Standard

Infrastructure – General – Tramway Engineering Survey

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1 PURPOSE

The purpose of this standard is to specify the minimum requirements for engineering and topographical survey of the tramway.

2 SCOPE

This standard shall be used by Yarra Trams and any third parties or Contractors for all surveying activities performed on the tramway and associated infrastructure. Survey of underground services is excluded from scope of this standard.

Tramway is a guided track system together with associated infrastructure designed for the movement of rolling stock (trams).

This standard is applicable to engineering and topographical survey required prior to undertaking project design works and preparation of as-built drawings after construction. This standard can also be used for verification during construction work.

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:

- Compliant;
- Partially Compliant;
- 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 Survey Information and Diagrams

4.1.1 This standard shall be followed for completing a feature survey of the area covered by the project.

4.1.2 It is the responsibility of the Surveyor to ensure that the survey is thorough enough to fulfil the requirements of the design.

4.2 Control Information

4.2.1 Permanent survey marks, of a type approved, with due regard to stability and permanence shall be identified.

4.2.2 On digital drawings, two Bench Marks shall be shown within the length of the job and Bench Marks every 500 metres. (Bench Marks shall be of reasonable stability and may be points on significant structures and/or especially placed marks, but shall not be standard Permanent Marks.)

4.2.3 Victoria's Survey Control Network (SCN) provides Victoria's realisation of Australia's positioning and vertical datum – the Geocentric Datum of Australia (GDA94) and the Australian Height Datum (AHD71), respectively.

4.2.4 Map Grid of Australia 94(MGA 94) and the Australian Height Datum 1971 (AHD71) shall be used in all surveys. The field observations must be converted into a Bentley File format (i.e. Microstation drawing file -*.dgn) with detail and symbology as specified in the PTV Infrastructure Drafting Standards.

4.3 Competency

4.3.1 Surveyor(s) shall have proper qualifications recognised by Surveyors Registration Board of Victoria (SRBV).

4.3.2 For the purposes of feature surveys and setting out the Works in conformity with the specification and drawings, the Surveyor shall engage experienced and qualified surveyors as above.

4.4 Survey Tools

4.4.1 When using GPS collection methods, it shall refer to the Land and Survey Spatial Information survey labels as defined by Surveyor-General of Victoria.

4.4.2 For recording and submission of GPS observations, surveyor shall follow the requirements outlined in latest edition of Surveyor-General of Victoria Practice Directives.

4.4.3 Distance measurements should be made with Electronic Distance Meters (EDM), total stations, or non-conductive measure tapes utilizing procedures consistent with the Surveyor-General of Victoria standards.

4.5 Calibration

4.5.1 All survey tools and equipment including total stations, levels, tapes, and GPS shall be calibrated.

4.5.2 Calibration records shall be available for audit. For calibrating of Electro optical Distance Meters (EDM) refer to latest edition of EDM Calibration Handbook issued by the Surveyor-General Victoria.

4.5.3 All survey tools including EDM or total stations shall be calibrated regularly (suggested schedule at least annually) against a standardised base line. A copy of the latest report of calibration shall be included in the Report of Survey.

4.6 Precision

4.6.1 All survey data with one, two and three dimensional uncertainty shall be expressed in terms of the 95% confidence level using standard error ellipse.

4.6.2 The semi-major axis of the error ellipse relative to the rail survey control for the coordinated positions shall be 50 mm or less at the 95% confidence level. For further information refer to 'ICSM - Guideline for the Adjustment and Evaluation of Survey Control – SP1'.

4.7 Safety

4.7.1 All personnel, including supervisors, surveyors, labourers and plant operators, shall at all times whilst on the tram network wear Rail grade high visibility clothing and personal protection equipment in accordance with the requirements of the VicRoads Worksite Safety – Traffic Management Code of Practice and Yarra Trams Safety Management System and cardinal rules.

