



National Asset Delivery Technical Surveys and Testing

Works Information for Clifton Bridge - Concrete Testing

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CONTENTS AMENDMENT SHEET

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LIST OF ANNEXES

Appendix 1 Supplementary Constraints

1 DESCRIPTION OF THE WORKS

1.1 Project objectives

1.1.1 The principle objective of this project is to carry out Concrete Testing to Clifton Bridge as outlined in this works information and testing drawings and provide a detailed report of the findings of the testing.

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

1.2 Scope of works

1.2.1 The *works* to be provided under this contract are:

Location: The bridge carries the A1 (northbound and southbound carriageways) over the A197 approximately 3.25km south of Morpeth, Northumberland.

Bridge Description: The bridge is formed of three spans of twin composite decks comprising reinforced concrete deck slabs and cantilevers supported by steel universal beams. Each carriageway is supported on a separate deck. The universal beams are braced by pairs of steel channel sections. The substructures are constructed of reinforced concrete supported on piled foundations.

Testing: Concrete testing is to be carried out on various elements of Clifton Bridge as per the testing drawings (drawing numbers 20/006/01, 20/006/02 and 20/006/03), to inform refurbishment works to the structure.

The elements that will undergo concrete testing are:

- The visible abutment faces, abutment bearing shelves and ballast walls.
- The visible face of the bridge piers and pier bearing shelves.
- The visible faces of the deck soffit.

1.3 Deliverables

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

- (1) The contractor is to undertake a testing inspection of Clifton Bridge and provide a factual report outlining the results of the testing. Further detail on requirements for reporting is provided in section 6.1.12.

2 EXISTING INFORMATION

- 2.1.1 Information relevant to the structure and scheme is provided in the Pre-Construction Information document and file.
- 2.1.2 The Drawings listed below apply to this contract. Refer to the site information for details of existing site conditions including ground conditions, limitation on access, position of existing structures etc.

Drawing Number	Title	Revision / Date
20-006-01	Abutment Bankseats - Testing	
20-006-02	Piers - Testing	
20-006-03	Deck Soffit - Testing	

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 *works* commencing. 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.

The Contractor shall submit all relevant method statement, risk assessments and other supplementary information such as specification of repair mortars for approval and acceptance by the Principal Contractor and Employer 2 weeks prior to commencing works on site.

3.2 Working hours & site specific constraints

3.2.1 The *Contractor's* working hours for site works shall be:

Expected to be night shifts Monday to Friday (anticipated working hours 20:00 – 06:00)

3.2.2 The A197 running beneath the structure is the responsibility of Northumberland County Council (NCC). NCC may have specific constraints for traffic management measures which could affect working times. There is a footway on the west side of the A197 running beneath the structure. The contractor will need include for maintaining pedestrian access during the works.

Any works that generate runoff will need appropriate containment and to be disposed of safely e.g. drainage gullies will need to be temporarily covered over. The contractor will provide this in their method of working.

Contractor shall remove all materials and tools and the end of each shift and leave the site in a safe condition to be returned to normal operation.

3.3 Health, Safety and Environment & Risk Management

Health and Safety requirements

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

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

3.3.3 For details of the CDM duty holders, refer to the pre-construction information which can be found uploaded with the tender documentation.

- 3.3.4 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

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

Risk Management

- 3.3.6 The *Contractor* identifies, manages and mitigates risks in accordance with the principles of ISO31000.
- 3.3.7 The *Contractor* submits a risk register, which captures all risks associated with the delivery of the *works* including those identified by the *Employer*, with his tender and maintains it for the contract period.

4 REQUIREMENTS FOR THE PROGRAMME

- 4.1.1 The *Contractor* submits programme to the *Employer* with his tender.
- 4.1.2 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) The contractor shall make adequate allowance in the programme for the establishment and removal of traffic management at the start and end of each shift.
- 4.1.3 The programme should be in the form of an activity and time related bar chart, produced as a result of a critical path analysis.
- 4.1.4 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:
- Testing to north and south abutments.
 - Testing to north and south piers.
 - Testing to deck soffit.
 - Durations for individual tests and inspections.
 - Allowance for switching of traffic management to cover testing on both halves of bridge.
 - Durations for laboratory testing.
 - Programme for reporting.

- (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 project

4.1.5 The *Contractor* updates the programme every 1 week. The *Contractor* submits an updated programme to the *Employer* upon request.

