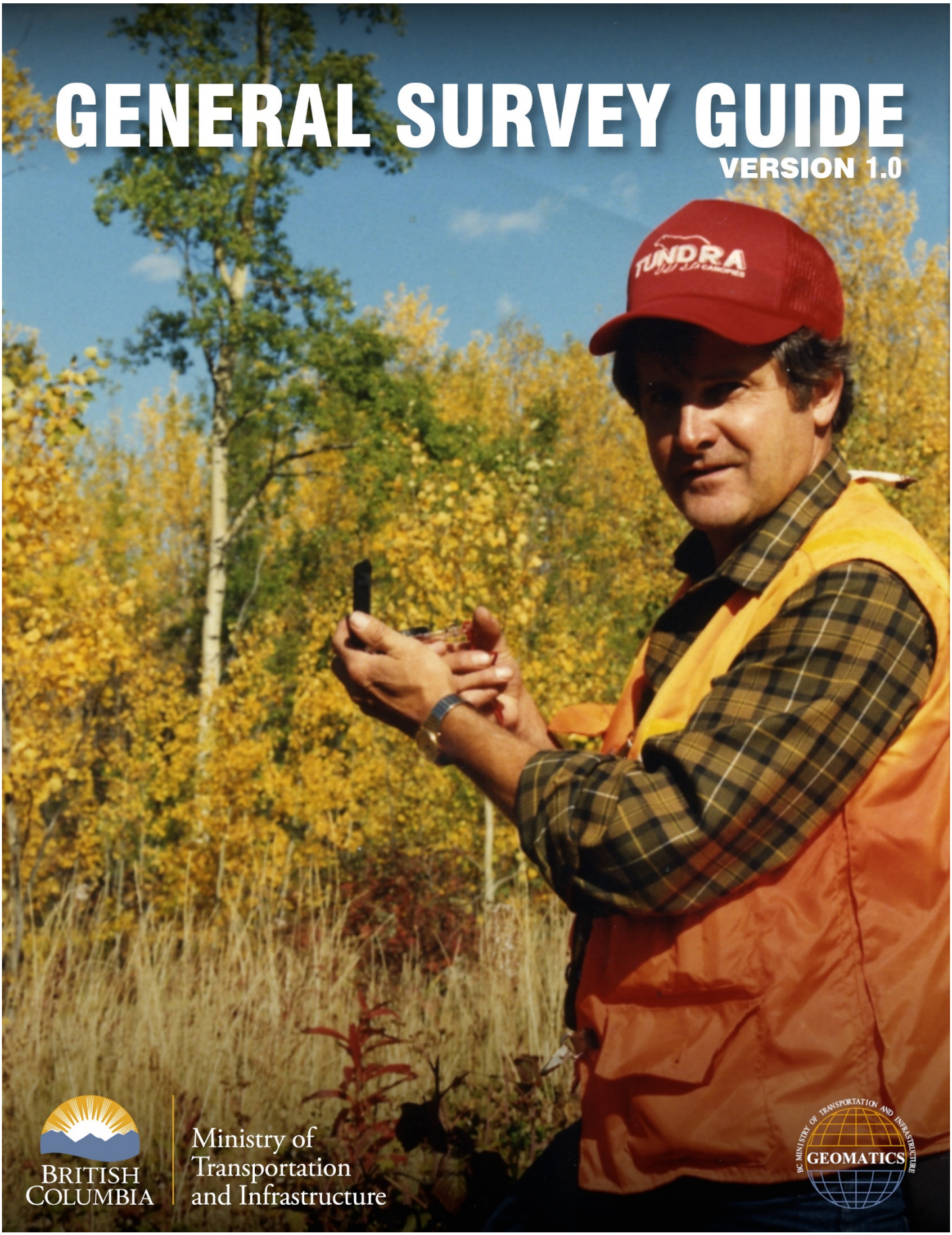
GENERAL SURVEY GUIDE

VERSION 1.0



BRITISH COLUMBIA

Ministry of Transportation and Infrastructure

BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
GEOMATICS

Cover photo: Herb Walker, 1977 BC Peace Area
Four decades as MOTI Survey Project Supervisor
Retired 1997, Currently resides in Port Alberni
"The difficult we do right away, the impossible just takes a little longer"

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Preface

The B.C. Ministry of Transportation and Infrastructure's General Survey Guide reflects our standard procedures, technology, and required deliverables.

