

Standard

Rolling Stock - Tram - Outlines

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PROUD OPERATOR OF



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Table of Contents

1	PURPOSE.....	3
2	SCOPE	3
3	COMPLIANCE	3
4	REQUIREMENTS.....	4
4.1	Tram Outlines	4
4.1.1	Static Outline	4
4.1.2	Kinematic Outline	5
4.1.3	Horizontal Swept Outline	5
4.1.4	Vertical Swept Outline.....	6
4.2	Assessment of Rolling Stock Outlines	6
4.2.1	Design Stage (Rolling Stock)	6
4.2.2	Testing	6
4.3	Expendable Items	7
4.3.1	Definition	7
4.3.2	Design Requirements	7
5	RELATED LEGISLATION & DOCUMENTS	8
	DOCUMENT VERSION CONTROL	8
	APPENDIX A – GLOSSARY	8



1 PURPOSE

This Standard defines the minimum requirements for the physical outline (or envelope) of trams deployed on the Yarra Trams Network. Outlines are specified relative to the track centreline.

The minimum requirements specified in this Standard shall be used for maintaining an acceptable clearance between trams and permanent or temporary structures and when passing other trams.

2 SCOPE

The requirements described in this Standard apply to:

- all trams that presently operate on the Yarra Trams Network,
- all new trams specified for operation on the Yarra Trams Network,
- all trams introduced from other networks for operation on the Yarra Trams Network, and
- all heritage trams that are reinstated for operation on the Yarra Trams Network.

3 COMPLIANCE

This standard shall be fully complied with. Deviation from this standard is only permitted when a waiver has been sought and approved by Yarra Trams.

‘Shall’ statements are mandatory in the context of compliance with requirements stipulated in this standard.

‘Should’ statements are considerations in the context of compliance with requirements stipulated in this standard.

‘Information’ statements provide additional content for clarification purposes only and are not requirements in the context of compliance with this standard.

‘So far as is reasonably practicable’ statements must at a minimum result in the provision of a technical risk assessment including proposed list of design controls to demonstrate compliance to this standard.

Any third party or contractor undertaking activities on Yarra Trams assets shall complete and return a compliance schedule for this standard. Assessment of compliance shall be provided for each requirement, defined by one of three permissible responses:

- a) Compliant;
- b) Partially Compliant;
- c) Non-Compliant.

Absolute requirements in this standard are defined within square brackets i.e. [AM 4000mm +/- 1%]. Absolute values shall not be accepted without prior consultation and acceptance by Yarra Trams. Deviation beyond Absolute values shall not be accepted under any circumstances.



4 REQUIREMENTS

4.1 Tram Outlines

A tram outline has the following parts: -

- static outline;
- kinematic outline, and;
- horizontal and vertical swept outlines.

4.1.1 Static Outline

4.1.1.1 The static outline (or static envelope) is governed by the vehicle interface specification depicted in Figure 1. The maximum allowed physical envelope of any tram shall fit within the vehicle interface specification, taking account of applicable margins. The vehicle interface specification is an Infrastructure construction specification.

4.1.1.2 Figure 1 is included for illustration purposes only and must not be relied upon for design. Design of new trams or modifications to existing trams must refer to the kinematic diagrams referred in the next sections.

