ISA INFORMATION FOR MUNICIPALITIES

JUNE 2021

Land Title and Survey Authority of BC

Contents

Introduction

Integrated Survey Areas (ISAs) have been a foundation of surveying and mapping in British Columbia for the last 50+ years, and continue to play an important role today. The Integrated Survey Monuments (ISMs) within ISAs are part of a larger provincial network of coordinate control monuments that form an important public utility supporting a range of activities: surveying, engineering, asset management, land development, construction and resource development, among them.

> *"Your municipality is on the front lines of managing and protecting this public good as the physical assets, the monuments, that make up the ISA are almost exclusively located within the municipal road rights of way."*

This document is designed to provide clear understanding of your ISA and its importance, as well as your municipality's unique responsibilities in maintaining its ISA.

A letter of commitment has been included with this document. Please review this letter of commitment and consider whether your municipality continues to be interested in accepting the responsibilities of an ISA. If your municipality is not able to sign the letter of commitment, please inform the LTSA, and we can begin the process of annulling your ISA.

About The Integrated Survey Area (ISA) Program

What is an ISA?

An ISA is an area where a network of permanent coordinate control monuments have been installed.

- These monuments are referred to as integrated survey monuments, or "ISMs."

- Each ISM has had its precise geographic coordinates surveyed by a geomatics professional.

- GeoBC has adjusted and processed the ISM's geographic coordinates to fit within the provincial coordinate control network, and stored the coordinate information in a provincial database called MASCOT.

- ISM coordinates are publicly available to all parties through the MASCOT website, as well as through "coordinate control listings" for each ISA on the LTSA's website.

- Section 14 of the *Land Survey Act* requires Land Surveyors to reference their survey to the two nearest ISMs when conducting a legal survey within an ISA.
    - o This connects surveys to a common reference with the NAD83 Canadian Spatial Reference System, allowing for accurate mapping of surveys at a provincial scale.

- The boundaries of your municipality's ISA can be accessed and reviewed through ParcelMap BC (under the "Administrative Areas" group layer).
    - o Minor updates have been made to some ISA boundaries to align with current cadastral and municipal boundaries. Historic mylar and PDF maps of the ISA boundaries are now superseded by the shapes as shown in ParcelMap BC.
    - o Your municipality's ISA coordinate control listing PDF may have been updated as a result of this review.

The Importance of ISAs

- ISAs represent over 50 years of infrastructure investment undertaken by individual municipalities, the Province, and the Office of the Surveyor General (previously as part of the Provincial Government and now within the LTSA).

- ISAs form a large and crucial part of the provincial coordinate control network.

- Surveying, mapping, navigation, and geophysical applications rely on accurate and stable control monuments with precisely known coordinates, as are found in ISAs.

- Municipalities use ISMs for many different applications, including:
    - As control for municipal engineering/construction projects;
    - For municipal surveying operations;
    - As a foundation for their GIS systems;
    - To identify GNSS (Global Navigation Satellite System) Instrument Errors;
    - As control for orthophotos;
    - To provide a resource for users who do not have survey grade GNSS equipment.

- Although surveyors normally have access to high-grade GNSS equipment, there are many reasons they also continue to require ISMs to complete their work:
    - To have a common frame of reference with other consultants on a project;
    - In areas where it is difficult to get a reliable signal through their GNSS equipment (e.g. urban canyons/areas, heavily treed locations etc.);
    - To ground-truth their equipment;
    - As a way of doing their work more efficiently;
    - When required to by statute.

- The LTSA launched a thorough stakeholder review of the ISA program, including the 52 municipalities with ISAs, the surveyor community, utilities and GeoBC. The consensus from our stakeholders was that the ISA Program continues to play an important role in the provincial survey system and should be revitalized.

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A Note on Accuracy

The georeferencing accuracy requirements for legal plans within an ISA are sometimes misunderstood. Below are the facts on absolute accuracy requirements for georeferencing of legal plans:

- There is a blanket provincial requirement for surveyors to meet an absolute accuracy of 0.20m for all georeferenced points in legal plans, regardless of where they are in the province;
- There is no additional absolute accuracy requirement for legal surveys conducted within ISAs; however,
- There is a requirement for surveyors to tie their legal survey to the two nearest ISMs;
- ISMs have varying absolute accuracy, which is calculated and published by GeoBC and is dependent on the way they were originally surveyed, as well as their fit and adjustment within the greater provincial network of coordinate control;
- Many ISMs have an absolute accuracy of around 0.02m or better, however there are municipalities with far worse accuracy. Some of these municipalities are currently undergoing refreshes to bring their municipal accuracy to within reasonable modern survey grade accuracy;
- Because surveyors are required to reference their projects to ISMs when conducting a survey within an ISA, the resultant absolute accuracy is dependant on the existing level of ISM accuracy. Published values of ISMs normally meet the 0.20m minimum requirement.