This is a living document that will be tracked by versions. This guide replaces the previous version dated October 2013. In the future, frequent adjustments to the guide will reflect the constantly changing field of surveying.

The contents of this guide are relevant to both Ministry staff and consultants. The guide is designed to be used as a contract, reference guide, and terms of reference guide.

The content of this guide shall be considered as the minimum requirement for all surveys. Under some circumstances, there may be job-specific requirements not outlined in this guide.

When survey services are required, the contract terms of reference will include a reference to this guide, or sections as applicable, as in the following example:

> *"This survey shall provide deliverables as defined in the B.C. Ministry of Transportation and Infrastructure General Survey Guide, and as applicable."*

The General Survey Guide has been developed by the B.C. Ministry of Transportation and Infrastructure Geomatics and Design Department and consultant representatives:

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Trevor Key	Geomatics Survey Supervisor
Sean MacIsaac	Geomatics Survey Supervisor
Brian Jorimann	Geomatics Survey Supervisor
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Dacey Heide	Geomatics Technologist
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Ken Blood	Geomatics Technologist & Survey Manager (WSP)
Rod Ralston	Senior Survey Lead (Stantec)
James Layton	Survey Crew Chief (Stantec)

Technical Advice

Questions on interpretation and application of standards and guidelines should be directed to:

Provincial Geomatics Group
B.C. Ministry of Transportation and Infrastructure

Email: moti.geomatics@gov.bc.ca

Contents

1 Introduction, Project Initiation, Research

1.01 Introduction

Surveyors are expected to use proven industry methods that safely, correctly, and efficiently achieve the desired objective and required deliverables. The Ministry encourages innovative and viable alternative solutions that will satisfy project deliverables.

The Ministry requires the following:

- Professional and qualified surveyors
- Well maintained and properly calibrated equipment
- A complete and clear understanding of project assignments
- The ability to perform survey requirements in adverse weather conditions
- Documentation to substantiate quality management procedures

1.02 Registration, Identification, Selection, and Performance Evaluation System (RISP)

Contracts for engineering and design services valued at less than $1,000,000 must be awarded through the Registration, Identification, Selection, and Performance Evaluation (RISP) system.

For more additional information on the selection process, see the Ministry eRISP website.

1.03 Project Terms of Reference, Scope, Schedule, and Budget

All survey projects are governed by “As and When” terms of reference that include the following:

- Methodology to be employed
- Specific work orders and schedules for assignments
- Safety procedures and policies
- Ministry standards to be followed
- Quality management procedures
- The cost for the provided services

1.04 Safety

The Ministry is a safety-oriented organization with provincial, regional, and district level occupational health and safety committees. All employees are expected to perform their duties in a safe manner, adhering to all laws, regulations, and rules affecting their work.

All Ministry and WorkSafeBC safety policies apply to all surveys. This includes, but is not limited to, policies regarding safety equipment, signs, traffic control, and procedures.

Copies of daily safety assessments, toolbox meeting notes, etc. should be kept on file and made available to the Ministry upon request.

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

SAFETY STATEMENT




PHILOSOPHY

The **Ministry of Transportation and Infrastructure** will take every reasonable step to ensure that our work is performed safely and in compliance with all applicable safety regulations, and in accordance with government policy.

As the **Owner** of Ministry lands, assets and works, and a partner in public information and corporate citizenship—the ministry will ensure a functioning safety management system that relies on feedback from sharing of safety and health information and collaboration, workplace audits, permits and operational reviews.

As an **Employer** we will provide the resources and support necessary to implement, maintain and review a comprehensive safety program.

Our **Supervisors** will orient new employees and ensure adequate and appropriate training of staff. Regular safety and health meetings, inspections and incident investigations will serve to promote safe working practices and conditions.

Our **Workers** will follow safe working procedures, report potential and existing hazards, immediately report work-related injuries and diseases, and actively participate in safety and health related training.

The **Ministry** and its **Joint Health and Safety Committees** are cognizant and in diligent support of both their legal and moral obligations for worksite safety and health.

