



TS 03618:1.0

Specification

Concrete Turnout Bearers

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Document history

Revision	Effective date	Summary of changes
1.0	26/08/2025	This standard is a first issue as TS 03618 and supersedes SPC 233 <i>Concrete Turnout Bearers</i> , version 1.4 and UGL Regional Linx standard TS 01100:1.0 (CRN CP 234) <i>Engineering Specification Concrete Turnout Bearers</i> .

Preface

This specification is a first issue as TS 03618 and supersedes SPC 233 *Concrete Turnout Bearers*, version 1.4 and TS 01100:1.0 (CRN CP 234) *Engineering Specification Concrete Turnout Bearers*.

This document specifies design requirements for design of prestressed concrete turnout bearers used in the heavy rail network in the MRA and CRN. It also outlines the type approval requirements for the bearers.

Changes from previous versions include harmonisation of TS 03618 and TS 01100.

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1 Scope

This specification details requirements for the design and type approval of prestressed concrete turnout bearers complete with resilient fastenings and insulators.

2 Application

This specification applies to all concrete turnout bearers used in heavy rail in the MRA and CRN to meet the requirements of TS 03612.

This specification is intended for use by Technically Assured Organisations (TAOs) and is applicable to all of the MRA and CRN. This standard applies to the design of new track work, track renewal work and maintenance of existing track.

This standard is not specifically intended to cover light rail or metro however, the principles of this standard may be applicable to the light rail and metro environments.

Concrete bearers for special applications, including multi-gauge tracks, are not covered by this specification.

3 Referenced documents

The following documents are cited in the text. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

Australian standards

AS/RISSB 1085.1 *Railway track material, Part 1: Steel rails*

AS/RISSB 1085.14 *Railway track material, Part 14: Prestressed concrete sleepers*

Transport for NSW standards

TS 00172 *Glossary of Track Terms*

TS 03510 *Track System*

TS 03499 (ESC 210) *Track Geometry and Stability*

TS 03612 *Sleepers and Track Support*

TS 03619 *Resilient Fastenings*

UGL Regional Linx standards

TS 01045 (CRN CS 210) *Track Geometry and Stability*

4 Terms, definitions and abbreviations

The following terms, definitions and abbreviations apply in this document in addition to the terms in TS 00172.

cast in shoulder component that prevents lateral movement of the rail foot and provides anchorage for the resilient fastening system

cast in synthetic insert component that allows a screwspike to provide lateral restraint for turnout switch plates

CRN Country Regional Network

MRA metropolitan rail area

OC operating class; track operating classes are specified in TS 03510

prestressed concrete turnout bearer concrete bearer where the deformed reinforcing bars (tendons) are stressed before casting the concrete

resilient fastenings clip elastic steel clips attached to bearers and designed to engage rail flanges. These clips fasten rails to the bearers providing lateral support. Standard resilient fastenings also generate toe load at the rail flange providing resistance to longitudinal movement.

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5 Design requirements

5.1 General

Concrete bearers shall be designed in accordance with AS/RISSB 1085.14 unless otherwise specified in this document.

Fastenings, cast in inserts, pads and insulators shall comply with TS 03619.

Concrete turnout bearers shall be designed to perform in operating environment in Table 1.

Table 1 – General operating environment

Criterion	Detail
Track gauge	1435 mm gauge with installation tolerance ± 4 mm. Tighter tolerances of ± 2 mm shall be required for bearers within 1.2 m of the switch tip and bearers within 1.2 m of the crossing nose to meet the requirements of TS 03499. Refer to TS 03499 for the MRA and TS 01045 for the CRN.
Rail	Error! Reference source not found. – 60 kg/m rail
Rail cant	All running rails shall have zero cant
Electric traction	1500 V DC

Criterion	Detail
Signalling	Track circuited signalling
Climate	Temperate
Locomotive sanding	Sanding may be applied for improved traction on extensive lengths of sharp curves and steep gradients. Concrete bearers shall be designed to minimise potential for soffit abrasion and rail seat erosion in the operating environment.
Nominal distance between axles	1.8 metres 30 tonne axle load 1.7 metres 25 tonne axle load 1.6 metres 23 tonne axle load
Minimum service life	50 years
Electrical insulation	Bearers and fastenings together with open track panels shall ensure a minimum electrical resistance between running rails of 10 ohms per track kilometre.
Thermal expansion and contraction	Thermal expansion and contraction forces act on the continuously welded rails with a rail temperature range from -10°C to 75°C about a neutral rail temperature of 35°C .