Municipal Stakeholder Review

In the summer of 2019, the LTSA sent a questionnaire to all municipalities with ISAs within their boundaries. The questionnaire asked opinions on the ISA Program. Below is a summary of the responses.

Support for the ISA Program

Responses indicated significant support among municipalities for the ISA Program:

- **80% of respondents** indicated that **their local government** has a desire to **keep it's designation as an ISA**.

- **51% indicated** that **they would be concerned** if legal survey plans were no longer mandated to tie to ISMs.

- **78% expressed a desire** to either **continue the ISA program** as-is, or have the program be "revitalized".

- **Only 5%** of respondents expressed a desire for the **program to be discontinued.**

Uncertainty of ISA Responsibilities

Responses to the questionnaire indicated a lack of understanding of the responsibilities that municipalities have toward their ISA:

- **29% of respondents** indicated that **their municipality is aware of the commitments required** by it in relation to its ISA.

- **17% indicated** that they **have a copy of their ISA agreement** with GeoBC on file.

- **17% indicated** that they have **replaced monuments** that have been destroyed.

- **24% believe** their **local government and GeoBC** are **living up to their commitments** to their ISA.

Responsibilities in an ISA

Municipalities, GeoBC, and the LTSA each have important responsibilities in managing and maintaining an ISA.
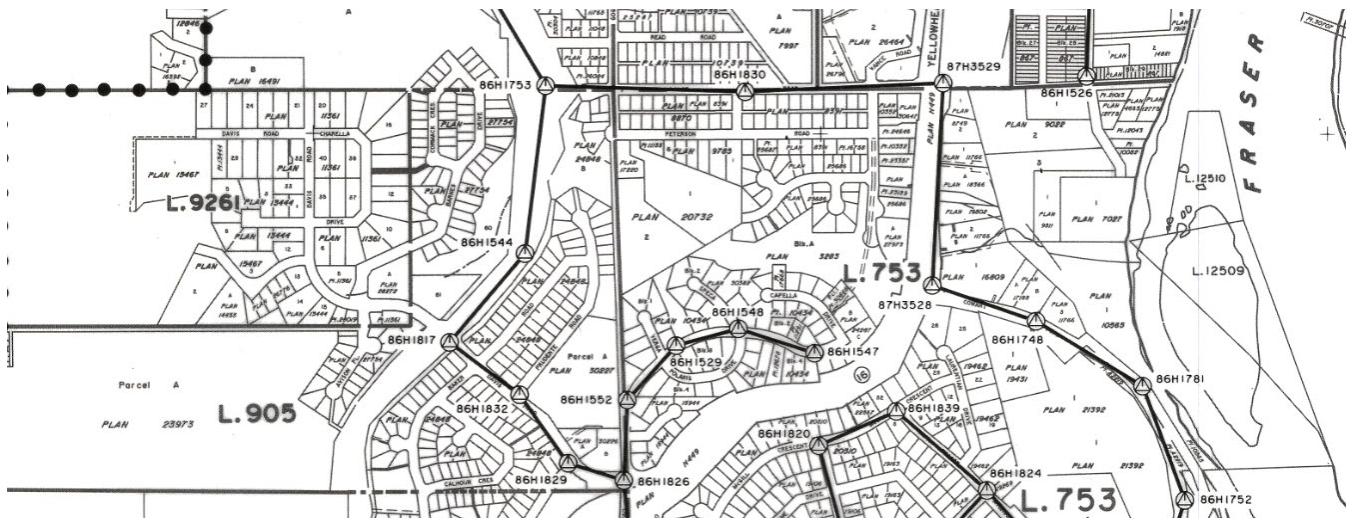
Municipalities:

- Protect ISMs from unnecessary damage or destruction due to development activities whenever possible:
    - implement policies and procedures to protect ISMs during development;
    - potentially implement a monument replacement fee to encourage monument preservation and offset replacement costs.

- Take a regular inventory of ISM condition and report back to LTSA for updating of MASCOT database.
    - Inventory can be undertaken in phases, with the expectation that all monuments in an ISA have been physically inspected at least every 5 years.
    - To supplement physical inspection, monument condition can be assessed through other means, such as orthophoto reviews and communication with local land surveyors.
    - See the LTSA's website for details on submitting ISM condition reports.

- Ensure an adequate density (see ISM Spacing section) of functional ISMs in your ISA by replacing damaged/destroyed monuments.