Grant Main, Deputy Minister

Kevin Richter, Assistant Deputy Minister

Nancy Bain, Assistant Deputy Minister

Jacquie Dawes, Assistant Deputy Minister

Dave Duncan, Assistant Deputy Minister

Deborah Bowman, Assistant Deputy Minister

References:
WorkSafeBC Resources Website
Ministry Traffic Control Manual
Nav Canada
Transport Canada

1.05 Entry onto Private Properties

Private property owners must be contacted prior to property entry. In most cases, the Ministry representative or project manager will notify the property owner and discuss these details during the survey request.

At the discretion of the Ministry representative, surveyors may be required to seek permission directly to enter private property by knocking on occupants' doors and asking permission. If permission is granted, note who granted permission in the field book. If permission is not granted, contact the Ministry representative for direction.

Follow all Ministry policies and procedures for entry onto private land, railway/utility rights-of-way, and any areas generally inaccessible to the public. Return any disturbed property to the condition in which it was found.

Surveys on Indian Reserves require special permission from the local First Nation. The Ministry's Indigenous Relations group will assist with the communications between the Ministry and First Nation. Once the First Nation has granted permission, the survey can commence.

A sample Ministry form H0224 to advise of possible entry on private property can be found in Appendix A.

To use Unmanned Aerial Systems (UAS) on private property, see Section 3.04 Unmanned Aerial Systems (UAS).

1.06 Research

Proper research ensures correct information is represented in the base survey and reduces problematic process errors in the design and construction phases. Research information includes, but is not limited to, survey control, property ownership, cadastral information, and utilities.

1.07 Correspondence

Complete form H0461X (see Appendix B) before starting any work. This form outlines the work that is to be completed and ensures the Ministry and the surveyor understand and agree to the scope of the work and actions needed to complete it.

Retain all records of correspondence that form part of the deliverable. Include records of telephone calls, emails, property owner notification letters, and any other project related enquiries and/or details.

1.08 Emerging Technology

The Ministry acknowledges alternative technologies may supply survey data that meet current Ministry standards for specifications and accuracy.

The Ministry representative may consider alternative survey methods that improve surveyor safety and/or deliver cost benefits.

The Ministry representative has sole discretion to allow new methods of data acquisition and will approve proposals for alternative survey methods on a project-by-project basis.

2 Control Surveys

2.01 General

Control is vital to integrate data sources and maintain continuity of previous work. Special care should be taken to confirm these control points are accurate and undisturbed.

2.02 Control Point Categories

- Origin control
- Corridor control
- Project/primary control
- Secondary control

2.02.01 Origin Control Point

An origin control point is a published and highest order coordinate from which corridor control networks are built. These are usually passive high precision monuments established by GeoBC or Natural Resources Canada (NRCAN). Active control is occasionally used in place of this. Preference is given to the lowest standard deviation and best location. Please see the following links for more information:

Natural Resources Canada Passive Control Networks (NRCAN) – *survey monuments*
Management of Survey Control Operations & Tasks (MASCOT) – *survey monuments*
BC Active Control System (BCACS) – *BC wide control network*

2.02.02 Corridor Control Point

Corridor control points are derived from origin control points and become part of the Ministry's network of control points. These points are used for LiDAR missions, LiDAR quality assurance (QA) and project coordinate consistency. Spacing is typically between 5 and 20 km to allow for a reasonable PPK or RTK solution to be collected. Locate each corridor control point in a safe, stable, clear area with an unobstructed view of the sky. Identify the point name with a nearby marker post.

2.02.03 Primary/Project Control Point

Establish primary/project control points from one origin control point or two corridor control points when beginning a project. In rare circumstances, a NRCAN Precise Point Positioning (PPP) solution can create a temporary origin control point within the project. Establish a minimum of three primary control points per project. Set one at the beginning and one at the end of the project outside of the project boundaries, typically 1 km apart with a maximum distance of 2 km apart. Control points should be ferrous metal, 0.3 m or longer in length, and set 0.1 m below the surface to reduce the chance of disturbance. Mark clearly with stakes, flagging, and/or paint. Use flagged tripods in rural areas such as bush or open fields.

2.02.04 Secondary Control Point

Establish secondary control points from primary/project control points to provide intervisible points where an optical instrument can be set up. Establish by traverse with a total station or by GNSS RTK methods. Secondary control points are typically less accurate and used for detail work. They should not be used to extend the control of a project or be included in the Survey Control Table unless requested by the Ministry.

