National Asset Delivery

Technical Surveys and Testing

Works Information for 570135 Wynhol Viaduct Lower Northbound M5 151.30/B and Wynhol Viaduct Upper Southbound M5 151.30/A Concrete Testing survey

CONTENTS AMENDMENT SHEET

Amend. No.	Revision No.	Amendments	Initials	Date
0	0	Original version issued with tender	ET	02/12/2020

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1 DESCRIPTION OF THE WORKS

1.1 Project Objectives

1.1.1 The principle objective to assess durability of the Wynhol Viaducts - Lower Northbound and Upper Southbound to determine options to extend their serviceable lifespan.

1.1.2 The specification that applies to the *Works* is included in Section 6.

1.1.3 The requirements contained in GG 101 shall be followed in respect of activities covered by this document.

1.2 Scope of works

The *Works* to be provided under this contract are:

Undertake structural testing surveys as detailed in this section, the Specification in Section 6 and Appendices. To determine the appropriate level of information, the *Contractor* shall perform the following investigations:

1) Corrosion Test Areas (Sections 1.2.1 and 1.2.2) comprising;
    a) Delamination Survey
    b) Concrete cover survey
    c) Half-cell Potential survey
    d) Concrete resistivity measurements
    e) Depth of carbonation
    f) Chloride ion contents determination
    g) Cement contents determination
    h) Sulfate contents determination
    i) Alkali contents determination
2) Deck waterproofing investigations (Section 1.2.2);
3) Bearing Inspection (Section 1.2.3);
4) Expansion Joint Inspection (Section 1.2.4);
5) Dilapidation survey (Section 1.2.5);
6) Material sampling and Waste Acceptance Criteria (WAC) testing of materials requiring disposal arising from these investigations (Section 1.2.2).

Other TST packages are to be commissioned under a separate work package, which will include a Ground Penetrating Radar (GPR) survey to the bridge deck, a Post-Tensioning Special Inspection and others. The *Contractor* shall consider the programme of the works is to run concurrently with other planned works provided at contract award by the *Employer*, in order to fully utilise road space and Traffic Management. As these other planned works are specified under a separate procurement method, the works have not yet been programmed. The *Employer* specify the dates for site works, and provide the *Contractor* with relevant information (i.e. programme and relevant contact details for others, and concurrent works) and sufficient lead time to enable effective mobilisation.

1.2.1 Corrosion Test Areas

Locations of Corrosion Test Areas (CTAs), with CTA types, referencing, size and dimensions are detailed in Appendix A. A CTA location plan is detailed in Appendix B.

It is proposed to undertake Corrosion Test Areas (CTAs) in 14 No. areas per structure, as detailed in Appendices A and B.

The required standards for testing are detailed in Section 6. Reporting requirements are set out in Section 1.3.

The scope of these investigations is as follows:

(1) The Contractor shall carry out a comprehensive delamination / hammer tap survey on all the concrete elements within the full extent and immediate vicinity of Corrosion Test Areas (i.e. an additional 0.5m around the edge of the CTA). The delamination survey shall be undertaken to determine the extent of any “hollow” or “ringing” spots which indicates the early onset of delamination or spalling. The location and the extent of any loose, detached, or ‘drummy’ sections of concrete shall be recorded and reported. The location, extent and section loss of any exposed reinforcement shall additionally be recorded and reported.

(2) Any concrete identified as loose, or which poses a threat to the public or the maintenance staff shall be fully removed. The *Employer* is to be made aware of areas of spalled concrete above 0.3m x 0.3m, or where reinforcement is exposed due to spalling, where loose concrete is removed.

(3) An electromagnetic cover meter shall be used to detect reinforcement bars positioned parallel and perpendicular to the concrete surfaces. The cover meter survey shall be used to locate the reinforcement prior to half-cell and resistivity surveys. The cover meter survey shall be used to avoid steel reinforcement and post-tensioned cables in drilling holes for carbonation test and dust samples.

(4) The size of CTAs is detailed within Appendix A, but the dimensions can be altered to suit the size and shape of the element being

investigated and level of associated risk. Readings shall be taken at 0.5m x 0.5m grid spacings within the test areas to determine the minimum concrete cover in that area, unless this is impractical, in which case nodes at smaller centres covering approximately the same size test panel as proposed in Appendix A is acceptable.

(5) An electrical potential survey using half-cell test equipment shall be carried out at node points defined by a grid marked on the concrete within the test areas and shall be undertaken on sound and non-delaminated concrete. Electrical continuity of the reinforcement shall be checked and confirmed prior to carrying out the corrosion potential survey. Portable silver/silver chloride reference electrode (SSC [0.5M KCl], Ag/AgCl/0.5M KCl) should be used for half-cell potential surveys and results shall be recorded in millivolts (mV).

The ASTM C876 [Ref 27.I] infers that a saturated copper/copper sulfate electrode (CSE) is the normal reference electrode used for measuring corrosion potential using half-cell survey. The advice reflects practice in the United States, but use of a CSE electrode is not recommended in the UK. Significant errors can arise from the use of CSE electrodes and their use is discouraged.

(6) Half-cell potential measurements shall be undertaken at 0.5m x 0.5m grid spacings over the proposed test panels. The survey grid spacing may be reduced near to vulnerable areas (such as joints) or if the potential gradient is greater than 100mV between readings taken at 0.5m x 0.5m spacings.

(7) Where corrosion potential readings indicate there is a high risk of reinforcement corrosion (-300mV for SSC probe and -350 mV for CSE probe), but concrete is intact with no detectable delamination, the actual condition of the reinforcement shall be investigated by exploratory breakout. A small grid CTA is to be undertaken surrounding any nodes where the electrical potential exceeds the threshold for the potential onset of pitting corrosion. Half-cell potential measurements within small grid CTAs are to be undertaken at 0.1m x 0.1m nodes, within a 0.5m x 0.5m area. Additional chloride sampling and resistivity measurements are to be undertaken at the location of the lowest reading and a localised reinforcement breakout is to be made to allow visual inspection of the steel.

