

New Zealand National Aerial Imagery Base Specification

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Glossary

Term	Description
Accuracy	The horizontal positional accuracy of features within orthophotos relative to control points.
Artefact	Any feature or distortion that does not represent real features on the ground and has been introduced during image capture or processing.
Atmospheric Effects	Conditions such as haze, smoke, dust, and environmental factors that can affect the clarity and detail of imagery.
Cloud Cover	The amount of cloud covering ground features in the imagery. Represented as a percentage.
Colour Balance	The adjustment of the colours to render a natural colour appearance.
GeoTIFF	TIFF image format with embedded georeferencing data.
Ground Sample Distance (GSD)	The ground sample distance (also referred to as Pixel size) for an orthophoto is the distance on the ground, measured in x and y components, represented by each pixel in the image.
Orthophoto	An aerial photograph geometrically corrected ("orthorectified") to ensure the scale is uniform: the photo has the same lack of distortion as a map. Unlike an uncorrected aerial photograph, an orthophotograph can be used to measure true distances, because it is an accurate representation of the Earth's surface.
Orthorectification	The process of removing the effects of image perspective (tilt), topographic relief (terrain) and lens distortion. Correcting an image to ensure the horizontal scale is constant. The output of this process is an orthophoto.
Radiometric Resolution	How finely a system can represent or distinguish variations of colour.
RGB	Natural Colour (red, green, blue), images offer a natural colour rendition. This means the colour of an object in the image is the same colour as if you viewed the object in person e.g. a green tree appears green.
RGBN	Four Band (red, green, blue, near infrared) images are similar to natural colour images, but also contain a near infrared band which is useful for identifying vegetation or heat sources.

Seamlines	Vector polygons delineating the extent of input images used to create the mosaicked orthophoto.
Sortie	A single planned data acquisition flight to collect imagery over a designated area.
Spectral Resolution	The number of different frequency bands recorded.
Sun Angle	The angle of the sun above the horizon.
Supplier	The supplier of the orthophotography.
Tile Layout	Vector polygons defining the extents of the tiles used in image tiling.
Tiling	The process of dividing an image into smaller, more manageable pieces (tiles) for processing and storage.
Vertical Feature Displacement	The apparent shift of vertical features (like buildings) in an image due to the angle of the camera.

Introduction

Purpose and Summary

This specification provides a foundation for New Zealand public sector aerial imagery data procurement. It defines a consistent set of minimum products to ensure compatibility across projects and regions. Individual buyers may choose to add additional products and requirements during procurement to suit their specific needs.

Using this specification, along with robust quality control checks, will ensure the delivery of consistent, high-quality imagery across New Zealand.

Background

The 1.0 version of this specification was developed by Land Information New Zealand (LINZ) in partnership with the Te Uru Kahika (NZ Regional and Unitary Councils) Geospatial Special Interest Group.

The aim of developing this specification is to ensure that when the public sector procures imagery, the data gathered meets minimum requirements. This allows LINZ to host a consistent set of data and provide open, online access. Additionally, it aims to ensure more consistent data between regions and provide clarity and certainty for suppliers when supplying data.

Revisions to this specification are managed by LINZ. Feedback and suggestion for changes to future versions can be provided to imagery@linz.govt.nz. Material changes are subject to external stakeholder consultation and review.

Acknowledgements

LINZ and Te Uru Kahika would like to thank all councils, suppliers and other stakeholders that provided the feedback that contributed to the development of the specification.

References

1. Standard for the Geospatial Accuracy Framework – LINZS25005, Toitū Te Whenua Land Information New Zealand, September 2009
2. Standard for New Zealand Geodetic Datum 2000 - LINZS25000, Toitū Te Whenua Land Information New Zealand, November 2007
3. Standard for New Zealand Geodetic Datum 2000 Projections: Version 2 - LINZS25002, Toitū Te Whenua Land Information New Zealand, July 2008

1 Minimum requirements

1.1 Resolution and Accuracy

1.1.1 Ground Sample distance (GSD)

0.3 metres or better

1.1.2 Horizontal accuracy

The minimum horizontal accuracy required:

≤100 cm (95%)

Accuracy

Accuracy as used in this specification, refers to local accuracy and is the uncertainty of the orthophoto relative to 4th order or better control. See Standard for the Geospatial Accuracy Framework (Reference 1) for accuracy related definitions.

95% confidence and Root Mean Squared Error

The 95% confidence requirements used in this specification are 1.96 times the root mean square error (RMSE). RMSE is the square root of the average of the set of squared differences between dataset coordinate values and coordinate values from an independent source of higher accuracy for identical points. 1.96 times the RMSE is used to estimate the local accuracy where accepted values are known (e.g. check sites).

1.1.3 Radiometric & spectral resolution

- Four band (RGBN)
- 32-bit colour (8 bits per band) radiometric resolution
- Red, green, blue, near infrared spectral resolution

1.1.4 Spatial control

The supplier is responsible for providing the ground control necessary to meet the spatial accuracy specified above.

