



Options to Improve Visual Amenity of Electrification

Phase 2 Conclusion Report

W1001K-BBR-REP-EOH-000005-A06

Title:	Options to Improve Visual Amenity of Electrification Phase 2 Conclusion Report	
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Balfour Beatty

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Abbreviations and Acronyms

AC	Alternating Current
ALO	Adjacent Line Open
AONB	Area of Outstanding Natural Beauty
ATF	Autotransformer Feeder System
DfT	Department for Transport
ECA	Environmental Colour Assessment
ELR	Engineers Line Reference
EMU	Electric Multiple Unit
ETCS	European Train Control System
GRIP	Governance for Railway Investment Projects
GWEP	Great Western Electrification Programme
HOPS	High Output Plant System
IEP	Intercity Express Programme
LCA	Landscape Character Assessment
LCT	Landscape Character Type
LLATF	Low Level Autotransformer Feeder System
LVA	Landscape and Visual Appraisal
LVIA	Landscape and Visual Impact Assessment
NCS	Natural Colour System
NR	Network Rail
OLE	Overhead Line Electrification Equipment
PRS	Project Requirements Specification
RGS	Railway Group Standards
RGGN	Railway Group Guidance Note
RSSB	Rail Safety and Standards Board
SIC	Single Insulator Cantilever
TSI	Technical Standards for Interoperability
TTC	Twin Track Cantilever
ZTV	Zone of Theoretical Visibility

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1. Introduction

1. Network Rail's (NR) Great Western Electrification Programme (GWEP) is installing overhead line electrification equipment (OLE) on the rail routes from Paddington to Bristol and Cardiff. Three Areas of Outstanding Natural Beauty (AONBs) are affected by the work. These are the Chilterns, North Wessex Downs and Cotswolds AONBs.
2. GWEP uses the Furrer and Frey "Series 1" electrification system. Series 1 is the system chosen for GWEP. This design was chosen for a number of reasons including obligations from the Department for Transport (DfT), standards, functional requirements and legacy issues. The legacy issues are mainly related to structures, route corridor width, and include distances between tracks. Some structures may need alteration or replacement to allow the OLE to fit. Structures may also be listed or have load restrictions. The width of the route corridor and distance between tracks dictate the size, span and distribution of the OLE.
3. The choice of the Series 1 system was driven by the functional and non-functional requirements of the programme, including:
 - Standards;
 - Technical Specification for Interoperability (TSI)
 - Railway Group Standards
 - Department for Transport (DfT) rolling stock strategy
 - Safe by Design requirements
 - Construction Design and Management Regulations (CDM 2015)
 - 140 mph linespeed
 - Sectional running times
 - Gauging
 - Route availability
 - Performance and reliability requirements
 - Ease of installation
4. The Series 1 system is an Auto Tension 25kV 50 Hz AC system for operation of train speeds up to 225 km/h (140mph) with multiple pantographs. Series 1 is optimised for installation with the High Output Plant System (HOPS) to maximise construction efficiency and minimise the time required on track. Series 1 can also be installed using conventional methods. The system is designed to support adjacent line open (ALO) operations thus increasing availability and efficiency. Many of the system principles have been developed from best practice taken from the Swiss FL200/260 system and the GEFF system installed on the Network Rail Great Eastern Route.
5. Balfour Beatty has been commissioned to undertake a review of options to improve the visual amenity of electrification in these Areas of Outstanding Natural Beauty.
6. This document is the Conclusion Report for Phase 2 of that commission. This report brings together the elements of work that have made up Phase 2. This report provides a history of the project and explains why certain work packages were undertaken.

7. This report includes the recommendations made in the Landscape and Visual Appraisal, Environmental Colour Assessment, LV Guidance and the Engineering reports.
8. This report will be used to inform NR as to the design and mitigation options (described later) to be considered in Phase 3.

1.1. Areas Affected

1. GWEP passes through three Areas of Outstanding Natural Beauty (AONB). An AONB is an area of countryside which has been designated for conservation due to its significant landscape value. Areas are designated in recognition of their national importance.
2. The purpose of the AONB designation is to conserve and enhance the natural beauty of the landscape. This includes meeting the need for enjoyment of the countryside and having regard for the interests of those who live and work there. To achieve these aims, AONBs rely on planning controls and practical countryside management.
3. The AONBs affected by the GWEP programme and illustrated in appendix 1 are:
 - Chilterns
 - North Wessex Downs
 - Cotswolds
4. The specific sections of the route are:
 - Four-track section from Tilehurst to Moreton Cutting including the Goring Gap
 - Two-track Badminton Line section from Alderton Tunnel to Chipping Sodbury Tunnel
 - Two-track section from Box Tunnel to Batheaston (electrification deferred)
5. OLE has the potential to affect the setting as well as the area directly within the AONBs. The remit has therefore been expanded to include the Vale of the White Horse and West of Old Sodbury.
6. Specific approvals for new OLE designs have already been granted for the following listed structures. These structures have been listed for their architectural and historical interest.
 - Gatehampton Viaduct
 - Moulsoford Viaduct

1.2. Justification for the Visual Amenity Review

1. Network Rail has statutory duties when operating within an AONB. The Countryside and Rights of Way Act (CRoW) 2000, Section 85, states:
 - "(1)In exercising or performing any functions in relation to, or so as to affect, land in an area of outstanding natural beauty, a relevant authority shall have regard to the purpose of conserving and enhancing the natural beauty of the area of outstanding natural beauty."
2. Relevant authorities include any statutory undertaker, such as Network Rail.
3. The AONB Conservation Boards are statutory independent corporate bodies set up under the provisions of Section 86 of the CRoW Act. The Management Plans of the Conservation Boards contain descriptions of recognised 'Special Qualities', which are considered to exist throughout the AONBs.
4. The NWD AONB management plan states
 - "One way of satisfying the 'Section 85' duties [to "have regard to" the purpose of conserving and enhancing the natural beauty of the area] placed on Government and other public bodies is by supporting the implementation of this plan."
5. The 'Special Qualities' which make each AONB unique, are set out in the AONB Management Plans and supporting documentation. An Advisory Group formed of stakeholders was established (see section 2.3) to guide and inform NR.
6. It was agreed, with the project Advisory Group that the best overall approach to evaluating the effects of the OLE upon the AONBs would be by reference to:
 - the aims of the Management Plans (as adopted statutory documents)
 - and, the Special Qualities of the AONB

The effects of the OLE on these aspects would be evaluated by a LVIA-based approach.

2. Background

1. The Chilterns Conservation Board and North Wessex Downs AONB Partnership raised concerns with NR about the visual impact of the OLE being installed. To address these concerns NR made a commitment to undertake a review of viable design options. NR also committed to set up an Advisory Group to comment on the mitigation options, provide guidance on the impact of electrification and help determine optimum options. NR also established a dialogue with a Railway Action Group made up of local stakeholders.
2. Subsequently NR commissioned Balfour Beatty to consider OLE design options from an Engineering perspective.

2.1. Original Balfour Beatty Brief

1. This section is extracted from the NR Conditions of Contract issued to Balfour Beatty.
2. The contract was to take particular account of the impact of the Furrer & Frey Series1 on the landscape and environment. The design services were to be performed in three phases.
3. For Phase 1 a range of options to minimise the visual impact of the electrification system were to be identified. The feasibility of each option is was to be assessed. Feasible options were to be identified for further development. In assessing feasibility of the options, the following factors were to be taken into account:
 - Effect on visual amenity
 - Whole Life Cost
 - Engineering Access required to construct and maintain the design
 - Timescales associated with the design and development required
 - Estimated impact on performance of the railway
 - Safety benefits of proposed options
4. Options proposed should where possible not adversely impact on the capability of the existing railway. This included but was not to be limited to:
 - Line speeds
 - Sectional running times
 - Platform lengths
 - Gauging
 - Route Availability
5. The output of Phase 1 was a report recommending those options to be further evaluated in the next phase.
6. In Phase 2 following agreement from the sponsor on the options developed in Phase 1, for each of the identified options, an initial outline design was to be prepared to facilitate a comparison of the impact on the visual amenity and to further develop the following;
 - Effect on visual amenity

- Whole Life Cost
 - Engineering Access required to construct and maintain the design
 - Timescales associated with the design and development required (including any product approvals, planning permission, network change etc.)
 - Impact on performance of the railway
 - Hazard Analysis
 - Compliance to Technical Specifications for Interoperability
 - Safety benefits of proposed option (e.g. reduced electrical footprint)
7. The output of Phase 2 was to include a report setting out those options viable for further evaluation in Phase 3. Viability was to be based on technical capability, cost and ability to meet the requirements for improvement of visual amenity.
8. Phase 3 envisaged options to be further developed from Phase 2. The original brief specified a detailed feasibility and option selection report is to be produced in Phase 3 outlining the following considerations:
- Effect on visual amenity
 - Whole Life Cost
 - Engineering Access required to construct and maintain the design
 - Timescales associated with the design and development required (including any product approvals, planning permission, network change etc.)
 - Delivery programme including delivery against other key interfaces, rolling stock introduction or cascade or ETCS introduction. Also need to include staging impacts.
 - Impact on performance of the railway
 - Hazard Analysis
 - Sustainability of option
 - Compliance to Technical Specifications for Interoperability
 - Safety benefits of proposed option (e.g. reduced electrical footprint)
9. The original brief specified that the Phase 3 output was to include sufficient engineering detail to support the selection of a single option and a report recommending to the Sponsor the single option to be presented to stakeholders and thereafter approval in principle (AIP) and detailed design.
10. The subsequent development of one option to Approval in Principle (AIP) and detailed design was not included in the scope of this commission.

