

Specifications for the Protection of Survey Marks – Reinstating or Replacing Marks

Version 2.1
Customer Services

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Foreword

These specifications are prepared for the protection of important geodetic and cadastral survey marks. They cover the reinstatement or replacement of marks likely to be disturbed or damaged as the result of a Works Agency carrying out a work.

Any comments or proposed amendments should be forwarded to Customer Services – Geodetic.

General Manager Customer Services

Land Information NZ
P O Box 5501
Wellington
Phone: 0-4-460 0110
Fax: 0-4-460 0112
Internet <http://www.linz.govt.nz/>

Document History and Approval

| Document History | | | |
|-------------------------|------------------|--------------------|---|
| Version | Date | Section No. | Summary of Changes / Amendments |
| 2.0 | 1 April 2003 | | This specification replaces the previous document: 'OSG Specifications for Reinstating or Replacing Geodetic Control Marks, version 1.1, 8 May 2000'. |
| 2.1 | 27 November 2006 | | References to Surveyor-General in the document changed to Customer Services. |

SPECIFICATIONS FOR THE PROTECTION OF SURVEY MARKS – REINSTATING OR REPLACING MARKS

1 Scope

The provision of a modern accurate survey system requires the protection of important geodetic and cadastral survey marks. Land Information New Zealand (LINZ), Customer Services - Geodetic, provides a Survey Mark Protection Advisory Service that identifies survey marks that should be protected¹.

This specification details the requirements for the reinstatement or replacement of marks identified as needing protection.

1. New Zealand Geodetic Datum 2000 (NZGD2000) Zero – 4th order geodetic marks.
2. New Zealand Geodetic Datum 2000 (NZGD2000) 5th order geodetic marks.
3. New Zealand Geodetic Datum 49 (NZGD49) geodetic marks.
4. Benchmarks.
5. Cadastral survey marks inside and outside Survey Conversion Areas² (SCAs).

¹ Further information of the Survey Mark Protection Advisory Service can be found on the LINZ web site at <http://www.linz.govt.nz/rcs/linz/pub/web/root/core/SurveySystem/surveymarks/index.jsp>

² SCA areas are where the parcel database, as converted from DCDB, has been enhanced with the capture of survey dimensions to create a Survey-accurate Digital Cadastre (SDC).

2 Definitions and Explanations

For the purpose of this specification:

- “**Replacement**³” means installing a new mark **not** in the same horizontal and vertical position as an existing mark, but which will be used instead of the existing mark after the existing mark has been removed.
- “**Reinstating**” means installing a new mark in exactly the same horizontal and vertical position as a mark that has been removed.
- “**Offsetting**” means the temporary utilisation of survey marks at a known position relative to the existing control mark. From these survey marks, a permanent new control mark will be reinstated after site works have been completed.

3 Specifications for Reinstating or Replacing NZGD2000 Zero-4th Order 2000 Marks

3.1 *Marks to be Protected*

All NZGD2000 Zero – 4th Order geodetic marks are to be protected unless Customer Services - Geodetic gives written permission that marks do not need protection.

3.2 *Authority to Carry out Work*

Because of the high accuracy requirements and specialised data requirements all NZGD2000 Zero – 4th Order marks to be offset and reinstated or replaced are to be undertaken by an Accredited Geodetic Supplier. The work is to be undertaken in accordance with the following Standards and Specifications (these may be obtained from the LINZ web site at

<http://www.linz.govt.nz/rcs/linz/pub/web/root/core/SurveySystem/surveypublications/>);

- OSG1: Accuracy Standards for Geodetic Surveys
- Customer Services specifications for Geodetic Physical Network
- Customer Services specifications for Geodetic Control Survey

³ Where a replacement mark is in the same horizontal position as the original mark but has a different vertical position this should be noted so that a link to the original mark can be noted in **Landonline**.

A list of Accredited Suppliers may be obtained from the LINZ web site at <http://www.linz.govt.nz/rcs/linz/pub/web/root/core/SurveySystem/GeodeticSuppliers/surveyproviders>

or by writing to:

Customer Services
Land Information New Zealand
National Office
PO Box 5501
WELLINGTON

Attention: Survey Protection Advisory Officer

4 Specifications for Reinstating or Replacing NZGD2000 5th Order Geodetic Marks

4.1 *Marks to be Protected*

All NZGD2000 5th Order geodetic marks are to be protected unless Customer Services – Geodetic give written permission that marks do not need protection.

As a minimum, NZGD2000 5th order marks are to be protected at the following density:

- urban areas (Class I surveys) – 95% of boundary marks shall be no more than 200m from a geodetic control mark;
- peri-urban areas (Class II surveys) – 95% of boundary marks shall be no more than 600m from a geodetic control mark;
- rural areas⁴ (Class III surveys) – 95% of boundary marks shall be no more than 2km from a geodetic control mark.