Maximum train speeds and axle loads shall be in accordance with TS 03510.

Maximum super deficiency for relevant traffic classification and speed profile shall be calculated in accordance with TS 03499 for the MRA and TS 01045 for the CRN.

Track geometry assumptions including curvature, gradient, superelevation, and cant deficiency shall be in accordance with TS 03499 for the MRA and TS 01045 for the CRN.

5.2 Track

Track configuration and operating requirements shall be as specified in TS 03510 and in Table 2.

Table 2 – Track information for OC

Parameter	OC-2, OC-5	OC-3, OC-4, OC-5	OC-1, OC-6
Nominal ballast depth	350 mm	300 mm	250 mm
Nominal track modulus	30 mPa	30 mPa	25 mPa
Nominal track condition index (TCI)	40 to 45	45 to 50	45 to 50
Axle load	30 tonnes	25 tonnes	21 tonnes
Nominal bearer centres	600 mm	600 mm	600 mm
Annual tonnage	70 MGT	20 MGT	20 MGT

5.3 Bearer dimensions

The bearer dimensions shall be in accordance with Table 3.

Table 3 – Bearer dimensions

Parameter	Dimension
Bearer length	From 2.5 m to 7.5 m
Limits of cross section (width)	240 mm to 300 mm
Limits of cross section (depth)	220 mm to 300 mm
Rail pad size (resilient fastening clip such as Pandrol e-clip or approved equivalent)	148 mm x 180 mm x 7 mm (± 0.5)

The dimensional tolerances for approved designs shall be in accordance with Table 4.

Table 4 – Tolerances on concrete bearer dimensions

Parameter	Tolerances
Length	+ 10 mm to – 5 mm
Width	± 3 mm
Depth	± 3 mm

Once bearer depth has been selected for infill panel members or longest turnout members as appropriate, depth of members shall be arranged to ensure the underside of all members form a single plane.

If the bearer depth required in the design is greater than 300 mm, consideration should be given to using spliced bearers.

All bearer surfaces shall be flat (non-curved) excepting the longitudinal top edges. The longitudinal top edges shall be rounded to a nominal 10 mm radius. The base surface may be rough cast. The top and side surfaces shall be smooth to prevent retention of moisture and foreign material.

5.4 Bearer design

Bearer design shall be in accordance with Table 5.

Table 5 – Bearer design

Parameter	Value
Design rail seat load	160 kN
Design bending moments	In accordance with figures in Appendix A
Design shear forces	In accordance with figures in Appendix A

Concrete and tendon stresses at transfer and under service loads shall be in accordance with AS/RISSB 1085.14.

5.5 Fastening assembly

Fastening assemblies are provided in bearers to hold rails securely in the rail seat. The fastening assemblies shall be designed and tested in accordance with TS 03619. Synthetic inserts shall be threaded internally and externally so as to be replaceable. Synthetic inserts shall be provided with protective plugs to prevent entry of foreign material.

5.6 Ancillary equipment

Provision for point machines shall be allowed for in the 'A' and 'B' bearers at the points. If swing nose crossings are used provision for the fastening of point machines shall also be required for the bearers affected at the crossing location.

5.7 Manufacturing

Approved designs shall be manufactured and tested in accordance with AS/RISSB 1085.14.

6 Handling and maintenance performance

Bearers should be installed by turnout transportation and layout equipment. Designs should keep manual work such as the fitting of pads, insulators and installation of fastenings to a minimum.

