

Light at the End of the Tunnel

The Application of Real-World and Digital Approaches on the A303 Amesbury to Berwick Down (Stonehenge) Scheme

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Introduction

The A303 Amesbury to Berwick Down (Stonehenge) scheme traverses one of the most iconic pre-historic landscapes in the world, known for its monumental stone circle, and the densest concentration of burial mounds in Britain and designated a World Heritage Site (WHS) in 1986 (HBMCE, 1985).

Plans to alleviate congestion past Stonehenge have been through multiple iterations since 1991. Schemes are inevitably controversial, raising concerns and igniting passionate debate. The tunnel project forms part of a wider series of plans to improve the WHS landscape.

Following Preferred Route Announcement by Highways England in 2017, an Outline Design was developed and was subject to multidisciplinary Environmental Impact Assessment (EIA) including Cultural Heritage (Highways England 2018a) and WHS Heritage Impact Assessment (HIA) (Highways England 2018b) as part of a Development Consent Order application.

Evaluation Techniques

The WHS landscape demands the highest professionalism and integrity in producing comprehensive documentation that was subject to intense public scrutiny and peer review. Assessment considered scheme impacts on individual heritage assets and their setting through the formal EIA process. The HIA formed part of the EIA and evaluated the effect of proposals on the Outstanding Universal Value (OUV) of the World Heritage property (UNESCO 2013, 291–94) and followed ICOMOS (2011) guidance. The iterative EIA and HIA processes informed Scheme design and mitigation proposals.

The project applied the latest technologies, combined with traditional evaluation methods, including the use of sensitivity mapping, zones of theoretical visibility, geophysical surveys, geoarchaeological and palaeo-environmental assessments, test pitting and archaeological trial trenching.

The project's approaches have been guided and monitored by the Heritage Monitoring Advisory Group (Wiltshire Council, Historic England, The National Trust and English Heritage Trust) with inputs from an independent Scientific Committee of experts in the archaeology of the WHS.

Real-Word Approaches

The project team undertook an extensive walkover survey over several years and in different seasons. The overall spatial scope of the survey was complex, focussed on a 2km linear corridor, but also including the Stonehenge part of the WHS and the landscape beyond. Every heritage asset potentially impacted by the scheme – whether an upstanding structure, visible earthwork, or buried archaeological site – was visited to check its condition and integrity, its physical surroundings and relationships with other sites, and its setting. Setting assessment and inter-visibility modelling was assisted with Zone of Theoretical Visibility (ZTV) modelling; both bare-earth and vegetated models. For each asset, the access routes, viewpoints, key sightlines, skylines, inter-visibility between monuments and inter-relationships, relationships with topography, ridge lines or valleys (coombes), hidden severance or implied relationships and subjective experience were noted and detailed. The project team considered current ambient noise, modern infrastructure, land use, light pollution, dark skies and astronomical and solstitial alignments to provide a real-world, comprehensive approach to understanding potential impacts on setting.

Digital Approaches

The team produced accurate Visually Verifiable Montages (VVM) from key viewpoints in the landscape, enabling the objective evaluation of project impacts on the skyline, surrounding area and setting. These depict the present situation, and that 15 years after the completion of Scheme construction. The images were key to understanding how the scheme would sit within the landscape post-construction, and how it would interact with the monuments, topography and inter-relationships across the WHS.

An interactive, immersive Virtual Reality (VR) app was also created using Computer Generated Imagery (CGI). A digital base model of the existing landscape was created, based on digital terrain data and aerial photographs. Features such as the Stonehenge monument were scanned to create 3D representations and the Scheme model was integrated. At selected viewpoints 360-degree visualisations could be explored in Augmented Reality (AR) using tablet computers and VR headsets. This app enabled statutory consultees and the public to consider scheme impacts, helped foster informed debate at public consultations and at the 2018 ICOMOS Advisory Mission.

Animated drive-throughs (e.g. <https://www.youtube.com/watch?v=Y0MCjIF5Tjs>) were also created for the public consultations, involving digitally recreating a photorealistic representation of the existing landscape. These included the 'federated' BIM model, animated traffic and a mosaic of high-resolution aerial images. Scenes were created in 3ds Max and V-Ray was used for rendering.

