

Code of Practice Mechanical anchors

1. Scope and Application

BTN008 Mechanical anchors states VicRoads' requirements for the design of post-installed mechanical anchors used to make structural connections to reinforced concrete substrates.

Bridge Technical Notes are a Code of Practice. Compliance with Bridge Technical Notes is mandatory.

Other than as stated in this document and relevant VicRoads standard specifications, the provisions of AS5100:2017 shall apply. Where this document differs from AS5100:2017, its requirements override those of AS5100:2017.

The requirements in this document are intended to reduce the risk of failure of connections made with mechanical anchors.

2. Design requirements

2.1. General

The design, selection and specification of mechanical anchors must be conducted by an engineering consultancy that is, as a minimum, prequalified in accordance with VicRoads' Prequalification Scheme at the Structures Simple level.

Mechanical anchors must have the load-carrying capacity required by the design and sufficient durability to achieve the required design life of the structure.

2.2. Design considerations

The design of mechanical anchors shall be in accordance with concrete capacity (CC) method as described in SA TS 101:2015, ETAG 001 Annex C or ACI 318-14.

For tensile loading, the mechanical anchors must be prequalified and designed in accordance with SA TS 101:2015.

The spacing of mechanical anchors and minimum edge distance must be in accordance with the product prequalification or specific supplier's recommendations.

Mechanical anchors shall be designed for the combined effects of shear, bending and/or tension as appropriate to the intended use.

Connections shall be designed with sufficient redundancy such that the failure of one anchor does not lead to progressive failure of the connection.

2.3. Design life

Mechanical anchors must have a minimum design life equal to the remaining design life of the structural components which are being connected. In the case of components with unequal design lives, the mechanical anchor must have a minimum design life equivalent to the longest remaining design life of the items being connected.

In the case of retrofitting applications, the chosen anchor must have a minimum design life equivalent to the remaining design life of the existing structure.

The design life of mechanical anchors must be demonstrated by testing in accordance with European Organisation for Technical Approvals (EOTA) requirements specifically EAD 330232 – Mechanical fasteners for use in concrete.

Grade 316 stainless steel anchors shall be used for permanent applications in bridges and road-related structures.

2.4. Restrictions

2.4.1. Permitted anchor types

Subject to selection of the appropriate anchor for the required loading and application from manufacturers' data, the following anchor types are permitted:

Torque Controlled Expansion Anchors

- thick sleeve anchors
- wedge anchors
- undercut anchors.

Undercut anchors have superior performance under tensile loading.

2.4.2. Anchor types not permitted

Deformation controlled anchors are not permitted for structural applications.

2.4.3. Permitted applications

Subject to appropriate design considerations and the restrictions on use stated in this document, mechanical anchors are permitted for use in applications where they are

subjected primarily to axial compressive forces and shear forces transverse to the anchor – for example:

- to attach ancillary items such as pipes and cables to a structure if the mechanical anchor is primarily in shear
- to attach retro-fitted bridge bearings to bridge substructures.

2.4.4. Applications not permitted

Mechanical anchors **shall not** be used in the following applications:

- in new structures if cast-in anchors can be used
- in existing structures if the connection can be achieved by the use of positive connections*
- if the remaining design life of the structural components being connected exceeds the tested/certified design life of the available mechanical anchor
- to support tensile loads in any orientation if anchor failure could result in collapse, instability or failure of the connection
- as holding-down connections for use with cantilever or portal sign structures and high mast light structures
- as holding-down connections for steel and concrete bridge barriers and bridge barrier posts
- if the thickness of the concrete substrate into which the anchor is being placed is less than 1.25 x required length of the anchor
- if the concrete substrate into which the anchor is being installed is friable, shows signs of delamination or any other defect other than the permitted use in cracked concrete in accordance with the product prequalification
- in concrete with characteristic strength less than 20 MPa or greater than 50 MPa - with the exception of undercut anchors which are permitted at strengths in excess of 50MPa if used in accordance with the product prequalification.

* Positive connections are defined as structural connections that are achieved by cast-in fitments such as rag-bolt assemblies or threaded ferrules, or by clamping either through or around the full depth of the elements being connected. For example, a threaded rod (or bolt) in a full-depth hole together with a backing plate.

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Bridge Technical Notes are subject to periodic review and may be superseded.