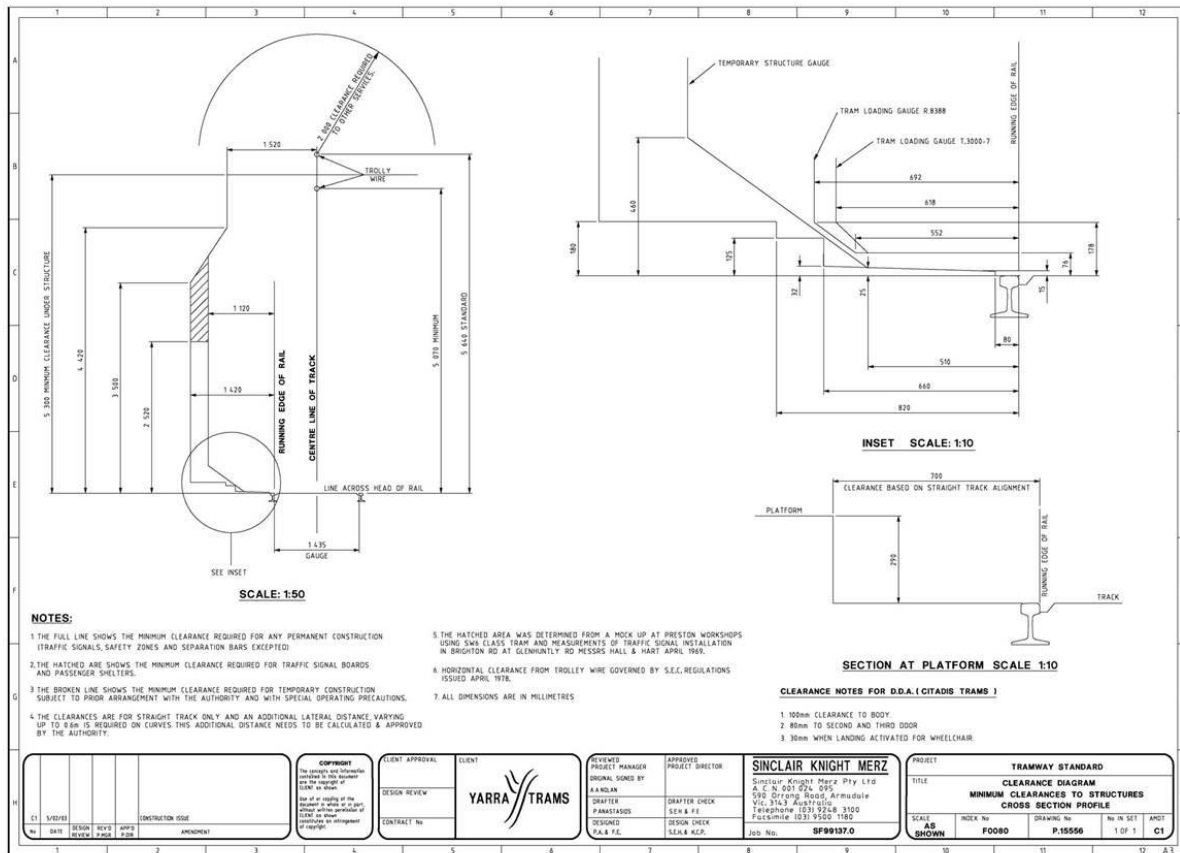


Figure 1 - Static Outline (Dimensions are in mm)



4.1.2 Kinematic Outline

4.1.2.1 The kinematic outline consists of the static outline subjected to: -

- the maximal vertical and lateral vehicle movement, and;
- the maximal body roll when subjected to a maximal cant deficiency.

4.1.2.2 All operating trams on the Yarra Trams Network shall comply with the Kinematic Outline; as specified in STD_T0306 Standard Drawing for Tram Kinematic Envelope.

4.1.2.3 STD_T0306 Rev.B appears below at Figure 2 for illustration purposes only. Design of new trams or modification to existing trams must refer to the current revision of STD_T0306.

