Toitū Te Whenua
Land Information
New Zealand

Utility Location Standard

LINZ OP S 01287

Office of the Surveyor-General

June 2022

Authority and regulatory attributes

LINZ OP S 01287	
Authority	The Surveyor-General has a function and duty to maintain a national survey control system under section 7(1)(b) Cadastral Survey Act 2002. That is defined as a system used to determine the position of points, features, and boundaries in cadastral surveys, other surveys, and land information systems. The Standard is provided to enable its use for the purposes indicated. The Surveyor-General has no power to require compliance with the Standard.
Type	Standard
Date	23 June 2022
Due for Review	2025

Contents

Foreword

Prior to the introduction of computer mapping technology, the position of utility assets was typically defined in relation to property boundaries and recorded on copies of hard copy cadastral maps – 'record sheets'.

However, the digital mapping of those cadastral boundaries often resulted in the location of the utility changing in relation to the boundary, as the mapping of the property boundaries was improved.

This standard provides a new framework for recording the location of utility assets. Instead of defining the position in terms of the property boundaries they are defined in terms of the geodetic control network. This is the same network used to define the position of property boundaries. Virtually all modern spatial data, including aerial imagery, uses this framework – which ensures it can be accurately integrated and spatially overlaid. Effectively the framework, and this standard, provide the glue that enables disparate spatial datasets to be joined together.

The Standard requires all positions to be defined in three dimensions. This recognises that the future demand is for 3D – whether for Smart Cities, Digital Twins, Building Information Modelling, City Modelling, or the 3D Cadastre.

It is intended to provide positions that are sufficiently accurate for future needs – it is no longer acceptable to have the locations of expensive assets inaccurately defined. GNSS / GPS and other positioning technologies are increasingly capable of delivering this level of accuracy at a reasonable cost.

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References

Term	Definition
NZTM2000	New Zealand Transverse Mercator 2000 (NZTM2000) is based on the New Zealand Geodetic Datum 2000 (NZGD2000). It is an internationally recognised projection that exhibits a low level of distortion at its east-west extents. It is the official projection applicable to the main New Zealand island group (North, South, Stewart/Rakiura and the smaller coastal islands). Details and formal specification can be found in LINZS25002.
NZVD2016	The New Zealand Vertical Datum 2016 (NZVD2016) is the official vertical datum for New Zealand and its offshore islands. Details and formal specification can be found in LINZS25009.
Survey Control Network	Horizontal control marks of Order 5 or better and vertical control marks of NZVD2016 Order 3V or better. A mark will usually have both the specified horizontal and the vertical orders. These marks can be found on the Geodetic Database available at https://www.geodesy.linz.govt.nz/gdb/.

Both NZTM2000 and NZVD2016 and can be readily transformed to other modern geodetic coordinate reference systems.

1 Introduction

Utility assets such as the three waters, power and telecommunication networks are often located close to other utilities and other physical objects. Knowing the location of these assets is therefore critical to help avoid collisions or damage from civil works. As well as having serious safety implications, such damage costs the utility sector millions of dollars each year.

Having confidence in the location of assets can also enable faults to be located and remedied in a timely manner.

The systems that utility organisations use for determining the location of these assets and for managing the associated records are now fully digital. These systems enable different datasets to be overlain with each other to determine their spatial relationship – provided the positions are defined on a common reference frame and are sufficiently accurate.

2 Purpose of Standard

This standard establishes a specification for the positional accuracies for recording utility assets. It is intended to be used when collecting information on the location of utility assets, such as when preparing an 'as built' record.

It is not expected that the Standard will be applied to existing records of utility assets, as this would require re-survey at huge expense. Rather it provides a standard that can be used whenever there is physical interaction with the asset, such as during maintenance or fault repair.

It is intended to provide consistency and confidence in the positional information of assets to enable relocation and design planning.

It provides a national standard that can be applied locally. For heights it requires use of the national vertical datum (NZVD2016) rather than the multitude of local datums that have been used to date. This will enable assets to be managed on a national basis in a consistent way without having to go through too many transformations.

Detailed specifications of as-built requirements can reference this Standard for the location elements.

The Standard is intended to enable the assets to be located, and relocated at any time in the future; using GNSS[1] technology as much as possible. The accuracy obtainable from various products using this technology is continuing to increase and become more affordable.

[1] Global Satellite Navigation System, such as GPS

It also provides for the recording of accurate invert levels. More accurate technologies may be required to determine these levels.

Applying the Standard will enable the resultant spatial information recorded in an Asset Management System to be accurately related to other types of spatial information, in three dimensions (X, Y, Z).

The Standard includes a requirement to record the date of the survey, to enable the impacts of land deformation (eg. earthquakes) to be managed in the long term.

