

# Experiencing Immersive Landscape Transformation at Stonehenge

## The Application of Free-to-roam Virtual Reality to Communicating Scheme Impacts in Relation to the A303 Amesbury to Berwick Down (Stonehenge) Scheme

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### Introduction

The A303 Amesbury to Berwick Down (Stonehenge) Road Scheme traverses one of the most iconic prehistoric landscapes in the world, known for its monumental stone circle, and the densest concentration of burial mounds in Britain. These monuments are linked physically to the earth and rock beneath, to the topography that surrounds them, to each other through visual relationships, to the skies and astronomy, and form a landscape without parallel, designated along with Avebury and associated sites as a World Heritage Site (WHS) in 1986 (HBMCE, 1985).

Plans to alleviate congestion past Stonehenge have been through over 50 design iterations since 1991. Proposed schemes are inevitably controversial, raising public concerns and igniting passionate support and opposition to major engineering works in a Neolithic and Bronze Age landscape. The present tunnel project forms part of a wider series of interventions that aim to improve the landscape around the monument, improving safety and the visitor experience and removing traffic from much of this iconic landscape.

Design development and impact assessment for the tunnel project benefited from innovative digital approaches, as described in a previous paper to CHNT ([Macnab and O'Brien, 2021](#)). Now an immersive Virtual Reality (VR) model has been developed to enable a wide range of stakeholders to experience the transformational scope of the tunnel project within the WHS landscape. Working with scheme promoter National Highways and their technical partner AmW (AECOM, Mace and WSP), specialist human experience design company MXT constructed one of the world's largest data-verifiable free-to-roam Virtual Reality (audio-visual) Computer Generated Imagery (CGI) experiences.

This paper will explore how the VR model was developed, its context within the broader metaverse, and the potential of the metaverse to enable access for a global audience.

## Objectives and Principles

The VR experience embodied two fundamental principles. The first was that the user, whether they were a key stakeholder or member of the wider public, should be free to roam wherever they wish around the entire World Heritage Site, to view it from wherever they wanted, both in summer and winter, before and after the proposed infrastructure is completed. The second key principle was that the entire model should be verifiable against data, such as heightmaps, traffic flows, sound data and recordings, engineering information, flora, fauna, time-of-day, and even the scans of the monumental stone circle itself. The objective of this experience was to inform the user, without embellishment, of the impact of the proposed infrastructure scheme.

## Development

From a blank screen to completion the project took only three months between November 2021 and January 2022 to build an accurate, super-realistic immersive experience of the World Heritage Site around, and incorporating, Stonehenge. With no time available for pre-production (which normally accounts for a third of total build time), data that had not been used in this way before was ingested, understood and catalogued, and ways of incorporating such information into a workflow were designed, in order to create a fully immersive experience. In addition to the compromises inherent in VR creation, the requirements of the project added layers of complexity not normally embedded into a virtual world, and required the most powerful commercial computing power available working at its limits. The sensitivity of the WHS landscape demanded an exceptional level of detail to ensure truthfulness in the VR experience that would be evident to all users. Early and continuing input from AmW's heritage team helped to develop a series of viewpoints (Fig. 1) to assist the user to fully experience the design of the infrastructure and its situation within the WHS landscape, both before (Fig. 2) and after (Fig. 3) construction of the tunnel project. The immersive experience was tested by heritage professionals with working knowledge of the WHS landscape, and with audiences that had no heritage background and no site-specific knowledge. Users were invited both to navigate to the pre-selected viewpoints and to roam freely across the virtual landscape. The knowledge built, techniques developed, workflow designed, and systems incorporated into the model can be leveraged across experiences, simulations, and solutions as the project moves forwards.



Fig. 1. Locations of selected VR viewpoints within the Stonehenge part of the WHS.



Fig. 2. VR Location 3: Present-day view from a path south of the current A303 looking towards the Stonehenge monument across the current A303.



Fig. 3. VR Location 3: Future view from a path south of the current A303 looking towards the Stonehenge monument.

### Potential Applications

This project provides a glimpse into the immense opportunities that the metaverse could offer in terms of world heritage, far beyond the application of immersive experiences in complex infrastructure planning. In 2019, visitor numbers to the Stonehenge WHS peaked at 1.6 million, falling to 315,000 during the COVID-19 pandemic. The persistent, interconnected, network of 3-D worlds that

will form the metaverse will provide for virtual visits, through demonstrably accurate digital recreations, far in excess of the numbers of people able physically to travel to the site, maintaining exactly the same level of access if travel or physical access to the site is restricted. Visits can be linked in real time to related and unrelated experiences, exhibits, academic works, and beyond. It will even be possible for virtual visits to sites that no longer exist as they once did. Over time these experiences can be adapted, expanded and evolved, much more flexibly and effectively than anything seen to date. The metaverse can be used to preserve heritage in perpetuity, to enable access to a global audience far larger than the numbers that can travel to world heritage sites, to accelerate and enhance knowledge sharing, and to open up considerably larger commercial opportunities for heritage organisations around the world.

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## **Conflict of Interests Disclosure**

Development of the VR model was undertaken by MXT, with input by heritage professionals within AECOM, as part of the AECOM Mace WSP (AmW) joint venture, for National Highways.

## **Author Contributions**

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## **References**

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