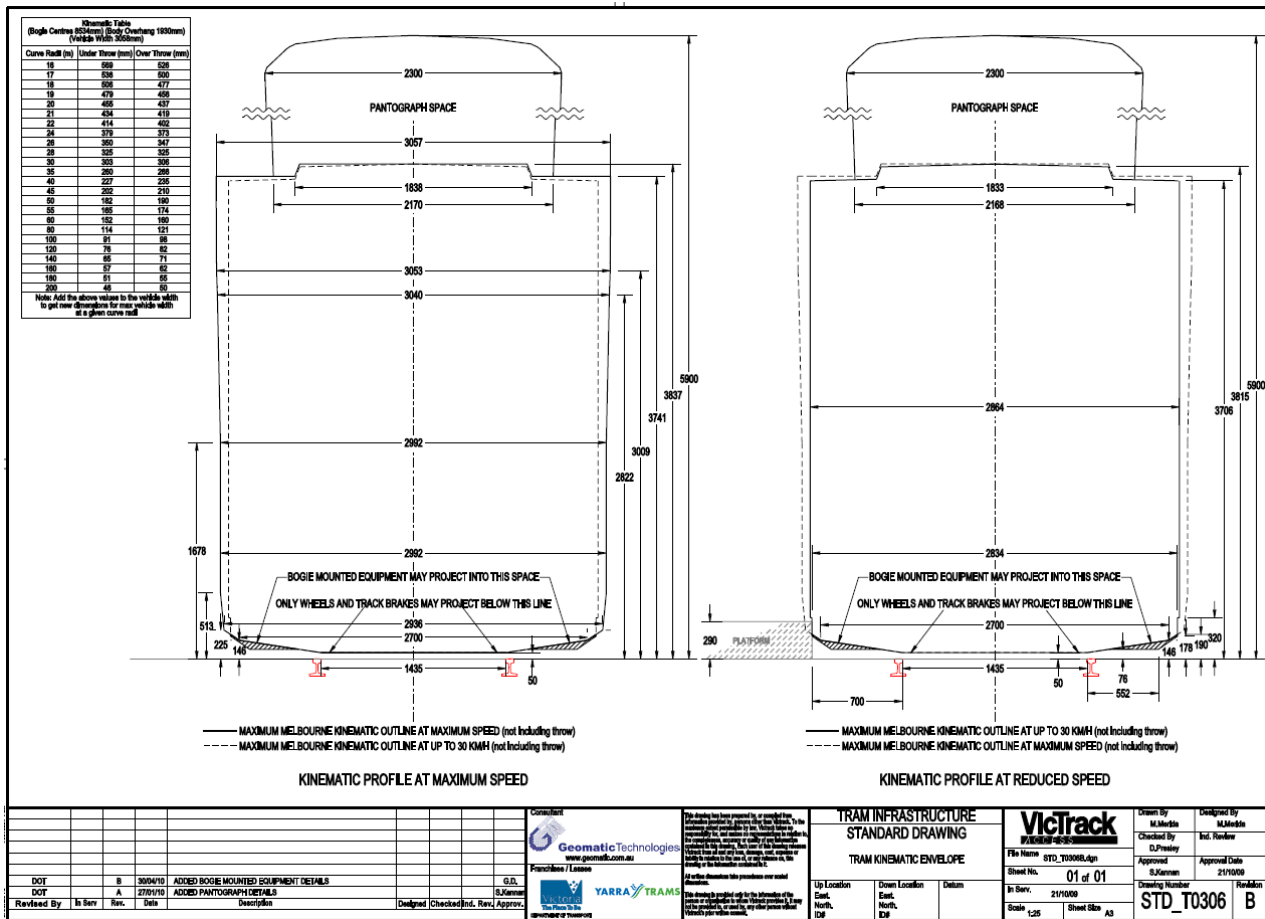


Figure 2 - Kinematic Outline (Dimensions are in mm)

4.1.3 Horizontal Swept Outline

4.1.3.1 The horizontal swept outline consists of kinematic outline plus a projection of the inner and outer curves made by a tram on horizontal curve tracks. The horizontal swept outline



is calculated by adding tram's maximum kinematic movements to centre throw and end throw.

4.1.3.2 All operating trams on the Yarra Trams Network shall comply with the horizontal swept outline; as specified in STD_T0306 Standard Drawing for Tram Kinematic Envelope for the reference vehicle shown in the Kinematic Table.

4.1.4 Vertical Swept Outline

4.1.4.1 The vertical swept outline consists of kinematic outline plus the upper/lower curve throw produced by the vehicle on a humped or dipped vertical curve.

4.1.4.2 Maximum vertical throw based on the vertical curves in Yarra Trams Network has been considered in the total allowed upper and lower heights as specified in STD_T0306 Standard Drawing for Tram Kinematic Envelope for the reference vehicle shown in the Kinematic Table.

4.2 Assessment of Rolling Stock Outlines

4.2.1 Design Stage (Rolling Stock)

4.2.1.1 During the design stage; the static, kinematic and swept outlines for trams shall be calculated to demonstrate that the design complies with the reference outlines; as defined in this Standard. Manufacturing tolerances shall be taken into account in the calculations.

4.2.1.2 The static, kinematic and swept outlines shall be assessed when modifying a vehicle's suspension characteristics or modifying the vehicles exterior or structure.