(8) Where small breakouts are necessary to enable electrical connections to the reinforcing steel, they shall be reinstated as per Section 1.2.1 Clause (16) of this document. Breakouts undertaken to facilitate connection to reinforcement (half-cell potential survey) shall be used to confirm reinforcement type, orientation, size, cover and condition. Furthermore, where corrosion potential readings indicate there is a high risk of reinforcement corrosion (-300 mV for SSC probe and -350

mV for CSE probe), local concrete breakout to check for initiation and severity of rebar corrosion shall be undertaken.

(9) Concrete resistivity measurements shall be carried out at the locations of the most negative half-cell potential values, at a minimum of two locations per test panel. The resistivity of the concrete shall be measured using electrodes temporarily attached to the concrete, across which measurements of voltage and current are taken. These measurements may be taken using a four-probe array or a two-probe array system. Probes shall be placed in holes drilled through the carbonated surface layer and through the surface contamination (a depth of 5 mm is considered sufficient), filled with a low resistivity contact medium. If the system is spring-loaded, applied pressure is considered sufficient to maintain electrical contact and as such these holes do not need to be drilled. The concrete resistivity shall be reported in units of kΩcm.

(10) The depth of carbonation shall be determined by testing freshly exposed concrete using phenolphthalein indicator in ethanol. The test shall be undertaken at each location where concrete has been drilled to obtain samples for determination of chloride ion content. The depth of carbonation at each location shall be recorded and supported with photographic record.

(11) Chloride content tests shall be obtained from all test panels from locations at the most negative electrical potentials measured. Samples shall be removed from the concrete at a minimum of two locations within each test area and be taken to a laboratory for testing (at the location of the two lowest half-cell readings). Prior to drilling holes, the position of existing reinforcement should be detected and marked on the concrete to minimise the risk of damaging bars. The diameter of sample holes should be small and a function of aggregate size. Incremental samples shall be obtained at depths of 5-30mm, 30-55mm, 55-80mm and 80-105mm. If there is a perceived risk of chloride ingress (i.e. active / historic water leakage) beyond this depth, two additional drillings to a total depth of 155mm are to be undertaken. Each sample shall be sealed and uniquely labelled and weigh at least 25g.

(12) Sampling holes shall be reinstated as per Section 1.2 Clause (16) of this document.

(13) Cement content, sulfate content and alkali content of concrete shall be determined on dust and lump samples retrieved from breakouts used to facilitate the inspection of reinforcement if highly negative half-cell readings are found. If no breakouts are necessary to check reinforcement condition, samples of concrete shall be collected from half-cell connection locations. The cement content from locations not

associated with elevated corrosion potential shall be determined from samples that are from representative locations as opposed to in one relatively concentrated location.

(14) Determination of alkali content, cement content and sulfate content shall be undertaken from a minimum of three samples per structure at representative locations. At least one sample from a pier, abutment and deck soffit or top slab shall be tested per structure.

(15) The mean cement content as determined by laboratory testing shall be used in the calculation of chloride ion content by mass of cement.

(16) All concrete removed from the structure, for the purposes of testing, shall be reinstated with a high strength, non-shrink, quick setting, proprietary mortar. Reinstatement material shall be placed in accordance with the manufacturer's instructions. All equipment used for placing shall be clean and free from contaminants. The finished surface shall have a colour and texture similar to that of the existing concrete. Delaminated or spalled concrete does not need to be reinstated.

1.2.2 Trial Pitting Works and Works Associated with Trial Pitting Activities

Trial pits are to be excavated within the carriageway at locations specified in Appendix B.

Trial pit sizes are to be a minimum of 1.8m x 1.8m to accommodate corrosion testing. There are to be three trial pits per structure (six total), all of which are to be utilised for the following testing:

a) Waterproofing visual inspection and pull-off testing at three locations per trial pit;

b) Corrosion Test Areas;

The required standards for testing are detailed in Section 6. Reporting requirements are set out in Section 1.3.

The scope of these investigations is as follows:

(1) The trial pits are to be located and marked on the carriageway surface. At trial pit locations, proposed work area shall be scanned using a Cable Avoidance Tool (CAT) and Signal Generator (Genny). Statutory undertakers' drawings (Site Information Pack) are to be consulted and a permit to dig shall be in place before works are to commence.

(2) At the two proposed trial pit locations adjacent to expansion joints (north expansion joint, northbound (lower), south expansion joint, southbound (upper)), initial pencil cores are to be undertaken at the interface of the joint nosing with the carriageway surfacing to confirm

depth of surfacing and extents of waterproofing. The anticipated depth of surfacing is 40mm but may vary up to 150mm.

(3) The surfacing shall be saw cut with dust suppression methods used, to the perimeter of the marked area, to the depth of surfacing. The surfacing shall be broken out and spoil removed, to expose the waterproofing layer within the full extent of the trial pit.

(4) The *Contractor* is to assume no asbestos is present in survey locations, however, it is expected that the *Contractor* will have Asbestos Awareness training for all site staff. A Refurbishment and Demolition Asbestos Survey shall be undertaken by *Others*, prior to disturbance of the waterproofing material within each trial pit, or any intrusive works, in accordance with the requirements set out in Section 6. Record information indicated that the waterproofing system was replaced in 1993 with a Servi-Deck / Servi-Pak system.

(5) The tensile pull-off method for adhesion testing shall be undertaken at three locations within each trial pit, to ascertain the bonding properties of the waterproofing to the bridge deck. Tests resulting in adhesive (glue) failure are to be repeated, until results are obtained for a different failure mode. Results of failure mode, alongside a detailed description of the waterproofing type / properties and visual condition, shall be recorded.

(6) The waterproofing layer is then to be fully removed within the extents of the trial pit (except for a lap of 150mm or greater to enable a sufficient bond to the waterproofing reinstatement material) to reveal the concrete deck slab. The visual condition of the deck slab shall be recorded. Corrosion testing shall be undertaken within each trial pit, in alignment with the requirements set out in this document. Depths of surfacing are to be recorded at all four corners of each trial pit.

