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# Specification for Road Works Series 02500 - Special Structures

**CC-SPW-02500**  
July 2021

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## TII Publications



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**Updates to TII Publications resulting in changes to  
Specification for Road Works Series 02500 - Special Structures**

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**Amendment Details:**

This document supersedes the June 2014 publication of CC-SPW-02500. The following principal amendments have been incorporated into this document:

- a) The document has been re-formatted in line with current TII drafting standards and references updated to new TII naming convention.
- b) The technical content of Clauses 2501, 2503 and 2504 has not been reviewed.
- c) Paragraph 2.1 – Statement added requiring soil structures shall be designed and executed in accordance with BS 8006-1, IS EN 14475 and IS EN 1997.
- d) Paragraph 2.2.1 – Statement added prohibiting the use of argillaceous material as fill material in reinforced soil structures.
- e) Paragraph 2.2.2 – requirements for stainless steel reinforcing elements have been removed and will appear in associated notes for guidance including explanation that use of stainless steel is subject to TII approval.
- f) Paragraph 2.2.2 – requirements for corrosion protection of carbon steel straps updated to align with BS 8006-1:2010.
- g) Paragraph 2.2.3 – requirements for bolts, nuts and screws have been arranged in a single clause.
- h) Paragraph 2.3 - New Section on Workmanship added.
- i) Paragraph 2.3.1 – Requirements added for the transport and handling of reinforcing elements.
- j) Paragraph 2.3.1 – requirement added that prefabricated concrete units shall not be transported to site or installed until the concrete has achieved 60% of its characteristic compressive strength, and must be installed by a suitably experienced contractor.
- k) Paragraph 2.3.1 - Statement added requiring lifting eyes to be either grouted following installation or fitted with galvanised or stainless-steel embedded fixings
- l) Paragraph 2.3.1 – Statement added prohibiting cutting of reinforcing straps on site.
- m) Paragraph 2.3.2 - Section added to specify dimensional tolerances upon completion of construction.
- n) Paragraph 2.3.3 - Section added to prohibit the installation of panels that are damaged or chipped.

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# 1. Corrugated Steel Buried Structures

## 1.1 General

Corrugated steel buried structures of clear span or internal diameter exceeding 900mm shall comply with this Clause.

The Contractor shall design the corrugated steel buried structures listed in Appendix 1/10 in accordance with DN-STR-03003, the design requirements given in Appendix 25/1 and the procedures given in DN-STR-03001.

## 1.2 Earthworks

Earthworks shall comply with CC-SPW-00600.

## 1.3 Steel Components

All helically wound systems and all bolted segmental systems, including the galvanizing of their plates, bolts and nuts, to be incorporated in the Works shall have a current NSAI Agrément Certificate, or equivalent.

The lockseams of helically wound systems shall be able to withstand tensile forces across the seam, according to steel sheet thickness, as tabulated below:

Nominal Sheet Thickness (mm)	Minimum Tensile Force across Seam (kN/m)
1.00	36
1.30	51
1.60	65
2.00	88
2.80	136
3.50	182
4.20	234

For intermediate sheet thicknesses, the minimum tensile force required may be determined by linear interpolation.

After forming, the depth of the corrugations shall be within a tolerance of  $\pm 6\%$  and the pitch of the corrugations within a tolerance of  $\pm 4\%$  of the nominal dimensions. Plates shall have a minimum lip of 45mm beyond each end crest. Cut edges shall be free from notches, gouges, rust or burrs.

When all the plates of a bolted segmental structure have been assembled, the nuts shall be tightened by applying a torque within the range stated by the designer/manufacturer. The tightening shall be repeated if necessary, to achieve the required torque.

Bolts, nuts and washers (if provided) shall be of such a design that no damage is caused to metal coatings when the nuts are tightened as described above.