4.7.2 Surveyor shall obtain permit before commencing work over, on or adjacent to tram track or railway property from Yarra Trams and relevant authorities. Any such survey work shall continue only to the extent permitted.

4.7.3 All works shall be in accordance with Procedure with title of 'Contractors working on Yarra Trams Sites or Property'.

4.8 Digital Terrain Model (DTM)

4.8.1 The survey works shall be of sufficient accuracy to form a DTM being a representation of the ground conditions.

4.8.2 The DTM shall be created by the placement of break-lines along salient features and other spot heights as deemed necessary.

4.8.3 Break-lines shall include, but not be limited to; rails, kerb lines, crown lines, track margins. The DTM shall extend to at least 30.0 m past the limits of works.

4.9 Site Survey

4.9.1 Before commencing any field survey, every attempt shall be made to contact all owners of the property to obtain permission to enter upon the lands for purposes of making the survey.

4.9.2 On both public and private lands, surveys shall be conducted in a manner which damage to the property or environment shall be minimised.

4.9.3 Care and discretion should be used in all survey procedures including cutting, witnessing, marking and monumentation. Where painting is necessary, lead-free paint shall be used.

4.9.4 Surveyor shall deliver location of all survey control points including co-ordinate listing.

4.9.5 All raw and processed data pertinent to surfaces and quantities measured by the Surveyor shall be delivered to Yarra Trams.

4.9.6 Surveyor shall ensure adequate information is provided to Yarra Trams on any changes to track or overhead alignment.

4.9.7 The information format shall meet PTV's requirements including compliance to relevant standards of pass assets interface system and Drawing Management System.

4.10 Detail Information

4.10.1 Details of survey scope shall be specified and agreed by Surveyor and Yarra Trams. Appendix B provides survey information that can be presented on digital drawings.

4.11 Services

4.11.1 Surveyor shall collect all information relevant to existing services through 'Dial before You Dig' within specified boundaries. Based on information obtained from service providers, all services within the vicinity of the works shall be shown on background plans.

4.11.2 Any services which may be of conflict to the proposed works must be highlighted on the drawings and brought to the attention of Yarra Trams.

4.11.3 Surveyor shall ensure that existing services are diligently identified and recorded with respective coordinates within specified scope of work boundaries. It is the surveyors' responsibility to determine location of assets within and in the vicinity of the project boundary.

4.11.4 Survey of the project site should preferably be completed prior to project concept design phase where alternative options for track alignment and construction type are being explored.

4.11.5 The surveyor must coordinate with Yarra Trams to establish the extent of Yarra Trams underground services within the works area. It can be done through checking on existing drawings of the Drawing Management System (DMS) and 'Dial before You Dig'.

4.11.6 All survey information shall be confirmed in writing by the Surveyor and service owner/operator.

4.11.7 Where there is ambiguity in the information provided, surveyor shall identify and recommend the best course of action to resolve this ambiguity (for example consideration of potholing).

4.11.8 Yarra Trams might seek clarification from surveyor during concept design phase. Surveyors shall support Yarra Trams with responding to inquiries in timely manner.

4.12 Survey notes

4.12.1 Surveyor shall ensure that surveys always reference the latest tramway standards.

4.12.2 All changes shall be captured and followed through Engineering Change Management Procedure.

4.12.3 Drawing and document changes shall be identified and recorded in revision table.

4.12.4 Vertical alignments for current grade work shall be surveyed and shown in drawings to enable designer to align it to new works.

4.12.5 Horizontal alignments for existing alignment work shall be surveyed and shown in drawings to enable designer to align it to new works.

4.12.6 Any existing deficiencies identified during the survey, and Dial Before You Dig information plotting shall be brought to attention of Yarra Trams at the earliest possible time.

5 RELATED LEGISLATION & DOCUMENTS

The following documents should be read in conjunction with this standard. Latest version of the referenced standards, procedures, guidelines, rules, and codes of practice shall be used.

