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FEEDBACK::

Proposals for the Survey Control Standard

To: **Anselm Haanen**
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This feedback is on behalf of the *Institute of Cadastral Surveying (*ICS).

The ICS is an organisation whose membership is actively engaged in cadastral surveying.

This response represents the collective views of the ICS Executive Committee and is based on the experience and wisdom of our leadership team and members who are passionate about the integrity and value of the survey system and cadastre – which relies upon a well-structured survey control network.

We thank you for the opportunity to provide feedback on the proposals for the Survey Control Standard.

General

1. The ICS considers that – in general – the proposals are clear and adequately anticipate the future demands in terms of urban development. The proposals will not adversely affect the cadastre and should result in (largely unnoticeable) benefits to surveyors undertaking cadastral survey definitions.

2. Surveyors that regularly utilise and interact with the survey control network will likely accept and agree with the proposed adjustment to the accuracy framework, and creation of a valuable geodetic marks category. In addition, the combining of the cadastral horizontal control network (CHN) with the cadastral vertical control network (CVN) is logical. And no longer developing the localised deformation monitoring networks (LDMNs) but replacing this concept with area-specific deformation measurements appears practical.

3. This ICS feedback consists largely of **commentary and practical opinions** from users who have a history of regular interaction with the geodetic survey control network, as well as from users who

have more recently been exposed to the NZ survey system after gaining qualifications and land surveying experience in other countries. The feedback is offered to provide LINZ with our customer viewpoint.

4. The section headers below reflect the sections within the Proposal.

1.0 Overview

5. Redrafting the Standard (LINZS25003) and Guideline (LINZG25704) into one document is efficient.

6. The availability of multi-GNSS positioning systems has certainly contributed to the ability to generate reliable GNSS positions. However, any GNSS usage and data needs to be cognisant of good survey practice during data capture. eg: awareness of external environmental factors; understanding of data processing parameters etc that may affect the position(s) generated.

7. Maintaining links to useful information on the LINZ website is always useful and provides a readily accessible authoritative source of information.

3.0 Accuracy Framework

8. The alignment between datum monitoring networks and cadastral control networks is explained in section 3.2.2 of the proposal. It is noted that there is no clear benefit to regularly update the NZGD2000 coordinate of the cadastre. We agree.

   However, it is also noted that some applications may find it useful to have a greater currency of updated published coordinates (of the national and regional datum monitoring network marks).

   The ICS questions how will these coordinates be published? They should be clearly noted to be newly generated coordinates and be sufficiently differentiated from the "current" NZGD2000 values reflecting the "current" National Geodetic Adjustment (NGA) values. We would anticipate that the publication of any updated datum coordinates could be easily addressed by way of selecting a breakdown tree or layer option - like the "historical coordinates" breakdown choice in the geodetic database (GDB).

9. The vertical relative accuracy standard for Order 3V is proposed to be tightened from the equivalent 100ppm to 50ppm (section 3.2.2). We consider this is acceptable and agree that it is justified.

   Our members that utilise Order 3V marks for source levels or benchmarks for surveys requiring minimum floor levels (for instance) find that those marks deliver reliable values and are located at sufficient densities to render them accessible. Increasing their accuracy will assist this work.

10. The alignment between datum monitoring networks (national and regional) and cadastral control networks will not necessarily be maintained in terms of their horizontal and vertical relative accuracy (section 3.3.2).

    Again, we consider this acceptable noting that it would be rare for a cadastral survey to be significantly (negatively) affected by including updated datum monitoring control marks alongside cadastral control network marks – when holding both at their published (in terms) coordinate values. Potential discrepancies or miscloses with user/project network adjustments may result if the values are not in terms – but that is a "user beware" factor.

11. The inclusion of private/commercial CORS station data being included within the cadastral control network is useful.

    However, our members have noted the variability of data streams from private providers is not always reliable. Such unreliability of these private CORS data streams would not affect updates or adjustments within the cadastral control network.

4.0 Survey Control Networks

12. The proposed changes to the Survey Control Networks appear to be based on sound reasoning, and account for the development of technology (eg: ability to rapidly deploy GNSS post-earthquakes) and signals the 'maturing' of the NZ survey control system in our view.