2.2. Modifications to the Brief

1. The original brief was written from an engineering perspective. It became clear that it would be necessary to review design options from a landscape and visual perspective, in order to respond to issues of landscape character and the Special Qualities of the AONBs. Consequently, a number of changes were made to the brief as the project developed, and NR responded to the dialogue with the stakeholder groups.
2. Early in the project it was considered worthwhile to produce Landscape and Visual guidelines to help reduce impacts of OLE, particularly in protected the landscapes. To facilitate this OLE Landscape and Visual Guidelines (Draft 03) was developed. The guidelines are provided to help minimise detrimental landscape effects and to deliver electrification projects which are an environmental as well as operational success, establish a set of delivery principles which help the public and all stakeholders to understand and have confidence in the electrification programme, and as a basis for joint working between NR project managers, engineers and landscape and cultural heritage specialists. As such it is applicable to more than the GWEP project.
3. Advice from the Advisory Group, and from the project landscape architect, suggested that a Landscape & Visual Impact Assessment (LVIA)-based approach would assist in identifying specific impacts upon the landscape and visual resources of the AONBs, having particular regard to the Special Qualities of the AONBs. A series of Landscape and Visual Appraisals was proposed. The LVA scope and methodology was agreed with the Advisory Group.
4. In the Goring Gap area, construction was already partially complete at the time of carrying out the LVAs. The exercise was therefore effectively retrospective but sought to confirm the areas of greatest effect on the AONBs. Such that design and mitigation measures could be discussed and agreed.
5. The modifications to the brief also reflected concerns that the Engineering (Balfour Beatty) side of the Project and the Landscape and Visual Impact (2B Landscape Consultancy) needed to be managed as one project rather than 2 commissions.
6. An Environmental Colour Assessment was also commissioned. An ECA identifies the prevailing background colours in the AONB landscape. This information informs possible choices of colours for OLE infrastructure to reduce its contrast with its surroundings and thus its visual impact.
7. Cost issues were originally to be considered through phase 1 and 2. This requirement was removed as it was felt it may rule out options before they could be fully considered in Phase 3.

2.3. The Advisory Group

1. NR had committed to set up an Advisory Group (AG) to comment on the mitigation options and provide guidance on the impact of electrification on the AONBs. The AG was formed of the Chilterns Conservation Board, Cotswolds Conservation Board, & North Wessex Downs AONB, Natural England, South Oxfordshire District Council, South Gloucester Council.
2. 2B Landscape Consultancy attended meetings with NR and the AG, to help interpret and understand issues arising.
3. The purpose of the Advisory Group was defined
 - To provide specialist technical advice to Network Rail (NR) on the impact of the introduction of overhead line electrification equipment
 - To contribute to and comment on all stages of the design options review being undertaken by Balfour Beatty;
 - To work with 2B Landscape Consultancy to identify and supply all appropriate supporting information to facilitate the Landscape & Visual Impact Assessment;
 - To provide comment and advice on the information and materials to be used for the subsequent Public engagement process.

2.4. Visualisation of Project

Figure 1 is a simplified visualisation of the work streams in this project.

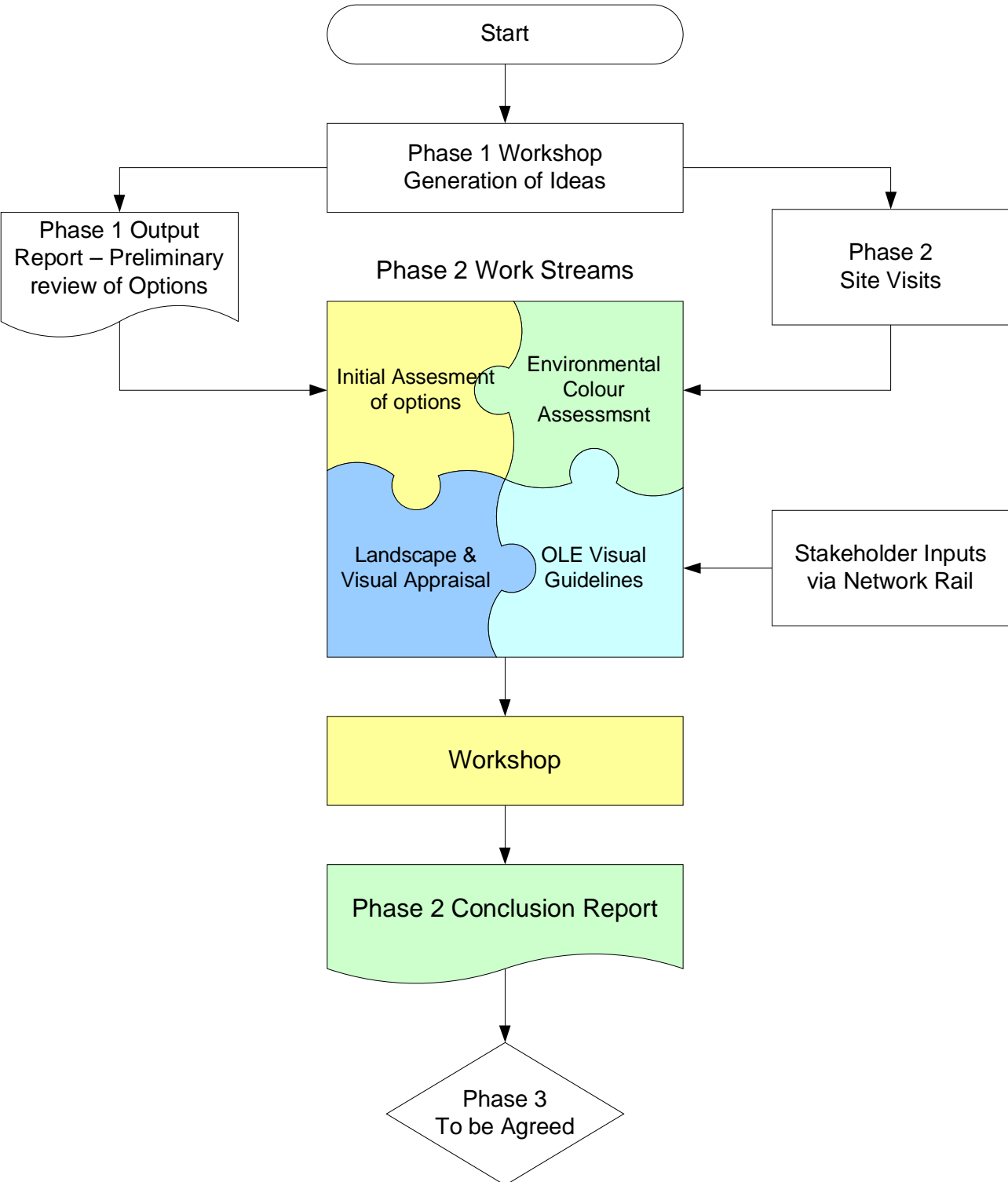


Figure 1 Visualisation of Project

3. Work Streams

1. The following work streams describe the development of phase 2 including issues brought up by the AG.
 - Phase 1 – output of Phase 1
 - Site visits
 - Initial Review of Options
 - OLE Visual Guidelines
 - LVA
 - ECA

3.1. Phase 1 Workshop and Preliminary Review of Options

1. The project commenced with a two-day workshop. The workshop was attended by people with different professional backgrounds. The attendees provided a mix of people with a range of experience. People with relevant experience from outside the rail environment were included. The skill-sets present included:
 - OLE Designer
 - Railway System Engineering
 - Railway Infrastructure Maintenance
 - Innovative thinkers
 - Architecture & Landscape Consultants
 - Structure masking specialists
2. The aim of the first day was to generate options to minimise the visual impact of electrification. The attendees were split into four groups. The day was structured around generic categories of potential changes to the electrification system. These categories were:
 - Modification to structures
 - Stealth by changes to the shape or material used;
 - Screening by hiding
 - “Blue Sky” options
3. The second day focused on assessing the options generated. Assessment criteria were developed based on the functional and visual amenity requirements. An assessment template was developed that incorporated a two-stage approach. The first stage had a filter to determine if the option obviously failed to:
 - Meet the overall functional requirements
 - Improve the visual amenity
 - Be safe to install or operate

- Avoid having a major negative environmental impact during construction
 - Provide benefit due to the time required to develop and install the option
4. This first stage filter was a “go” or a “no go” decision. Options were dropped if they failed to meet any of the above criteria.
 5. The second stage was applied to the remaining options and provided an initial ranking. This ranking was based on an assessment of the visual improvement of each and the impact of implementing the option. This ranking was relative to the baseline Furrer and Frey “Series 1” system design. The ranking prioritised those options that should be progressed.
 6. A total of 79 options were generated and considered. The assessment process reduced this number to 11 for further consideration. These were;
 - Relocating the ATF
 - Lattice Booms and Cantilevers
 - Classic Headspan Design
 - Mix of Headspans and Portals
 - Alternative Headspan Designs
 - Improved Aesthetic Shape
 - Portal Structure
 - Braced Structure
 - Viaduct twin TT portal
 - Green Bridges
 - Landscape based Mitigation

3.2. Phase 2

1. There were 4 interrelated work streams in Phase 2.
 - OLE Visual Guidelines development
 - Phase 2 Initial Assessment of Options
 - Environmental Colour Assessment
 - Landscape and Visual Appraisal
2. These work streams continued with input and feedback from NR and the AG.

