Asset Management Data Standard

Geometry Guidance

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WAKA KOTAHI NZ TRANSPORT AGENCY

Te Kāwanatanga o Aotearoa New Zealand Government

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Forward

Geospatial information is vital to the NZ Transport sector, underpinning the management, analysis and reporting of land transport assets now and into the future

This guidance provides a new framework for recording the location of transport assets. 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 guidance, provide the glue that enables disparate spatial datasets to be joined together, ensuring consistency and confidence in the positional information of assets to assist maintenance and support planning. The guidance is not intended to have retrospective effect – it does not require existing records to be updated.

The guidance 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 transport assets inaccurately defined. GNSS / GPS and other positioning technologies are increasingly capable of delivering this level of accuracy at a reasonable cost.

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.
Digital Elevation Model (DEM)	A Digital Elevation Model (DEM) is a digital cartographic dataset that represents a continuous topographic elevation surface through a series of cells. Each cell represents the elevation (Z) of a feature at its location (X and Y). Digital Elevation Models are a “bare earth” representation because they only contain information about the elevation of geological (ground) features, such as valleys, mountains, and landslides, to name a few. They do not include any elevation data concerning non-ground features, such as vegetation or buildings. NZ 8m Digital Elevation Model (2012)

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

Introduction

Transport assets are often located close together and beside other physical objects, having confidence in the location of assets can enable faults to be located and remedied in a timely manner.

The systems that 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.

Purpose of the guidance

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

It is not expected that the guidance will be applied to existing records, as this would add a large expense to Road Controlling Authorities (RCAs). Rather it provides a framework 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 operational and maintenance activities.

It provides a national approach 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.

The guidance is intended to enable the assets to be located, and relocated at any time in the future; using GNSS (Global Satellite Navigation System) technology, such as GPS as much as possible. The accuracy obtainable from various products using this technology is continuing to increase and become more affordable.

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

Applying the guidance 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).

Target audience and users

An RCA or asset manager will be able to specify (e.g. in contracts) that this guidance should be used when recording the location of new or maintained assets.

The guidance is intended to be used by RCAs, contractors, surveyors and engineers who undertake work on the assets.

Once adopted the guidance should be complied with in its entirety, to secure the benefits of a common framework.

Scope

The guidance is limited to the position (X, Y, Z coordinates) associated with an asset.

Data about the asset itself is excluded from this guidance and is more appropriately defined within the Asset Management Data Standard.

Datums and Projections

Horizontal Position

All horizontal positions should be reported in NZTM2000

Vertical Position

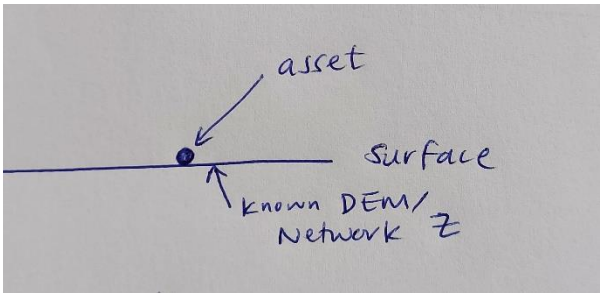
All vertical positions should be reported in NZVD2016

Suggested Asset Geometries

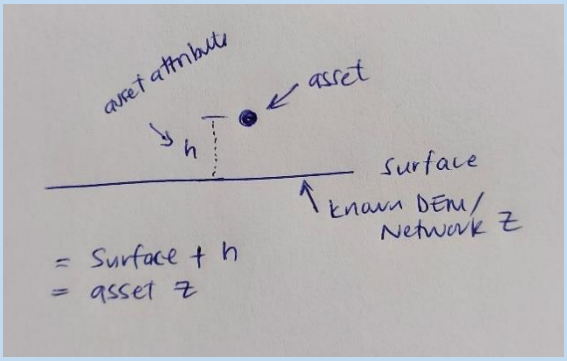
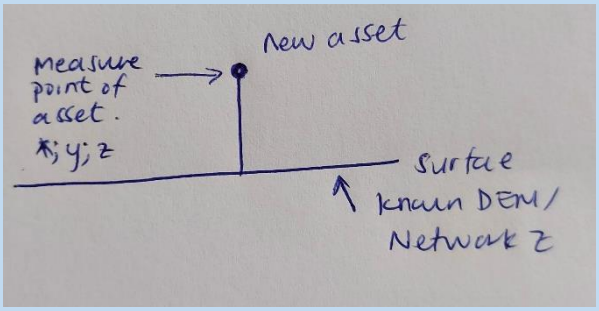
Geometry Type	Lat/long	Start Lat/Long	End Lat/Long	Z	Asset Information
Point	Y			Y	Y
Polyline, Polygon & Voxel [1](3d Polygon)	Y	Y	Y	Y	Y

The capture and use of Z:

New assets should have z location collected with a high level of accuracy, where not available or feasible, z-location can be calculated by the system. This involves using the Network Model as a base point and a DEM. Accuracy level for DEM calculated Z geometry will only be as good as the DEM currently available (current DEM for all New Zealand is NZ 8m Digital Elevation Model (2012)) & network model (LiDAR surveys of regions can update the model overtime as available).

Does the asset sit on the surface?	Existing Asset	New Asset	
YES	If the asset has no previous Z geometry information, then Z value defaults to the surface level of the DEM/Network Model. If the asset sits flush on the surface, then no further maths	Record the Z from the new asset data collection device on the ground.	

[1] *Voxel is an image of a three-dimensional space region limited by given sizes, which has its own nodal point coordinates in an accepted coordinate system, its own form, its own state parameter that indicates its belonging to some modelled object and has properties of modelled region.* (*https://www.techtarget.com/whatis/definition/voxel*)

	needs to be applied.		
NO	If the asset sits a height above the surface, then the Z value calculated from the DEM/Network Model and add the asset height difference to the DEM Z from the asset height field.	Record the Z from the new asset data collection device. If the asset is flush with the ground, then the device should be placed on the ground for measurement, otherwise record the Z value from the base of the asset at its start height from the surface.	 
All Z information (measured in meters) needs to be recorded to the **nearest 2 or 3 decimal point**			

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 which provide clarification on how to determine the measurement position.

Accuracy

Level of accuracy is important; however, we understand that for assets prior to the new guidance being implemented not all geometry attributes may have been recorded. The accuracy will be calculated based on the method of collection used for both horizontal and vertical reference systems.

Options include:

- nothing,
- draped,
- LiDAR, and
- survey.

Data for the Location

The Asset Management Data Standard, will be updated in the next release to store additional attributes against each asset, these are:

Term	Definition
Horizontal Position	(mE,mN)
Horizontal Collection Method	nothing, draped, LiDAR, survey
Horizontal Class	Automatically calculated based on collection method
Horizonal Projection	NZTM2000
Vertical Position	(mZ)
Vertical Collection Method	nothing, draped, LiDAR, survey
Vertical Class	Automatically calculated based on collection method
Vertical Projection	NZVD2016
Survey URL Link	(a link to where survey metadata are captured for reference) – minimum metadata to be included are date of survey, control points used, equipment used, reference systems, calculated accuracy, data collection organisation.