(7) Reinstatement of waterproofing shall be undertaking using compatible system with BBA certification, in accordance with manufacturer's instructions. Prior to reinstatement of the waterproofing, the bridge deck shall be prepared by removing all traces of existing waterproofing within the trial pit (with the exception of the lap) and abrading the concrete to remove laitance and contamination.

(8) On completion of waterproofing reinstatement, the excavation shall be reinstated using 12mm HRA surface course directly from a hot box. Reinstatement shall be laid and compacted to leave a level finish with the existing road surface. An appropriate number and thickness of lifts, and number of compaction passes shall be determined by the *Contractor*. The total minimum thickness of surfacing shall allow for the existing surfacing depth. Joints are to be sealed using a compatible sealant.

(9) A sample of the excavated spoil material shall be tested for the Waste Acceptance Criteria and the presence of tar, to determine the concentrations of leachable compounds and therefore determine disposal requirements prior to disposal at an appropriate site. All waste materials are to be disposed of in accordance with relevant legislation as set out in Section 6. A PAK marker spray test is also to be undertaken on site to determine the presence of tar-bound materials in the surfacing.

1.2.3 Inspection of Bearings & Freyssinet Hinges

For the inspection of the bearings and Freyssinet hinges, the *Contractor* is to remove and reinstate existing cover plates and fixings (the existing cover plates can be re-used, however new fixings may be required). Replacement fixings will be a like-for-like replacement of existing to facilitate the inspection. The *Contractor* shall confirm the existing fixing type and arrangement. Should the *Contractor* damage any of the cover plates during removal, they shall submit a replacement cover plate design to the *Employer* for acceptance and reinstate cover plates as per the accepted design.

Close visual inspection of all Freyssinet hinges to the tops and bottoms of piers shall be undertaken and any visible deterioration shall be recorded. A localised hammer tap survey shall be carried out as part of this inspection. The *Contractor* is to remove any localised vegetation and excavate to fully inspect the Freyssinet hinges. The *Contractor* shall deploy suitable environmental controls during any vegetation clearance. Any excavation required is likely to be soft material affecting a localised area, that can be excavated by hand digging. If particular difficulty arises exposing a hinge, i.e. due to the volume of soil, an alternative hinge (another pier) may be inspected. However, in this instance the *Contractor* shall identify an alternative location where water leakage / other environmental conditions are likely to have adversely affected the hinge.

Close visual inspection of all abutment bearings shall be undertaken. Bearings shall be cleaned prior to the inspection to facilitate inspection of the components that accommodate movement.

The following properties shall be checked and recorded:

a) Sufficient capacity for residual movement with respect to the type of bearing/Freyssinet hinge, taking into account the temperature of the structure;

b) Visible defects;

- Cracks;

- Incorrect position;

- Unforeseen movements and deformations;

c) Condition of bedding and fixing;

d) Condition of corrosion protection, dust protection and seals;

e) Condition of sliding and rolling surfaces;

f) Visible defects of adjoining structural parts.

Specific checks also to be undertaken (applicable to sliding/roller bearings);

- Condition of sliding/rolling surfaces;
- Continuity or otherwise of the line of contact;
- Sloping movement;
- Rotation about vertical axis;
- Offset in sliding/rolling plane;
- Relative positions of the top and bottom plates;
- Rotation angle about the transverse axis.

1.2.4 Inspection of Expansion joints

Inspection of the upper side and underside of expansion joints shall be undertaken. Prior to inspecting the expansion joints the *Contractor* should review the structure records and familiarise themselves with joint details, drainage details, articulation, and access methods.

All expansion joints shall be inspected for the following:

a) Capability to withstand traffic loading;

b) Accommodation of movement;

c) Ride quality (including visual inspection of nosing and adjacent surfacing);

d) Skid resistance (including visual inspection of nosing and adjacent surfacing);

e) Noise / vibration;

f) Potential sudden deterioration;

g) Water tightness.

A delamination survey shall be undertaken to the nosing joint to determine the extent of any “hollow” or “ringing” spots which indicates the early onset of delamination or spalling.

1.2.5 Dilapidation Survey

A visual survey shall be undertaken to the entirety of the bridge, including the deck soffit (including cantilevers), piers and abutments. A hammer tap survey shall be carried out on all exposed concrete surfaces. Full extents of concrete defects and areas of deterioration are to be recorded and catalogued with a referenced photograph. Specific locations of all defects associated with concrete and reinforcement are required.

All information gathered from site shall be retained for reporting purposes.
Deliverables are defined in Section 1.3.

1.3 Deliverables

The *Contractor* is required to produce the following deliverables:

1.3.1 The *Contractor* is required to present the findings of the site surveys in a detailed testing report. The report shall be issued in PDF format and Microsoft Word format. All inspection images are also to be provided separately in .jpg format. Furthermore, any information that needs to be reviewed as part of the tender package must be provided as part of the submission and not referenced with a link. All deliverables shall be provided in a timely manner as per Section 5. There are to be 6 No. separate reports per structure, the reports are to be as follows;

a) Concrete testing and Trial Pit findings including visual condition of concrete, depth of surfacing

b) Waterproofing investigations

c) Bearing Inspection

d) Expansion Joint Inspection

e) Dilapidation survey

f) WAC testing, testing for the presence of tar-bound materials and testing for ACMs in the waterproofing

1.3.2 The concrete testing report is to contain the following information:

a) Date, temperature, weather conditions and test locations;

b) Location and description of the components under investigation;

c) Description of the apparatus used during cover meter survey and concrete testing;

d) A summary table of cover meter readings, half-cell readings in mV (SSC / CSE probe), depths of carbonation, resistivity readings and results of laboratory analysis for each test panel to identify the key

site measurements taken, and interpretation of the minimum and mean depth of concrete cover over each test panel area;

e) Plots of half-cell readings into a contour map for each test panel. The plots are to identify the key site measurements taken and whether likelihood of corrosion activity is low / intermediate / high;

f) Place and date of the laboratory analysis;

g) Chloride ion content results for each dust sample as % by mass of cement. The summary shall record whether the chloride content is deemed to be low / intermediate / high as applicable.