3.2.1. OLE Visual Guidelines

1. It became apparent there was limited guidance for the OLE designer in respect of minimising landscape and visual impacts. It was considered helpful to provide some form of guidance on the landscape and visual impacts of OLE.
2. Guidelines on overhead line routing are well established for the National Grid. These guidelines are known as 'the Holford Rules'. Since the formulation of the Rules, requirements for environmental assessment have been introduced. Whilst environmental assessment for overhead lines addresses wider topics than the visual amenity issue on which the Rules concentrate, they remain a valuable tool in the selecting and assessing potential route options as part of the environmental assessment process. Although the location of OLE is fixed to the existing rail lines, it was considered that a similarly brief guidance document would be useful for this project.
3. NR instructed the development of a document which became the OLE Landscape and Visual Guidelines (Draft 03) prepared by 2B Landscape Consultancy. This document was commented upon by the AG and became a resource which assisted in the assessment of options.
4. These guidelines extend beyond the GWEP in that they are provided,
 - to help minimise detrimental landscape effects
 - to deliver electrification projects which are an environmental as well as operational success,
 - to establish a set of delivery principles which help the public and all stakeholders to understand and have confidence in the programme
 - as a basis for joint working between NR project managers, engineers and landscape and cultural heritage specialists.

3.2.2. Phase 2 Output Report - Initial Assessment of Options¹

1. The 11 options recommended in Phase 1 were reduced to 6 for further investigation. The methodology adopted is described in that report. The 6 options recommended were;

- Series 1 Amended
- Viaduct Portal
- Viaduct twin TT Portal
- ATF options
- Landscape Based Mitigation
- Colour

3.2.2.1. Series 1 Amended

1. There are a number of options for amending Series 1. The masts could be shortened to be in line with the top of the boom. This has the effect of reducing the height and the overall visual mass. The ATF if not lowered could be supported on vertical insulators on the boom. This would reduce the visual clutter of the ATF suspended from a cantilever at the top of the mast.
2. It has also been recommended that the lattice boom is reassessed to determine if a less visible form can be introduced. This may mean replacing with a solid beam that is less visually intrusive.

3.2.2.2. Viaduct Portal

1. The viaduct portal is similar to proposals made in Phase 1 for a curved portal or an improved aesthetic shape. The Viaduct portal structure is already designed, approved and in use at Gatehampton Viaduct. Consistency of form along the route has visual amenity value. This structure could also be designed for two track areas.
2. Adoption of this structure elsewhere would require fewer approvals and checks than a new structure.

3.2.2.3. Viaduct twin TT Portal

1. The structure is also already designed, approved and in use at Moultsford Viaduct. This also provides the advantage of Consistency of form along the route.
2. The large 10ft required for this structure may limit the locations it could be installed.

¹ The reference for this is W1001K-BBR-REP-EOH-000002-A04.

3.2.2.4. ATF options

1. Moving the ATF (creating Low Level Autotransformer Feeder System – (LLATF)) has been potentially identified as an effective way of improving visual amenity. The ATF can be placed in troughs on or off the ground. This has the visual amenity benefits of consistency, simplicity and minimising clutter on the elevated gantry structures.
2. With the ATF removed mast height can be reduced to the top of the boom. This reduces visual mass. In some cuttings the OLE may height reduction may result in the OLE no longer being visible.
3. LL ATF might not always be suitable or provide overall visual amenity benefits. If for example LL ATF is raised off the ground on an embankment there may be no overall visual improvement.

3.2.2.5. Landscape Based Mitigation

1. Landscape mitigations include using new or established earthworks or vegetation to screen or obscure the OLE. This may take place on NR land where clearances allow, or on adjacent land, subject to agreement. Offsetting (improvements to the surrounding landscape or built form) could also be considered, as it would enhance the resilience of the landscape to development such as the OLE.

3.2.2.6. Colour

1. The use of colour has potential to reduce the impact of the new OLE structures within the protected landscapes of the AONBs by identifying a range of colours which integrate with the indigenous colour palette existing within the study area. The Environmental Colour Assessment -ECA has made recommendations for the most appropriate colours.

3.2.3. Landscape and Visual Appraisals

1. Landscape and Visual Appraisals (LVAs) have been carried out for Chilterns and North Wessex Downs, and for Cotswolds (north). The Appraisal methodology follows the Guidelines for Landscape and Visual Impact Assessment 3rd Edition (2013), produced by the Landscape Institute and the Institute of Environmental Management & Assessment. The reports are titled Landscape and Visual Appraisals (LVAs), rather than a Landscape and Visual Impact Assessments (LVIAs) because they do not form part of a larger EIA. Their purpose is specifically to assess the Landscape and Visual effects of the OLE on the Special Qualities of the AONBs and their Settings.
2. An LVA has been completed for Chilterns and North Wessex Downs AONBs. The reference for this is W1001K-BBR-REP-EOH-000003-A01.
3. The LVA process involved desktop assessment, and assessment of twenty-seven viewpoints. Effects on both the Landscape resource and upon Visual amenity were considered.
4. The AONB Management Plans, Landscape Character Assessment (LCA) and Buildings Design Guide documents were reviewed, together with the Oxfordshire Wildlife and Landscape Study (OWLS), and County LCAs where they provided information which informed the Special Qualities of the AONB.
5. Zones of Theoretical Visibility (ZTVs) established the likely extent and indicative magnitude of visibility of the OLE, by using multiple 'targets' along the rail line and blending multiple ZTVs to show the areas likely to have visibility of the greatest number of OLE gantries. This exercise was verified by site visits and observations. The ZTVs in no way determine the assessment – they guide site work to areas which most need to be reviewed and assessed.
6. A range of viewpoints was selected and agreed with the AONBs. The aim was not to identify every possible viewpoint affected by the OLE, but to find examples of the locations where the OLE would have the highest degree of effects and which were reasonably representative of the range of views likely to be experienced by users of the AONB.

3.2.4. LV Assessment Findings

1. Landscape Effects: Overall, the findings of the Landscape and Visual Appraisal were that the OLE would have the greatest Landscape Effects upon Special Qualities or Landscape Character Areas which are located, close to the OLE. This is a reflection of the extent to which the OLE contrasts with such characteristics and the magnitude of its effects upon them.

3.2.4.1. Chilterns and North Wessex Downs

The landscape were characterised for Chilterns and North Wessex Downs were characterised as follows:

Special Qualities - Chilterns and North Wessex Downs AONB

- **Substantial-Moderate Effects** upon Landscape and Land Management ('panoramic views'), Development and Natural Resources ('distinctive architecture' and 'tranquillity') and upon Leisure and Tourism.
- **Moderate Effects** upon Landscape and Land Management ('woodlands, hedgerows and commons'), Historic Environment and upon Communities and Social and Economic well-being (effects on villages and small towns).

Key Characteristics of the North Wessex Downs (NWD) AONB LCAs and OWLS:

- **Substantial Effects** upon LCAs close (and parallel) to the OLE: NWD 6D Thames Floodplain, OWLS Chilterns LCT10 River Meadowlands and LCT15 Terrace Farmland
- **Substantial-Moderate Effects** upon OWLS, LCA Chilterns LCT4 Estate Farmlands, Berkshire Type N Elevated Wooded Chalk with Slopes: N1 Basildon (views from NT land and presence of Basildon House)
- **Moderate Effects** upon: NWD LCT2 Downland with Woodland (2B Ashampstead Downs); NWD LCT5 Downs Plain and Scarp (5D Moreton Plain); NWD LCT7 River Valleys (7D Pang Valley);
- **Moderate-Slight Effects** upon OWLS, LCA Vale of White Horse LCT 8 Lowland Village Farmlands and OWLS LCA Chilterns LCT 20 Wooded Estate Slopes and Valley Sides, SOx LCT Enclosed Escarpment (Areas 8b and 11d)
- **Slight Effects** upon NWD LCT1 Open Downland (1D Blewbury Downs), NWD LCT8 Lowland Mosaic (8A Hermitage Wooded Commons), OWLS LCA Chilterns LCT 21 Wooded Farmland and OWLS LCA Chilterns LCT 23 Wooded Plateau, SOx LCT Amenity Landscapes (Area 7g).