2.03 Control Accuracy and Spacing

Table 1: Control Point Accuracies and Spacing

Point Classification	Relative to Parent Control		Relative to Neighboring Point		Spacing (m)
	Horizontal (mm)	Vertical (mm)	Horizontal (mm)	Vertical (mm)	
Origin Control	Determined by source of point				
Corridor Control	5 + 0.5 ppm	10 + 0.5 ppm	5 + 0.5 ppm	10 + 0.5 ppm	5 km – 20 km
Primary/Project Control	15	15	10	10	200 - 2000
Monitoring Point	Project Specific				
Secondary Control	20	20	10	10	50 - 300

2.04 Point Naming Convention

All control points must follow a naming convention to indicate how and when the points are set. If a brass cap monument is used with an alphanumeric name, then only a suffix of "-YY" is needed where YY are the last two digits of the year the monument was set. E.g. Tonka-15. For control points using tags or a simple numeric identifier, a prefix and suffix are required. E.g. G4321-18.

Prefixes:

- G – GPS Primary (Static)
- K – GPS Secondary (RTK)
- T – Total Station Primary (Closed and adjusted control loop)
- S – Total Station Secondary (Side shot)

2.05 Horizontal and Vertical Datum

Deliver all Ministry projects in the following horizontal and vertical datums:

- Horizontal: UTM NAD83 CSRS 2002.0 epoch (1997.0 for Vancouver Island)
- Vertical: CGVD28 using the HT2.0 Geoid (HTMVBC00 for Metro Vancouver, Abbotsford, and east to Hope)

The Ministry will switch to the new 2013 datum and geoid at the same time as the Association of British Columbia Land Surveyors.

2.06 Survey Control Table

The Control Table defines all points listed above, along with UTM zone, geoid, combined scale factor, and ground conversion tack point (used when local coordinates representing true ground distances are required). A sample control table is provided in Appendix C. All fields must be completed unless otherwise stated by the Ministry representative.

2.07 Control Point Calculation and Raw Data

The Ministry may request source information, including, but not limited to:

- Raw data files
- Baseline processing report
- NRCAN PPP Solution summary (if used)

- Closure reports of any traverse networks
- Network adjustment method and residuals
- Check shots taken
- Photos of the point location

3 General Survey Requirements

3.01 Technical Research

A project scope may require information such as control, previous surveys, orthophotos, photos, topographic maps, LiDAR data, composite plans, record drawings, etc. See the following links for origin control point information:

Natural Resources Canada Passive Control Networks (NRCAN) – *survey monuments*
British Columbia Active Control System (BCACS) – *B.C.'s active control network*
Management of Survey Control Operations & Tasks (MASCOT) – *survey monuments*

Other required information may include relevant material related to properties, Crown lands, Indian Reserves, gazette notices, Agricultural Land Reserve (ALR) plans, and mineral claims.

The Ministry has access to many digital gazettes and road surveys and can provide copies if they are required to complete a project. Please contact the Ministry representative for the project to obtain copies. The following links may provide relevant information:

BC Land Title and Survey Authority (LTSA) – *property information, plan retrieval, r/w plans, etc.*
Government Access Tool for Online Retrieval (GATOR) – *tube/tray plans, Crown grants, etc.*
Gazette Searches – *request searches on gazette notices and road surveys*
Mineral Titles – *mineral titles, maps, and GIS database*
Agricultural Land Reserve (ALR) – *maps and GIS database of the ALR*
Online Cadastre – *property information, plan retrieval, r/w plans, etc.*
Canada Land Survey System – *property information, plan retrieval, r/w plans, etc.*

Relevant utilities information may be obtained through the following links:
BC One Call – *must be contacted prior to survey to supplement utility information*
Local Municipal Websites – *municipal utilities and related information*
Regional District Websites – *regional district websites and contacts*
Integrated Cadastral Information Society (ICIS) – *GIS based parcel fabric and utilities*
Highway Electrical – *email requests for project-specific highway electrical information*

3.02 Terrestrial 3D Laser Scanning

Laser scanning has made its way into mainstream surveying. Workflows have advanced considerably, allowing simple registration to project coordinates. Do not use unregistered or "assumed" coordinates unless requested by Ministry geomatics representatives. Laser scanning technology opens many new applications of detailed survey pickup, including:

- Monitoring of topography or structures
- Rockface geometric analysis
- Busy or dangerous area survey
- Line of sight and clearance calculation
- Inaccessible terrain
- Highspeed data collection

Tolerances of this data are specific to the application. Surveyors are responsible for interpreting the accuracy of the methods used. Pushing beyond a scanner's typical range may compound beam divergence, angular, tilt, and ranging errors.

