Network Rail

King's Cross Station Redevelopment Programme Package 6 GRIP 5

Civil Specification Volume 8: Structural Timber

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Network Rail

King's Cross Station Redevelopment Programme Package 6 GRIP 5

Civil Specification Volume 8: Structural Timber

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G20 Timber

GENERAL INFORMATION REQUIREMENTS

100 This Specification shall be read in conjunction with the General Contract Preliminaries, the General Structural Clauses and all other Contract documents.

110M BASIS OF DESIGN

• The structural timberwork shown on the drawings and described in this specification has been designed to BS 5268 where applicable, unless stated otherwise.

150 STRENGTH GRADING OF TIMBER

- To be carried out by companies currently registered under a third party quality assurance scheme operated by any of the certification bodies approved by the UK Timber Grading Committee.
- Timber of a basic thickness less than 100mm and not specified for wet exposure to be strength graded at an average moisture content not exceeding 20% with no reading being in excess of 24% and clearly marked as 'DRY' or 'KD' (kiln dried).
- Timber graded undried (green) and specified for wet exposure conditions to be clearly marked as 'WET' or 'GRN'.
- Structural timber members cut from large graded sections to be regraded to approval and marked accordingly.

160 GRADING AND MARKING OF SOFTWOOD

TYPE(S) OF TIMBER

210M GRADED SOFTWOOD FOR FLOOR JOISTS AND DECK IN WESTERN RANGE BUILDING

- Strength graded to BS 4978 or BS EN 519 or other national equivalent and so marked. Strength class to BS EN 338: C24
- Preservative treatment: to BS 5268-5
- Type: CCA Minimum preservative treatment P2 30g/L
- Moisture content at time of erection: As clause 450.

GRADED SOFTWOOD FOR WALL PLATES AND RAFTERS IN WESTERN RANGE BUILDING

- Strength graded to BS 4978 or BS EN 519 or other national equivalent and so marked. Strength class to BS EN 338: C24
- Preservative treatment: to BS 5268-5
- Type: CCA Minimum preservative treatment P3 30g/L
- Moisture content at time of erection: As clause 450.

GRADED SOFTWOOD FOR TILING BATTENS IN WESTERN RANGE BUILDING

- Strength graded to BS 4978 or BS EN 519 or other national equivalent and so marked. Strength class to BS EN 338: C18
- Preservative treatment: to BS 5268-5
- Type: CCA Minimum preservative treatment P8 15g/L
- Moisture content at time of erection: As clause 450.

310M PLYWOOD FOR WESTERN CONCOURSE MEZZANINE TILE-CLAD ROOF

Design and supply the curved plywood base for the tiled skin to the exterior of the Mezzanine and Bridge in the Western Concourse in accordance with the following performance requirements:

• Use the design loads listed in the following table:

Load Description	Value
Dead Load	Self-weight of timber determined by contractor based on final type and thickness of plywood selected.
Superimposed dead loads:	
- Tiles and grout (where present)	0.3 kN/m ² (load per square metre of plywood)
 Acoustic treatment (where present) 	0.3 kN/m ² (load per square metre of plywood)
 Fire-protection board to plywood soffit 	0.5 kN/m ² (load per square metre of plywood)
Live Load:	
 Maintenance access point load at any point on a plywood board 	1.2 kN acting vertical
- Construction Live Load	1.5kN/m² (load per plan projected area)
	-This value may be reduced at the discretion of the installer
Wind Load	±0.24k N/m ²

Geometry and span arrangements

Fabricate plywood in singly-curved elements following the geomtry defined on the architect's drawings.

It is assumed that the plywood will designed to single-span between glulam timber ribs arranged radially, at centres not exceeding 600mm so that a 1200mm wide ply piece will span continously over three ribs. At each end of a sheet of plywood it is expected that a timber cross-piece will be introduced between the radial glulam beams to form a connection between adjacent pieces of plywood to prevent differential in- and out-of-plane movements. This is not expected to be a structurally spanning member. Size this to suit the practicalities of forming a screwed and glued joint between butting pieces of plywood.