Trackwork fitted with concrete bearers shall be suitable for maintenance with conventional track maintenance equipment. Such equipment may include:

- tamping machines
- track adjustment jacks
- track lining machines
- fastening insertion/removal equipment.

7 System performance

System performance requires the concrete bearer assembly to function as part of the track structure. The bearer shall be able to transfer all the relevant track forces generated by train operations and the forces of rail thermal expansion and contraction to the ballast.

Pads shall possess sufficient edge stiffness to prevent the bearer from tilting (about its longitudinal axis) in order to resist longitudinal track forces arising from thermal expansion, contraction and rail creep.

The area of the bearer bases shall be adequate to ensure an even load distribution through the ballast bed with maximum ballast pressure.

8 Allowance for retrofit

For plated bearer designs there shall be two zones running the length of the bearer that are clear of reinforcement, and which can be used for repair, or retrofitting of equipment. These zones are defined in **Error! Reference source not found.**. The zones include an allowance of 10 mm clearance to the reinforcement. Any cored holes shall be:

- perpendicular to the bearer top surface, that is vertical in the installed position, to maintain this clearance
- no deeper than 190 mm from the top surface
- a maximum diameter of 50 mm
- placed no closer than 2 diameters from another hole unless the existing holes are filled.

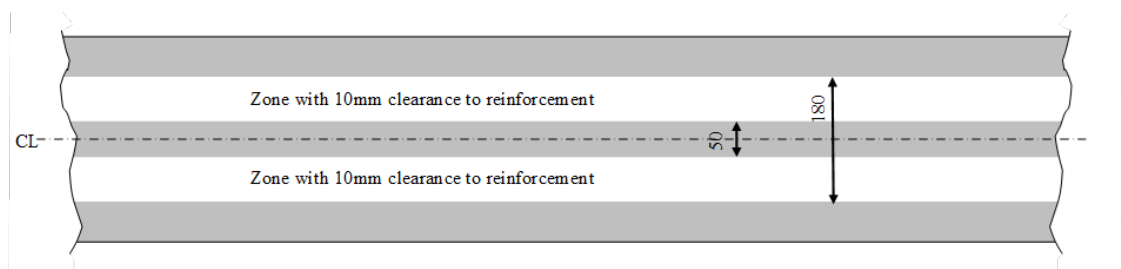


Figure 1 – Reinforcement free zone

Epoxy suitable for high strength concrete repair, with similar mechanical and thermal expansion properties and strength >50 Mpa, shall be used.

Note: Existing holes for screwspikes in a bearer should be within the zones in Figure 1. If this is not the case design advice should be sought from the RIM before any coring is carried out.

9 Bearer marking

The following marks shall be permanently displayed on each bearer:

- mark of manufacture
- year of manufacture with 50 mm high numbers
- batch number and date stamp
- bearer identification number in accordance with the relevant track design.

Lettering and marks shall be on the upper surface of the bearer between the rail seats.

10 Type approval requirements

New bearer designs shall be tested in accordance with AS/RISB 1085.14.

The following type approval submission requirements shall apply to new designs of concrete turnout bearers:

- one set of design calculations including the following:
 - fastening assemblies with all cast-in components, insulators and clips
 - tendon design stress including strain relaxation
 - tendon bond stress including losses from interface bond/anchorage
 - concrete strength including shrinkage creep and curing effects
 - the complete integrated bearer system as a unit including spalling and delamination effects
 - the effects on bearer strength from manufacturing tolerances for example concrete shape and tendon placement, and the design attrition allowance
- two sets of fully detailed drawings including fastening assembly detailing:
 - tendon type, size and material
 - shoulder type, detail and material
 - insert details and material
 - insulator type, detail and material
 - clip type, detail and material
 - concrete mixture specification and properties
 - concrete curing specification
- documentation of testing outcomes.