## 1.4 Hot Dip Galvanizing of Steel Components

All surfaces of steel components shall be hot dip galvanized in compliance with IS EN ISO 1461. Plates for bolted segmental structures shall be galvanized after forming the corrugations and completing all necessary cutting, punching and drilling. Units in which the metal coating has been burned by welding or otherwise damaged in fabrication, transport or handling at Site shall be made good in compliance with Series 1900.

Bolts and nuts shall be hot dip galvanized in compliance with IS EN ISO 1461.

## 1.5 Concrete Foundations of Arch Profile Structures

Concrete foundations shall be constructed as described in Appendix 25/1 with concrete complying with CC-SPW-01700.

## 1.6 Concrete Invert Pavings

Where described in Appendix 25/1, concrete invert pavings shall be constructed in compliance with that Appendix using Class C25/30 concrete complying with CC-SPW-01700.

Concrete invert pavings shall be reinforced with a steel fabric complying with CC-SPW-01700 having mesh dimensions not greater than 150mm x 300mm and a nominal wire size not less than 5mm. All laps in the mesh shall be at least 150mm. The steel fabric shall be securely fixed to the structure by means of fixings at the bolt positions. It shall extend to within a distance not greater than 100mm, or less than 40 mm inside the edges of the concrete on each side. A nominal cover of 45mm shall be provided to all other faces, including that to the crest of the corrugations in the structural steel.

Concrete invert pavings shall be cast in lengths not exceeding 10 metres with the provision of a water bar between adjacent panels and the joints sealed with a joint sealant in accordance with CC-SPW-02300.

At each end of the structure the concrete invert paving shall be either:

- i. terminated with a toe that returns at least 200mm under the structural steel forming the structure. The steel fabric shall be folded under the lips of the structure to suit. The toe shall be detailed with a thickness of not less than that required for the paving in accordance with DN-STR-03003.
- ii. detailed to suit any headwall arrangement e.g. paving reinforcement lapped with headwall reinforcement.

All foreign matter and free-standing water shall be removed from the steel surfaces to be paved, before commencing work.

## 1.7 Proprietary Invert Pavings

Any proposed proprietary invert paving systems shall have a current NSAI Agrément Certificate, or equivalent.

## 1.8 Proprietary Secondary Protective Coatings Applied Above Hot Dip Galvanised Coating

Any proposed proprietary protective coating systems shall have a current NSAI Agrément Certificate, or equivalent.



## **1.9 Protective Coatings**

Where described in Appendix 25/1, exposed galvanized steel surfaces shall be prepared and protected after erection in compliance with that Appendix. The additional protective coating may be factory or site applied and shall have a service life of at least six years in aggressive conditions.

## 2. Reinforced Soil Structures

### 2.1 General

Reinforced soil structures shall be designed and executed in accordance with the latest editions of BS 8006-1, IS EN 14475 and the relevant parts of IS EN 1997 as per CC-SPW-00010 Clause 4.

Notwithstanding the above, reinforced soil structures shall comply with the specific requirements of this Clause.

Where reinforced soil structures are specified as Contractor designed elements, they shall be listed in Appendix 1/10 and the design requirements shall be specified in Appendix 25/2.

All reinforced soil structures shall comply with the requirements set out in DN-STR-03001 for strengthened earthworks.

### 2.2 Materials

#### 2.2.1 Earthworks

Earthworks for reinforced soil structures shall comply with CC-SPW-00600.

Notwithstanding the above, argillaceous material shall not be permitted for use in design as backfill to reinforced soil structures.

#### 2.2.2 Reinforcing Elements for Reinforced Soil Structures

Carbon steel strip to be hot dip galvanized shall comply with IS EN 10025-1 and IS EN 10025-2, either grade S235 JR or S355 JR each having a silicon content of not less than 0.25% and not more than 0.40%. The fabricated element shall be galvanised in compliance with CC-SPW-01900 and shall include a non-structural sacrificial thickness of steel of not less than 0.75mm per surface of element and achieve a galvanised coating thickness of 85µm.