2.1 Target audience and users

A utility organisation or asset manager will be able to specify (e.g. in contracts) that this standard must be used when recording the location of new or maintained assets.

The Standard is intended to be used by contractors, surveyors and engineers who undertake the actual survey and measurement of the assets.

Use of the Standard is not mandatory. However, once adopted the Standard should be complied with in its entirety, to secure the benefits of a common reference frame with clear accuracy standards.

2.2 Scope

The Standard is limited to the position (X, Y, Z coordinates, at a particular date) associated with an asset.

The positions of linear assets, including those that do not follow a straight line, are typically surveyed at selected points, especially the end points. Once digitally recorded and mapped in an asset management system, the positions of any point on the asset are able to be determined. The Standard is therefore focused on positions on the complete asset; not just those that have been surveyed. This also applies to structures such as manholes, which may have only a few points surveyed but nevertheless need to have their full extent spatially defined.

The standard focuses on a relatively simple generic way of recording the position of the feature and its accuracy. This is unlike other practice and standards, such as AS 5488 Classification of Subsurface Utility Information (SUI), which refer to the method of determining the position.

Data about the asset itself is excluded from the Standard, as this is more appropriately specified by the asset manager or those with expertise in the asset itself. Reference to this standard, for the location components, can be included in those specifications.

Specification of a format for transferring the resultant positional information is not within scope.

3 Datums and Projections

3.1 Horizontal Position

All horizontal positions shall be surveyed in terms of NZTM2000.

3.2 Vertical Position

All vertical positions shall be surveyed in terms of NZVD2016.

4 Accuracy

4.1 3D Coordinates

All points shall be defined in both horizontal (X, Y) and vertical position (Z).

4.2 Accuracy Classes

Classes can be applied separately to vertices (e.g. points physically surveyed) and to segments (e.g. an interpolated line between surveyed points). Different classes may be applied to each.

4.3 Horizontal Accuracy Standards

The horizontal accuracy of a position shall be better than the following tolerances relative to the nearby survey control network:

Class	Horizontal Accuracy
H1	0.10 m
H2	0.30 m

4.4 Vertical Accuracy Standards

The vertical accuracy of a level shall be better than the following tolerances relative to the nearby survey control network:

Class	Vertical Accuracy
V1	0.05 m
V2	0.10 m
V3	0.30 m

4.5 Application of Accuracy Classes

The accuracy classes shall be applied to meet the criteria in the following table:

Criteria	Vertical Class	Horizontal Class
1. Assets with invert levels in urban areas	V1	H1
2. Assets in urban areas, except where lower accuracy criteria 4, 5, & 6 can be used	V2	
3. Assets in rural and remote areas 4. Assets not directly accessible by survey 5. Laterals 6. Assets in private ownership within residential properties.	V3	H2

The above criteria specify the minimum accuracy standards. A more accurate class may be used.

Utilities not accessible by survey

Examples of assets that may not be directly accessible include pipes laid without a trench (e.g. directional drilling, pipe bursting) and lined pipes (incl. laterals) without manhole access

Defining the extents of assets and points to be surveyed

This standard does not specify which points on or around the asset are required to be surveyed. The specification of such points, along with other information about the asset, needs to be specified by the asset manager.

Assets may have only a few points surveyed. Other points on or around the asset can be defined by interpolation or measurements, digital models, or manufacturers specifications relative to those points (e.g. pipe widths, manhole voids).

Defining the extents of these 'volumetric' assets by coordinates can be valuable for calculating clearances, avoiding collisions, etc.

Accuracy

Accuracy means the surveyed position shall not differ from the true position, in terms of the nearby survey control network, by more than the stated amount (at 95% confidence level). This means that if the defined position were set out in future, the asset should be located within a circle of radius 0.10 m (for Class H1), 95% of the time.

Meeting the accuracy requirements

One way of meeting the requirements is to directly measure from two nearby control marks. In most cases the same control marks can provide coordinates for both horizontal and vertical connection. However other methods may be used, provided they meet the accuracy requirements.

Connecting to at least one nearby control mark ensures that the survey is in terms of other work in the vicinity and that regional effects, such as plate tectonics, do not impact the accuracy of the survey over time.

Data for the Location

The following data produced in accordance with this Standard should be provided maintained, and included in any subsequent transfers:

Horizontal position	(mE, mN)
Horizontal class	The horizontal accuracy class used (H1 or H2)
Horizontal projection	NZTM2000
Vertical level	(mZ)
Vertical class	The vertical accuracy class used (V1, V2 or V3)
Vertical datum	NZVD2016
Date of survey	(date)

Recording the date of the survey will help manage the impact of any gradual or major deformation events.