- Replacement of ISMs is a complex project that starts with entering into a written agreement with GeoBC and includes the below steps:

    o Coordinating with GeoBC on their requirements for ISM surveys;

    o Planning specific monuments/locations to target for replacement, in consultation with an appropriate geomatics professional;
        - Note: A project must consist of multiple monument replacements (at minimum 10) to make it viable for GeoBC to process;

    o Bearing the costs of survey tablets, monuments, installation and survey of the ISMs being replaced, either directly by the municipality, or supplemented through a monument replacement fee if implemented;

    o Contracting a qualified geomatics professional to survey the replaced monuments, ensuring the survey design is approved by GeoBC before started;

    o Paying GeoBC a fee for their assistance with planning and standards, and their computational analysis of the survey results;

    o Quality assurance and quality control of survey returns, as directed by GeoBC;

    o Providing final survey results/calculations to GeoBC for review, approval and publishing.

GeoBC:

- GeoBC has responsibilities to ensure monument surveys in ISAs are done correctly so that they can be included in the provincial coordinate control network. GeoBC's responsibilities start after being contacted by a municipality about a monument replacement/expansion campaign and include the following:

  - Enter into written agreement with the municipality concerning survey standards, costs, data ownership, data access, and data maintenance;
  - Provide municipality/survey contractor with technical requirements and standards for ISM survey;
  - Provide advice on survey method and network design for ISM installation/replacement campaigns;
  - Approve survey method before any work is started;
  - Receive survey returns;
  - Prepare and publish official coordinate control monument listings on MASCOT;
  - Provide the LTSA with official coordinate control monument listings and a database extract for updating the MASCOT layer on PMBC.

LTSA:

- Work with GeoBC and municipalities to:

  - Establish, expand, and annul ISAs in consultation with municipalities and stakeholders;
  - Prepare and maintain electronic maps of ISA Boundaries;
  - Publish official coordinate control monument listings;
  - Consult with Association of BC Land Surveyors on ISA-related matters.
  - Notify BC land surveyors of changes to ISAs;
  - Notify Land Title Office of changes to ISAs.

Best Practices in an ISA

The Risks to ISMs

The biggest risk to your municipality's ISMs is development activity. *Every time a road is repaved or re-graded, a sidewalk is replaced, a building is constructed, or a utility is installed, control monuments within your municipality are at risk of being damaged or destroyed.*

There is no way to completely prevent the impact of development on control monuments, however, measures can be put in place to protect your municipality's control monuments, and replace them when necessary.

ISMs were originally installed in your municipality with great care, and at a significant cost. The cost of replacing ISMs is also significant. It makes sense to have a plan in place to protect ISMs whenever possible, and to recover replacement costs directly from the party responsible for damaging the monument.

Protecting ISMs

Below are some guidelines that municipalities use to help protect their ISMs. **Consider whether your municipality could improve on any of the below initiatives:**

- Regularly engage with internal municipal departments to:
    - emphasize the importance of retaining ISMs whenever possible;
    - emphasize the costs associated with destroying ISMs;
    - promote the retention of ISMs through project redesign or appropriate construction protocols whenever possible;
    - Consider the destruction of monuments as a last resort, only after other options have been carefully considered.

- Have a clear set of internal processes so that all relevant departments understand their role in protecting ISMs;

- Explain what an ISM is to those undertaking development activity;

- Make mapping of ISMs easily available so developers can understand where ISMs are in relation to their development activity;

- Require ISMs to be shown on all design drawings for development projects;

- Have your intake process include verifying whether an ISM may be impacted by development activity;

- Implement a monument replacement fee to pass/offset the cost of monument replacement to the party causing the monument damage through development activity;

- Have a system in place to recoup monument replacement fees before final approval of development activity;

- Inspect monuments before and after development activities to assess for damage/disturbance;

- Flag/protect monuments in an active construction site to avoid disturbance if possible;

- Marker condition reports have revealed that ISMs are often paved over. They remain in good condition, however, become inaccessible after repaving. This common occurrence can be addressed by including maintenance of monument accessibility into repaving projects.

Municipal Regulation Examples

Every municipality is different and will require different rules and regulations for monument preservation.

Below are some examples of the public facing bylaws, specifications, and rules used by municipalities to protect their survey monuments.

- **City of Surrey:**
  - Bylaw 14577 (p. 9 "Survey") outlines fees associated with replacement of survey monuments.

- **City of Vancouver:**
  - Construction Specifications (s. 3.10 "Survey Monuments");
  - Engineering Design Manual (s. 2.3.5.6; s. 7.5.7 for Third-Party Utilities).