This provides control at a spacing of approximately 300m, 800m and 3km respectively. In addition to the above, consideration will also be given to protecting marks such as:

- terminal marks at the end of long road alignments; and
- marks at road intersections.

4.2 *Authority to Carry out Work*

The work is to be carried out by or under the supervision of a Licensed Cadastral Surveyor.

4.3 *Mark Type*

New marks shall:

- be constructed with a stainless steel pin or bronze pin set in concrete or grouted into bedrock set flush or below ground level;
- be constructed in a way so as to not be a hazard;
- have a cast iron box and lid constructed over the mark set flush with the ground surface where the mark is below ground level and is located in solid permanent material (ie sealed carriageway, footpath etc);

⁴This includes those rural areas in some form of agricultural production (not pastoral, forestry or conservation).

- have the topsoil reinstated to cover the mark with consideration given to placing a metal plate buried above the mark or have a cast iron box and lid constructed over the mark if necessary to provide additional protection in unusual situations where the mark is below ground level and is located in soft material (ie grass berm, open field); and
- have an identification bronze plaque stamped with the Customer Services - Geodetic four character geodetic code secured adjacent to the mark or to the underside of the cast iron cover where used.

4.4 *Description of Work to be Carried Out*

Work may include either offsetting and reinstatement or replacement of the survey mark.

4.4.1 *Offsetting and Reinstatement*

The work involves the horizontal offsetting (and vertical where it is known) and reinstatement of that mark in its original position.

The mark is to be offset and reinstated to C3 accuracy standards (refer to OSG Accuracy Standard 1). This requires that the mark be replaced to within 3mm (horizontal and vertical) of its original position. Where this can not be achieved it is deemed to be a replacement.

Where there is an existing protection structure (eg a trig beacon), Customer Services - Geodetic will confirm as to whether the new mark requires the reinstatement of a similar structure.

The mark retains the same geodetic code and name.

4.4.2 *Replacement of a Mark to be Destroyed*

The work involves the placement of a new mark, which shall:

- be tied to all adjacent NZGD2000 geodetic marks with a minimum of two marks of the same or a higher order (eg marks at a four way intersection may require tying to four adjacent marks);
- be tied to existing marks that have been proved stable and reliable;
- meet OSG Accuracy Standards M30H (10mm \pm 30ppm at 95% confidence) for horizontal position and M100V (10mm \pm 100ppm at 95% confidence) for vertical position (refer to OSG Standard 1);
- where possible be tied to the existing mark before it is destroyed or if this is not possible then the new mark is to be directly connected (by survey) to any adjacent cadastral traverse marks;

- where possible be tied to the existing mark before it is destroyed and prove that this mark is reliable. Reliable in this context means in the same position as it was in when it was last surveyed. Note that in the case of NZGD49 marks upgraded to NZGD2000 5a marks, adopted bearings and distances may have been used to derive the NZD2000 coordinate position and therefore any difference in coordinate position may not be an indicator of reliability; and
- have a new geodetic code and name which is to be obtained from Customer Services - Geodetic.

Where there is an existing protection structure (eg a trig beacon), Customer Services – Geodetic will confirm as to whether the new mark requires the reinstatement of a similar structure.

4.4.3 *Data to be Supplied*

The following data shall be supplied in hard copy or digital format:

- a report detailing the method of survey with proof that the accuracy standards for the survey have been met;
- proof of mark reliability checks for the marks tied to;
- a completed access diagram suitable for incorporating into a LINZ Mark Diagram (Mark and Site Details Form).
- field notes clearly showing a diagram of the survey, field observations and measurements. All marks shown on the field sheets shall have their full name and geodetic code indicated.

The data shall be supplied to:

Customer Services
 Land Information New Zealand
 National Office
 PO Box 5501
 WELLINGTON

Attention: Survey Protection Advisory Officer

5 Specifications for Reinstating or Replacing NZGD49 Geodetic Marks

5.1 *Marks to be Protected*

All NZGD49 geodetic marks are to be protected unless the LINZ Survey Mark Protection Advisory Service, Customer Services - Geodetic, gives written permission that the marks do not need protection.

As a guide, NZGD49 marks are to be protected where they:

- are important for cadastral survey purposes, ie are shown as regularly used in local cadastral surveys; and
- have been identified as suitable for upgraded to NZGD2000 status in the future.

5.2 *Authority to Carry out Work*

The work is to be carried out by or under the supervision of a Licensed Cadastral Surveyor.