13. Local-scale deformation networks (LDMN) will no longer be a specific category within the general deformation monitoring network. Local datum monitoring is to be carried out as needed utilising the Cadastral Control Network.

    We would agree with this development. It would not have an adverse impact on cadastral surveys.

14. Combining the Cadastral Horizontal Control Network (CHN) and Cadastral Vertical Control Network (CVN) into the proposed Cadastral Control Network (CCN) is logical, and represents a maturing and refinement of the Cadastral Control Network.

15. The National Height Network (NHN) is being removed, and marks will be retained as Valuable Marks but not actively maintained.

    (Our main comments regarding "valuable marks" follows in section 7 below.) On the matter concerning NHN marks not (necessarily) being actively maintained – we suggest such marks are initially assessed on their merits with regard to maintenance thereof, rather than unanimously being reassigned as valuable marks - and classified as not to be maintained.

    There is value in maintaining marks that have long records of high order vertical values – especially within a slowly deforming landscape and after earthquake events. Not only for useful academic analysis, but potentially to assist any forensic type investigations in the future.

5.0 Datum Monitoring Network (DMN)

16. The proposal to relabel 'deformation monitoring networks' to 'datum monitoring networks' is understandable and does not restrict or limit the purpose or intent of the monitoring network in any way.

17. The proposal to no longer have Local Deformation Monitoring Networks (LDMNs) was initially commented on above.

    The justification (in 5.3) includes commentary that GNSS re-surveys of Order 3, 4, and 5 control marks would continue to be carried out in response to major earthquakes – primarily to deliver the similar outcome with respect to the former LDMNs.

    We also note that re-surveys of those control marks would be required on occasion to account for the control marks within those networks that – over time – no longer meet the survey mark

attributes of their respective Orders. eg: where adjacent vegetation growth subsequently renders the mark to be within a poor GNSS environment, and so requiring infill or update surveys.

6.0 Cadastral Control Network (CCN)

18. The Cadastral Control Network (CCN) will replace the Cadastral Horizontal Control Network (CHN) and the Cadastral Vertical Control Network (CVN).

    It is noted that this network is the most-used network for providing coordinates and heights for engineering and other applications. From a cadastral surveying perspective, these "other applications" will include building location and recession plane surveys for building consent purposes.

19. One issue for marks within the CCN is the identifiability of a mark as a control mark (sections 6.2.2 and 6.3.2). Although it will obviously assist that a mark is suitably identified as an important CCN mark – by way of an appropriate protection structure – that will never guarantee that it is protected.

    Despite the 'threat' of penalty that is signalled as part of the beforeUdig process, we are aware of many instances where important geodetic marks are being destroyed or damaged as part of development works – with or without the beforeUdig assessment.

    We suggest that there is an increased level of follow-up on situations where marks are identified as requiring protection (through the beforeUdig process) to ensure that marks are suitably protected and retained, or offset/replaced as necessary.

20. Permanence (sections 6.2.3 and 6.3.3) of survey marks has always been subjective. Currently, a new control mark is expected to survive some 50 years – it is proposed that marks now should be expected to survive for 100 years.

    No matter what type of mark or protection structure or location is stipulated, there will often be situations where future subdivisional development works; or landscaping; or utility installations etc will negatively impact on a mark that was emplaced with all intentions for it to be permanent (for ~100 years).

    We suggest that the permanence target of ~100 years be the objective, but that regular mark maintenance and replacement (infill or network extension) be included within LINZ considerations regarding overall CCN maintenance.

21. Changes to control mark densities are proposed (section 6.3.4), that introduce flexibility in density factors (varying by 50% - from 200m to 300m).

    We agree that a relaxation of this factor will have negligible impact on cadastral surveyors undertaking their work. An extra travel time (drive or walk) of ~100m to a CCN mark on occasion is trifling.

22. The density proposals also note that a sufficient framework of marks at urban/rural margins to support land development will be ensured, and that when development is complete, LINZ will densify the network in terms of the standard (section 6.3).