h) Cement content results for each dust sample as % by mass of concrete. The summary shall record whether the cement content is deemed to be low / intermediate / high as applicable.

i) Sulfate content results for each dust sample as % by mass of cement. The summary shall record whether the sulfate content is deemed to be low / intermediate / high as applicable.

j) Alkali content results for each dust sample shall be presented in kg/m3. The summary shall record whether the sulfate content is deemed to be low / intermediate / high as applicable.

k) Copies of the laboratory testing results for each of the dust samples recovered.

l) Copies of the UKAS accreditation for any testing laboratories used.

m) Proprietary details of the repair mortar used for the reinstatement of concrete.

n) Any surface preparation undertaken for each reinstatement location before placing.

o) The placing method used for each reinstatement location.

p) Photographic record at each location, before, during and after the reinstatement works.

q) A photographic record of the survey with at least one photograph per test panel location, and any defects noted during the inspection.

r) Photographic record of reinforcement at each breakout location.

s) Details of reinforcement exposures including size of the breakout in mm, (including depth), concrete cover to reinforcement in that location, and condition, diameter and type of reinforcement.

t) Date and place of sampling and other relevant details supplied with the sample. This shall be in the form of a series of sketches showing the location of each sample.

u) A summary sketch showing the location of reinforcement breakouts.

v) Sketches showing the extent and position of any delaminating and / or spalled concrete during the survey, and the location, extent and section loss of any exposed reinforcement.

w) Summary sketches showing the location of CTAs.

x) A series of detailed CTA sketches including node points, orientation and relative position, location of reinforcement breakouts, chloride dust drillings, carbonation measurements and resistivity measurements kΩcm for each test panel. Where CTAs were undertaken within trial pits, the depths of surfacing in each corner of the trial pit should be included.

y) Date and place of sampling and other relevant details supplied with the sample. This shall be in the form of a series of sketches showing the location of each sample.

z) A summary sketch showing the location and readings of the resistivity survey in kΩcm for each test panel.

1.3.3 The waterproofing investigations report is to contain the following information:

a) A description of the type / properties of the waterproofing system shall be provided. The condition of the waterproofing is also to be provided.

b) The temperature and relative humidity and weather are to be reported.

c) The pull-off test apparatus and adhesive system are to be described.

d) A summary table presenting the findings of pull-off tests, to include date, test location, testing agent, interpretation of results including an average % failure of each mode of failure, and the average pull-off adhesion strength for each predominant mode of failure.

1.3.4 The bearing (and Freyssinet hinge) inspection report shall cover all relevant aspects in Section 1.2. The report shall also contain previously identified defects and associated maintenance history, summary of existing defects, and conclusion and recommendations. The report is to include drawings of the structure and bearings.

1.3.5 The expansion joint inspection report shall cover all relevant aspects in Section 1.2. The reporting of defects shall include:

a) Location and description, including dimensions, and photographic record.

b) Possible cause of defect.

c) Risk to structure and traffic and / or the public without remedial works.

d) Suggested remedial works and a timescale for completion.

e) Consequences of not resolving the defect in the recommended timescale.

f) Suggested revised inspection routine (before and after remedial works).

1.3.6 The dilapidation survey report shall contain details on visual condition of concrete, extents of delamination and dimensional survey of defects to bridge deck, piers and abutments. Each noted defect shall have a unique identification reference used on all produced documentation. The report is to include defect mapping with location and extents of all concrete defects shown on drawings. The order of stating dimensions shall be consistent and generally in the sequence of length, width and depth. The report shall also include close-up views of any concrete defects found, and photographs of any exposed reinforcement and / or spalled areas.

Appended to the report shall be a bill of quantities with dimensions recorded as per the Standard Method of Measurement for Concrete Repair. This shall be provided in Microsoft Excel format and contain all concrete defects associated with the structures.

1.3.7 The Waste Acceptance Criteria and Tar Testing Report shall be provided by a UKAS approved testing laboratory. The results of WAC analysis will determine the minimum disposal requirements that need to be met so that waste can be disposed of at an appropriate landfill (inert waste landfill / non-hazardous waste landfill / hazardous waste landfill).

2. EXISTING INFORMATION

Following inspections, reports are to be submitted to the *Employer* as per Section 1.3.1. Reports are to be provided to the *Employer*'s contact via email. The *Employer* is to approve the reports, and the *Contractor* are to allow for one round of amendments following review by the *Employer*.

Refer to the Site Information for details of existing site conditions including ground conditions, limitation on access, position of existing structures etc. The Contractor is to review all provided information that is pertinent to the works that they are carrying out. A zip file of available information that is on IAMIS has been provided. The following drawings show the structure details.

