Technical Direction

Bridge

BTD 2019/01 | RMS.19.1378 – 24 September 2019

Provision for Electrical Continuity of Steel in Concrete Structures

Summary:	Audience:
This technical direction sets out provisions for electrical continuity of steel in concrete structures to enable future concrete durability condition assessment and, where required, future cathodic protection or other electrochemical repair applications.	• Designers • Regional Managers • Motorway Managers • Project Managers • Industry Partners

Background

The initial cost associated with providing electrical continuity of steel reinforcement in concrete elements during construction of new bridges is negligible when compared to life-cycle benefits achieved. Such provision enables future concrete durability condition assessment and, where required, electrochemical repair applications including cathodic protection.

Information

This technical direction applies to all new bridges and associated structures whether a cathodic protection (prevention) system will be or will not be installed.

The technical direction supersedes BTD 2008/13 *Provisions for Future Cathodic Protection of Reinforced Concrete Bridges* which primarily mandated achieving electrical continuity of steel reinforcement in the bridges. BTD 2008/13 is now withdrawn.

Approvals:

Owner:	Christian Christodoulou Director Bridges and Structures	**Review Date:**	24 September 2024
Authorised by:	Chris Harrison Director of Engineering	**Effective Date:**	24 September 2019

Bridge Technical Direction

This bridge technical direction applies to bridges and structures with design life not less than 100 years, including tunnels, retaining walls and culverts. It is relevant to elements –

a. entirely or partially located in exposure classification B2, C1, C2 or U in accordance with AS 5100.5; and

b. with carbon steel reinforcement only or carbon and stainless steel reinforcement.

The following provisions apply:

1. Electrical continuity must be established for all reinforcement including pre-tensioning strands (or wires or bars) and embedded steel components.
2. The electrical continuity must be provided within each element and between adjoining elements of the structure, where practical.
3. Post-tensioning reinforcement and associated steel components (e.g. couplers and prestressing anchors) must be either electrically connected to or isolated from other reinforcement within each element.
4. Two electrical paths (as redundancy) must be provided to achieve electrical continuity.
5. Steel anchors or inserts for fixing steel items with large exposed surface areas (e.g. bridge bearings, light poles, etc.) must be electrically isolated from the reinforcement.
6. The design must be completed and certified by a competent cathodic protection person with the level of expertise specified in Appendix E of AS 2832.5 or by a person eligible to Level 3 Cathodic Protection Senior Technician certification conforming to ISO 15257, or higher.
7. The design must account for potential galvanic coupling between metal components or/and possible adverse effects of welding on the mechanical properties of steel including hydrogen embrittlement.
8. The electrically interconnected reinforcement must be further connected to “reinforcement connection access points” to enable verifying the electrical continuity and future condition assessment or cathodic protection during the service life of the structure.
9. Bridge or structure elements below ground or water surface (e.g. concrete or steel piles) must be electrically connected to reinforcement connection access points above ground or water surface.
10. A minimum of two reinforcement connection access points must be provided for each electrically connected zone (i.e. each element or electrically connected elements).
11. For concrete elements consisting of multiple members (e.g. a bridge pier comprising two or more columns), a minimum of one reinforcement connection access point must be provided at each member (i.e. each column).
12. Electrical continuity needs not to be provided between adjoining precast culvert units, however it must be provided within each unit. The reinforcement connection access points need not to be provided at each unit, however two access points must be provided at each end of the culvert with the first unit at each culvert end connected to the closest two access points, headwall, wing wall and base slab. For culverts under divided carriageways, two points must be further provided at unit(s) located under the carriageway median.
12. The reinforcement connection access points must be located away from vandalism and must remain accessible during service. The points must be located at least 1.5 metre above ground or high water level, as relevant.
13. The reinforcement connection access point must be a threaded female socket with M12 internal coarse thread. The access points must be made of corrosion resistant material without relying on coating to achieve corrosion protection and be protected from crevice corrosion and degradation. The access point must not induce galvanic coupling when connected to carbon steel.

14. The design drawings must include –
    - details of the primary electrical continuity and reinforcement connection access points; and
    - the statement “ELECTRICAL CONTINUITY AND ISOLATION (WHERE RELEVANT) MUST BE TESTED AND CERTIFIED IN ACCORDANCE WITH AS 2832.5 AND FIB BULLETIN 33, RESPECTIVELY, BEFORE AND AFTER CONCRETING”.

References:

AS 2832.5	Cathodic protection of metals – Steel in concrete structures
AS 5100.5	Bridge design – Concrete
fib Bulletin 33	Durability of post-tensioning tendons
ISO 15257	Cathodic protection - Competence levels of cathodic protection persons - Basis for a certification scheme

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