Key Characteristics of South Oxfordshire (SOx) and Berkshire LCAs (where not assessed under previous headings):

- **Substantial-Moderate Effects** upon Berkshire Type N Elevated Wooded Chalk with Slopes: N1 Basildon (views from NT land and presence of Basildon House)
- **Moderate-Slight Effects** upon SOx LCT Enclosed Escarpment (Areas 8b and 11d)
- **Slight Effects** upon SOx LCT Amenity Landscapes (Area 7g)

3.2.4.2. Cotswolds AONB Special Qualities

- **Substantial-Moderate Effects** upon Materials and Colour and Tranquillity
- **Moderate Effects** upon Historic associations
- **Moderate-Slight to Slight-Minimal Effects** upon Views.

Key Characteristics of the Cotswold AONB LCAs:

- **Moderate Effects** upon LCA 11 Dip-Slope Lowland and LCA 19 Unwooded Vale
- **Moderate-Slight Effects** upon LCA2 Escarpment
- **Slight Effects upon** LCA9 High Wold Dip-Slope

Local Landscape Character (Cotswolds):

- **Substantial-Moderate** for the Grade II listed portal at the west end of Chipping Sodbury tunnel
- **Slight-Minimal** for Registered Parks and Gardens

2. Visual Effects were, for the most part, proportionate to proximity of the viewer to the line, although the aspect of the view and nature of any screening played a part.

3.2.4.3. For the assessed Chilterns and North Wessex Downs viewpoints

- **Very Substantial Effects** would occur for recreational receptors at close proximity to the OLE (V20 Ridgeway near South Stoke);
- **Very Substantial-Substantial Effects** would occur for residential and recreational receptors at close proximity to the OLE (VPmC and V07 at South Stoke);
- **Substantial Effects** would occur at close proximity to the OLE (e.g. VPmG Basildon Park) for highway users; and for recreational walkers, at more distant key viewpoints such as VPmE, Hattonhill Shaw / Hartslock Nature Reserve; and for river travellers (see V18-19-VPmE) as they approach the Moulsoford and Gatehampton Viaducts and see the OLE in other views from recreational boats.
- **Substantial-Moderate Effects** would occur for highway users in proximity to the rail line (VPmA Hithercroft Road, VPmF Lower Basildon); and for recreational walkers (V02 north west of Uffington, V03 Hithercroft Road, V05 Reading Road, V06 Wallingford Road, V11 Gatehampton Road, V12 St Bartholomew's Church, V17 Sulhamstead).
- **Moderate Effects** would occur for highway users at VPmB Cholsey Hill, VPmC South Stoke, VPmD Spring Farm, V05 Reading Road, V06 Wallingford Road, V13 Pangbourne Station; and for residents at VPmC South Stoke, V16 Pangbourne east; and for recreational walkers at V15 Pangbourne Meadow, V16 Pangbourne east.
- **Moderate-Slight Effects** would occur for highway users at V03 Hithercroft Road; and for recreational walkers at V01 Uffington Castle, V09 Lough Down and V10 Lardon Chase.
- **Slight Effects** would occur for highway users at V02 north west of Uffington, V08 Icknield Road, V14 Hardwick Road (walkers + vehicle users).
- **Minimal Effects** would occur for recreational walkers at V04 Blewburton Hill.

3.2.4.4. For the assessed Cotswolds (North) viewpoints

- **Substantial through to Moderate Effects** would occur only in close proximity to the rail line for highest-sensitivity Recreational Receptors (at four of the thirteen viewpoints assessed)
- **Minimal to No Effects** for more distant Recreational Receptors would be experienced.
- **Moderate to Slight effects** in close proximity to the rail line and **Minimal to No Effects** further afield would be experienced by Highway users

3.2.5. Wider Observations

1. Potential effects on Train passengers are recognised but not quantified due the range of Sensitivities and Magnitudes which could be ascribed to them - this is discussed in the Chilterns North Wessex downs LVA.
2. Cumulative Effects upon sensitive receptors in the Chilterns, North Wessex Downs LVA, such as National Trails, were found to range from Moderate to Slight-minimal, whilst for Road and River Travellers were found to be Moderate. In the Cotswolds, it was concluded that, due to the limited visibility of the OLE, cumulative landscape and visual effects, upon highway and recreational receptors, would be Slight to Minimal. In all cases, Cumulative effects would be reduced through Design improvements and Mitigation measures.
3. Enhanced OLE Design options were found to reduce the Degree of Effect by one or possibly two levels of assessment (e.g. from Moderate to Moderate-Slight or Slight). Mitigation planting and the use of Environmental Colour Assessment have the potential each to incrementally improve any of the chosen options, and to support specific aspects of the Special Qualities of the Cotswolds AONB.
4. Adverse Effects would be likely to arise from deployment of Steel Palisade Fencing at the railway boundary but such effects could be reduced by the use of Steel Mesh Fencing.
5. Given that OLE will remain a feature of the Great Western railway through the AONBs, the benefit of reducing impacts through design or other mitigation measures, in valued, protected landscapes, is substantial and worthwhile. Therefore, whilst changes may appear to be incremental on a scale of 'worst possible to none', they should, nonetheless, be regarded by decision-makers (Network Rail and Statutory Consultees) as significant improvements, worthy of identifying, agreeing and implementing.

3.2.6. Environmental Colour Assessment

1. An ECA is carried out through an established process of using Natural Colour Systems (NCS) colour swatches on site and relating background colours directly against the NCS colours. Observations were recorded at over twenty locations.
2. There were a number of reasons for undertaking an Environmental Colour Assessment (ECA) including:
 - Establishing the extent to which application of colour would reduce the impact of OLE structures within an AONB;

- Seeking colours which integrate with the indigenous colour palette
 - Having due regard of the Special Qualities of an AONBs in respect of indigenous colours;
 - Identifying a range of colours to trial as a physical extension of the colour assessment.
3. An ECA has been completed for Chilterns and North Wessex Downs AONBs (reference W1001K-BBR-REP-EOH-000004-A01). An addendum has been completed for the Cotswolds AONB.

3.2.6.1. How the Natural Colour System (NCS) works

1. NCS uses a co-ordinate system to describe colour in terms of white to black content and intensity of colour to provide an overall 'nuance'. This is then referenced to hue using a colour wheel of Yellow - Red - Blue - Green with ten intervals between adjacent primary colours in steps of 10%, where Y10R = Yellow with 10% Red, Y20R = Yellow with 20% Red, and so on. Colours can then be described by their nuance and hue using a precise alpha-numeric system.

3.2.6.2. Environmental Colour Assessment findings

1. The dominant background colours (such as earth, tree trunks and branches) were found to be in the range of Yellow with 20% Red (NCS Y20R). Taking into account nuance, colours were generally in the range S 4005-Y20R to S 7005-Y20R.
2. The OLE galvanising is typically S 2002B - essentially a pale blue-grey colour. For this reason, the galvanised structures present a discordant colour (hue) match with the surrounding dominant landscape colours. Similarly, RAL 'Moss Green' is the default colour for steel palisade fencing, and is commonly used for steel overbridges and other items of steel-clad infrastructure. This is a dark blue-green, which is inconsistent with the surrounding yellow-greens found in vegetation across the landscape.
3. The following recommendations emerged from the ECA:
 - that the dominant colours are trialled on masts of several sections of the OLE.
 - those colours to be applied to consecutive gantries: S 4005-Y20R, S 5005-Y20R, S 6005-Y20R and S 7005-Y20R.
4. Suggested trial locations in Goring area would be:
 - Lower Basildon,
 - South Stoke,
 - Cholsey
 - South Moreton
 - West of Uffington
5. In the Cotswolds, the trial locations would be:
 - Sodbury Tunnel West Portal
 - Sodbury Tunnel east portal ATS Compound
 - West of Luckington Road Bridge
 - Alderton Road

4. Workshops

1. Liaison between NR and the AG was proposed in 2017 to be advanced through a workshop approach. The reference for the report is W1001K-BBR-REP-EOH-000006-A02.

4.1. Description

1. The purpose of the workshops was to:
 - explore the technical issues around potential modifications, their likely physical characteristics, and how they might benefit or impact on the AONBs;
 - discuss (and if possible agree) which modification or mitigation measures would potentially be effective;
 - seek to determine an approach to take the project forward, including the public consultation and post-consultation reporting;
 - bring together the strands of work undertaken so far and create a range of options to be taken forward into Phase 3;
 - obtain the input of the Advisory Group, related to LVA, ECA, and on-site observation and discussion
 - provide the Network Rail Communications team with an insight of the messages they will need to share with the public

4.2. Site Visits

1. Site visits were undertaken to allow an on-site assessment, discussion and appreciation of the landscape. The site visits informed the decision making process for potential mitigation and also the scoring of the same. Site visits took place on the following dates:
 - Chilterns/North Wessex downs 13/14th September 2017
 - Cotswolds 15th December 2017
 - North Wessex Downs (Uffington) 8th February 2018

4.3. Assessment Sheets

1. Assessment sheets were developed to capture and record a complex collective facilitated decision making process. The assessment sheets were initially completed in the workshop where the stakeholders input could be recorded. The assessment sheets were completed in draft off site by 2B Landscape consultancy. A dedicated meeting of the AG was held on 14 February 2018, to discuss the draft tables completed during the site visits and to modify and ratify the results with the AG. This enabled the workshop process to draw together a common understanding of issues to be carried forward into Phase 3.

