

SECTION 93

Materials and workmanship generally

- 1** Materials and workmanship for structural metalwork repairs shall be in accordance with the requirements of Section 90: Steelwork (BS 5400), Sections 140 and 141: Steelwork (BS 5950), and Sections 170 - 176: Protective Treatment as applicable unless modified by this Section.

Repairs of defects by welding only shall not be permitted.
(93.001)

Design and methods of repairs to structural metalwork generally

- 2** Unless detailed on the Contract Drawings, the design of structural metalwork repairs shall be carried out by the Contractor.

Repairs to structural metalwork shall be designed in accordance with BS 5400: Parts 3, 5, 9.1 and 10 or BS 5950: Part 1 as applicable, and shall satisfy the load capacity, serviceability limits, durability and life expectancy and other design requirements for the structure specified in Section 23: Structural Repair Survey.

Where the design is carried out by the Contractor, proposals for the repair shall be submitted in accordance with Section 23: Structural Repair Survey.

The detailed method statement for the Contractor's proposed method of carrying out the repair shall be provided with details of any dynamic load restrictions.

Repairs to structural metalwork and the method of carrying out such repairs shall not:

- (i) adversely affect the structure by the introduction of local stiffening,
- (ii) adversely affecting the load path through the structure,
- (iii) introduce details which either reduce the existing fatigue life or have a fatigue life less than that specified in Section 23: Structural Repair Survey.

Existing members, supports and restraints of the structure to be repaired shall not be subject subjected to any additional or changed loading unless the Contractor can demonstrate by calculation that the structural capacity of the affected member and adjoining members can accommodate such additional or changed loading.

The design of any repair shall prevent wherever reasonably practicable, timber directly interfacing with any part of the metallic structure, whether or not protective treatment is applied.

Repairs shall be detailed to avoid the ingress or retention of moisture. Edges of joints shall be adequately clamped and if necessary sealed with a compound in addition to the surface treatment.

For repairs to bridges, welding of temporary attachments to any part of the existing structure or Permanent Works shall not be permitted.

(93.002)

Deterioration and defects to be identified

3 The factual report in accordance with Section 23: Structural Repair Survey shall detail the apparent deterioration of elements of the structure and identify defects which may be pertinent to the performance or durability of the structure. Deterioration to be detailed and defects to be identified shall include but not be limited to the following:

- (i) loss or deterioration of protective treatment or other coating and the condition of underlying metal,
- (ii) corrosion,
- (iii) cracking including, orientation, shape, size, depth, any evidence suggesting new or long standing cracks,
- (iv) loose bolts or rivets including size, any evidence suggesting new or long standing looseness, and whether the connection is "working" under dynamic load,
- (v) water seepage or retention including rate of seepage or degree of retention, source of water, any evidence suggesting new or long standing water seepage, leachate or rust staining, and whether the area is wet, damp, dry or subject to wetting or drying,
- (vi) buckling or distortion of sections including degree of buckling, and any evidence suggesting new or long standing distortion.

All defects shall be logged and shown on dimensioned sketches, to show the location, extent, and degree of deterioration and to detail the defect on the structure. Defects affected by dynamic loading or which may affect the fatigue life of the structure shall be noted accordingly. Photographs, in accordance with Section 23: Structural Repair Survey for each defect shall be included, but shall not to be used as a substitute for dimensioned sketches.

(93.003)

Identification of material type and properties

4 The type of material of the structure or element shall be identified and classified as cast iron, wrought iron, early steel or steel.

Where not available in records of the structure, and where required to enable the repair to be executed, tests shall be carried out by the Contractor to identify and quantify, as necessary, mechanical and metallurgical properties of the structural metalwork.

Where welding is to be carried out, mechanical and metallurgical properties of all structural metalwork to be welded shall be determined and used to determine the welding procedure.

Details of tests proposed to be carried out by the Contractor and the location and extent of any samples to be taken for such testing shall be submitted for the agreement of the Employer's Representative.

(93.004)

Cracks in metallic structures: testing regime

- 5** Cracks have been identified or are suspected to occur in the following locations:

(INSERT).

Where cracks are present or are suspected to occur in a member, the protective treatment shall be removed and the surface adjacent to the cracks cleaned as necessary. One of the following testing procedures shall be carried out to confirm the presence and/or to determine the extent of any cracks:

- (i) magnetic particle inspection (MPI) in accordance with BS 6072 and Section 90: Steelwork (BS 5400),
- (ii) dye penetrant tests in accordance with BS 6443.

A method statement identifying the area to be tested, extent of surface preparation and method proposed to confirm the presence and/or to determine the extent of any cracks shall be submitted for the agreement of the Employer's Representative. Following testing, full details shall be provided of all cracks including sketches showing the location, orientation, length and width of the cracks.

(93.005)

Cast iron

- 6** Repairs to any element identified as cast iron shall only be undertaken after obtaining specialist advice.

Cast iron elements shall not be:

- (i) welded when the element considered is subject to dynamic loading,
- (ii) flame cut,
- (iii) subjected to impact loading due to the method of repair,
- (iv) subjected to tensile loading due to the method of repair.

(93.006)

Wrought iron

- 7** Repairs to any element identified as wrought iron shall only be undertaken after obtaining specialist advice.

Wrought iron elements shall not be:

- (i) welded,
- (ii) flame cut,
- (iii) subjected to impact loading due to the method of repair.

Where wrought iron is to be repaired, the existence of, and extent of laminations or other internal imperfections shall be identified, and the repair shall be designed, detailed and carried out to avoid lamellar tearing.

(93.007)

Bi-metallic reaction

- 8** When new metalwork is to be incorporated within an existing structure of different metals, details shall be provided to demonstrate that no adverse bi-metallic reaction will occur.

(93.008)

Cleaning off for inspection and measurement

- 9** Sufficient protective treatment, concrete, corrosion products, detritus or other material which obscures the element to be inspected shall be removed to enable assessment and accurate measurement of the section.

(93.009)

Re-use of existing connections

- 10** Where existing bolted or riveted connections are required to be dismantled, the assumptions made regarding the condition of any element or part of an element, which is hidden by the existing connections, used in the design shall be stated by the Contractor. Upon dismantling of the existing connection, the elements shall be inspected by the Contractor, and should the extent of corrosion invalidate the design assumptions, the Employer's Representative shall be advised of the extent of corrosion found, and the Contractor's revised design proposals based on the actual section.

(93.010)

Replacement of existing rivets

- 11** High strength friction grip bolts, close tolerance bolts or swaged collar grooved rivets, to replace existing rivets shall comply with, and be installed in accordance with Section 90: Steelwork (BS 5400). Notwithstanding the requirements for structural capacity of the repair, the new connection arrangement shall have not less than the structural capacity of the original riveted connection.

(93.011)

Rivet removal

- 12** The method of removing existing rivets shall be agreed with the Employer's Representative. Mechanical shearing of rivet heads and punching out of rivet shafts shall be the preferred method. The surrounding metalwork shall not be damaged or adversely affected. Removal of rivets by flame cutting shall not be permitted.

The number of rivets which may safely be removed from an element at any one time under the conditions applicable at the relevant stage of the repair, shall be determined by the Contractor, and stated in the detailed method statement for the repair.

No more than **(INSERT)** no. rivets and/or bolts may be removed from **(INSERT)** under **(INSERT)**.

(93.012)

Holes for bolts and rivets

- 13** New holes shall be formed by drilling. Punching or flame cutting shall not be used to form holes.

All holes from which bolts or rivets are removed shall, as far as is reasonably practicable, have replacement bolts or rivets inserted.