11 User documentation

The following information shall be provided to prepare the technical maintenance plan:

- safety instructions including bearer handling and installation and safe fastening installation procedures
- spacer and insulator installation methods
- maintenance documentation giving details of inspection requirements including frequency, method and requirements

- bearer installation and maintenance requirements and methods, including any special tools and equipment.

Appendix A Bending moment and shear force envelopes (normative)

Figure 2 to Figure 6 show bending moment envelopes and shear force envelopes for the various types of turnout bearers.

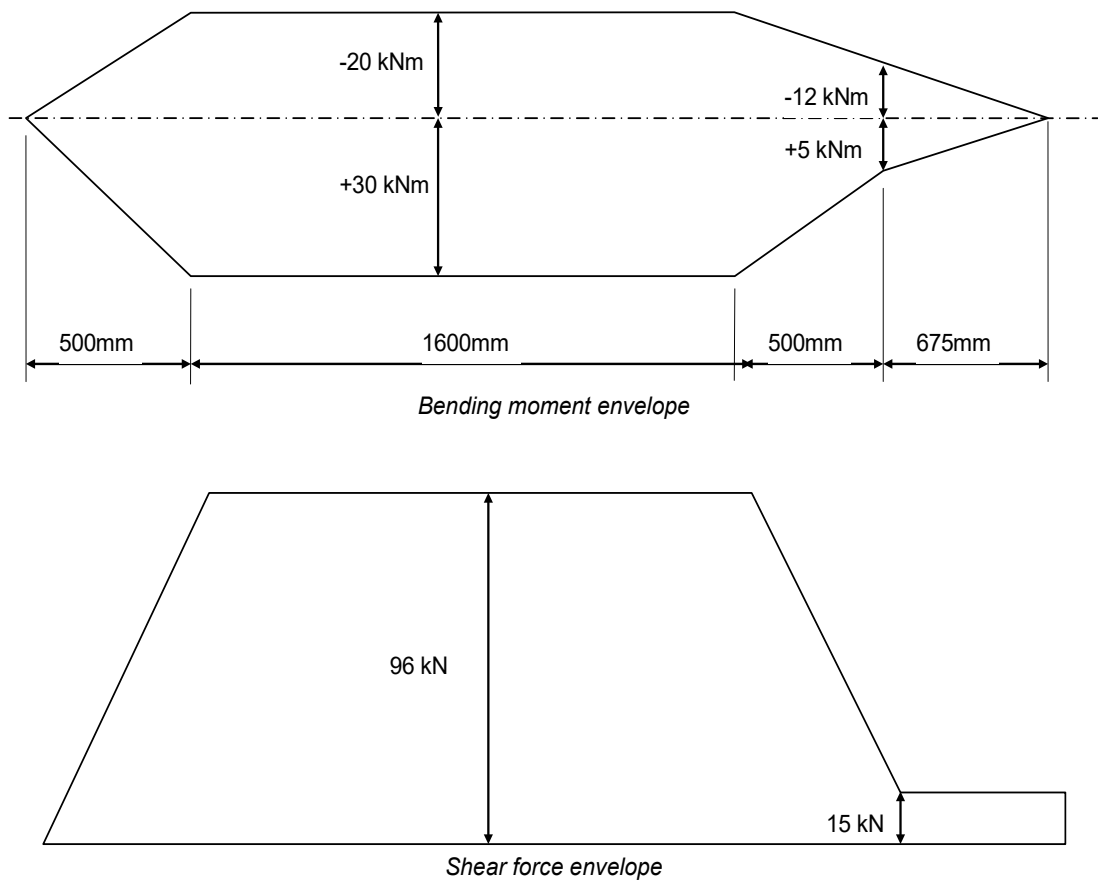


Figure 2 – Type 'A' for point motors – bending moment and shear force envelope for turnout bearers