Adjust this proposed spanning arrangement in any desirable way to achieve fabrication, erection, cost and programme efficiency, subject to the satisfying the performance requirements of this specification. Note, however, that the steelwork fabricator will provide attachments for the glulam ribs and that any proposed changes should be coordinated by the Contractor before steelwork working drawings and fabrication are commenced, to ensure that the plywood fixings are provided to the steelwork support frame.

• Thickness of plywood

Determine the thickness of the plywood in accordance with BS5268-2 to ensure that:

- The the system is sufficiently strong to resist the design loads over the span arrangement adopted.
- The combined displacements of the plywood and glulam system under transient loads (live loads, wind loads and suspended ceiling and services loads) does not distort the surface supporting the tiles more severely than span/300.
- Deformation of steelwork

As the installation of glulam, plywood, tiles, fire-protection, ceiling and other finishes proceeds the steel frame will continue to deflect under the additional loads. Deflections equivalent to 40mm over a 10m span will develop, equivalent to a distortion of span/250. Allow for this deflection in the design of the timber glulam/plywood system.

 Manufacture plywood to the relevant national standards and quality control procedures specified in BS 5268-2, and so marked.

Type: To contractor's selection to suit geometrical or other requirements

Grade: To contractor's selection to achieve strength and deflection requirements

Nominal thickness/number of plies:. To contractor's selection to achieve strength, deflection and shape requirements

Finish: Unsanded

• Preservative treatment: None Required.

330M GLUED LAMINATED TIMBER FOR WESTERN CONCOURSE MEZZANINE TILE-CLAD ROOF

Design and supply the curved glulam ribs to support the plywood backing to the skin to the exterior of the Mezzanine and Bridge in the Western Concourse in accordance with the following performance requirements:

• Use the design loads listed in the following table:

Load Description	Value	
Dead Load	 Dead load of plywood spanning onto glulam Self-weight of glulam determined by contractor based on final type and size of glulam elements adopted. 	
Superimposed dead loads:		
- Finishes on plywood	Tiles, grout, acoustic treatment, fire-protection loads on plywood spanning onto glulam (see section 310M)	
 Ceiling and services suspended from glulam beams 	0.5 kN/m ² (load per plan projected square metre)	
Live Load:		
- Maintenance access load	Assume a maintenance crew working on a plan area of 2m by 2.4m imposing a total load of 6kN (equivalent to 1.25kN/m ²	
- Construction Live Load	Construction load on plywood spanning onto glulam	
Wind Load	Wind load on plywood spanning onto glulam as defined in the Architectural Specifications Section A	

• Geometry and span arrangements

Fabricate curved glulam elements to be arranged radially to match the geometry of the plywood shell shaped as defined on the architect's drawings.

It is assumed that the glulam timber ribs will be arranged radially, at centres not exceeding 600mm. The glulam beams will span onto square hollow section steel beams at approximately 2m centres along the cladding surface, forming chords between radial steel primary members. The chord arrangement means that the secondaries will not follow the cladding profile exactly but from the primary beam location will "drift" away from the cladding surface on plan and in level. The steelwork details on the design drawings indicate pairs of cleats at each glulam beam position with a pair of boltholes so that two glulam beams can be fixed to each cleat. Each glulam member is assumed to have a single span from one steel secondary to the next and to be fixed to the steel frame at each end by a single bolt through one of the pairs of boltholes. Refer to the steelwork design drawings for exact details of the steel frame arrangement.

The steel frame as erected will vary from the precise design geometry due to normal fabrication and erection tolerances and due to deflections under self-weight. An allowance has been made to

accommodate these variations from exact geometry at the steel/glulam interface. This assumes that the glulam beams will not have connection holes pre-drilled but will be placed into the cleats and positioned to an "exact" geometry and temporarily held in position with a coach screw. Subsequently the connecting bolt hole will be site-drilled through the the glulam beam using the holes in the steel cleat as a guide, and a bolt inserted to form the final connection.