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) The exact traffic management layout is not known at this stage. For the purposes of rendering it is assumed that traffic management will be in form of traffic lights on the A197, switched over to accommodate access on both sides of the underside of the bridge.
- (2) The M&R contractor will be consulted regarding traffic management requirements and layout upon successful awarding of the contract.

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

- (1) The welfare facilities will be provided by the Principal Contractor which in this case will be the M&R contractor providing the traffic management.

6 SPECIFICATION FOR THE WORKS

- 6.1.1 The *Contractor* shall undertake the works in accordance with the following specification:

The location of required investigations:

- 6.1.2 Concrete testing and further surveys shall be carried out as specified below and as specified in the Testing Drawings or as directed by the Overseeing Organisation.
- 6.1.3 The Contractor shall allow for carrying out the total number of tests required. The total number of tests required are given on the testing schedules in the Testing Drawings and a summary of the Total Tests Required are provided in the table below.

Total number of tests or estimated area					
Tests to be carried out	Abutments	Piers	Deck Soffit	Grand Total	
On-site Surveys & Sampling					
Visual Defect Survey	120	514	1170	1804	m ²
Delamination Survey					
Cover Survey on 500 x 500mm grid					
Half Cell Potential Survey on 500 x 500mm grid					
Resistivity Tests on 1 x 2m test panels on 500 x 500mm grid.	16	16	12	44	m ²
Chloride Sampling Locations (Drill locations)	50	100	40	190	No.
Carbonation Testing at Chloride Locations	50	100	40	190	No.

Break-outs to expose reinforcement condition (bar diameters to be measured and compared with expected sizes from as-built information)	6	12	4	22	No.
100 dia concrete cores for compression strength testing (suitable location to be determined on site)	8	8	6	22	No.
Trial holes for targeted testing of concrete on abutments and piers	2	2	0	4	No.
Laboratory Tests					
Chloride Testing at 4no. samples per location	200	400	160	760	No.
Cement Content Testing	as required for chloride concentrations				
Concrete compressive strength testing to cores.	8	8	6	22	No.

- 6.1.4 The location of these tests are shown on the Testing Drawings and will be agreed with the Contractor before work commences.
- 6.1.5 The results of the chloride sampling will be supplied to the Overseeing Organisation as soon as they become available.
- 6.1.6 Each test/inspection location shall be given a unique reference number and means shall be included to identify the location on the structure.
- 6.1.7 The Contractor shall inform the Overseeing Organisation of any issues with the testing regime prior to work starting on site.

Requirements for concrete investigation by the Contractor including:

- 6.1.8 Physical investigation:
- (1) The type of defects to be recorded:
- A full visual survey shall be undertaken. All defects shall be recorded, including extents, width of cracks, location on abutments, etc. A copy of the defect sketches shall be supplied to the Overseeing Organisation as soon as they are available.
 - The exposed concrete bridge elements shall have a delamination survey undertaken to ASTM D4580/D4580M - 12(2018). The extents of any delamination identified from the survey shall be clearly marked on the bridge element and on the defect sketches.

6.1.9 Survey by instrument:

(1) **Reinforcement cover survey:**

A cover meter survey shall be undertaken at points identified on the testing drawings. The orientation, and surveyed depth, of the reinforcement shall be recorded; along with the survey locations.

The concrete cover to the outermost reinforcement in each direction shall be determined using an electromagnetic cover meter. Each bar will be located by a continuous movement, back and forth, of the cover meter sensor. The direction of the sensor movement will be perpendicular, generally, to the reinforcement considered.

The cover meter shall be used in accordance with the Manufacturer's instructions and the recommendations of BS 1881-204: 1988.

Calibration of the cover meter shall be carried out on site preferably utilising the concrete breakout for the half-cell measurement. If there is not a readily available area of broken out concrete with reinforcement exposed then the calibration shall be checked by drilling at one location on the bridge element, exposing the reinforcement and carrying out direct measurement of the cover. All holes formed for this purpose shall be reinstated using an approved proprietary polymer modified cementitious repair mortar.

All site measurements shall be recorded and reported direct depth measurement in mm.

(2) **Electrical potential mapping**

Surface half-cell testing shall be carried out at locations shown on the testing drawings.

In areas which have a surface coating/impregnation which make it difficult to obtain half-cell readings, the Overseeing Organisation may

delete the tests. Alternatively, the Overseeing Organisation may replace the half-cell tests with resistivity tests.