Name	Document number
#112-Standard Survey to Locate Underground Services	TBD
Deviation from Standards Procedure	CE-021-PR-0004
Engineering Change Management Procedure	CE-021-PR-0014
Road Management Act	
Guide to Land and Survey Spatial Information LASSI by Land Victoria	
Surveyor-General of Victoria Practice Directives	
EDM Calibration Handbook issued by Surveyor-General Victoria	
Guide to Road Design Part 3: Geometric Design (2016 Edition)	AGRD03-16
SMS 6.3.2 Procurement Procedure	PL-020-PR-0001
Contractors working on Yarra Trams Sites or Property	c501wi0005
Vicmap – Mapping for business intelligence	
Technical Drawing Part 401-Engineering Survey and Engineering Survey Design Drawing	AS 1100.401
Geographic information - Well-known text representation of coordinate reference systems	AS ISO 19162
Worker Competence Tram Track Safety	IN-019-TR-0005
Network Technical Standard Tramway - Track and Structure	PTV-NTS-007
Drawing Management Systems Standard Processes	PTV- NTS-012
Infrastructure Drafting Standards	PTV-NTS-008
ICSM - Guideline for the Adjustment and Evaluation of Survey Control – SP1	
Classification of Subsurface Utility Information (SUI)	AS 5488

DOCUMENT VERSION CONTROL

Version History	Date	Detail
1.0	20 May 2019	Original approved issue
2.0	25 Mar 2020	Update Standards Template. Update Section 3 Compliance to be standardised clause with the other Engineering Standards. Update title of document to be standardised format. Update Document ID metadata to be CE instead of IN. Update Section 5 references to CDMS references, if available Update Author

APPENDIX A – GLOSSARY

Word	Definition
EPA	Environment Protection Authority
GPS	Global Positioning System
LASSI	Land and Survey Spatial Information
SRBV	Surveyors Registration Board of Victoria (SRBV) is a statutory body responsible for establishing and maintaining the competency and educational standards for licensed surveyors, maintaining a register of licensed surveyors and managing disciplinary procedures.

APPENDIX B – SURVEY FEATURES

The following survey information shall be presented on digital drawings:

A.1) Rail running edges, survey points shall accurately represent the gauge line of rails at top of rail level

A.2) Overhead poles location and Identification

A.3) Wall bracket location and Identification (where wall brackets are used in lieu of poles)

A.4) All tram infrastructure and furniture with appropriate details/comments (pits, poles, tram stops, overhead poles with pole bonds, full details of overhead trolley wire network in areas where the tracks may be realigned, etc.)

A.5) Tram stop flags

A.6) All visible service authorities' infrastructure and furniture with appropriate details/comments (pits, pit lids, valves, drains, poles, and foundations, etc.)

A.7) All road infrastructure and furniture with appropriate details/comments (traffic signal poles and pits, signs, etc.)

A.8) All significant vegetation

A.9) All drainage features, including the proving and documentation of sizes and invert levels of pits and pipes in areas where track drainage may need to be installed. Pits with respective location and discharge to the council drain should be identified by Surveyor. Functionality of each drain will be checked by Yarra Trams.

A.10) Line marking and traffic loops affected by the works shall be clearly shown in surveys.

A.11) Existing road boundaries, i.e. building lines and kerbs (top, invert and lip) and the location of points of access to properties shall be shown.

A.12) Existing Surface spot levels.

A.13) Where works are likely to involve extensive work in or around traffic signalling systems or conduits or are likely to involve extensions to the existing traffic signal systems surveys shall be arranged to identify location, composition and depth of existing traffic signal conduits. Any conduits which are substandard (asbestos or not to regulation depth) shall be identified during surveys as well as location.

A.14) Surveyor shall organise appropriate traffic management in accordance with Vic roads and Local council requirements. This includes TMP and MOA where applicable Surveyor shall determine the accuracy of the obtained results and clearly outline the measurement locations(For example, measurement from rail running head and running edges for investigating cant and twist deficiencies).