Adjust this proposed spanning, fixing and tolerance control arrangement in any desirable way to achieve fabrication, erection, cost and programme efficiency, subject to the satisfying the performance requirements of this specification. Note, however, that the steelwork fabricator will provide attachments for the glulam ribs and that any proposed changes should be coordinated before steelwork working drawings and fabrication are commenced.

• Size of glulam members

Determine the size of the glulam members in accordance with BS5268-2 to ensure that:

- The the system is sufficiently strong to resist the design loads over the span arrangement adopted.
- The combined displacements of the plywood and glulam system under transient loads (live loads, wind loads and suspended ceiling and services loads) does not distort the surface supporting the tiles more severely than span/300.
- Deformation of steelwork

As the installation of glulam, plywood, tiles, fire-protection, ceiling and other finishes proceeds the steel frame will continue to deflect under the additional loads. Deflections equivalent to 40mm over a 10m span will develop, equivalent to a distortion of span/250. Allow for this deflection in the design of the timber glulam/plywood system.

- Manufactured to BS EN 386 and BS EN 390, with glued end joints to BS 5268-2, clause 3.4.
- Timber: Free from active attack by insects or fungi.
- Strength class to BS EN 338: To contractor's selection to achieve strength and deflection requirements
- Finished lamination thickness: To contractor's selection to achieve strength and deflection requirements. Note that the steel secondary and cleat arrangement shown on the design drawings assumes a glulam rib depth of 100mm to create tolerance gaps and if deeper elements are needed notches will be required at the ends to make tolerance adjustment possible.
- Adhesive type: To BS EN 301 and capable of withstanding climactic conditions specified in BS EN 386 for service class Type II (or better).
- Surface classification: Regularised
- Preservative treatment: Not required.
- Works applied finish: Refer to architect's specification for fire retardant.

350 TRUSSED RAFTERS

- Designed and fabricated to BS 5268-3.
- Manufactured by a firm currently registered under a third party quality assurance scheme.
- Truss system: To be proposed by manufacturer for acceptance by the Employer's Representantive. Any proprietary systems to be Agrément certified or to have "TRADAmark"
- Drawing reference(s): ENG-DWG-OAP-WRB-CSP-0100 series and associated sections and details.
- Types/weights of roofing/insulation/ceiling materials: Refer to the drawings
- Ancillary components to be supplied by the truss fabricator: Refer to the drawings.
- Gangplate and other metal fixings: To be stainless steel Grade 1.4303 (A2).
- Preservative treatment: to BS 5268-5
- Type: CCA Minimum preservative treatment P3 30g/L

WORKMANSHIP GENERALLY

401 CROSS SECTION DIMENSIONS OF STRUCTURAL SOFTWOOD AND POPLAR

- Dimensions on drawings are target sizes as defined in BS EN 336.
- The tolerance indicators (T1) and (T2) specify the maximum permitted deviations from target sizes as stated in BS EN 336, clause 5.3:

Tolerance class 1 (T1) for sawn surfaces

Tolerance class 2 (T2) for planed surfaces.

420 WARPING OF TIMBER

The amount of bow, spring, twist and cup in a piece of timber of specified grade must not exceed the limits set down in BS 4978 or BS EN 519 for softwood, or BS 5756 for hardwood.

430 SELECTION AND USE OF TIMBER

- Do not use timber members which are damaged, crushed or split beyond the limits permitted by their grading.
- Ensure that notches and holes are not so positioned in relations to knots or other defects that the strength of members will be reduced.
- Do not use scarf joints, finger joints or splice plates without approval.
- Where new structural timber is added to existing timber joists or roof members in the Western Range Building, ensure that shrinkage of new timber is accounted for in detailing connections to existing timber, and that existing timber notches, holes or defects are avoided at connections, so the strength of the members and their connections is not reduced.

440 PROCESSING TREATED TIMBER

- Carry out as much cutting and machining as possible before treatment.
- Retreat all treated timber which is sawn along the length, ploughed, thicknessed, planed or otherwise extensively processed.
- Treat timber surfaces exposed by minor cutting and drilling with two flood coats of a solution recommended for the purpose by main treatment solution manufacturer.