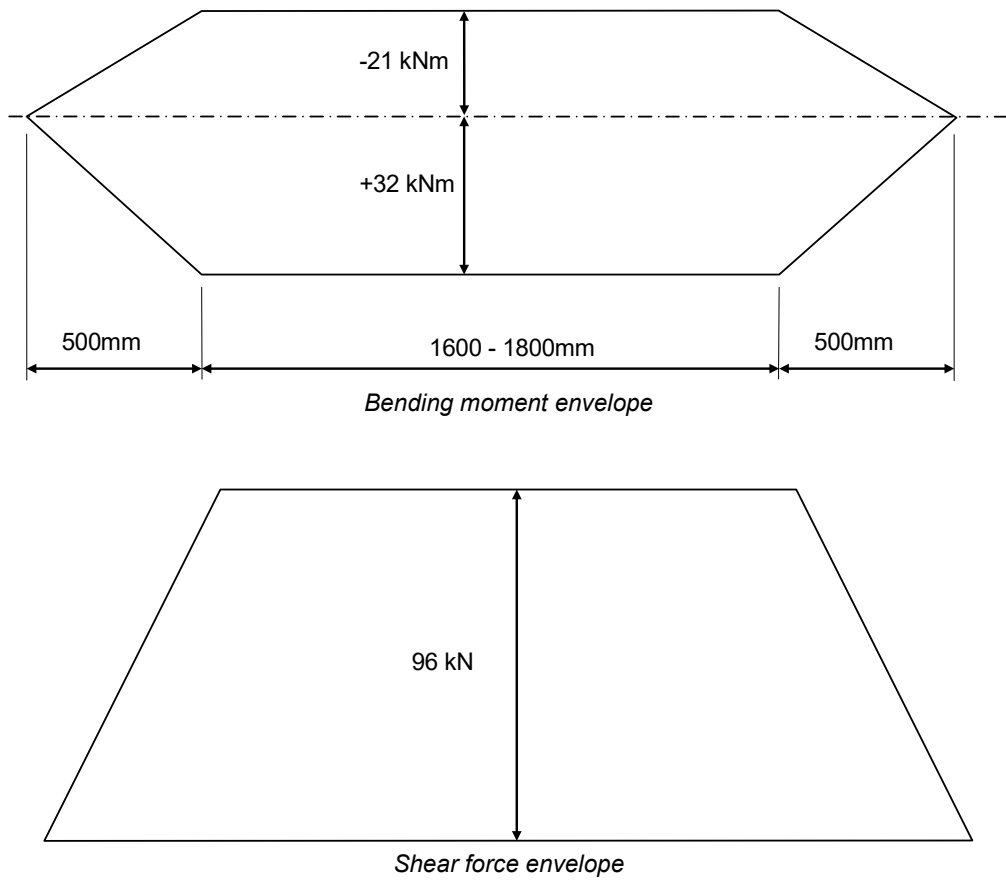


Figure 3 – Type B – length 2.6 m – 2.8 m – bending moment and shear force envelope for turnout bearers