3.03 Aerial LiDAR and Orthophotography

Aerial LiDAR and orthophotography are viable, cost effective and productive means to supplement transportation corridor surveys. They are not intended, and must not be used, as standalone representations of the corridor infrastructure and digital elevation model.

All aerial LiDAR deliverables must pass QA testing to ensure horizontal and vertical compliance with Ministry specifications. Include a report file produced by the BCMAPCHECK macro in the deliverable to prove the LiDAR meets the Ministry's specifications. Store this file in the LiDAR folder "\DesignModel\00_SurveyBase\SourceData\"

Do not attempt to disguise aerial LiDAR as ground survey. Boundaries encapsulating each data source are required. All data within those boundaries is to be homogenous.

LiDAR obtained by the Ministry should follow these minimum specifications:

- 10 cm pixel orthophotos
- Horizontal accuracy of 20 cm (two 10 cm pixels)
- Vertical accuracy of 10 cm
- Intelligently thinned point files (remove non-critical points to the surface)
- Maintain 15-20 points per meter squared
- Remove noise due to atmospheric influence from the dataset

These specifications can be altered if requested by the Ministry representative.

Survey grade LiDAR is achievable, and the Ministry has obtained it with the application of comprehensive survey and data collection procedures during acquisition, combined with proprietary processing methods. The objective is to have the LiDAR surface represent the true ground elevations within 3 cm of ground surveyed QA/quality control (QC) points. This level of detail requires extra work and will be discussed on a project by project basis.

3.04 Unmanned Aerial Systems (UAS)

The Ministry's UAS program allows the use of both photographic and LiDAR systems to supplement traditional survey methods. UAS will be used at the discretion of the Ministry representative on a project by project basis.

Complete all UAS activities in the safest manner and adhere to all statutory requirements. If operating from private property, obtain proper permissions and complete form UAS100 in Appendix D.

Surveyors are responsible for ensuring they understand and comply with the new regulations implemented June 1, 2019. The Ministry representative must receive a copy of the pilot's certificate and proof of drone registration before beginning any UAS activity.

When completing mapping and LiDAR projects, all data must be geographically referenced to the project control. All deliverables must pass QA testing to ensure horizontal and vertical compliance within Ministry specifications. Include a report file produced by the BCMAPCHECK macro in the deliverable to prove the data meets the Ministry's specifications. Store this file in the Photogrammetry folder "\DesignModel\00_SurveyBase\SourceData\". If requested by the Ministry, the surveyor must provide a copy of all checks used to verify the UAS data.

Orthophoto pixel sizes should be no larger than 5 cm unless approved by the Ministry representative.

No attempt will be made to disguise UAS data as ground survey.

Report any incidents to the Ministry in a timely manner with a complete description of the incident. If the incident is reportable to Transport Canada, provide a copy of all correspondence to the Ministry representative.

3.05 Point Cloud Applications

When using a point cloud for Civil 3D represented features, clean up non-essential points and overhanging areas. Remove spikes and excess triangles along with the extracted point features and survey figures. It is generally unacceptable to bring more than 1 million points into a surface definition.

Full point cloud information, generally a LAS with intensity and RGB values, can be useful in other emerging software to analyze clearance, geotechnical structure, and other details. If new software becomes more robust, this may become a standard deliverable to enhance the general survey model.

3.06 Topographic Survey Requirements and Accuracy Specifications

3.06.01 Survey Limits

Understanding the survey objective is critical to properly determining the required topographic and planimetric extents. Always consult the Ministry representative to clarify the survey objective.