1.2 Imagery acquisition

1.2.1 Sensor requirements

All imagery must be captured using a digital camera system capable of meeting the requirements of this specification.

1.2.2 Sun angle

The sun angle at the time of the imagery capture must be more than 30° above the horizon.

1.2.3 Cloud cover

All orthophotos must be 100% cloud free.

1.2.4 Atmospheric effects

Image detail and clarity must not be lost because of atmospheric conditions including haze, smoke, dust, and environmental factors.

1.2.5 Environmental Conditions

Ground conditions must be free of extensive standing water such as rainfall induced ponding or flooding. If in doubt, the supplier should contact the buyer for further guidance.

1.2.6 Coastal photography

Coastal marine areas to be captured within 3 hours of low tide.

1.3 Orthorectification

1.3.1 Datums and Coordinate Reference System

The required datum for latitude, longitude, and ellipsoid heights is the New Zealand Geodetic Datum 2000 (NZGD2000) (Reference 2).

Projected data products are to be delivered in NZTM2000 projection, EPSG: 2193 (Reference 3).

1.3.2 Vertical feature displacement

The horizontal displacement of buildings and other vertical features shall be no more than 1 metre for every 3 metres of vertical height.

1.3.3 Undertaking orthorectification

The Orthorectification process must be undertaken in a manner that ensures:

- straight lines on the ground are straight in the image,
- common overall scale and resolution is maintained,
- differences in contrast and brightness are minimised,
- the joins between all tiles are seamless, with no gaps, overlaps, or visible join lines between adjacent images,
- the pixels on adjacent tiles must align,
- features at ground level (valleys, ridges, buildings, roads, etc.) are continuous across sorties and seamlines,
- no duplication of ground features.

1.4 Deliverables

1.4.1 Imagery

Delivery of the imagery must include or conform to the following:

- a) GeoTIFF format with a block size of 512 by 512, using a lossless compression such as LZW.
- b) EPSG:2193 coordinate system is defined in each raster file header.

- c) Void areas (non-imaged areas, for example, areas outside the project area but within the project tiling scheme) are coded using "NODATA" where each band value is equal to 255. This value must be identified in the appropriate location within the raster file header.
- d) Partial tiles are acceptable on large water bodies, using NODATA beyond 50 metres from land.
- e) Separate directories for each product type.
- f) Tiled to LINZ 1:5k tiles: <https://data.linz.govt.nz/layer/104691-nz-15k-tile-index>
- g) Files must be named in this format: [sheet]_[scale]_[tile].[ext]
Example: BK34_5000_0740.tif

Table 1 - Tile naming convention

Field	Example	Detail
Sheet	BK34	LINZ Topo50 identifier (4 characters)
Scale	5000	Nominal scale of NZTopo50 subtiles
Tile	0740	Row number (07), column number (40) of tile with respect to an upper left origin
Ext	tif	File extension according to format convention

1.4.2 Tile layout

A vector tile layout as a geopackage or Esri shapefile.

1.4.3 Survey Report

A Survey Report must be provided in PDF format and include the following:

- Project summary
- Deliverables summary
- Quality assurance and control summary
- Data processing summary
- Camera model and capture information including capture dates, flying height and flight planning.
- Accuracy of the data
- Coverage map

1.4.4 Seamlines

The supplier will supply a mosaic layout as a geopackage or Esri shapefile of the orthophoto seamlines. At a minimum, each polygon will be attributed with:

Field	Format	Example
IMAGERY_ID		123-4567
FLOWN_DATE	dd/mm/yyyy	23/09/2025
LOCAL_TIME	hh:mm:ss	13:59:15
CAMERA		KOWHAI
ALTITUDE		16000ft

1.5 Copyright and Creative Commons

The buyer requires unrestricted copyright to all delivered data and reports, allowing it to release data for widespread re-use with a Creative Commons Attribution 4.0 International license (CC BY 4.0), and attribution to the buyer in line with the New Zealand Government Open Access Licensing framework (NZGOAL). This specification places no restrictions on the rights of the data provider to resell data or derivative products.

<https://creativecommons.org/licenses/by/4.0/>

1.6 Backed up Project Source Data

Raw project source data is NOT a base specification deliverable. However, the supplier must hold a copy of all relevant raw project data, for a minimum of five years beyond the final project delivery.

2 Aesthetic quality criteria

2.1 Radiometry

- Image seams are blended to achieve a smooth seam,
- only minor radiometry differences exist between adjacent imagery tiles, and
- radiometry is consistent without a 'checkerboard' appearance.

2.2 Brightness

- All features in bright areas can be interpreted.

2.3 Shadows

- Ground features in shadow areas are interpretable.

2.4 Contrast

- Ground features can be identified across bright and shadowed areas of imagery while maintaining high contrast.

2.5 Colour balance

- Overall imagery exhibits a 'natural colour' balance and not biased by a particular hue.

2.6 Foreign artefacts

- Less than five artefacts are present per 2.4 x 3.6 km tile, and
- no ground feature is obscured by a foreign artefact.