Before the half-cell survey is undertaken, an area of concrete shall be broken out to expose the reinforcement. A check shall be undertaken to prove the continuity of the reinforcement of the deck using the procedure described in Technical Report 60 – Electrochemical Tests for Reinforcement Corrosion.

The half-cell survey shall be undertaken on the areas shown on the testing drawings. The tests shall be undertaken using a silver-silver chloride half-cell electrode. The Contractor shall clearly state which electrode will be used.

Half-cell potential surveys shall be carried out in accordance with standard ASTM C876 - 2015. The electrical continuity in the reinforcement shall be checked prior to commencement of reading. This shall be achieved by drilling through the concrete to the surface of the reinforcement cleaning the reinforcement to bright metal and the connection made using a self-tapping screw. (The drill hole may be widened using a hammer and chisel to facilitate attachment). Electrical continuity is established if a stable resistance reading of less than 1 ohm is achieved.

Measurements of electrode potential shall be made on a 0.5 x 0.5m grid. However, the Overseeing Organisation may require that the grid be reduced around areas where the potential gradient between readings is greater than 100mV. The Overseeing Organisation shall notify the Contractor of the location and extent of any such areas and confirm this in writing.

The voltages measured shall be recorded in millivolts and shall be tabulated with data as to the location of the reading. Furthermore, the

locations of the measured voltages shall also be recorded on sketches which are to be to scale.

Results shall be presented in the form of an equipotential contour plot with contours at 50mV intervals.

(3) **Breakouts**

When indicated on the testing drawings areas of concrete shall be broken out to expose the reinforcement.

The areas to be broken out shall at first be checked with a cover meter to determine the location, depth and orientation of the reinforcement.

The concrete breakouts should ideally be at a junction of the primary and secondary reinforcement. After the position of the reinforcement has been verified then the concrete shall be broken out. The breakout areas shall be a minimum of 150mm x 150mm. The breakout shall fully expose the reinforcement. The condition of the reinforcement shall be recorded, along with any loss of section.

The reinforcement bar diameters shall be recorded using a set of Vernier callipers and once any corrosion has been removed. The breakout and exposed reinforcement shall be photographed.

The exact location of the breakouts should be referenced and recorded on a drawing.

Breakouts in the concrete made to facilitate electrical connection to reinforcement shall be reinstated using an approved proprietary polymer modified cementitious repair mortar.

(4) **Concrete resistivity**

The tests shall be undertaken at the locations shown on the testing drawings. The system used for the resistivity testing, two or four probe, shall be clearly stated by the Contractor.

The areas to be broken out shall at first be checked with a cover meter to determine the location, depth and orientation of the reinforcement.

The resistivity tests shall be carried out in accordance with BRE Digest 434 and Concrete Society TR No. 60. Two reading per Area of Interest are to be taken at the highest half-cell locations.

All holes in the concrete shall be reinstated using an approved proprietary polymer modified cementitious repair mortar.

6.1.10 **Intrusive Investigation**

(1) **Location, number, diameter, depth of cores**

Concrete cores shall be taken at locations and sizes shown on the testing drawings.

The purpose of the cores, i.e.: what tests are required for each core, will be stated on the testing drawings.

The position of reinforcement near the face from which cores are to be removed shall be located by use of a cover meter prior to commencement of coring operations.

Cores shall be removed by use of a diamond tipped coring tool with an outside diameter of 100mm, or as specified by the Overseeing Organisation. Cores shall be positioned such that reinforcement in

the structure is avoided. Orientation of the drilling shall be perpendicular to the concrete surface.

Cores shall be marked with a unique reference and a record shall be kept of the position on the structure from where the cores were removed. After drilling cores shall be washed clean with fresh water and surface dried with paper towels. Cores shall be wrapped in polythene.

Core holes shall be reinstated as per Series 5700.

6.1.11 Laboratory Testing

(1) Chloride Penetration

Chloride testing shall be undertaken at the locations shown on the testing drawings. The drill hole locations shall be checked using a cover meter and if the location coincides with any reinforcement then the drill hole shall be moved to an area free from reinforcement.

The orientation of the drilling shall be perpendicular to the concrete surface. A masonry drill bit 20mm diameter with unworn flutes is to be used.

The dust from the first 5mm of depth shall be discarded. The hole shall be extended in 25mm depth increments and the dust collected as separate samples and sent for testing. The drill hole and location shall be cleaned of dust using compressed air between each successive depth of sampling.