Drawing Number	Title	Revision / Date
530/AC5/10.15	Reinforcement Details of Typical Abutment	Jan 1973
530/AC5/10.16	Reinforcement Details of Typical Abutment	Jan 1973
530/AC5/10.17	Abutment Reinforcement Details	Jan 1973
530/AC5/10.35	Abutment Reinforcement Details	Jan 1973
530/AC5/10.43	130'-0" Span Anchorage Details	Jan 1973
530/AC5/10.11	186 Ft Construction Length Anchorage and Access Hole Details	Jan 1973
530/AC5/10.28	112' Span and 22'-6" Cantilever Anchorage and Access Hole Details.	Jan 1973
530/AC5/10.29	150 Ft Span and 39 Ft Cantilever Anchorage Details	Jan 1973
530/AC5/10.51	Retaining Wall Details	Jan 1973
530/AC5/10.52	Retaining Wall Details	Jan 1973
530/AC5/10.53	Retaining Wall Details	Jan 1973
530/AC5/10.54	Crib Wall and Median Retaining Wall	Jan 1973
530/AC6/3.8	Apron Slab & Retaining Walls at Junction	May 1973
525619-001	Location Plan & Joint Replacement Details	2003
530/AC5/10.13	Pier Post-Tensioning Details	Jan 1973
530/AC5/10.12	Pier Dims	Jan 1973
530/AC5/10.32	Pier Reinforcement	Jan 1973
530/AC5/10.14	Bearing Details	Jan 1973
530/AC5/10.XX	186' Span and 39' Cantilever Deck Reinforcement	Jan 1973
530/AC5/10.26	150' Span and 39' Cantilever Deck Reinforcement	Jan 1973
530/AC5/10.38	130 Ft Span Deck Reinforcement	Jan 1973
530/AC5/10.60	150' Span 39' Cantilever Deck Reinforcement	Jan 1973
530/AC5/10.25	112 Ft Span and 22 ½ Ft Cantilever Deck Reinforcement	Jan 1973
530/AC5/10.58	186' Span and 39' Cantilever Reinforcement	Jan 1973
530/AC5/10.7	186' Span and 39' Cantilever Reinforcement	Jan 1973
530/AC5/10.22	Diaphragm Reinforcement	Jan 1973
530/AC5/10.44	End Diaphragm Details (Abutments 3 & 4)	Jan 1973
530/AC5/10.57	Drainage Details	Aug 1974
530/AC9/8.1	Edge Detail	Jan 1973
505766/001	Maurer Expansion Joint type D240T (Wynhol NB)	Jan 1997
505766/002	Maurer Expansion Joint type D240T (Wynhol SB)	Jan 1997
530/AC5/10.31	Details at Maurer Sohne Joint	Jan 1973
J/2.358/1	D80 Expansion Joint Northbound	Jan 1997
J/2.358/3A	D80 Expansion Joint Section	Jan 1997
530/AC5/10.1	General Arrangement	Jan 1973
530/AC5/10.2	General Arrangement (2)	Jan 1973
530/AC5/10.4	Abutment No. 2 General Arrangement	Jan 1973
530/AC5/10.3	Abutment No. 1 General Arrangement	Jan 1973
530/AC5/10.5	Abutment No. 3 General Arrangement	Jan 1973
530/AC5/10.6	Abutment No. 4 General Arrangement	Jan 1973
530/AC10/XX.XX	General Notes – Concrete and Reinforcement	Jan 1973
530/AC5/10.21	Gravity Footings	Jan 1973
530/AC5/10.56	Ground Anchors	Jan 1973

Drawing Number	Title	Revision / Date
530/AC5/10	Viaduct General Arrangement	Jan 1973
530/AC5/10.21	Prestressed Cantilever	Unreadable
530/AC5/10.32	Ground Beam to Columns	Jan 1973
530/AC5/10.45	Layout at abutments 3&4	Jan 1973
530/AC5/10.55	Layout at Abutments 1 & 2	Jan 1973
530/AC10/8.8	Parapet for under bridges	Jan 1973
530/AC5/10.50	Parapet Details	Jan 1973
530/AC9/8.7	Median Retaining Wall	Jan 1973
530/AC5/10.12	Piers	Jan 1973
530/AC5/10.13	Piers 2	Jan 1973
530/AC5/10.20	Pier Reinforcement	Jan 1973
530/AC1/2.4	Plan & Profile CH200	
530/AC9/3.32	Plan & Profile	Jan 1973
530/AC5/10.10	Prestressing Details	Jan 1973
530/AC5/10.36	Prestressing Details Lower Viaduct	Jan 1973
530/AC5/10.59	Cantilever Prestressing Details	Jan 1973
530/AC5/10.9	Midspan Prestressing	Jan 1973
530/AC5/10.23	Cantilever Prestress 2	Jan 1973
530/AC5/10.8	Cantilever Prestress & Reinforcement	Jan 1973
530/AC5/10.9	Midspan Prestress & Reinforcement	Jan 1973
530/AC5/10.18	Setting Out Geometry	Jan 1973
530/AC5/10.14	Roller Bearing	Jan 1973
530/AC5/10.19	Piers 3	Jan 1973
530/AC5/10.29	Reinforcement Details	Jan 1973
530/AC5/10.13	Unreadable	Jan 1973
SFD_126134	Unreadable	Jan 1973

The following documents show typical requirements under the Natural England licence. The *Contractor* is to work in accordance with the Natural England licence (Bat Mitigation Licence).

File Title	Comment
A13-3a-bat-work-schedule.doc (2).pdf	Works will be scheduled by the *Employer.* The *Contractor* will work in accordance with the schedule.
Appendix H1.pdf	

Appendix H2 - 07.11.16.pdf	Previous reports undertaken on the Structure. These provide the ecological history of the structure.
Appendix H2 - 2008-2010.pdf	
Appendix H2 -23.11.16.pdf	
Appendix H2 -31.03.16.pdf	
Appendix H2 -2006-2008.pdf	
Appendix H2-07.07.20.pdf	
bats-method-statement amended.pdf	Any works undertaken by the *Contractor* will require similar controls. The *Contractor* will provide a Method Statement for the works that consider all ecological and environmental constraints to undertake the Works. The *Contractor* will plan and undertake all works in accordance with their accepted method statement.
bats-method-statement_ July 2020.doc	
Work Schedule, amended - 23.12.19.PDF	Works will be scheduled by the *Employer.* The *Contractor* will work in accordance with the schedule.
5.282.07.01_Wynhol_BatRoostInspectionResults_Sept2019.pdf	It is anticipated that current roost conditions are as per the provided report.
Dwgs\HE601873-KIER-ELS-M5_ML_151.3_Z-DR-LE-300008 C1.pdf	These drawings show the typical supervision extent required for similar works undertaken. This supervision is to be undertaken by *Others.*
Dwgs\HE601873-KIER-ELS-M5_ML_151.3_Z-DR-LE-300001 C1.pdf	
Dwgs\HE601873-KIER-ELS-M5_ML_151.3_Z-DR-LE-300002 C1.pdf	
Dwgs\HE601873-KIER-ELS-M5_ML_151.3_Z-DR-LE-300003 C1.pdf	
Dwgs\HE601873-KIER-ELS-M5_ML_151.3_Z-DR-LE-300004 C1.pdf	
Dwgs\HE601873-KIER-ELS-M5_ML_151.3_Z-DR-LE-300005 C1.pdf	
Dwgs\HE601873-KIER-ELS-M5_ML_151.3_Z-DR-LE-300006 C1.pdf	
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3. CONSTRAINTS ON HOW THE CONTRACTOR PROVIDES THE WORKS

3.1 General

3.1.1 The *Contractor* Provides the Works in such manner as to minimise the risk of damage or disturbance to or destruction of third party property.