Proprietary reinforcing elements and systems using such elements shall have a current NSAI Agrément Certificate or equivalent.

Non-proprietary reinforcing elements shall comply with the requirements of BS 8006-1 & IS EN 14475.

#### 2.2.3 Fasteners

Fasteners shall comply with the requirements of BS 8006-1 & IS EN 14475.

Notwithstanding the above, the following requirements shall apply.

Bolts, screws and nuts shall comply with EN ISO 898-1, product grades A and B, and shall comply with EN ISO 4014, EN ISO 4017 and EN ISO 4032, and shall be made from one of the following:

- i. Steel property class 8.8 complying with IS EN ISO 898-1 galvanized in compliance with Series 1900.
- ii. Stainless steel to IS EN 10088-1, designation 1.4401 or 1.4436 except that the 0.2% proof stress of the bolt shall be not less than 450N/mm<sup>2</sup> and the tensile strength shall be not less than 700N/mm<sup>2</sup>.

Plain washers shall be of either Form A or Form E complying with BS 4320 and shall be made from the following:

- i. Cold rolled carbon steel strip CS4 complying with BS 1449: Part 1.1 hot dip galvanised in compliance with Series 1900.
- ii. Stainless steel strip designation 1.4401 or 1.4436 complying with IS EN 10029, IS EN 10048, IS EN 10051 and IS EN ISO 9445.

Dowels and rods shall be made from one of the following:

- i. Steel bar conforming to IS EN 10080 and BS 4449 (Grade B500B), galvanized in compliance with Clause 1911.
- ii. Steel of grade S 355 JR complying with IS EN 10025 galvanized in compliance with Clause 1911.
- iii. Stainless steel to IS EN 10088-1, designation 1.4401 or 1.4436 except that the 0.2% proof stress shall be not less than 450 N/mm<sup>2</sup> and the tensile strength shall be not less than 700N/mm<sup>2</sup>.

## 2.2.4 Prefabricated and Precast Facing and Capping Units

Proprietary facing units and systems using such units shall have a current NSAI Agrément Certificate, or equivalent.

Non-proprietary prefabricated and precast facing and capping units shall comply with the requirements of BS 8006-1 & IS EN 14475.

Notwithstanding the above, the following requirements shall apply:

Reinforced concrete shall comply with CC-SPW-01700.

Pre-cast concrete facing panels shall be provided with a pattern profile finish to exposed surfaces where this form of construction shall be adopted for road over road or road over river crossings. The proposed pattern shall be subject to the written approval of the Employer's Representative.

All concrete surfaces shall be of a uniform colour.

Where used in the design for structures in conjunction with a parapet, the pre-cast concrete facing panels of a reinforced soil structure shall extend to the underside of the parapet edge beam

## 2.3 Workmanship

### 2.3.1 General

Reinforced soil structures shall be executed in accordance with BS 8006-1, IS EN 14475 and the specific requirements of this Clause.

Reinforcing elements shall be prefabricated and delivered to site ready for installation into the Works. The elements shall be:

- i. Loaded, unloaded and handled in such a manner that:
- ii. no permanent set or other structural damage is caused;
- iii. the protective coating is not damaged.
- iv. Stored flat and clearly marked to identify items having different lengths and cross-sectional dimensions.

Cutting of reinforcing elements on site shall not be permitted.

Prefabricated concrete units should not be transported to site or installed until the concrete has reached a compressive strength of 60% of its characteristic compressive strength and shall be installed by a suitably experienced contractor.

Following installation of precast panels, lifting eyes' embedded fixings shall be left exposed only where embedded fixings are either:

- i. Stainless steel strip designation 1.4401 or 1.4436 complying with IS EN 10029, IS EN 10048, IS EN 10051 and IS EN ISO 9445
- ii. Hot-dip galvanized in compliance with Series 1900.

Where stainless steel or galvanised fixings are not used, lifting eyes shall be injected with grout following installation of panels.