    This action would be enhanced by working with the developers survey consultants to encourage the establishment of CSN marks (Schedule 4 CSR 2021) – so that comply with CNN mark attribute requirements - in appropriate locations within developments, so that subsequent LINZ geodetic

control survey projects can readily incorporate them into new CCNs without the need to emplace new CCN marks.

23. The proposal to no longer require finder diagrams (for CCN and DMN? marks) is explained – noting that utilisation of positioning technology and high-resolution imagery instead will enable marks to be easily located - appears reasonable.

    However, this proposal relies on the user/finder deploying some sort of positioning technology (including hand-held GNSS; mobile phone location apps; metal detector for buried marks etc) and/or having access to tools that can report/print aerial images with marks located thereon. Not all geodetic mark users will have access to these tools all of the time. It also does not account for marks in more remote locations that do not have recent/modern imagery.

    A well-drawn finder diagram is invaluable when those tools are not available. Perhaps this could become optional – to allow for situations where a finder diagram provide an appropriate mark location option.

    Further, the ready location of CCN marks is always enhanced when they are metal marks (ITs or IRs) or if BPs or PINs has metal reinforcing rods in their concrete collars (or they have a cast iron box and lid protection structure). This of course, assumes that a metal detection device is being used to search for these buried/flush marks, that may have grass, debris, or vegetation creep over them over time.

    Mark and site photographs are being retained, and are also useful in identifying potential vegetation obstruction at a date in time - as long as those features are captured in the background of the images taken. Note though, that subsequent planting or the installation of utility poles or large signage established after the photos being taken is unable to be accounted for.

7.0 Valuable Geodetic Marks

24. The establishment of a valuable geodetic mark category is supported. As previously noted, many old trigs or precise-levelled benchmarks have significant historical value and need to be recorded and retained within the geodetic database. The value of some marks is sometimes not realised until they are lost.

25. It should be noted that not all survey or positioning projects are for cadastral surveys (definitions of property rights), or the establishment of geodetic control for LINZ.

    Geodetic marks may be used for non-cadastral/non-geodetic projects for various agencies or clients. eg: Regional Councils for well-positioning; utility companies for asset data capture; agricultural companies for positioning of rural infrastructure (irrigators etc) or farm mapping.

    In addition, many property rights surveys connect to old trig stations to define secondary parcels (easements and covenants) with those observations and connections not needing to be captured into Landonline as the dataset can be presented as “parcels without survey information”. Thus, LINZ would not record that those marks have been used – and potentially elevating their status as an often-used mark.

26. The additional networks of control marks were initiated (installed, monitored, utilised and maintained) by other agencies historically. The marks are often well-built substantial structures and provide a more than suitable permanent reference mark. Many of these have been adopted by LINZ in recent decades and captured into the geodetic database. eg: local “Catchment Board” benchmarks alongside river systems. These marks can have valuable historical relevance and often

are in locations that can be useful for LINZ (in terms of geodetic mark density in a urban/rural or rural zone), and cadastral surveyors (in terms of sound and stable local reference markers). These types of existing marks offer a ready-made network of marks that can easily be upgraded to a higher order by network observations (if appropriate); but primarily need to be preserved as much as possible, so should be categorised as "valuable geodetic marks."

Appendix B: Rate of mark loss

27. The analysis of survival rates for geodetic marks using control mark inventory survey data is interesting. The higher survival rate for marks that are 'easily identifiable' is not unexpected.

    Basically, if a digger operator sees a feature on the ground (a capped mark) then they are more likely to investigate and/or avoid it (likely having had experience with damaging water supply points previously – with water valve boxes looking like survey mark boxes!).

    We note though that the rates of mark loss analysis may be skewed due to the refinement of the mark attribute requirements for Order5 marks over the years. ie: initially, marks within rural roadways with suitable traffic management controls were allowable – now marks in carriageways are not desirable, thus rendering them no longer suitable.

    The beforeUdig service is a useful mechanism to alert developers that important marks are in the vicinity of their proposed works. What would be another useful statistic is the rates of mark survival that had been flagged by beforeUdig for protection.

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