450 MOISTURE CONTENT

Of timber at time of erection to be not more than

- Covered in generally unheated spaces: 24%
- Covered in generally heated spaces: 20%
- Internal in continuously heated spaces: 20%.

451 MOISTURE CONTENT TESTING

- When instructed by Employer's Representative, test timber sections with an approved electrical moisture meter used in accordance with manufacturer's recommendations.
- Test 5% but not less than 10 lengths of each cross-section in the centre of the length.
- 90% of values obtained to be within the specified range. Provided Employer's Representative with records of all tests.

480 TRUSSED RAFTER TESTING - NOT REQUIRED

510M PROTECTION

- Keep timber dry and do not overstress, distort or distort or disfigure sections or components during transit, storage, lifting, erection or fixing.
- Store timber and components under cover, clear of the ground and with good ventilation. Support on regularly space, level bearers on a dry, firm base. Open pile to ensure free movement of air through the stack.
- Arrange sequence of construction and cover timber as necessary during and after erection to ensure that specified moisture content is not exceeded.
- Keep trussed rafters vertical during handling and storage.

520 EXPOSED END GRAIN

Seal exposed end grain of the following with.before delivery to site:

- All trusses, rafters, purlins and battens for use in roof spaces: clear end grain sealer.
- All timber for floor joists and boards: clear end grain sealer.
- Where existing timber joists or roof members are cut to make alterations as shown on the Drawings, the end grain of the cut face shall be treated before completion of the connection to new timber, in accordance with the manufacturer's instructions for the end grain sealer.

JOINTING TIMBER

580M FRAMING ANCHORS

- Material/finish: Stainless steel in roof areas.
- Fix anchors securely using not less that the number of nails recommended by the anchor manufacturer. Fixings to Concrete and Masonry shall be designed in accordance with the Structural Specification for Fixings to Concrete and Masonry.
- Nails to be not less than 30 x 3.75mm, stainless steel, unless specifically approved by the Employer's Representative.

595 NAILS

To BS 1202 Finish as clause 670.

596 SCREWS

- To BS 1210. Minimum tensile strength 550N/mm2.
- Stainless steel screws to be used in roof spaces and to fix plywood panels to glulam ribs in Western Concourse Mezzanine and Bridge tiled cladding.
- Finish: sherardized for mild steel as clause 670.

600 BLACK BOLTS AND NUTS

- To BS EN ISO 898-1 and BS EN 20898-2.
- Finish (applied by manufacturer): sherardized as clause 670.

610 BLACK CUP AND COUNTERSUNK HEAD BOLTS AND NUTS

- To BS 4933.
- Finish (applied by manufacturer): sherardized as clause 670.

620 WASHERS

- Plain to BS 4320, spring to BS 4464.
- Material and finish to match bolts.
- Dimensions when seated directly on timber surfaces, unless specified otherwise.
- Diameter/side length: not less than 3 times bolt diameter.
- Thickness: not less than 0.25 times bolt diameter.

625 STAINLESS STEEL BOLTS, NUTS AND WASHERS

- Bolts and nuts: To BS EN ISO 3506, Grade 1.4303 (A2) with washers of matching material
- Washer dimensions: Diameter: Not less than 2 times bolt diameter. Thickness: Not less than 0.2 times bolt diameter.

626 NAILING

- In joints, use not less than two nails and opposed skew nailing unless specified otherwise.
- Drive nails fully in without splitting or crushing the material being fixed.
- Punch nail heads below surfaces that will be visible in the completed work.

627 SCREW FIXING

- Screws to be turned, not hammered, into pre-drilled holes. The hole for the shank to be equal to the shank diameter. The hold for the thread to be about half the thread diameter.
- Drive countersunk heads flush with timber surface, or not less than 2mm below it if they are to be stopped.
- Washers and screw cups, where specified, to be of the same material as the screw.