### **2.3.2 Dimensional tolerances**

The dimensional tolerances on completion of the construction of reinforced soil structures shall be as follows:

- i. Location on plan shall be a maximum of +/- 25 mm
- ii. Verticality shall be a maximum of 2 mm per m (maximum 25 mm for a height in excess of 12.5 m)
- iii. Bulging (vertical) shall be a maximum of 3 mm per m
- iv. Bowing (horizontal) shall be a maximum of 3 mm per m
- v. Steps at joints shall be a maximum of 6 mm
- vi. Alignment along the top of the structure shall be a maximum of +/- 10 mm

Deformations that occur following construction shall comply with the limits specified in BS 8006-1. Permanent surface settlement monitoring points shall be provided to allow the extent of such deformations to be monitored.

### **2.3.3 Damage and repairs**

Installation of concrete panels that are damaged or chipped prior to installation shall not be permitted.

Precast concrete facing panels forming part of a reinforced soil structure shall be replaceable in the event of damage.

## **3. Reinforced Clay Brickwork Retaining Walls of Pocket-type and Grouted Cavity Construction**

### **3.1 Materials**

Cement, aggregates, water and mortars for reinforced brickwork retaining wall structures shall comply with the relevant Clauses of CC-SPW-02400, except where different requirements are given in this Clause.

Clay masonry units (bricks) shall be HD type Class B clay engineering bricks conforming to IS EN 771-1 and the following performance characteristics:

- i. The mean compressive strength of the bricks shall be not less than 40N/mm<sup>2</sup> when tested in accordance with IS EN 772-1;
- ii. The water absorption of the bricks shall be not more than 7% by mass when tested in accordance with IS EN 772-7;
- iii. The freeze/thaw resistance category of the bricks shall be F2.

Unless otherwise described in Appendix 25/3, concrete shall be designed concrete. It shall comply with the requirements of CC-SPW-01700.

Reinforcement and all cutting, bending and fixing of reinforcement shall be in accordance with CC-SPW-01700.

Wall ties shall be as described in Appendix 25/3.

Damp proof courses shall be as described in Appendix 25/3.

### **3.2 Storage of Materials**

Bricks shall be unloaded with due care to minimize damage, placed on site in different stacks according to strength and type, and be marked clearly. They shall be stacked on prepared level areas, avoiding ground contamination and be protected from rain or snow.

Cement, lime and lime/sand mix shall be stored off the ground in dry areas and used in the sequence of delivery. Different types of cements shall be stored separately and clearly identified. Lime and lime/sand mix shall be protected from drying out.

Reinforcement shall be stored on site in a safe manner and be free from loose rust, scale, dirt, paint, oil, grease or any other harmful material, prior to fixing.

### **3.3 Laying of Bricks**

Brickwork shall be laid in accordance with CC-SPW-02400.

Bricks shall not be used within 14 days of firing.

The maximum height of brickwork to be built in a day shall be limited to 1.0m and 12 hours shall elapse before recommencing bricklaying.

Cutting of bricks shall be kept to a minimum. When cutting is necessary, cutting discs shall be used.

Where sleeves, chases or holes are required, they shall be provided during the erection of brickwork.

### **3.4 Mixing of Mortar**

15 Mortar shall be mixed mechanically until its colour and consistency are uniform. The constituent material shall be accurately measured.

Where ready mixed mortars are specified, their use shall be in accordance with the manufacturer's instructions and IS EN 998-1 and IS EN 998-2.

Mortar shall be made in small quantities only as and when required. Mortar which has begun to set or which has been mixed for a period of more than one hour shall be discarded.

When additives or admixtures are used, the recommendations of the admixture manufacturer should be followed and they shall be demonstrated in the trial panel.

Mortars shall be tested in accordance with IS EN 1052-1.

### **3.5 Concrete – General**

Batching, mixing, compliance, transporting, placing, compacting and finishing of concrete shall be in accordance with the requirements of CC-SPW-01700.