Give special consideration to intersecting driveways and roads, changing terrain, and any other features that may impact or affect the anticipated design requirements. These situations can significantly extend the intended corridor limits. All surveys should start and end in a tangent. The Ministry representative may adjust the survey limits as needed. Capture utilities beyond the proposed survey limits to ensure enough information is collected. For example, capture the next utility pole or marker.

Field crews must understand the scope of work being completed. At times, the boundaries set may not include important features that could be important to the project. Use your judgement to determine if significantly more detail is needed. In the event of “scope creep,” inform the Ministry representative of the increase in time and expenses of the survey.

3.06.02 Survey Point Coding and Attribution

All collected survey figures (chains) must have the following minimum attributes:

- Feature Code (see Appendix E)
- Unique Survey Figure Identifier (e.g. SH1, BL5, DE15)

All collected points must have the following minimum attributes:

- Point Name (using the convention YYYYMMDDINIT#### where YYYYMMDD is the date, INIT are the surveyor’s initials and #### is the point number)
- Northing
- Easting
- Elevation
- Feature Code (see Appendix E)
- DTM Attribute (Y or N)
- Attributes 1 through 5 (see Appendix E)

3.06.03 Survey Point Accuracy and Spacing

Table 2: Survey Point Accuracy and Spacing

Topographic survey (Relative to Primary Control)	Horizontal (m)	Vertical (m)	Spacing (m)
Curb & Gutter	0.020	0.015	0.1-10
Curb Returns	0.020	0.015	0.1-5
Traffic Islands	0.020	0.025	0.1-5
Intersections	0.020	0.025	1-5
Small Radius Curvature	0.020	0.025	5-10
Rock Areas	0.020	0.025	5-10
Pavement Overlay	0.020	0.015	1-20
Pavement	0.020	0.025	1-20
Urban Detail	0.020	0.025	0.1-20
Gravel Road Prism	0.100	0.050	1-20
Ditches and Watercourses	0.100	0.050	1-10
Undulating/Natural Terrain	0.300	0.150	5-20
Steep Terrain	0.500	0.300	5-20
Inaccessible Terrain	1.000	0.500	5-20

3.06.04 Survey Point Density

The horizontal and vertical nature of the terrain dictates most of the point spacing and survey figure requirements to produce an accurate ground model.

The Ministry representative or project terms of reference may establish a point density that will sufficiently represent the topography and features. As a rule, maintain a maximum 20 m average spacing of points in all directions.

There will be circumstances where higher point densities will be required to satisfy drainage issues, plan representations, and quantity concerns.

Survey point location is critical when surveying along a road template involving adjacent and parallel survey figures. For example, gutter and top of curb shots must be perpendicular. In these situations, consider triangle (TIN) model formation when selecting point locations. Pick up additional points in intersections where paint lines are minimal to ensure proper surface modelling of the intersection.

While performing survey processing in Civil 3D, pay careful attention to common errors such as:

- Improper feature coding
- Crossing survey figures
- Unintended point and survey figure duplication offsets
- Improper survey figure direction when representing drainage flow
- Missing point attributes
- Not defining changes in surface material
- Use of un-joined points that should be breaklines
- Spikes and dips in elevation not indicative of the terrain
- Improper designation of feature and ground points

- Survey data boundary not created or improperly representing the surface
- Incorrect or inconsistent point density
- Missing survey figure boundaries
- Feature points mistakenly used in TIN formation
- TIN triangle sides joining to non-adjacent survey figure points (boundary needed)
- Incorrect triangle formation (see Figure 3 and Figure 4)

Use appropriate point spacing to accurately depict the horizontal and vertical geometry of the mapped feature. Point spacing examples are shown below.

When points on parallel survey figures don't align, crossing survey figures and differing curves can result. See Figure 2. The best practice is to take points at all figures in a cross-section, especially when dealing with smaller radius curves. See Figure 1. This sample shows correct pick up, minimizing crossing survey figures. Always check closely when setting point geometry to curve to avoid unwanted results.