5.3 *Mark Type*

New marks shall:

- be constructed with a stainless steel pin or bronze pin set in concrete or grouted into bedrock set flush or below ground level;
- be constructed in a way so as to not be a hazard;
- have a cast iron box and lid constructed over the mark where the mark is below ground level and is located in solid permanent material (ie sealed carriageway, footpath etc);
- have the topsoil reinstated to cover the mark with consideration given to placing a metal plate buried above the mark or have a cast iron box and lid constructed over the mark if necessary to provide additional protection in unusual situations where the mark is below ground level and is located in soft material (ie grass berm, open field); and
- have an identification bronze plaque stamped with the Customer Services - Geodetic four character geodetic code secured adjacent to the mark or to the underside of the cast iron cover where used.

5.4 Description of Work to be Carried Out

Work may include either offsetting and reinstatement or replacement of the survey mark.

5.4.1 Offsetting and Reinstatement

The work involves the offsetting (horizontal and vertical where it is known) and reinstatement of that mark in its original position.

The mark is to be offset and reinstated to C3 accuracy standards (refer to OSG Accuracy Standard 1). This requires that the mark be replaced to within 3mm (horizontal and vertical) of its original position. Where this can not be achieved it is deemed to be a replacement.

Where there is an existing protection structure (eg a trig beacon), Customer Services – Geodetic will confirm as to whether the new mark requires the reinstatement of a similar structure.

The mark retains the same geodetic code and name.

5.4.2 Replacement of a Mark to be Destroyed

The work involves the placement of a new mark, which shall:

- be tied to all adjacent NZGD49 geodetic marks with a minimum of two marks of the same or a higher order (eg marks at a four way intersection may require tying to four adjacent marks);
- be tied to existing marks that have been proved stable and reliable;
- meet OSG Accuracy Standards M30H (10mm \pm 30ppm at 95% confidence) for horizontal position and M100V (10mm \pm 100ppm at 95% confidence) for vertical position (refer to OSG Standard 1);
- where possible be tied to the existing mark before it is destroyed or if this is not possible then the new mark is to be directly connected (by survey) to any adjacent cadastral traverse marks; and
- where possible be tied to the existing mark before it is destroyed and prove that this mark is reliable. Reliable in this context means in the same position as it was in when it was last surveyed; and
- have a new geodetic code and name which is to be obtained from Customer Services - Geodetic .

Where there is an existing protection structure (eg a trig beacon), the Survey Protection Advisory Officer will confirm as to whether the new mark requires the reinstatement of a similar structure.

5.4.3 *Data to be Supplied*

The following data shall be supplied in hard copy or digital format:

- a report detailing the method of survey;
- proof of mark reliability checks for the marks tied to;
- proof that the accuracy standards for the survey have been met;
- a completed access diagram suitable for incorporating into a LINZ Mark Diagram (Mark and Site Details Form).
- field notes clearly showing a diagram of the survey, field observations and measurements. All marks shown on the field sheets shall have their full name and geodetic code indicated.

The data shall be supplied to:

Customer Services
Land Information New Zealand
National Office
PO Box 5501
WELLINGTON

Attention: Survey Protection Advisory Officer

6 Specifications for Reinstating or Replacing Benchmarks

6.1 *Marks to be Protected*

All Benchmarks are to be protected unless the LINZ Survey Mark Protection Advisory Service, Customer Services - Geodetic, gives written permission that the marks do not need protection.

As a guide, benchmarks to be protected are:

- fundamental benchmarks;
- marks that have been upgraded to Order 2000 geodetic survey marks; and
- marks of particular importance ie marks connected to the cadastre or marks identified as suitable for upgraded to NZGD2000 status in the future.

6.2 *Authority to Carry out the Works*

The work is to be carried out by or under the supervision of a Licensed Cadastral Surveyor.

6.3 *Replacement Marks*

New replacement marks shall:

- be constructed to a similar standard to the mark they replace or a stainless steel pin set in concrete or grouted into bedrock set flush or below ground level, as specified by Survey Mark Protection Advisory Service, Customer Services - Geodetic;
- be constructed in a way so as to not be a hazard;
- have a cast iron box and lid constructed over the mark where it is below ground level and set flush with the ground surface; and
- have an identification bronze plaque stamped with the new Customer Services - Geodetic four character geodetic code secured adjacent to the mark or to the underside of the cast iron cover where used.

6.4 *Survey of Horizontal Position*

The survey of the horizontal position must meet separate requirements depending on the type and order of the benchmark (see separate Specifications above for NZGD2000 and NZGD49 marks (Sections 3, 4, and 5).

If the benchmarks horizontal position is of a low order, ie the position has been scaled off a map, any new benchmark shall be tied into the geodetic network or local

cadastral marks. Where this is not practical, and with the written permission of the LINZ Survey Mark Protection Advisory Service, Customer Services - Geodetic, the coordinates of the new benchmark may be scaled off a map.