630 BOLTED JOINTS IN TIMBER

- Bolt spacings (minimum): to BS 5268-2, Table 81
- Locate holes accurately and drill to diameters as close as practical to the nominal bolt diameter and not more than 2mm larger.
- Place washers under all bolt heads and nuts that would otherwise bear directly on timber. Use spring washers in locations which will be hidden or inaccessible in the completed building.

- Tighten bolts so that washers just bite the surface of the timber. Ensure that at least one complete thread protrudes from the nut.
- Check at agreed regular intervals up to Practical Completion and tighten as necessary to prevent slackening of joints.

640 BOLTED JOINTS WITH TIMBER CONNECTORS

- Connectors: To BS EN 912, type(s) and size(s) as shown on drawings.
- Finish: Stainless steel in roof spaces, or sherardized as clause 670
- Bolt hole: where appropriate, size to suit bolt diameter
- Bolts and washers: to BS 5268-2
- Where not otherwise shown, spacings, end and edge distances to be not less than standard values to BS 5268-2, Section 6
- Set out with centres of bolt holes not more than 2mm from specified positions.
- Assemble joints without crushing timber, deforming washers or overstressing bolts.

650 GLUED JOINTS

Design joints between plywood sheets and glulam ribs in Western Concourse Mezzanine and Bridge tiled cladding backing to be by screw fixing with 6mm dia stainless steel screws at max 250mm centres or closer as determined by justification calculations. In addition, use Type II phenolic/aminoplastic adhesive at this joint to provide further control against in- and out-of-plane differential movements at this interface which could result in reflected cracking through the tiled surface.

Obtain manufacturer's confirmation that adhesive is compatible with preservative/fire retardant treatment.

660M PURPOSE MADE CONNECTIONS

Provide purpose made connections as shown on the design drawings in material and finish indicated.

670 ANTI-CORROSION FINISH(ES) FOR FASTENERS

• To BS 7371-6 for galvanizing, with internal threads tapped and lightly oiled following treatment.

- To BS 7371-8, Class 1 for sherardising
- To BS EN ISO 4042 and passivated, for zinc plating

ERECTION AND INSTALLATION

710 PROPOSALS FOR ERECTING STRUCTURAL TIMBER TO WESTERN CONCOURSE MEZZANINE AND BRIDGE TILED CLADDING BASE

At least 20 working days before starting erection of timber structure, submit details of:

- Method and sequence of erection.
- Type of craneage.
- Temporary guys and bracing proposed for use during erection.

711 JOINT TOLERANCES FOR FRAMED ELEMENTS

- For single bolt connections with or without connectors, 1mm for the centre of the joint with respect to the centre line of the members.
- For multiple nailed, screwed or bolted joints, punched metal plates and mechanically fixed or glued gusset plates, 1.5mm for the centre of the joint with respect to the centre line of the members.
- For the assembly as a whole, 5mm for the intersection of member centre lines.

712 FABRICATION AND ERECTION TOLERANCES Permissible deviations are as shown below.

Dimension (m)	Permissible Deviation (mm)
0-2	4
2-4	5
4-8	10
8-12	15
12-16	20
Over 16	25

These apply to variables such as:

- Plumb
- Linear dimensions of members
- Clear dimension between members

Position on Plan

The position on plan of any column shall be within 5mm of the intended position.

Level of floor beams

- For any beam the difference in level between the two ends shall not exceed 5mm
- The deviation from the specified level of any beam at the support position shall not exceed 10mm.
- The level of adjacent beams within 5m on plan shall be within 5mm

740 PRE-ERECTION CHECKING

- Not less than 10 days before proposed start date, structures to which timber structure will be attached, particularly the steel frame for the Western Concourse Mezzanine and Bridge cladding.
- Check connection points to supporting structures, etc: for accuracy of setting out
- Check holding down bolts: for position, protruding length, condition and slackness.
- Report any inaccuracies and defects to Main Contractor and Employer's Representative without delay.
- Obtain agreement of Employer's Representative to commence erection.

