Technical Notes on
Zones of Theoretical Visibility (ZTVs)
for the proposed Stonehenge Hotel, Bulford

2B Landscape Consultancy Ltd
assessment - design - visualisation - realisation
https://www.2bconsultancy.co.uk
Tel: 01430 423204

Landscape Institute Registered Practice

1 ZTVs Generally

1.1 The following notes are intended to inform the Zones of Theoretical Visibility (ZTVs) maps and graphics submitted to accompany the planning application for the Stonehenge Hotel at Bulford.

1.2 It must be understood that Zones of Theoretical Visibility are just that - theoretical. Given the variability and seasonality of vegetation growth (trees and hedges, as well as arable crops) and the fact that topographical models are only models, it is not possible to make definitive statements as to intervisibility and visual impacts on the basis of a ZTV alone.

1.3 ZTVs are, however, useful mapping tools to indicate the possible extent of intervisibility. In considering the use of ZTVs to indicate the degree of intervisibility between the proposed Stonehenge Hotel at Bulford and the Stonehenge World Heritage Site, a number of methods have been used to try to make the likely relationship as clear as possible.

2 GIS-based ZTVs

2.1 The Geographic Information Systems (GIS)-based ZTVs (**Fig01 ZTV- Bare Earth with Building Obstructions** and **Fig02, ZTV with Woodland and Buildings**) use Ordnance Survey Terrain 5 topographic mapping with OS VectorMap Woodland and Building data added as 'obstructions'. The terrain height is indicated by the shading in the base mapping, from white (lowest) to brown (highest).

2.2 Building heights were set at a constant 8m, which underplays tall buildings and overplays single-storey buildings such as bungalows (typically 5.5-6m to ridge) where they occur. As the basis for a model, however, 8m is a sensible average. Woodland data, which does not include isolated trees , small tree groups or hedgerows, is usually assigned a height of around 12m. In this instance, review of woodland heights, with the benefit of the Google Earth 3D model, suggested a range between 10m and 17m, which were modified according to location.

2.3 One of the more sophisticated parameters of the GIS-based ZTVs is that of 'viewer eye-height'. The analysis process takes account of the fact that eye-height results in a viewer being able to see over a small mound, whereas the ground at the same location may not 'see' over that same mound. Thus the addition of an eye-height parameter gives a more realistic impression of actual visibility. Eye-height is set at 1.8m, which would equate to that of a relatively tall (2mh) person, to represent a worst-case situation.

2.4 For the GIS-based ZTVs, the target height (at the hotel) was set at 16m above ground-level to account for the sloping site and to err on the side of caution as regards the hotel roof. This also accounts for the fact that the target is a single point, whereas the roof is an area - the slight height increase offsetting the larger area.

3 Fig01 ZTV- Bare Earth with Building Obstructions

3.1 Bare Earth' is a common form of ZTV and is quite useful as a form of baseline in rural areas. However, in areas with significant built form, such as the areas north and east of the WHS, Bare Earth on its own would fail to show the effect of permanent built structures. Therefore the baseline is 'Bare Earth with Building Obstructions'.

3.2 This is useful in showing a scenario without any tree and vegetation cover and might be said to reflect the situation in winter. However, this is not accurate, as belts of woodland may include evergreen conifers and also have sufficient depth to still form an effective screen in winter, or at least to filter views and reduce them accordingly.

4 Fig02, ZTV with Woodland and Buildings

4.1 The addition of OS VectorMap woodland boundaries, assigned with appropriate heights, provides a more realistic impression of intervisibility, although woodlands form blocks in the GIS model which do not fully represent the feathered nature of a tree canopy.

4.2 Clearly, comparing Fig 01 to Fig 02, the latter shows a considerably reduced area of ZTV as a result of the screening effects of local woodland.

5 Fig03, Google Earth Pro ZTV or 'Viewshed'

5.1 Google Earth Pro offers a 'viewshed' function which can be helpful in some circumstances. Presumably as a result of the WHS status and global interest in Stonehenge, much of the area, including Bulford, is covered by enhanced 3D modelling data derived from photogrammetry. This measures the differences between adjacent aerial photographs to establish the 3D form of topography, buildings and vegetation. It is remarkably accurate, showing for example individual vehicles, trees etc. Of particular interest, it represents tree canopies very well indeed which, in this case, allows a useful exploration of the relationship between the hotel, adjacent trees and the landscape beyond.

5.2 On the other hand, the accuracy of the viewshed - or rather of the data used, seems to fall off with distance from the target. In the case of the Stonehenge viewshed, there is a patch of green indicated around 1km west of Stonehenge which appears to be the result of a change of data types from the photogrammetric to the less-detailed Google Earth model.

5.3 A further limitation of Google Earth Viewsheds is that they do not offer an 'eye-height' parameter. In effect, it is as if a light is shone from the target height - the green viewshed shows where the light

falls on trees, ground etc, so is not accurate to the visual experience of a standing or walking human being. Accepting this limitation, the accuracy of the GE 3D model makes it a useful comparison to the GIS-based ZTV.

6 Overall results - Differences and similarities between ZTVs

6.1 **Fig02, ZTV with Woodland and Buildings**, suggests visibility of the top of the hotel from rising land south and west of Bulford, where there are some heritage assets, but outside the WHS. Visibility within the WHS is indicated around Durrington Walls, Durrington Field and near Old King Barrows, at a distance of around 3.5-4km from the hotel. There is a further small area of visibility indicated about 1km north-west of Stonehenge.

6.2 **Fig03, Google Earth Pro ZTV (Viewshed)** indicates a similar picture to that described by Fig02, although it is more fragmented, probably as a result of the 'rougher' terrain and woodland outlines. The relatively small areas occurring on flat, high land indicate that only the top area of the hotel would be theoretically visible.

7 Google Earth Visualisations - Figs 04-05-06

7.1 Given that the proposed hotel was modelled in 3D and that this model can be inserted into the Google Earth 3D photogrammetric model, it is worth looking more closely at the relationship between the hotel roofline and the surrounding woodland.

7.2 **Fig06 Proposed Hotel - Aerial View**, is included to give confidence that the hotel model is located accurately, in terms of position and height, with the Google Earth 3D model. The outbuildings to the south side of the hotel are common to both models and their alignment indicates a close match (less than 0.5m) between the models.

7.3 **Fig04 Proposed Hotel seen from tree top level - looking west**, shows that, although a large building, the roof of the hotel is broadly level with the surrounding trees. The red line running towards the horizon is pointing towards Stonehenge, which is not visible in this view.

7.4 **Fig05 Proposed Hotel seen from tree top level - looking east**, is looking towards the hotel from the direction of the WHS. This serves to show that only parts of the topmost portions of the roof would be visible in views from this direction, and that the hotel reads as part of the urban fabric of the built form of Bulford, occasionally visible through the tree canopy.

8 Summary

8.1 The proposed hotel is located 6.3km from Stonehenge and over 3km from the eastern edge of the WHS. Only the very upper parts of the hotel would be glimpsed from the surrounding area. This would be seen as part of the urban fabric of Bulford.

8.2 Whilst leaf loss in winter would reduce the strength of the screening effect, the depth of tree cover around the hotel is such that there would still be a screening effect, with filtering of any views of the upper parts of the hotel. These filtering and screening effects, combined with the distance between the proposed hotel and sensitive heritage assets within the WHS, would suggest likely negligible visual effects upon those assets as a consequence of the hotel development.