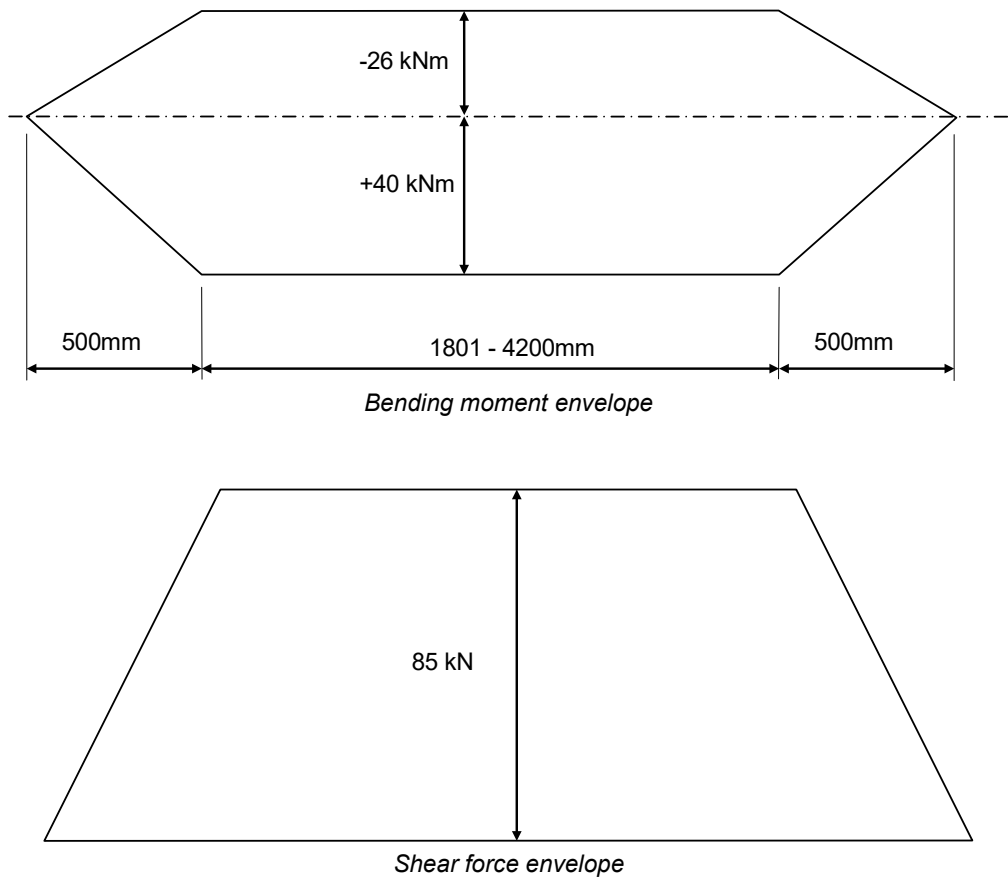


Figure 4 – Type C – 2.801 m – 5.2 m – bending moment and shear force envelope for turnout bearers