750 MODIFICATIONS/REPAIRS

- Inform Employer's Representative of any defects due to detailing or fabrication errors.
- Obtain approval of proposed methods of rectification before starting modification or remedial work.
- Timber members/components may be rejected if, in the opinion of the Employer's Representative, the nature and/or number of defects would result in an excessive amount of site repair.

760 TEMPORARY BRACING

Provide as necessary to maintain structural timber components in position and to ensure complete stability during construction.

770 ADDITIONAL SUPPORTS

- Where not shown on drawings, position and fix additional studs, noggings or battens for appliances, fixtures, edges of sheets, etc., in accordance with manufacturer's recommendations.
- All additional studs, noggings or battens to be of adequate size and have the same treatment, if any, as adjacent timber supports.

775 BEARINGS

- Timber surfaces which are to transmit loads to be finished to ensure close contact over the whole of the designed bearing area.
- Packings, where necessary, to cover the whole of the designed bearing area, to have a crushing strength not less than the timber being supported and, in external locations, to be rot and corrosion proof.

780 WALL PLATES

Ensure that wall plates are:

- Positioned and aligned to give the correct span and level for trusses, joists, etc.
- Fully bedded in fresh mortar

Joints: at corners and elsewhere where joints are unavoidable use nailed half-lap joints. Do not use short lengths of timber.

784 INSTALLING JOISTS GENERALLY

- Position at equal centres not exceeding designed spacing and true to level.
- Install bowed joists with positive camber.
- Position end joists approximately 50 mm from masonry walls.

786 INSTALLING JOISTS ON HANGERS

- Bed hangers directly on and hard against supporting construction. Do not use packs or bed on mortar.
- Cut joists to leave not more than 6mm gap between ends of joists and back of hanger.
- Rebate joists to lie flush with underside of hangers.
- Fix joists to hangers with a nail in every hole.

790 JOIST HANGERS FOR TIMBER FLOORS IN WEST RANGE BUILDINGS

- To BS EN 845-1, size and type to suit joist, design load and crushing strength of supporting construction.
- Material/finish: Stainless Steel Grade 1.4303 (A2)

800M TRUSSED RAFTER INSTALLATION

- Carefully inspect each truss before erection to ensure compliance with shop drawings and specification, including:
 - Grades and sizes of members
 - Full penetration of nails.
- Erect trusses plumb, at equal centres not exceeding designed spacing and in accordance with BS 5268-3, clause 9.3 and TRA site installation guide.
- Do not use damaged trusses
- Do not modify without approval.
- Fixing: Truss clips and bottom chords of standard trusses and rafters of raised tie trusses bearing fully on wall plates.
- Do not fix bottom chords of standard trusses to internal walls until roofing is complete and cisterns installed and filled.

805 TRUSS CLIPS

- Manufacturer and reference: To supplier's selection
- Material/finish: Stainless Steel Grade 1.4303 (A2)
- Fix securely with 32 x 3.5mm stainless steel square twisted nails in every hole

810 PERMANENT BRACING OF TRUSSED RAFTERS

- Set out bracing and binders as shown on drawings unless approved otherwise.
- Size of bracing and binders Braces and binders should be at least 100 x 25mm softwood and free from major strength reducing defects and distortion. Refer to the design drawings.
- Fix bracing and binders to every rafter, strut or tie with not less than two fasteners
- Fasteners: 75 x 3.35mm stainless steel round wire nails
- Any lap joints must be side by side extending over and nailed to at least two truss members.

820 VERTICAL RESTRAINT STRAPS

- Type: Flat straps bent over trusses and rafters.
- Material: Stainless steel Grade 1.4303 (A2)
- Size: Not less than 75mm² cross-section.
- Overall length 1500mm: end of strap 900mm below underside of wall plate; twisted immediately beneath joist/trussed rafter; bent over top of joist/trussed rafter and extending 100mm down far side.
- Centres: Position at not more than 1.2m centres.
- Fix straps securely to timber members with not less than 30 x 3.5mm stainless steel square twist nails.
- Fix straps securely to masonry with not less than four stainless steel screws evenly spaced.
- Locate at least one screw within 150 mm of the bottom end of each strap.