3.1.2 The *Contractor* complies with the constraints and meets with the requirements outlined in Appendix 1.

3.1.3 The *Contractor* submits information detailing how the *Contractor* will provide the Works to the *Employer* prior to the mobilisation. This information will include any lifting plans, risk assessments, method statements, the *Contractor's* staff training information and any other relevant Health and Safety requirements.

3.2 Working hours & site specific constraints

3.2.1 Any required lane closures shall be deemed as taking place during night-time hours. Other works shall be deemed to take place during daylight hours.

3.2.2 The *Employer* is to provide all traffic management. The *Contractor* must specify what lane closures are required. This information is further detailed, alongside associated activities, in Section 3.3 Table 1. Full road closure will not be allowed under this contract.

3.2.3 The Traffic management is to be off peak lane closures. Night time working windows shall be assumed as Monday to Friday between the hours of 23:00hrs and 05:00 hrs (but will be subject to actual traffic conditions).

3.2.4 The post-tensioned tendons follow a hogging profile over piers and the edge of the duct is anticipated to be within 100mm of the top of the deck slab at the location of trial pits over piers. The total depth of the carriageway surfacing is anticipated to be circa 40mm. Care must be taken when undertaking trial pitting and related activities so as not to cause damage to the post-tensioned tendons.

3.2.5 Bats have been recorded roosting in the viaduct. These include the Lesser Horseshoe Bat (Rhinolophus Hipposideros). This is a major colony with upwards of 100 bats observed. A bat mitigation license will need to be obtained from Natural England prior to works within the abutments. The *Employer* will apply for this licence. The *Contractor* will implement any requirements of the licence. It is anticipated that works will adopt a precautionary approach, be restricted to avoid maternal and hibernating seasons and specific working hours with the following constraints:

3.2.5.1 Bats roost within abutment chambers and at joint locations. Plywood screens will be placed over manholes which provide access into deck chambers to

avoid dust, light and noise from carrying into the deck chambers (where the majority of bats roost).

3.2.5.2 All bat access points will be retained and works are limited to temporary disturbance only.

3.2.5.3 Bats will be temporarily excluded from working areas during works, and access will be reinstated after works have been completed. At all times there will be entry/exit locations open into the deck chambers for bats whilst works is being undertaken.

3.2.5.4 Temporary lighting will be required during the works. The generator for the lighting will be located in an area to prevent a toxic build-up of fumes potentially affecting the bats.

3.2.5.5 Refer to the Site Information for other bat mitigation measures that are typically required on this site.

3.2.6 Access into the structure is via the abutments which have locked steel doors. Keys will need to be obtained from the *Employer* prior to entry to abutments. The *Contractor* will need to apply safe confined space working methodology when working within the abutments.

3.2.7 Access to the land beneath the structures will require 3rd party consent (refer to Survey Information Pack for land registry plans).

3.2.8 Pipes associated with the structure are predominantly asbestos cement pipes. These pipes are not to be interfered with as part of these works. The *Contractor* will be provided with all asbestos information prior to the *Start Date.*

3.3 Recommended concurrence / phasing of works

3.3.1 It is recommended that works requiring traffic management are programmed concurrently to effectively utilise road-space and access.

3.3.2 It is also recommended that works undertaken from ground level are programmed concurrently to best utilise access to third party land.

3.3.3 The *Contractor* is to liaise with the *Employer* prior to programming works to ensure that effective and efficient use of road space is maximised. The *Contractor* should liaise with others to ensure that other works outside the scope of this TST are considered and if safe and appropriate, undertaken within the same Traffic management.

3.3.4 Tasks set out within this works package alongside anticipated Traffic management requirements and access requirements are set out in Table 1.

Activity	Traffic Management Minimum Requirements	Special Access Requirements	Phasing of works
Trial Pitting activities	Northbound Lanes 2 & 3, Southbound Hard shoulder and Lane 1	None	Tranche A
Expansion Joint topside Inspection	All lanes, to be phased as per Section 3.2.2.	None	Tranche A
Concrete testing to high level underbridge elements	Lane 1 and hard shoulder, both directions	Underbridge unit.	Tranche A
Concrete dilapidation survey	Lane 1 and hard shoulder, both directions	Underbridge unit.	Tranche A
Bearing Inspection to top Freyssinet hinges	Northbound Lanes 2 & 3, Southbound Hard shoulder and Lane 1	Underbridge unit.	Tranche A
Concrete testing to low level elements	None	3rd Party Land.	Tranche B
Bearing inspection to bottom Freyssinet hinges	None	3rd Party Land.	Tranche B
Bearing Inspection to abutments	None	3rd Party Land. Confined space.	Tranche B
Expansion Joint underside Inspection	None	3rd Party Land. Confined space.	Tranche B

Table 1 – Recommended Phasing of Works

3.4 Health, Safety and Environment & Risk Management

Health and Safety requirements

3.4.1 In Providing the Works the *Contractor* meets the requirements of Annex 2 of the supplementary constraints in relation to health and safety duties.