6.5 *Survey of Vertical Position*

The survey of the new benchmarks shall meet the following requirements for vertical survey:

- be tied to an adjacent geodetic benchmark and where possible this should be the existing mark before it is destroyed;
- be tied to existing mark that has been proved stable and reliable (this may be by visual inspection); and
- meet OSG Accuracy Standards for Geodetic Surveys C3 (3mm at 95% confidence) for vertical position (refer to OSG Standard 1).

6.6 *Data to be Supplied*

The following data shall be supplied in hard copy or digital format:

- proof of mark reliability checks for the marks tied to;
- proof that the accuracy standards for the survey have been met;
- a completed access diagram suitable for incorporating into a LINZ Mark Diagram (Mark and Site Details Form).
- field notes clearly showing a diagram of the survey, field observations and measurements. All marks shown on the field sheets shall have their full name and geodetic code indicated.

The data shall be supplied to:

Customer Services
Land Information New Zealand
National Office
PO Box 5501
WELLINGTON

Attention: Survey Protection Advisory Officer

7 Specifications for Reinstating or Replacing Cadastral Survey Marks

7.1.1 *Marks to be Protected Inside SCA Areas*

Customer Services – Geodetic does not specifically require cadastral survey marks to be protected within SCA areas. However the LINZ Survey Mark Protection Advisory Service shall be notified of any cadastral survey marks likely to be destroyed and will have consideration for the protection of cadastral marks such as:

- terminal marks at the end of long road alignments;
- marks at road intersections; and
- permanent reference marks or witness marks of particular importance ie marks identified as suitable for upgraded to NZGD2000 status in the future.

Where identified these marks shall be protected in accordance with the specifications below.

7.1.2 *Marks to be Protected Outside SCA Areas*

All Cadastral Survey marks are to be protected unless with the written permission of the LINZ Survey Mark Protection Advisory Service, Customer Services - Geodetic.

Consideration should be given to protecting marks such as:

- terminal marks at the end of long road alignments;
- marks at road intersections; and
- permanent reference marks or witness marks that are important for cadastral surveying.

As a guide, cadastral marks are to be maintained at the following density:

- urban areas (Class I surveys) – 95% of boundary marks shall be no more than 200m from a cadastral mark;
 - peri-urban areas (Class II surveys) – 95% of boundary marks shall be no more than 600m from a cadastral mark; and
 - rural areas⁵ (Class III) – 95% of boundary marks shall be no more than 2km from a cadastral mark.
-
- This provides control at a spacing of approximately 300m, 800m and 3km respectively.

⁵ This includes those rural areas in some form of agricultural production (not pastoral, forestry or conservation).

7.1.3 Authority to Carry out Work

The work is to be carried out by or under the supervision of a Licensed Cadastral Surveyor.

7.2 Mark Type

New marks shall be constructed in accordance with Sections 36 and 38 of the Surveyor-General's Rules for Cadastral Survey 2002/1 (these may be obtained from the LINZ web site at <http://www.linz.govt.nz/rcs/linz/pub/web/root/core/SurveySystem/surveypublications>):

7.3 Description of Work to be Carried Out

Work may include either offsetting and reinstatement or replacement of the survey mark.

7.3.1 Offsetting and Reinstatement

The work involves the horizontal offsetting and reinstatement of that mark in its original position.

The mark is to be offset and reinstated to C3 accuracy standards (refer to OSG Accuracy Standard 1). This requires that the mark be replaced to within 3mm (horizontal) of its original position. Where this can not be achieved it is deemed to be a replacement.

The mark retains the same name.

7.3.2 Replacement of a Mark to be Destroyed

The work involves the placement of a new mark that shall:

- be tied to all adjacent cadastral survey marks (eg marks at a four way intersection may require tying to four adjacent marks);
- be tied to existing marks that have been proved stable and reliable;
- meet Sections 26 of the Surveyor-General's Rules for Cadastral Survey 2002/1 Class I surveys (these may be obtained from the LINZ web site at <http://www.linz.govt.nz/rcs/linz/pub/web/root/core/SurveySystem/surveypublications>); and
- where possible be tied to the existing mark before it is destroyed or if this is not possible then the new mark is to be directly connected (by survey) to any adjacent cadastral traverse marks.

7.3.3 Data to be Supplied

A cadastral survey dataset (CSD) of the survey shall be lodged at the local Processing Centre. This CSD may be:

- a survey approved as to survey;
- a survey approved for record purposes only; or
- a field note approved for record purposes only.

Notification that a CSD has been lodged shall also be sent to

Customer Services
Land Information New Zealand
National Office
PO Box 5501
WELLINGTON

Attention: Survey Protection Advisory Office