830 LATERAL RESTRAINT STRAPS

Refer to the Design Drawings for details.

840 STRUTTING TO FLOOR JOISTS

Unless specified otherwise strutting to be one of the following:

- Herringbone strutting, at least 38 x 38mm softwood
- Solid strutting, at least 38mm thick softwood and at least three quarters of depth of joist.

Unless specified otherwise, securely fix strutting between joists as follows:

- Joist spans of 2.5 to 4.5m: One row at centre span.
- Joist spans over 4.5m: Two rows equally spaced.
- Strutting must not project beyond top and bottom edges of joists.

Outer joist to be blocked solidly to perimeter walls.

850 INSPECTION

Give Employer's Representative reasonable opportunity to inspect structural timberwork before covering up.

860 BOLTED JOINTS

Inspect all accessible bolts at the end of the Defects Liability Period and tighten if necessary.

TIMBER SURVEY

Allow for 15 rooms in the West Range Buildings where, at the instruction of the Employer's Representative, condition survey and grading of existing floor timbers are to be undertaken in order to establish the need for any strengthening to accommodate new loading conditions such as mechanical and electrical plant. The timber condition survey shall be carried out and results reported to the Employer's Representative such that timely instruction on repairs or treatment of the timber floors can be made without knock-on effects to the rest of the construction programme, as approved by the Employer's Representative, and in accordance with English Heritage requirements for Listed Building Consent approvals procedures.

1000 METHOD OF TESTING

- By visual inspection, hammer soundings, moisture content survey, drilling and opening up as appropriate.
- Methods are to be appropriate for a Grade I listed structure of this nature. Prepare method statements and submissions as necessary to secure approval from English Heritage for the opening-up works.

1010 Condition Survey

- Identify nature and extent of damage/decay to all timbers (structural and non-structural) and their connections, including any associated metalwork.
- Identify nature and cause of any decay, distinguishing between wet rots, dry rot (serpula Lacrymans) or type of insect attack.
- Determine % section loss and whether decay is historic or ongoing.
- Identify timbers at risk from future decay by determination of moisture content by micro-drilling and using deep probe portable battery-operated moisture meters.
- Damage recorded to include deterioration of joints, accidental damage, fire damage, strength loss due to previous alterations etc.

1020 Strength grading

• Visually strength grade existing floor joists in accordance with CP112 or a visual grading standard complying with BS EN 518, to enable design calculations to be undertaken in accordance with BS 5268-2. Include the cost of microscopic species identification by TRADA, BRE, or similar authority as approved by the Employer's Representative.

1040 Lifting of Floorboards

- Lifting of boards is to be approached in stages to minimise the disturbance of original construction. In all instances, floorboards are to be lifted over a width no less than 0.5m and to suit the actual width of the individual floorboards, at any opening up location.
- Initially, only modern replacement boards, and original boards fixed by screws or otherwise previously cut and disturbed are to be lifted.

- Where insufficient information is available from the initial stage, further areas of modern boarding and original boarding as described in stage 1 not indicated on the drawings will be lifted, where this may provide sufficient information to avoid lifting of historic boarding
- Where this is not possible, and following consultation and agreement with London Borough of Camden and English Heritage, historic boarding in the areas indicated on the drawings is to be lifted, with the areas individually monitored to minimise the extent of disturbance
- No cutting of boards is permitted; the boards are to be carefully lifted, retaining existing nails for re-use where possible, and board orientation and location recorded to ensure successful reinstatement.

1050 Removal of Existing Floor Pugging

• Floor pugging may occur to suspended timber floors. Where existing pugging obscures the inspection of the timber floor structure and following consultation and agreement with English Heritage, areas sufficient to enable inspection of the floor void are to be carefully removed, and the pugging boards and battens carefully de-nailed and set aside for reinstatement.

1060 Reporting

- Prepare a report summarising findings
- Include 1:100 scale drawings showing type and distribution of defects described above.