3.4.2 When implemented, the *Contractor* shall comply with the requirements of the *Employer*'s safety passport scheme and ensure that all of their employees, and any of their subcontractor's, are registered in accordance with the implementation of the scheme.

3.4.3 For details of the CDM duty holders, refer below:

Client – Highways England (*Employer)*

Principal Contractor – To be appointed by the *Employer.* It is anticipated that Traffic Management will be provided by the Principal Contractor.

Contractor - *Contractor*

Principal Designer – Highways England (*Employer)*

Designer – *Contractor*

3.4.4 Before commencing the construction phase of the *works*, the *Contractor* confirms to the *Employer* that adequate welfare facilities are in place. Where the facilities detailed in section 5 are not deemed adequate, the *Contractor* provides all necessary facilities to Provide the Works, and to comply with the minimum requirements set out in HSE guidance document L153.

Environmental requirements

3.4.5 In Providing the Works the *Contractor* meets the requirements of Annex 2 of the supplementary constraints in relation to environmental duties.

3.2.9 The *Employer* shall apply for a bat mitigation licence from Natural England to enable works within the abutments.

Risk Management

3.4.6 The *Contractor* identifies, manages and mitigates risks in accordance with the principles of ISO 31000.

3.4.7 The *Contractor* submits a risk register, which captures all risks associated with the delivery of the *works* including those identified by the *Employer*, with the tender and maintains it for the contract period.

4. REQUIREMENTS FOR THE PROGRAMME

4.1 The *Contractor* submits programme to the *Employer* with their tender.

4.2 The *Contractor* Provides the Works taking into account the following programme constraints:

(i) The *starting date* and *completion date* and any post site works, reporting and review period;

(ii) The services and other things provided by *Employer* (see Section 5);

(iii) Recommended concurrency / phasing of works as outlined in Section 4. Also other works outside the scope of this TST where it may be appropriate to undertake works concurrently, i.e. utilising the same Traffic management.

4.3 The programme should be in the form of an activity and time related bar chart, produced as a result of a critical path analysis.

4.4 The programme should preferably be provided in either a PDF or MS Excel format and cover the full contract period including post site activities. Activities should be clearly defined and named and the programme should detail the following:

(i) dates and times associated with the project, including the *starting date*, *completion date* & *Contractor's* planned completion, and any other dates or times that will specifically impact the delivery of the project;

(ii) activities associated with delivering the site works and project outputs.

4.4.1 The *Contractor* updates the programme every 2 weeks. The *Contractor* submits an updated programme to the *Employer* upon request.

Commission Date: As awarded

Mobilisation – 3 weeks from Commission Date

Draft Report Submission Date – 6 weeks from completion of site works

Review Period for the *Employer* – 2 weeks

Final Report Submission Date – 1 week from Draft Report Submission Date

Completion – 1 week following final report approval

5 SERVICES AND OTHER THINGS PROVIDED BY THE *EMPLOYER*

5.1.1 The following temporary traffic management will be provided by the *Employer* to allow the *Contractor* to Provide the Works:

(1) Traffic Management.

(2) Welfare facilities will be provided by the *Employer.*

(3) Bat Mitigation License to be obtained by *the Employer.* The *Contractor* shall work in accordance with the Bat Mitigation License.

5.1.2 The other things that will be provided by the *Employer* are as follows:

(1) not used.

5.1.3 Things that will be provided by the *Contractor* are as follows:

(1) Specialist access equipment / machinery, plant and materials required for trial pitting activities and all aspects of Works are to be provided by the *Contractor.*

6 SPECIFICATION FOR THE WORKS

The *Contractor* shall undertake the works in accordance with:

6.1.1 All works shall be undertaken in accordance with CS 450 Inspection of Highway Structures.

6.1.2 All sampling and testing should be carried out by specialist testing firms or laboratories approved by the UK's Accreditation Service (UKAS) Body for laboratory testing to ISO/IEC 17025.

6.1.3 The testing shall be undertaken in accordance with departmental Standard CS 462 Repair and Management of Deteriorated Concrete Highway Structures and CS 464 Non-destructive testing of highways structures.

6.1.4 All concrete removed from the structure shall be reinstated using a suitable high strength, non-shrink, quick setting, proprietary repair mortar complying with BS EN 1504-3:2005 Structural and non-structural repair and placed in accordance with BS EN 1504-10:2017 Site application of products and systems and quality control of the works.

6.1.5 Electromagnetic cover meter surveys shall be undertaken using the method described in BS 1881-204:1988 Testing concrete. Recommendations on the use of electromagnetic cover meters. The information to be included in the testing report shall be in accordance with BS 1881-204:1988 Clause 10.

6.1.6 The procedure for measuring the electrode potential of steel reinforcement and interpretation criteria shall be in accordance with TRL AG9 The Half-Cell Potential Method of Locating Corroding Reinforcement in Concrete Structures, ASTM C876-15 Standard Method for Half-cell Potentials of Uncoated Reinforcing Steel in Concrete, and in accordance with the recommendations of CS TR60 Electrochemical Tests for Reinforcement Corrosion and CS TG2 Guide to testing and monitoring the durability of concrete structures.

6.1.7 Measuring electrical resistivity of concrete shall be in accordance with the procedure given in CS TR60 Electrochemical Tests for Reinforcement Corrosion. Resistivity interpretation criteria shall be aligned with Table 5 of Digest 434 Corrosion of reinforcement in concrete: Electrochemical Monitoring

6.1.8 The depth of carbonation shall be determined in accordance with BS EN 14630 Products and systems for the protection and repair of concrete structures. Test methods. Determination of carbonation depth in hardened concrete by the phenolphthalein method.

6.1.9 Analysis of dust samples to determine chloride content, sulfate content and alkali content shall be carried out through a UKAS Accredited laboratory in

accordance with BS 1881-124, Testing Concrete - Part 124: Methods for Analysis of Hardened Concrete. No chemical tests shall be undertaken on site with the exception of carbonation testing.