4.4. Summary of Findings

4.4.1. Modification of the OLE

1. Modification of the OLE was considered primarily in terms of whether design modifications, such as using a tubular steel frame ('Gatehampton viaduct portal') or a Twin-T design

(‘Moulsford viaduct portal’) would have a beneficial effect. Due to the frequent presence of the more robust anchor portals, the benefit of the more refined designs was limited. The locations where refined portal design was considered to have merit tended to be from close viewpoints, where reduction in clutter would be perceptible and beneficial.

2. Lowering of the Auto Transformer Feed cabling and associated supports was considered to be highly beneficial, but very much subject to the detail of how the Low-Level ATF (LLATF) was implemented.

4.4.2. Fencing / other infrastructure changes

1. There were a number of locations where fencing could be improved, either by replacing with steel mesh and/or painting in accordance with the principles of the ECA. It was recommended by the AG that the current absence of boundary fencing would continue to be case, or if not, suitably sensitive design would be used.

4.4.3. Screening / planting

1. This was most often regarded as having either high or medium potential to reduce OLE impacts. In some cases this might occur on NR land, for example by letting embankments ‘scrub-up’. In many cases, however, it would require planting beyond NR’s land ownership. Whilst this might affect deliverability, it would also strengthen Green Infrastructure and biodiversity, thus achieving multiple benefits.

4.4.4. Colour Change

1. Colour change, principally in the form of painting the OLE masts and beams, was frequently regarded as beneficial, especially where the OLE would be backgrounded against trees or terrain. It was agreed that colour trials would be important in informing a decision as to the real-world benefits of colour change. One aim of the trials would be to review the effects of colour change on masts which are both ‘backgrounded’ and ‘skylined’, subject to viewpoint.

4.4.5. Offsetting

1. Offsetting could include landscape or other improvements in the vicinity of the train line, without necessarily directly screening it. Opportunities for offsetting were not generally identified at individual sites during the Workshop. Nonetheless, the principle of mitigation through offsetting is established within the GWEP programme, for example through Biodiversity offsetting. Landscape and Visual impacts could be offset in the same way, and opportunities should be taken to seek multiple benefits (biodiversity, landscape and visual) from all mitigation proposals. One identified instance of a notable visual benefit was attributed to changing the colour (from bright blue to something more recessive) of an existing NR bridge parapet in the Cotswolds. The bridge colour is not directly connected with the OLE, but with the rail line generally. The present colour is contrary to the vernacular colours of the Cotswolds, which constitute one of the AONB’s Special Qualities.

4.4.6. Findings Summary

- The following is a simple numerical summary of the findings of the workshop, which describes at how many of the studied sites the interventions (Modification, Fencing, Planting, Colour, and Offsetting) were considered to result in beneficial effects, from High to Low. It shows that High beneficial effects were considered to most often result from Colour change, closely followed by Planting and by OLE Modification. A similar pattern occurs for Medium beneficial effects, with Colour and OLE Modification scoring joint highest, followed by Planting. Most other results are inconclusive in the overall count, although they may be valid when applied to the conditions at specific viewpoints. Such statistical analysis provides an overview but is simplistic. It is strongly recommended that readers of this Conclusion Report refer directly to the Workshop Report for more detailed assessment and location-specific recommendations.

		Degree of Effect					
		HIGH	HIGH-MED	MEDIUM	MED-LOW	LOW	N/A
Mitigation measure	Modifi- cation of the OLE	9	2	11	2	3	0
	Fencing / other	3	2	5	3	4	7
	Screening / planting	11	1	9	2	0	1
	Colour (ECA)	12	4	11	0	2	1
	Offsetting	1	0	4	0	4	13

4.4.7. Conclusions

- The Workshop sessions and report provided a consensus opinion (from Network Rail, their consultants, and the Advisory Group) on what would constitute the most effective design modifications or mitigation measures, to reduce the landscape and visual impacts of the OLE through the AONBs. This should inform the next stage of the Visual Amenity project (Phase 3), by providing an evidence base of the likely effectiveness of mitigation measures, against which to assess the technical and cost feasibility of carrying out such measures.

5. Conclusions

5.1. Actions arising from the Work Shop

1. NR decided to review 2B figure of the TT Portal to explore and expose any signalling or service constraints with its potential further adoption.
2. It was decided to include a review of proposed biodiversity mitigations. A meeting with NR bio diversity team, wildlife trusts and the Advisory Group would be organised in due course.
3. BBR were asked to review the feasibility of a vertical insulator on the mast or beam, to hold the ATF instead of the gibbet arrangement. This is possible and a solution is available in the design catalogue.

5.2. Phase 3 Enabling Works

1. The following have emerged through the project to date. They have been called Phase 3 enabling works as they fall outside the scope of Phase 2, yet have been considered beneficial to the project objectives.
2. The TT Portal structure has already been designed. It meets the functional requirements and may in certain locations meet visual amenity objectives. NR should complete a study exposing any signalling or service constraints to its further adoption.
3. The colour trial suggested in the ECA report should be planned. The level of potential benefit should be discussed with the AG. The role of the public in these trials should be considered further, e.g. how is the choice of colour to be communicated, and public views collected.

5.3. Phase 3 Evaluation of Options

1. Phase 2 has included Landscape and Visual Appraisals, Environmental Colour Assessments, and Workshop sessions with the Advisory Group. These have resulted in the effects of the OLE being evaluated, and mitigation opportunities being proposed and discussed. The options recommended to take forward into Phase 3 are:
 - Series 1 Amended:
 - Solid beam modification
 - ATF options (all assume cropping masts to boom level):
 - § Vertical insulators
 - § Low-Level ATF
 - § Ground-level ATF
 - Viaduct Portal as replacement for standard portal
 - Viaduct Twin T as replacement for standard portal (review possible locations)
 - Landscape-based Mitigations
 - Colour (painting)
 - Fencing
 - Offsetting (Biodiversity/Landscape/Visual)

2. It is recommended that a schedule (spreadsheet) be drawn up to enable review of the above measures (and other site-specific measures identified during the Workshop process) for each location or section of OLE affecting the AONBs. This should set out:
 - Location/length (chainage)
 - Types of intervention (above options and any site-specifics)
 - Relevant Workshop or LVA viewpoint(s)
 - Workshop or LVA commentary on degree of benefit from modification
 - Technical or ownership issues
 - Deliverability: short/medium/long-term (e.g. planting following negotiation, re-design requiring approvals)
 - Safety implications (access, repeated access)
 - Sustainability (e.g. need for re-painting at intervals or a one-off intervention)
 - Cost sources (e.g. re-design, structure modification, blockade, land purchase, maintenance)
 - Cost estimate (could also be summarised at the end of the schedule per mitigation measure)
3. Viability assessment (although this may be better considered according to mitigation measure across the AONBs as a whole, rather than on a site-by site basis).

5.4. Lessons Learnt

1. The following points have been noted throughout the Visual Amenity Review by the Advisory Group, Network Rail and their Consultants:
 - Retrospectively improving the visual amenity of OLE has a number of disadvantages compared to designing for visual amenity at project conception. The complexity of the railway system with numerous interfaces and disciplines makes change in one sub system difficult.
 - Early identification and involvement of stakeholders will enable an OLE project to avoid the need for retrospective work. The use of the OLE Visual Guidelines created as part of this project will enhance OLE designer's appreciation of visual amenity issues.
 - In the absence of significant prior experience, the optimum solution to improving visual amenity was originally seen in a purely Engineering context. This project has shown visual amenity can be a complex issue in which locational factors such as landscape character, topography and viewpoints are important considerations.
 - Although not directly related to OLE, it has been noted on numerous site visits that Railway palisade fencing and other infrastructure associated with electrification is frequently an unnatural 'Moss' green. It has been recommended that the use of more natural colours is adopted for this fencing and related infrastructure.