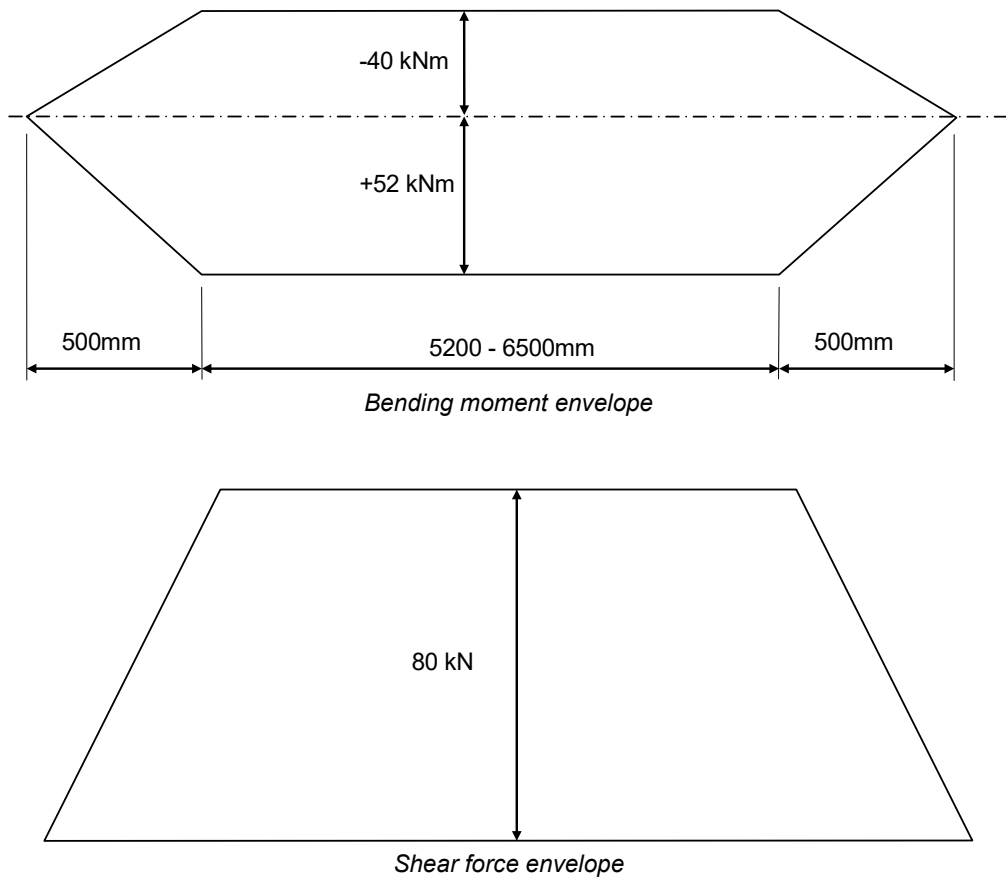


Figure 5 – Type D – length 6.2 m – 7.5 m (across parallel tracks) – bending moment and shear force envelope for turnout bearers

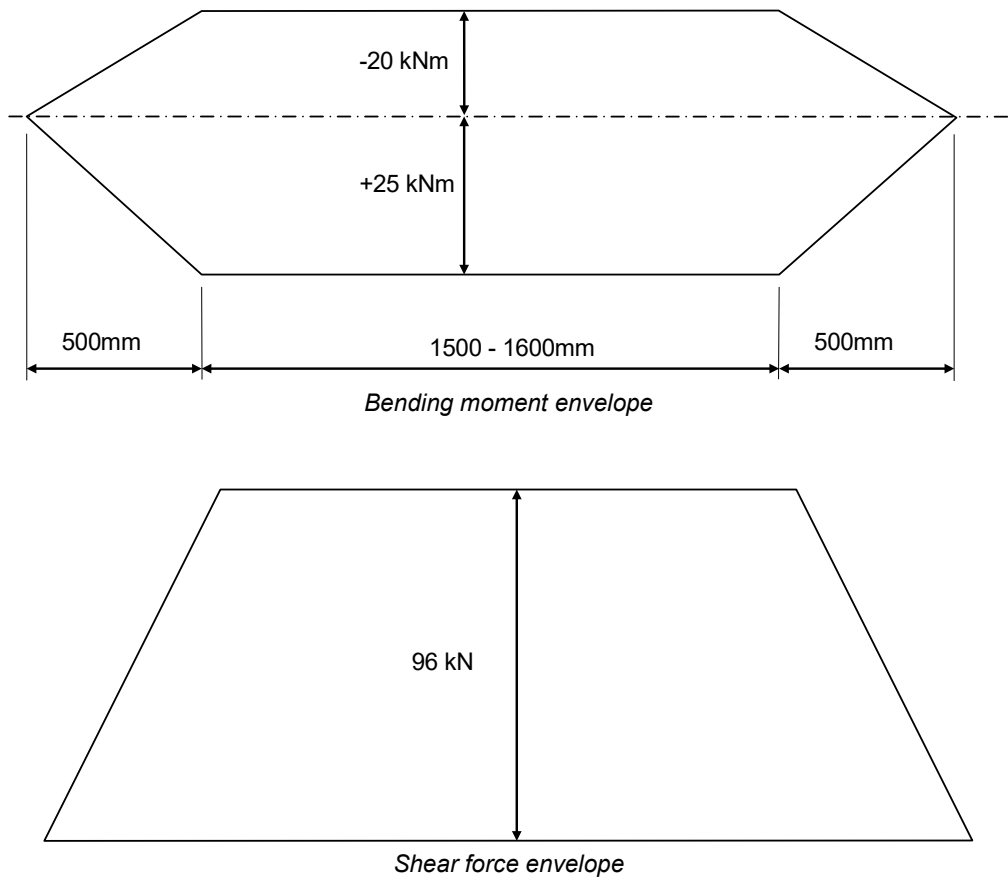


Figure 6 – Type F – flat ties – bending moment and shear force envelope for turnout bearers