6.1.10 Sampling for measuring chloride and cement content shall be undertaken using the procedures described in BRE IP 21/86 Determination of the chloride and cement contents of hardened concrete and in accordance with the recommendations of CS TR60 Electrochemical Tests for Reinforcement Corrosion and CS TR32 Analysis of hardened concrete: A guide to tests, procedures and interpretation of results. Interpretation of results shall be in accordance with CS 462 Repair and management of deteriorated concrete structures.

6.1.11 The tensile pull-off method for adhesion testing of the waterproofing shall be undertaken in alignment ASTM D7234-19 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Adhesion Testers. Waterproofing to be reinstated with suitably compatible material and have BBA HAPAS Roads and Bridges Certificate.

6.1.12 Waterproofing shall be reinstated in accordance with the method statement agreed with the Certification Body, and in accordance with CD 358 Waterproofing and surfacing of concrete bridge decks Revision 1. The minimum adhesion and bond strength of the waterproofing system shall be compliant with Table 6.4 of CD 358.

6.1.13 Excavation, laying and compaction of materials (trial pitting) shall be undertaken in accordance with DfT Specification for the reinstatement of openings in Highways, Fourth Edition S10. Simplified guidance can be sought in DfT Practical Guide to Street Works. The minimum, nominal and maximum compacted lift thickness is to be in alignment with Annex 8 Table A2.2 of DfT Practical Guide to Streetworks.

6.1.14 Tar testing and interpretation of results shall be undertaken in accordance with County Surveyors Society Guidance note ‘Road Materials Containing Tar’.

6.1.15 Waste shall be classified and tested to specific Waste Acceptance Criteria prior to disposal, in accordance with Hazardous Waste Regulations 2005, Landfill Regulations 2005 and Waste Framework Directive 2008/98/EC. Waste Acceptance Criteria testing shall be undertaken in accordance with in accordance with BS EN 12457-2:2002 Characterisation of waste - Leaching -

Compliance test for leaching of granular waste materials and sludges; and the Landfill Regulations [9] by a UKAS accredited laboratory.

6.1.16 Bearing inspections are to be undertaken and reported on in accordance with BS EN 1337-10:2003 Structural Bearings – Inspection and Maintenance.

6.1.17 The requirements of CD 357 Bridge Expansion Joints Are to be adhered to with respect to inspection of expansion joints. Expansion joints should also be inspected in alignment with TfL Inspection guidance for bridge deck expansion joints.

6.1.18 The Concrete Dilapidation survey is to comprise an inspection of the general condition of the concrete to all concrete elements, within touching distance. Measurements obtained from the Concrete Dilapidation survey are to be obtained using the Concrete Repair Association Standard Method of Measurement for Concrete Repair.

Appendix A - Test Areas Information

Wynhol Viaduct South (Upper)

Test Area Type	CTA Ref.	Location	Position	Dimensions
A	T1	Within carriageway trial pit	Immediately south of North expansion joint, L3.	1.5 x 1.5m (Trial pit to be 1.8m x 1.8m minimum)
A	T2	Within carriageway trial pit	Over pier 3, L3	
A	T3	Within carriageway trial pit	Over pier 7, L3	
B	T4	Cantilever at expansion joint (wrap-around)	North elevation and underside of cantilever support beam, south of North East joint.	2.0 x 1.5m
C	T5	North Abutment face	Identify areas of deterioration on site and locate CTA appropriately.	4.0 x 1.5m
C	T6	South East Wingwall return	South east wingwall return in area of visible deterioration.	
D	T7	Tops of piers (transverse elevation)	Top of Pier 2, north face.	3.0 x 1.5m
D	T8	Tops of piers (transverse elevation)	Top of Pier 4, south face.	
D	T9	Tops of piers (transverse elevation)	Top of Pier 6, south face.	
E	T10	Bottom of piers adjacent to freyssinet hinges	Bottom of Pier 1, south face, above hinge.	3.0 x 1.5m
E	T11	Bottom of piers adjacent to freyssinet hinges	Bottom of Pier 6, east face. Wrap around north and south faces of pier.	
F	T12	Deck / cantilever soffit	Span 1 soffit, in area of visible deterioration.	2.0 x 2.0m
F	T13	Deck / cantilever soffit	Span 4 soffit, in area of visible deterioration.	
F	T14	Deck / cantilever soffit	Span 8 soffit, in area of visible deterioration.	

Wynhol Viaduct North (Lower)

Test Area Type	CTA Ref.	Location	Position	Dimensions
A	T15	Within carriageway trial pit	Over pier 2, L1	1.5 x 1.5m (Trial pit to be 1.8m x 1.8m minimum)
A	T16	Within carriageway trial pit	Over Pier 6, L1	
A	T17	Within carriageway trial pit	Immediately North of South expansion joint, L1	
B	T18	Cantilever at expansion joint (wrap-around)	North elevation and underside of cantilever support beam, south of North East joint.	2.0 x 1.5m
C	T19	South abutment face	Identify areas of deterioration on site and locate CTA appropriately.	4.0 x 1.5m
C	T20	North abutment face	Surrounding area of cracking & incipient spalling as identified in the 2016 Principal Inspection	
D	T21	Tops of piers (transverse elevation)	Top of Pier 1, north face.	3.0 x 1.5m
D	T22	Tops of piers (transverse elevation)	Top of Pier 5, south face.	
D	T23	Tops of piers (transverse elevation)	Top of Pier 8, south face.	
E	T24	Bottom of piers adjacent to freyssinet hinges	Bottom of Pier 3, south face, above hinge.	3.0 x 1.5m
E	T25	Bottom of piers adjacent to freyssinet hinges	Bottom of pier 6, north face.	
F	T26	Deck / cantilever soffit	Span 3 soffit, in area of visible deterioration.	2.0 x 2.0m
F	T27	Deck / cantilever soffit	Span 5 soffit, in area of visible deterioration.	
F	T28	Deck / cantilever soffit	Span 6 soffit, in area of visible deterioration.	

Appendix B - Test areas location plan