6. References

W10001K-BBR-REP-EOH-000001 Phase 1 Preliminary Assessment of Options

W10001K-BBR-REP-EOH-000002 Phase 2 Output Report - Initial Assessment of Options

W10001K-BBR-REP-EOH-000003 Phase 2 Landscape and Visual Impact Assessment

W10001K-BBR-REP-EOH-000004 Phase 2 Environmental Colour Assessment

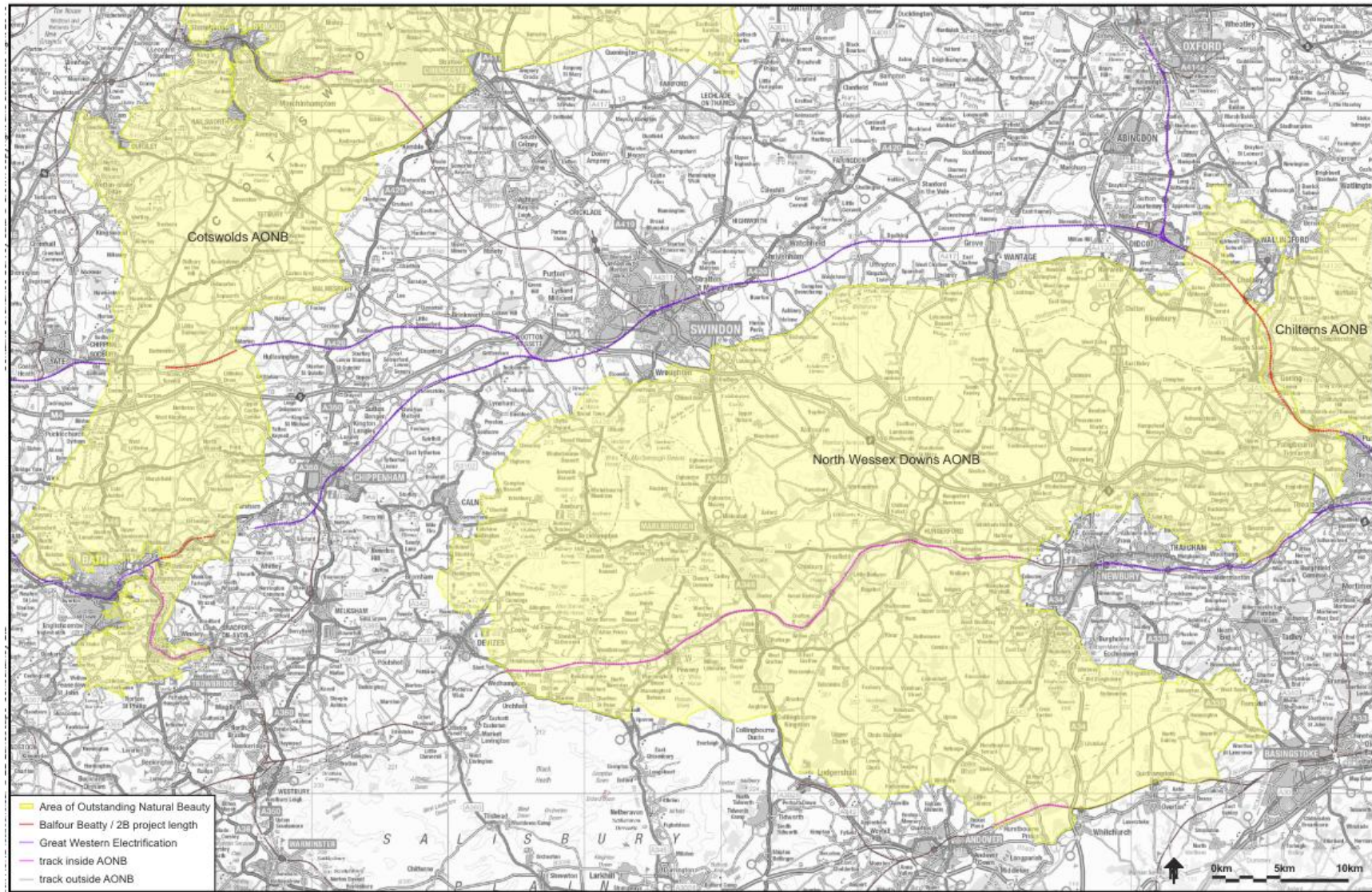
W10001K-BBR-REP-EOH-000006 Phase 2 Workshop Report

W10001K-BBR-REP-EOH-000005 Phase 2 Conclusion Report

OLE Landscape and Visual Guidelines, 2B Landscape Consultancy

Appendix A Map of AONB

Balfour Beatty



**Appendix B
Headspan Letter**



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13th October 2017

Dear Lucy, Ian, Ally, Andy,

Infrastructure Specification for Great Western electrification – Chilterns, North Wessex Downs & Cotswolds AONBs – Head-spans

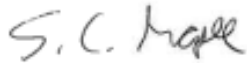
I refer to the recent workshop with your officers, and my Head of Consents and Environment, where Network Rail committed to issue a formal response to the Advisory Group in relation to the use of 'Head-spans' as discussed at the workshop.

We remain committed to working with you to reduce the visual impact of the Overhead Line Equipment (OLE) in the 3 AONBs through a package of mitigations appropriate to each location.

However, following thorough internal review we have to inform you that this will not involve any options to change the structures to that referred to as 'head-span' systems. This is because available head-span systems are not capable of meeting the safety, resilience and technical compliance requirements of a modern multi-pantograph train system. Whilst the new Intercity Express Train (IET) fleet can operate in both diesel and electric we are running an entirely electrified line to Cardiff by 2019 including through the AONBs, and we have to have compliant, safe, reliable and resilient overhead line equipment that supports the running speeds and journey times we're obliged to deliver to government and the public.

We wanted to inform you of this formally as agreed. We continue to emphasise that we remain committed to working with you on a suitable package of mitigation measures to reduce the visual impact of the structures and we are confident we can find ways to do this working with you. We look forward to advancing the work in the way agreed at the workshop.

Yours sincerely,



Simon Maple
Director, Route Sponsorship (Western)

Appendix C
Tabulated response to Chilterns letter

This document tabulates the issues raised by the letter:

Chilterns Conservation Board response – Balfour Beatty Options to Improve Visual Amenity of Electrification Phase 2 Output Report – Initial Assessment of Options Draft dated 11th November 2016.

The second column provides responses from Network Rail, some of which refer to actions and reports which followed the letter, during 2017-18.

Issue raised by CCB 22/12/2016	Response
<p>The Chilterns Conservation Board is concerned that the Phase 2 report does not recommend options which will minimise the harm to the AONB, that no new designs are being developed, merely options already in the Series 1 catalogue or minor modifications to Series 1, that options are not being tailored to the different AONB landscapes, and that the OLE Advisory Group is not being involved in shortlisting or decision making.</p>	<p>NR increased the scope of work to include LVA & ECA.</p>
<p>1. The terms of reference for the OLE within the AONBs Advisory Group includes “to comment on all stages of the design options review being undertaken by Balfour Beatty”. The Chilterns Conservation Board is concerned that the Balfour Beatty Phase 2 Output Report was not shared in draft with the OLE within the AONBs Advisory Group at an earlier date, we note that it is dated 11th November 2016 and is not labelled ‘draft’. It was shared over a month later, just before our Advisory Group meeting of 15th December 2016. It contains the statement “It is expected that before Phase 3 can commence Network Rail will assess these options and get feedback from the Advisory Group and other stakeholders” (page 4). The AONB Advisory Group should be part of the process, we should have been involved in the Phase 1 workshop, in the shortlisting of options for the Phase 1 report, the selection of options for Phase 2, and commenting on the draft Phase 2 report before it is finalised.</p>	<p>Noted and we have hoped to address the AG concerns within the Phase 2 Conclusion Report.</p> <p>We have included the AG within the workshops and consider they have been part of the process.</p>
<p>2. The problem with the OLE in the AONB arose in 2015 because of a lack of engagement between Network Rail, the statutory bodies (Natural England, the AONB bodies and the local authorities), and the local community over the design of OLE though the nationally protected landscape. It is important that history does not repeat itself.</p> <p>By treating the engineering side of the project (Balfour Beatty) and the landscape and visual impact assessment (2B landscape consultancy) as two separate and parallel commissions, with direct timely input from the OLE Advisory Group only sought on the latter, there is a disconnect. This makes it more difficult to find the best solution.</p>	<p>NR did modify the brief by introducing Guidelines, LVA, and ECA into the project and including the AG with the Phase 2 Workshops to achieve a collaborative assessment.</p>
<p>3. The draft landscape and visual appraisal (LVA) for the Chilterns/ North Wessex Downs has not tested all the Phase 1 shortlisted options. The draft LVA work cannot be said to have</p>	<p>There were discussions around this at the time. It was known that not all Phase 1 options would be</p>