The drilling dust is to be encouraged to the surface by withdrawing the drill frequently and then the dust is to be collected by brushing

onto a piece of paper and funnelling into a sample bag. The minimum sample weight for each sample is 10g.

The sample bag shall be clearly labelled with location, depth, and structure of origin.

The numbering sequence of samples is to be agreed with the Overseeing Organisation.

The process shall be repeated for 4no. increments at each location e.g. 5 to 30mm, 30 to 55mm, 55 to 80mm and 80 to 105mm.

After the final sample has been taken from each drill hole, the holes shall be cleaned by blowing out with compressed air and reinstatement of holes shall be carried out with an approved proprietary polymer modified cementitious repair material. Chloride content shall be determined from the dust sample removed from the structure.

Chloride content shall be determined in accordance with the method described in BS 1881-124: 2015.

The results of chloride content testing shall be reported in terms of total percentage chloride content by weight of cement.

(2) **Carbonation penetration**

The depth of carbonation shall be measured at every drill hole undertaken for chloride testing. The depth of carbonation shall be measured using a solution of Phenolphthalein. The Overseeing Organisation may vary the number and locations of the carbonation penetration test. They will inform the Contractor in writing of the variation before commencement of site works.

The carbonation testing shall be undertaken in accordance with BS 1881-124:2015.

Carbonation testing shall only be undertaken on freshly exposed concrete surfaces that are free from dust contamination. All traces of

drilling dust shall be cleaned from the hole using a paint brush and compressed air.

The depth of carbonation shall be measured from the surface to the boundary of the stained/unstained concrete. All site measurements shall be recorded and reported as a direct depth measurement in millimetres.

(3) **Cement content**

Cement content shall be determined from cores or dust samples removed from the structure by use of material not used in tests to determine chloride content.

Cement content shall be determined in accordance with the method described in BS 1831-124: 2015.

(4) **Other tests**

Concrete Breakouts.

When indicated on the testing drawings areas of concrete shall be broken out to expose the reinforcement.

The areas to be broken out shall at first be checked with a cover meter to determine the location, depth and orientation of the reinforcement.

The concrete breakouts should ideally be at a junction of the primary and secondary reinforcement. After the position of the reinforcement has been verified then the concrete shall be broken out. The breakout areas shall be a minimum of 150mm x 150mm. The

breakout shall fully expose the reinforcement. The condition of the reinforcement shall be recorded, along with any loss of section.

The reinforcement bar diameters shall be recorded using a set of Vernier callipers and once any corrosion has been removed. The breakout and exposed reinforcement shall be photographed.

Tests for carbonation shall be undertaken on the freshly exposed concrete surfaces.

Upon completion of all measurements then breakout area shall be reinstated using an approved proprietary polymer modified cementitious repair mortar.

Reinstatements shall be carried out in accordance with Series 5700. The edges of each repair patch shall be trimmed back to a rectangular shape comprising straight lines, e.g. a square, rectangular or rectilinear polygon. The perimeter of each repair shall be prepared to prevent feather edging or overbreak. Concrete shall be removed at the perimeter to a depth of 15mm or more, but no closer to the existing reinforcement than 10mm.

Finish on completed surfaces shall be U3 in accordance with Series 1700.

Requirements for reporting

6.1.12 Report:

Test results shall be compiled into one report. The report shall detail the type, number and location of tests/inspections undertaken and to what standards. The format of the testing reports shall be agreed with the Overseeing Organisation prior to work commencing but shall include, as a minimum:

- The method used for carrying out the tests;
- Information on the equipment used to carry out the tests;

- The test results and interpretation of the test results
- Any pass-fail criteria;
- The unique test reference number;
- The location of each test.
- Fully annotated drawings of recorded defects, which shall be easily cross referenced with the report and test results.
- A detailed narrative and conclusion for each test area, including commentary on its condition and outcome of testing and compared to similar areas.
- Areas where testing could not be completed or results not obtainable.

The format of the drawings shall be agreed with the Overseeing Organisation prior to work commencing.

Testing results shall be provided in excel or table format in addition to the report.

Electronic copies of the completed test reports and drawings will be supplied to the Overseeing Organisation as part of the deliverables. Draft documents shall be supplied a maximum of 4 weeks after receipt of the initial tests results. The Overseeing Organisation shall review and make comments. Final test documents shall be supplied a maximum of 4 weeks after receipt of final test results/receipt of comments on the draft documents, whichever is longer.

The scheme will not be considered complete until the final test documents have been received and approved by the Overseeing Organisation.