodology

2.1.1 This section provides a description of the methodology for the production of the photomontages shown on *Figure 10.6*. It should be noted that the photomontages are provided for illustrative purposes only, in line with the *Guidelines for Landscape and Visual Impact Assessment (Third Edition). (GLVIA)* (Landscape Institute and Institute of Environment Management and Assessment, 2013). The landscape and visual impact assessment in *Chapter 10 of the ES* is not based on the images on *Figure 10.6*.

2.1.2 The following assumptions and limitations are identified. These assumptions are based upon the professional judgement of suitably qualified and experienced specialists, as listed in *Appendix 6.1 of the ES*.

2.2 Key assumptions

2.2.1 The baseline photographs that form the basis of the photomontage are a flattened 2D representation of what the human eye would see.

2.2.2 Whilst every effort has been made to ensure a suitable level of accuracy is maintained throughout the production of photomontages, no final image is 100% accurate. Therefore photomontages are used for illustration purposes only. This is due to the level of accuracy of photograph survey used to provide references for fixing camera perspectives e.g. OS mapping data and handheld GPS equipment.

2.2.3 Photomontages are assumed to be required to reflect the worst case impacts of the scheme in year 1 of operation (2020) and the function of the proposed mitigation in the year 15 of operation (2035). For the photomontages in 2035, plant growth is assumed to reflect variations in mitigation planting establishment. Therefore, woodland and individual trees are assumed to establish to between 8-10m; and shrubs and hedgerows between 3-4m.

2.2.4 The 3D modelling is based on 3D and 2D highway, structural and environmental mitigation design information provided in August 2014.

2.2.5 No information was available for highway signage at the time of photomontage production and therefore this information has not been shown.

2.2.6 A photomontage is the superimposition of a rendered, photorealistic image of the proposals onto a base photograph, to visually represent the scheme.

2.3 Viewpoint locations and base photographs

2.3.1 Viewpoint locations were selected to illustrate:

- ‘representative’ viewpoints, which cover a number of visual receptors where the visual effects are likely to be similar;
- ‘specific’ viewpoints, where key viewpoints are in the landscape, such as local visitor attractions or viewpoints with cultural landscape association; and

- specific issues discussed in the assessment of the scheme in *Chapter 10 of the ES*.

2.3.2 The selected viewpoints illustrate a range of visual effects and different parts of the scheme including major structures, sections within cutting, sections on embankment, some adverse visual effects and some beneficial. The guidance within *IAN 135/10* recommends consultation and agreement with stakeholders. The approach to selecting photomontage locations is taken in accordance with the methodology identified in Chapter *10 of the ES* and the *GLVIA*.

2.3.3 The selected viewpoint locations are shown on *Figure 10.7* and *Figure 10.8*. The photographs were taken between May and September 2014 in clear weather conditions where even light levels would prevail. At each viewpoint location, the following survey data were collected:

- GPS reference noting the location of the camera;
- date and time the photograph was taken;
- the height of the camera above ground level (approximately 1.55m); and
- weather conditions at the time of photograph.

2.3.4 The baseline photographs were taken using a Canon EOS 5D digital SLR camera with a fixed 50mm lens. All photographs were taken on a tripod mounted and levelled to the vertical and horizontal axes as well as using the maximum resolution of the camera and including the RAW metadata (data file that records the date, time and shooting settings for use in post-production).

2.3.5 A series of photographs were taken with a minimum of 50% overlap between frames to reduce barrel distortion. These photographs were then manually stitched together in Adobe Photoshop software to produce a single panoramic image. During this process only minor improvements have been made to the photographs to balance brightness and contrast where necessary. None of the photographs have been distorted in terms of scale. Final images were cropped to 87.5 degree field of view to ensure a suitable image size for a comfortable viewing distance (12cm tall images should be viewed at approximately 27cm from the human eye).

2.4 Reference points and other information

2.4.1 To assist the process of matching the baseline photograph with the 3D digital model of the proposals, reference points were identified at each viewpoint location. Reference points are features within a photograph that can be identified from a topographical survey or OS and aerial photographical data. Examples include telegraph poles, field boundaries and pylons.

2.5 Construction of the base model and camera matching

2.5.1 The existing 3D ground model information used to create ZTV was imported into Autodesk 3DS Max Design to create the base terrain and provide topographical context to the scheme and surrounding area. Landform Panorama tiles (.dxf tiles from OS open data 2013) are only accurate to within 3m of elevation (up or down). Therefore these data sets have only been used as a guide to assist the camera match process.

2.5.2 Information from the topographical survey of the site was imported into the base model to create a more detailed base model of the site and surrounding area.

2.5.3 In 3DS Max Design, locations of the baseline photographs were added to the base model using a 3D camera, created to match the specification of the camera and lens type and located to the GPS coordinates surveyed on site. The photographs were then matched to the 3D environment using information from OS, topographical survey and aerial data.

2.6 Construction of the scheme model and rendering of final image

2.6.1 A 3D model of the scheme was created using information supplied by the project engineers. This information included data such as road and pavement 3D lines, highway fencing lines, gantry locations and bridge structure general arrangement drawings. Additional information was added from drawings of the proposed environmental mitigation.

2.6.2 The final 3D model of the scheme was then matched to materials and finishes (e.g. concrete walls, tarmac, grass) and then merged into the existing scene. The environment lighting and atmospheric effects were also matched to the existing conditions as closely as possible using the RAW metadata.

2.6.3 All proposed mitigation planting was modelled to represent native woodland, trees, shrub and hedgerow planting for both year 1 of operation (2020) and year 15 of operation (2035), as follows:

- Year 1:

  Tree and shrub shelters and feathered tree planting(1.5m tall) within native mixes; individual native tree planting (1.8m tall including double stake and wooden post and rail stock fences 1.5 x 1.5 x 1.2m tall) and individual formal tree avenue planting (5m tall with underground guying system).

- Year 15:

  All native woodland, trees and shrub planting ranging from 5 to10m tall; hedgerow and shrub planting between 3 and 4m tall; all individual tree planting (native and formal) approximately 8m tall (free standing with stock proof fencing and stakes removed).

2.6.4 The relevant 3D cameras were then used to render the scheme over the baseline photograph as an image exported as jpeg and pgn formats for use in Adobe Photoshop for final image production.

2.6.5 Photoshop software was used to remove features in the baseline photograph that would be removed by the scheme as well as ensuring existing foreground features that would be retained were shown.

2.6.6 The final display of the finished photomontage should be printed at high resolution on a good quality printer. Photomontages have been produced for year 1 (2020) and year 15 (2035). The correct viewing distance of approximately 27cm has been provided for each viewpoint which is considered to most accurately represent the view from the human eye.

3 Bibliography

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