Issue raised by CCB 22/12/2016	Response
<p>properly shaped the shortlist, which is dominated by engineering considerations and technical feasibility. The Board does not consider that all of the strongest options (see 3D visualisations at Appendix 1) in terms of visual improvement have been shortlisted.</p>	<p>taken forward for consideration.</p>
<p>4. Network Rail's Contract Requirements for the work Balfour Beatty is undertaking refers to "design for new or modified OLE contact systems". But no new designs are presented or developed in Phase 2. The Board expected that the work would involve redesigning gantries and finding a bespoke aesthetically improved for the AONB, which could also influence good practice in future projects in protected landscapes. Instead, after considering a long list of alternatives including some new or modified designs and creative thinking, the Phase 2 options are all pre-existing gantry designs from the Series 1 OLEMI design catalogue. This is disappointing.</p>	<p>The Viaduct twin TT and portal are new designs. We had some debate at the time around the fact that if a portal is required there will be some effect on visual amenity. The improvement between one portal and another is difficult to assess. Overall the visual difference between an "aesthetically improved" and viaduct portal is likely to be small. Each of these is likely to be better than the series 1 portal. However the choice of the viaduct portal is therefore more compelling for consistency and ease of building. E.g. it has already been approved by other authorities.</p>
<p>5. The blue skies thinking about aesthetic OLE design that took place in 2013-14 for the design competition organised by the Royal Institute of British Architects, Future Railway and the Enabling Innovation Team is reported on briefly in section 3 with illustrations in appendix 3. Why are the outputs not being harnessed for this GWEP, why only maintain a 'watching brief'? This is not a new or emerging field, these designs were submitted over two years ago in spring 2014. They show what can be achieved when aesthetics are a strong part of the design brief (while still following technical specifications). They should be an inspiration, even a potential commission, for the GWEP Options to Improve the Visual Amenity of Electricity project.</p>	<p>The work undertaken for this completion was at an early stage and at the time was for two track railways. The contact system has not been designed so for the immediacy of GWEP it had little immediately to offer against visual amenity.</p>
<p>6. Network Rail's Contract Requirements for the work Balfour Beatty is undertaking identifies (at page 6) three stretches of railway running through the AONB:</p> <ol style="list-style-type: none"> 1. Tilehurst – Moreton Cutting including the listed structures Gatehampton Viaduct and Moulsoford Viaduct (Chilterns and North Wessex Downs AONB), 2. Alderton Tunnel – Chipping Sodbury Tunnel (Cotswolds AONB) 3. Box Tunnel – Batheaston (Cotswolds AONB) <p>and requires that "for each of the above sections of line, a range of options to minimise the visual impact of the electrification</p>	<p>This has been addressed through the latest workshop, LVA and ECA.</p>

Issue raised by CCB 22/12/2016	Response
<p>system shall be identified". The Phase 2 report falls short of this in that it does not differentiate between the sections or provide tailored solutions. This differentiation is essential because the landscape character is different and the railway line is different (e.g. four track through the Chilterns AONB, two track through the Cotswolds, sometimes in cutting, sometimes on embankments) meaning completely different problems and solutions.</p>	
<p>7. Furthermore Balfour Beatty has not followed the brief to "minimise" the visual impact, which the Board takes to mean identify and recommend the best performing option in visual impact terms. Instead the Phase 1 and Phase 2 Reports uses the terminology that Balfour Beatty has been commissioned to "review the potential options to improve the visual amenity of the OLE". Sometimes 'lessen' is used instead. Improving or lessening is not the same as minimising. Reviewing is not the same as designing. The scope and ambition of the project is being watered down.</p>	<p>The workshops within Phase 2 stages have focused on looking at the ways to minimise the visual impact of OLE on the AONB's.</p>
<p>8. The Chilterns Conservation Board has already expressed concern in May 2016 and June 2016 that the shortlisting process at Phase 1 did not involve the OLE within the AONB Advisory Group; this has been repeated at Phase 2 with no opportunity for the stakeholders to advise on which options minimise the visual impact and which suit the landscape characteristics of the three different stretches of line.</p>	<p>The impacts and mitigation options have been considered collaboratively within the Phase 2 Workshops.</p>
<p>9. The introduction (page 5) would benefit from a description of what AONBs are, their statutory basis, their value and the duty that Network Rail is under to have regard to conserving and enhancing their natural beauty (Section 85 of the Countryside and Rights of Way Act 2000 http://www.legislation.gov.uk/ukpga/2000/37/section/85). At the moment the introduction is heavy on benefits of electrification and the engineering systems. It fails to put this into a natural environment context or explain the problem with the installation to date and why this commission is necessary. This was not covered in the Phase 1 report either. A new section equal in coverage to the background on electrification background and Series 1 (four pages) and technical, functional and assurance requirements (seven pages) would help balance this and explain the context and need for the work more fully. It would provide balance and reassurance that the context is understood. It could include mapping of the AONBs, their special qualities, local character areas, their value to residents and visitors, and their statutory protection. If Balfour Beatty lacks the specialist knowledge of the AONBs the Advisory Group could assist.</p>	<p>Noted – This has been considered within the LVA and ECA.</p>
<p>10. Section 4 (page 19) on landscape and visual impact assessment could explain that the industry standard is the Landscape Institute's Guidelines for Landscape and Visual</p>	<p>Noted. The Landscape and Visual Appraisals refer to, and are based upon methodologies</p>

Issue raised by CCB 22/12/2016	Response
Impact Assessment 3rd Edition which contains a recommendation methodology (not a 'statement of principles' as currently described).	within, GLVIA3.
11. Under the approach reported in section 6, Balfour Beatty has assessed a shortlist of options against the standard design principles in the OLE: Landscape and Visual Guidelines, which are for OLE everywhere (inside and outside protected landscapes). This misses the point that for AONBs, section 3 of the OLE: Landscape and Visual Guidelines advises "Especially in sensitive locations or where the OLE will be viewed at close proximity (stations, crossings etc), have regard to the special qualities or characteristics of those areas/ assets and reflect them in the OLE design." The options should be tailored to their location; the project brief required a range of solutions for each of the three AONB sections.	Section 5 of the Phase 2 report was noting that the design principles from the L&V Guidelines (such as simplicity, consistency etc.) provide a basis against which to assess all designs.
12. The options examined in section 6.1 for visual improvement of Series 1 are tinkering. The structures will retain the existing steel portals including the heavy horizontal booms which are, in the Chilterns Conservation Board's view, the main cause of harm. Reconsidering how to attach the small parts steel and lowering of ATF is helpful but does not remove the horizontal structure. It does not achieve enough of an improvement.	As realistic and effective measures, these are not regarded as tinkering, nor would they be trivial to implement. Alternative designs (e.g. viaduct portal) are considered elsewhere and were reviewed during the Workshop sessions in 2017
13. Section 8 is poorly structured and confusing, it is unclear what sometimes contradictory statements labelled 8.2 a to s are. Given that the main output of Phase 2 appears to be the further assessment of 11 options from Phase 1, and shortlisting these down to 6 options, it would be helpful if the three pages of tables showing the comparative assessment (currently Appendix 2) were brought forward into the main report.	There is the potential to revisit this section if it is considered value will be added. .
14. It is not clear what Phase 2 has involved or achieved, what value it has added. It appears to be a whittling down of 11 to 6 options based on a short assessment in Appendix 2. Why reduce the number of options at this stage when some rejected options may be the best options in the toolkit for certain landscape stretches through the AONB?	This was commented on before the joint workshops. A purpose has been to reduce the options for taking into Phase 3.
15. In section 9.3 headspans are acknowledged as scoring highly visually, but rejected for reliability and safety reasons. The Board considers that more project resources should be put into solving these reservations, and evaluating the risk and likelihood of problems if used for relatively short stretches as the railway passes through the Chilterns AONB. The higher masts appear to be overplayed, the diagram Figure 11 shows the headspan mast as only fractionally higher than Series 1 portals. The overall visual effect of headspans is substantially better than portals	NR has responded to the AG on headspans. NR revisited headspans with the NR Engineering team (see Headspan letter).

Issue raised by CCB 22/12/2016	Response
because of the downward arching cradle of wires and absence of horizontal steel boom.	
16. In section 9.4 a mix of headspans and portals is written off as being visually worse, the Board disagrees. Knowing the stretches of line in the Chilterns, it holds a landscape variety (see LCAs) and a presence of other existing structures in the landscape which would mean that the combination of headspans and portals could work well (as evidenced by the ZTV work in the LVIA which indicates a patchwork of visible and less visible stretches). By applying this mix in a tailored way to each stretch of AONB landscape, it is probable that locations for occasional portals could be found which are less visible or more screened (in cuttings, behind trees etc). This option should be revived, allowing headspans in more visible locations and reducing operational risks by careful locating occasional portals or rigid headspans in less visible locations.	See above.
17. Section 12.4 addresses options for the relocating the ATF. In order to understand the visual benefit, diagrams would be helpful to show whether there would be a trench in the ground to carry to ATF and earth wire, a box along the ground, or a new horizontal cable housing at low level (how low?). If lowering the ATF would involve the raised cable housing structures as installed west of Didcot station, these have a visual impact too which would need factoring in.	Noted – this work will be assessed within Phase 3.
18. In the Appendix 2 Assessment of Options table, three visual improvement columns sit alongside fifteen engineering/practicality columns. The visual improvement columns have no red-amber-green (RAG) colour coding so are underplayed in the comparative assessment, RAG colours should be added. Visual improvement is given three possible simplistic answers (“Yes, No, and ?”) in contrast to the other columns where narrative is included. Who is making these judgements and how robust are they? The views of the OLE Advisory Group have not been sought. It is not clear how they relate to the next Appendix 2 table “Options Assessed Against Visual Design Principles”.	BB make the assessment, they can of course be challenged. The LVA and ECA including the Workshops have been a collaborative involvement with the AG.
19. It is also unclear how the Phase 1 and Phase 2 assessments marry up. There are inconsistencies, for example headspans and lattice beam were assessed in Phase 1 assessment templates as bringing visual improvement (see Phase 1 Assessment Templates) and were shortlisted at Phase 1, but are now scored in Phase 2 as having no visual improvement and are dropped off the list. What has changed in terms of visual assessment?	As expected lessons were learnt from Phase 1. For example the OLE visual guidelines were not available at the start of the project to provide guidance. Nor was the benefit of LVA/ECA fully appreciated.
20. Despite para 9.3 explaining that classic headspan designs score highly visually, and referring to visual mass, less clutter,	Noted (See NR headspan letter).