- **City of Vernon:**
  - Bylaw 3843 Schedule N (Note, as this bylaw was created in 1992, some regulations are no longer relevant. For example, there is no longer a need for intervisibility (visibility from one to another) of control monuments).

ISM Spacing

Achieving the correct density of ISMs within your ISA is an important aspect of a well-functioning ISA. The goal is to find a balance between convenience in accessing ISMs, redundancy in the network, and cost.

- Modern ISAs are now established with typical monument spacings of 500m to 1km.
  - Older ISAs were much more dense, as surveyors needed line-of-sight from one monument to the next. This provides an opportunity for municipalities with older ISAs that may have a higher density of ISMs.
    - Consider targeting key ISMs for protection to preserve a 500m to 1km density. ISMs that will not help to achieve a density of 500m to 1km may not be critical to maintenance of an ISA.

- While monument spacing of 500m to 1km is typical, there are exceptions to this spacing standard:
  - in urban built-up environments, a higher density may be required, as determined by the municipality in consultation with the Surveyor General;
  - In rural areas, a lower density (up to 2km) may be acceptable.

- It is recognized that achieving an adequate density of ISMs is unique to the cadastral layout within a municipality.
  - Municipalities should consult with the office of the Surveyor General if they are unsure whether they are achieving an adequate density.
  - Additionally, the office of the Surveyor General may identify areas of concern to a municipality.

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Modern ISA Best Practices

Some ISAs were developed over 50 years ago, using best practices from a different era in survey technology. Depending on when your ISA was established, ISM density and arrangement may be outdated and not entirely suitable for modern practices. Below are some tips for modern ISAs.

- There does not need to be line-of-sight visibility between ISMs, as modern survey practice no longer requires this.

- There is little merit in attempting to place a new monument in the exact previous position of a destroyed one. Setting a new replacement monument in a more ideal location (optimum GNSS conditions + ground stability) should be the higher priority during replacement campaigns.

- ISMs should be placed off of roadways whenever possible. Monuments in roadways are hard to access and pose a safety risk to users.
  - Target easily accessible monuments as key monuments to preserve.
  - If the need to replace a monument arises, consider moving the monument off of the roadway and onto the sidewalk if possible.

- Special consideration to monument installation should be taken by municipalities that experience substantial frost heave.
  - Installation of helix monuments mitigates the effects of frost heave.
  - After installation, local governments should allow for one winter & spring to pass prior to GNSS observations. In theory, most of the heaving/settling will occur during the seasons immediately after installation.
  - Monument selection and installation is the responsibility of the local government.
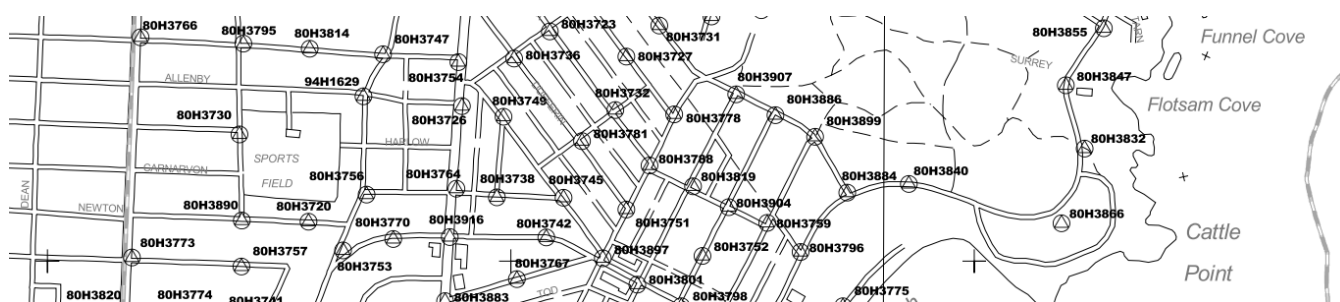
Monument Installation Guidelines

Monument type and placement decisions are the responsibility of the municipality. It is recommended that your municipality consults with a geomatics professional with local knowledge prior to monument installation.

Generally, ISM's should be located:

- In open sky for optimal GNSS observation, especially in the south quadrants;
- Away from surfaces that may cause multipath;
- On stable ground;
- In areas where there are no planned disturbances on the horizon;
- In low traffic areas, not in the roadway;
- Away from underground utilities (a sweep for utilities before installing may be advisable depending on circumstances).

ISA Letter of Commitment

A letter of commitment has been included with this document. The commitment letter goes over the responsibilities that municipalities have for their ISA.

Signing and returning this letter of commitment indicates that your municipality continues to be willing to accept the responsibilities of an ISA.

If your municipality is not willing to sign the letter of commitment, please inform the LTSA, and we can begin the process of annulling your ISA.