4.2.2 Testing

4.2.2.1 Physical tests shall be undertaken for new build trams to demonstrate compliance with the reference outlines; defined in this Standard and confirm kinematic envelope design calculations. Testing shall also include demonstration of compliance with kinematic envelope for suspension failure modes considered in the design.

4.2.2.2 Physical testing shall consist of: -

- physical measurement of static outlines of the first tram, and;
- physical measurement of vertical, lateral and roll movement of nominated sample trams on their suspension.



4.3 Expendable Items

4.3.1 Definition

4.3.1.1 The following may be an example of expendable items: -

- mirrors;
- lighting and light-signaling devices;
- speakers / horns;
- antennae;
- roof gutters;
- CCTV cameras;
- platform gap fillers, and;
- skybreakers.

4.3.2 Design Requirements

4.3.2.1 Expendable items incorporated in the design of new trams in the Yarra Trams Network shall only project outside of the kinematic envelope to the extent provided in clause 4.1.2.3.

4.3.2.2 For the existing Yarra Trams Network fleet; expendable items may project beyond the kinematic outline. In this case, they shall have a low consequence, especially with respect to the safety of passengers and pedestrians or to the safe operation of the tram on the Yarra Trams Network, when assessed in accordance with Yarra Trams risk assessment processes, SFAIRP.



5 RELATED LEGISLATION & DOCUMENTS

The following table lists documents that shall be read and applied concurrent with this Standard, where applicable exclusions do not exist or where the documentation contravenes local laws and legislation.

Name	Document number
Railway Safety Management	AS 4292
Clearance diagram minimum clearances to structures cross section profile	P.15556
Standard Drawing for Tram Kinematic Envelope	STD_T0306
AMS03 Taxonomy	CE-023-IS-0001

DOCUMENT VERSION CONTROL

Version History	Date	Detail
1.0	17 Mar 2020	Original approved issue.

APPENDIX A – GLOSSARY

The following table lists the specific terms used within this Standard. Further guidance on engineering terms used within Yarra Trams is on the Asset Management Glossary.

Word	Definition
Body Roll	The angular translation of the body cross-section relative to the plane of the rails.
Bounce	The vertical translation of the vehicle body relative to the rails that may be expected to occur in response to track irregularities.
CCTV	Closed – Circuit Television.
Cant	The height difference, at a common location, measured in millimetres, between the running surfaces of both rails.
Cant Deficiency	The extent by which the cant on curved track is less than that required for the gravitational force component acting parallel with the rails towards the inside of the curve to exactly counterbalance the centrifugal force acting on a vehicle towards the outside of the curve in the same plane.
Centre Throw	The maximal curve throw of the vehicle body towards the inside of a horizontal curve.
Curve Throw	The extent to which a transverse cross-section of a vehicle is displaced inwards or outwards from the track on a perfectly aligned horizontal curve for zero cant and excluding dynamic effects.



Word	Definition
End Throw	The maximal curve throw towards the outside of a horizontal curve at the vehicle end.
Expendable Items	A part of vehicle that is outside of the rolling stock outline but is sacrificial /frangible and has low consequences in the event of an infringement.
Horizontal Swept Outline or Horizontal Swept Envelope	Two-dimensional cross-section for the vehicle that consists of the kinematic outline, plus the inner and outer curve throw produced by the vehicle on a curve.
Kinematic Outline or Kinematic Envelope	Trace of the maximum external limits of vehicle movement on straight track.
Lateral Translation	The horizontal displacement of the vehicle body relative to the rails.
Shall	With reference to the CE-023-IS-0001 - AMS03 Taxonomy, the word "Shall" is taken in this context to mean a non-optional activity or requirement.
Static Outline or Static Envelope	An outline drawing or specification of a notional vehicle cross-section, or item of vehicle equipment, which prescribes permissible rolling stock dimensions under specified conditions of load and suspension translations in vertical directions.
Track Centreline	The virtual line equidistant between the inside faces of the rail heads.
Vertical Swept Outline	Two-dimensional cross-section for the vehicle that consists of the kinematic outline, plus the upper and lower vertical curve throw produced by the vehicle on a humped or dipped vertical curve.