The rate of placing of concrete with respect to the rate of brickwork construction shall be as required by Appendix 25/3.

### **3.6 Cold Weather Working**

Cold weather working shall be in accordance with the requirements of CC-SPW-01700 and CC-SPW-02400 as appropriate.

### **3.7 Hot Weather Working**

During hot weather, the Contractor shall ensure that the constituent materials of mortar and concrete are sufficiently cool to prevent stiffening before placement in their final position. Cement shall not be allowed to come into contact with water at a temperature greater than 60°C.

### **3.8 Protection of New Work**

Protection of newly laid brickwork shall be in accordance with CC-SPW-02400.

In addition, during freezing conditions, brickwork shall be covered with an insulating layer followed by a waterproofing material. Covers shall be held clear of the brickwork and be well secured.

Side protection shall be provided in exposed site conditions.

### **3.9 Weatherproofing, Backfill and Drainage**

The retaining face of the wall shall be flush-jointed and tooled and shall be subsequently painted with a waterproofing material in accordance with CC-SPW-02000.

Backfill shall be in accordance with CC-SPW-00600. Before commencing backfilling, a period of 14 days or longer, if required by Appendix 25/3, shall elapse after the completion of the wall.

Permeable backing to the retaining wall shall be in accordance with CC-SPW-00500.

When used, weep-holes shall not be allowed to drain freely across footways or carriageways.

### **3.10 Trial Panels**

The Contractor shall construct a trial panel of pocket-type reinforced clay brickwork retaining wall of dimensions specified in Appendix 25/3 prior to commencement of permanent work. The trial panel shall be used to demonstrate the colour of mortar, workability of mortar, formation of pockets and infilling of concrete. When required in Appendix 25/3, the panel shall be dismantled in such a manner that the effectiveness of each element can be examined.

## **4. Access Underpasses**

### **4.1 General**

This clause covers reinforced concrete box structures to be constructed beneath an existing road.

Access Underpasses comprising concrete box structures shall be in accordance with CC-SCD-02501, CC-SCD-02502 and CC-SCD-02503 in MCDRW Volume 4 and shall comply with this Clause.

The design and approval of the structure shall be in accordance with the design requirements described in Appendix 25/4; the procedures given in DN-STR-03001; and the requirements specified on CC-SCD-02501, CC-SCD-02502 and CC-SCD-02503.

### **4.2 Road Restraint Systems**

The road restraint system (vehicle and pedestrian) shall comply with the requirements of CC-SPW-00400.

The vehicle restraint system shall be designed in accordance with DN-REQ-03034 with visibility considered in accordance with DN-REQ-03031.

The pedestrian restraint system required at the top of the headwall shall be designed in accordance with DN-STR-03012.

### **4.3 Drainage**

Drainage shall comply with the requirements of CC-SPW-00500.

The requirement for a drainage system incorporating a sump with pumping system shall be avoided. If no alternative is available, details of this system for drainage shall be included in the Technical Acceptance Report, produced in accordance with DN-STR-03001, for discussion with TII.

### **4.4 Earthworks**

Earthworks, including the requirements for backfilling of the structure, shall comply with the requirements of CC-SPW-00600.

### **4.5 Pavement**

Reinstatement of the pavement above the proposed structure shall be in accordance with the requirements of the Road Opening License.

The access track through the structure shall be in accordance with CC-SCD-00703.

### **4.6 Road Marking**

Road marking shall be reinstated in accordance with the requirements of CC-SPW-01200.

### **4.7 Structural Concrete**

All structural concrete shall comply with the requirements of CC-SPW-01700.




All exposed concrete shall be impregnated with a hydrophobic impregnation system in accordance with CC-SPW-01700.

## **4.8      Waterproofing**

Waterproofing of the structure, including bridge deck waterproofing and epoxy resin shall comply with the requirements of DN-STR-03012.





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