In an industry first, the team employed cutting-edge auralisation (sound demonstration) techniques, to communicate the soundscape changes resulting from the scheme. The auralisations enabled the public to understand the current levels of noise caused by the existing road and then how that would change following scheme construction.

In another innovation, the team also produced the UK's first purpose-built [digital Environmental Statement](#), allowing the public to fully navigate the document digitally, creating an interactive and intuitive platform making the information more accessible and easier to understand.

These innovative approaches have broken down barriers and shown that, through the use of digital tools, we can shed light on and enable understanding of complex information and scheme impacts.



Fig. 1. Stonehenge CGI image, post-scheme construction © Highways England



Fig. 2. Recording the soundscape at Stonehenge for the auralisations © AECOM

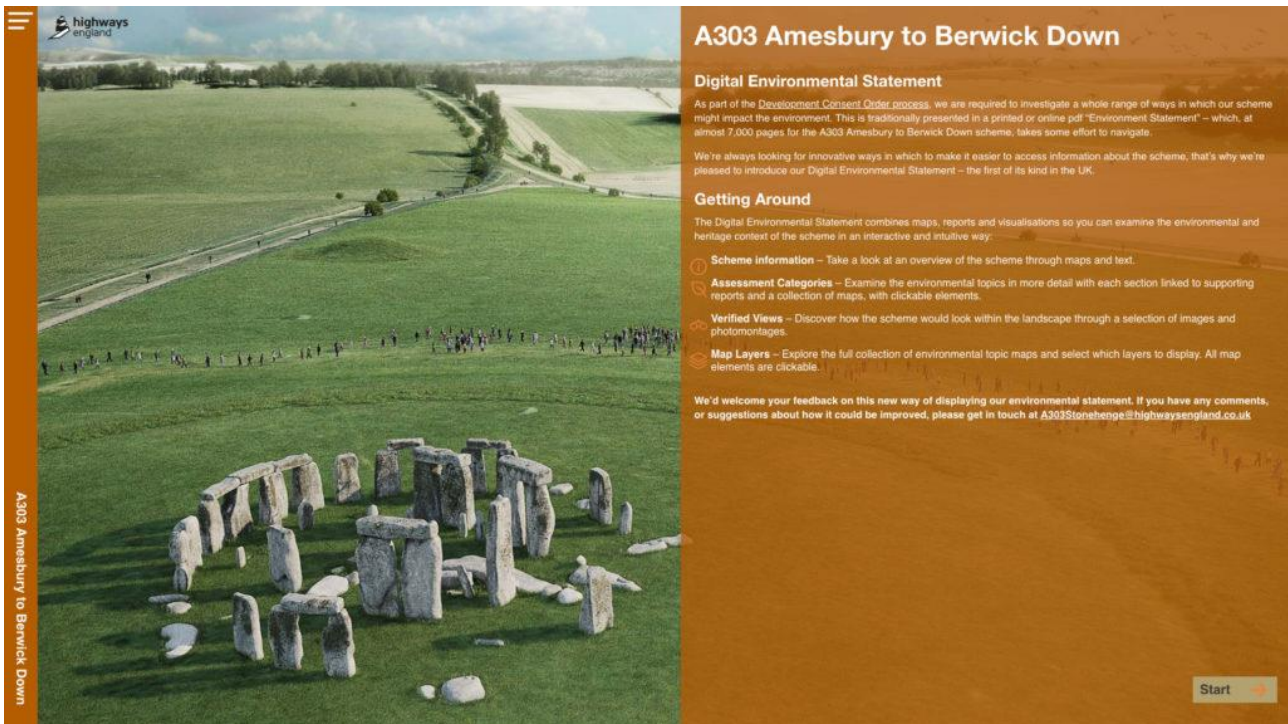


Fig. 3. Landing page for the A303 Amesbury to Berwick Down Digital Environmental Statement © Highways England

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Conflict of Interests Disclosure

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