Issue raised by CCB 22/12/2016	Response
<p>simplicity and clearer lines, the Appendix 2 Assessment of Options table answers “Visual Improvement?” for headspans with “No” for close up views, “?” for looking down and “No” for distant views. The Board disagrees, and would also challenge the negative assessment of visual improvement for a mix of headspans and portals.</p>	
<p>The Chilterns Conservation Board recommends that Phase 2 report is redrafted in the light of these concerns. The process is not achieving the brief. There is an overemphasis on engineering and an under-emphasis on aesthetics and natural beauty. It needs closer working of landscape and engineering professionals and input from the local community. Identifying landscape character, track characteristics (2 track, 4 track, cutting, embankments etc.) and the degrees of harm in different locations should be used to find bespoke solutions to meet the project brief “for each of the above sections of line, a range of options to minimise the visual impact of the electrification system shall be identified”. The Board is concerned that failure to shortlist options which minimise the visual impact make it less likely that retrospective work through the Chilterns AONB would later pass a cost/benefit analysis or approvals process. The options must be strong enough to make the difference required.</p>	<p>It is Network Rails intention that that the Workshops and LVA and ECA have addressed some of the original concerns raised by the AG.</p>

Appendix D Definitions

Terms commonly used in Electrification

Definitions

Advisory Group	A Group of stakeholders set up by NR to provide advice on improving visual amenity.
Alternating Current	The electric current that reverses its direction many times a second at regular intervals, used to power the trains.
Area of Outstanding Natural Beauty	An Area of Outstanding Natural Beauty is an area of countryside which has been designated for conservation due to its significant landscape value.
Auto Tension	Auto Tension equipment is used to maintain a constant designed tension in the contact and catenary wires.
Autotransformer Feeder System	The system used for supplying power to the OLE. It incorporates ATF cables, generally one per track, attached to OLE masts and connected to autotransformer stations at intervals alongside the track
Bare Earth	A term used by landscape architects when developing a LVIA. It shows no obstructions such as trees or buildings on a map.
Cantilever	OLE structure comprising horizontal or near horizontal members supporting the catenary projecting from a single mast on one side of the track
Catenary	The longitudinal wire that supports the contact wire.
Conductor	Any insulated wire, cable or bar that carries electric current.
Contact wire	Carries the electricity which is supplied to the train via the pantograph.
Conservation Board	A Conservation Board is the public body established to conserve and enhance the natural beauty of the AONB and to increase the understanding and enjoyment of the special qualities of the AONB.
Contact & catenary wire tensioning	In order to keep the wires taut, they are installed in lengths of no more than 1500m, and tensioned at each end.
Direct Current (DC)	Electrical current that flows in one direction, like that from a battery.
Dropper	A wire suspended vertically from the catenary to support the contact wire.
Environmental Colour Assessment	Environmental Colour Assessment is a study undertaken to establish the naturally occurring colours within a landscape. This is then used to establish colours which would have a recessive, or camouflaging, effect on new structures within the landscape enabling them to integrate with, rather than stand out from, their setting.
Environmental Impact Assessment	The purpose of an Environmental Impact Assessment (Town and Country Planning Regulations 2011) is to ensure that the environmental effects of a proposed development are properly considered.

Electric Multiple Unit	An EMU is a multiple unit train consisting of self-propelled carriages, using electricity as the motive power. An EMU requires no separate locomotive.
European Train Control System	The European Train Control System is the signalling and control component of the European Rail Traffic Management System. It is a replacement for legacy train protection systems and incompatible systems currently used.
Feeder station	A facility next to National Grid electricity transmission lines that extracts 25,000V and transmits it to the railway. The spacing of these stations depends on the electrification system used.
Furrer & Frey	The manufacturer of the Series 1 and 2 OLE.
Governance for Railway Investment Projects	(GRIP) describes how Network Rail manages, and control projects that enhance or renew the national rail network.
Great Western Electrification Programme	Electrification of the railway between London and Oxford, Newbury, Bristol and Cardiff. Electrifying this part of the Great Western will enhance 235 miles of railway.
Head Span	A system of wires held in tension spanning between masts either side of the tracks to support the OLE catenary and contact wires.
High Output Plant System	HOPS a “factory” train design and built for Network Rail to undertake the GWEP project. The train can install the foundations, main structural steel work and small parts steel.
Intercity Express Programme	The new fleet of trains, delivered by the Intercity Express Programme. The trains, expected to come into use from 2016, will take advantage of the newly electrified railway.
Insulators	Components that separate electrically live parts of the OLE from other structural elements and the earth. Traditionally ceramic, today they are often synthetic materials.
Kinematic envelope	The space that defines the train and all its allowable movements - rocking, swaying, bouncing, for example.
Landscape	The European Landscape Convention (ELC) definition of “landscape” is: “... an area, as perceived by people, whose character is the result of the action and interaction of natural and / or human factors.”
Landscape Character Assessment	Landscape Character Assessment (LCA) is the process of identifying and describing variation in the character of the landscape. It seeks to identify and explain the unique combination of elements and features (characteristics) that make landscapes distinctive.
Landscape Character Type	These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas in different parts of the country, but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement

	pattern, and perceptual and aesthetic attributes.
Landscape and Visual Appraisal	A Landscape and Visual Appraisal is an assessment of the Landscape and Visual resources of an area and the likely effects upon them arising from development. An Appraisal does not accompany a formal Environmental Impact assessment.
Landscape and Visual Impact Assessment	A Landscape and Visual Impact Assessment is usually a component of a formal Environmental Impact Assessment, but is otherwise similar to a Landscape and Visual Appraisal.
Loading gauge (vehicle gauge)	The dimensions to which trains must conform.
Mast	Trackside column, normally steel, that supports the OLE.
Midpoint anchor	At the midpoint of the standard length of OLE wires, the wires are fixed in position to keep the contact wire stable.
Natural England	Natural England is the non-departmental public body of the UK government responsible for ensuring that England's natural environment, including its land, flora and fauna, freshwater and marine environments, geology and soils, are protected and improved. It also has a responsibility to help people enjoy, understand and access the natural environment.
Neutral section	A length of electrically isolated or non-conducting material incorporated into the contact wire to completely separate electrical sections of OLE. It may take the form of a short insertion in the contact wire or that of an extended overlap.
Overhead line electrification equipment	Overhead line electrification equipment is the system that supplies electric power to the trains.
Overlap	Each length of contact wire overlaps with the next so that the pantograph slides smoothly from one to the other.
Passing Clearance	The calculated distance between swept envelopes of trains passing on adjacent tracks
Pantograph	The device on top of the train that collects electric current from the contact wire to power the train.
Project Requirements Specification	The PRS describes and records the functional and process requirements of the project or system.
Series 1	This is the new overhead line equipment range for routes above 110mph to be electrified.
Series 2	This is the new overhead line equipment range for routes below 110mph to be electrified.
Single Insulator	A cantilever supporting contact wires over one track.

Cantilever

Six-foot The space between two adjacent tracks.

Small parts steel This is the term used to describe the steelwork attached the main structural elements such as masts and beams to fix the contact wire in place.

Speed Restriction Speed restriction required at a specific location or section of track.

Structure Clearance The calculated clearance between lineside structure and vehicle swept envelope taking account of appropriate track tolerances and accuracy of survey measurement.

Structure gauge The defined space into which a structure must not intrude, to avoid trains colliding with it. This is larger than the kinematic envelope and loading gauge.

Swept Envelope A Cross Sectional profile, taken at right angles to the track, enclosing all dynamic movement*, static deflections and overthrows of all points along the surface of the vehicle, that can be reasonable expected to occur under the appropriate range of operating conditions.

Technical Standards for Interoperability (TSIs) mean the specifications by which each subsystem or part of subsystem is covered in order to meet the essential requirements and to ensure the interoperability of the European Community's high speed and conventional rail systems.

Ten foot The space between two pairs of adjacent tracks.

Tensioning The catenary and contact wires are installed in lengths that are tensioned at either end in order to keep the contact wire as still as possible

Third rail system Railway electrification system using a third rail located alongside the track to supply DC power to the trains. No longer permitted for new installations on national railways.

Twin Track Cantilever A cantilever supporting contact wires over two tracks.

Zone of Theoretical Visibility Zone of Theoretical Visibility analysis is a process for determining the visibility of an object in the surrounding landscape. The process is objective in which areas of visibility or non-visibility are determined by computer software using a digital elevation dataset. The output from the process is a map of theoretical visibility.

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