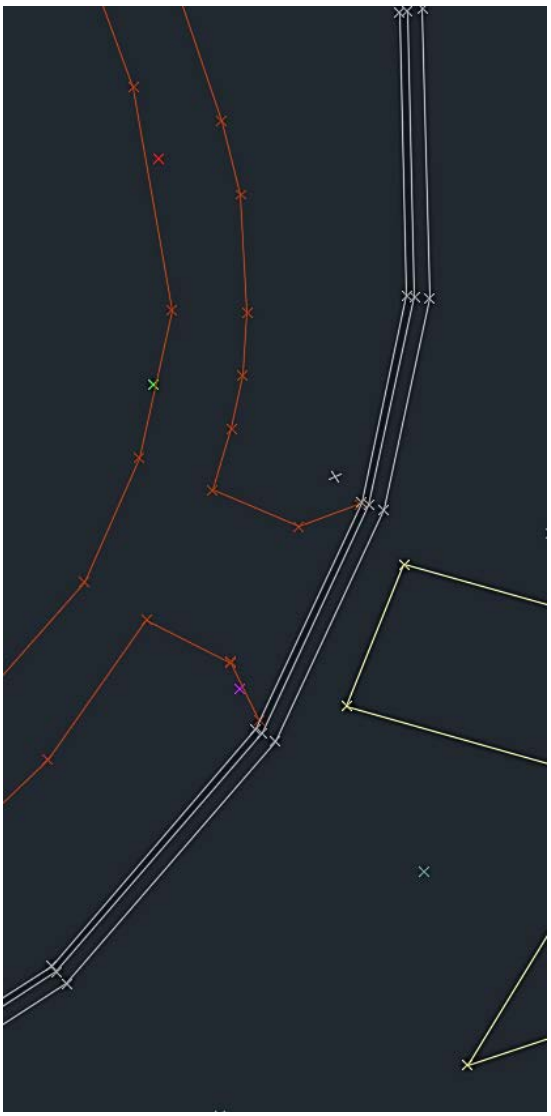

Figure 1: Correct Point Collection

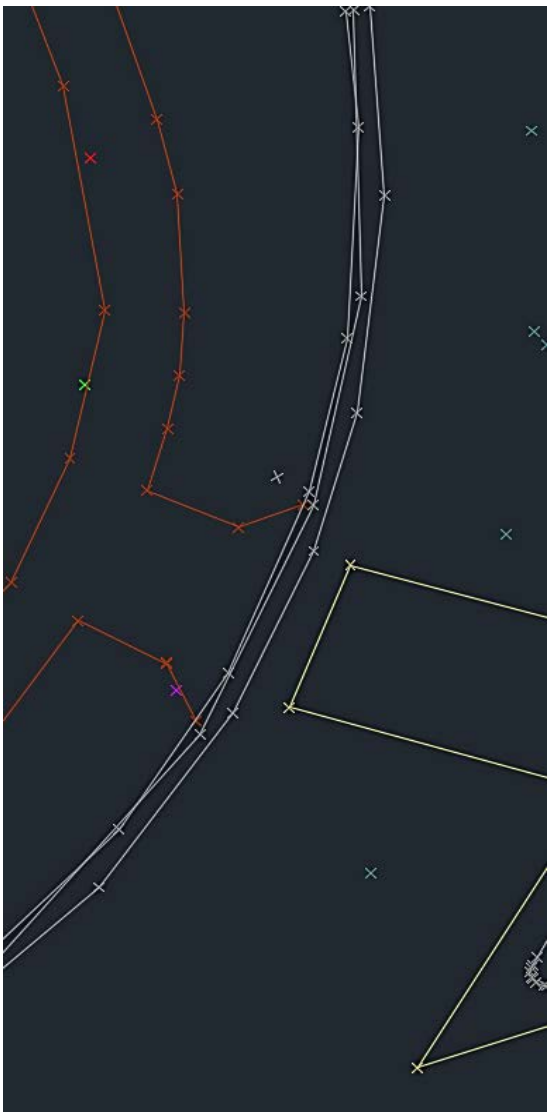

Figure 2: Incorrect Point Collection

3.07 Surface Triangulation Technique

Figures 6 and 7 show correct breakline and boundary definition. Figures 3 and 4 show the triangulations with only the points in the definition and no breaklines or boundary. Without breaklines in the survey, thouands of individual edge swaps and triangle deletions may be required to achieve the same result. Moreover, the surveyor can apply curves to improve triangulation while reducing overcollection of points. In the correct examples, contours are generally more linear as triangulation is improved. Question how the model has been built if you encounter a lot of "z-shaped" contours.

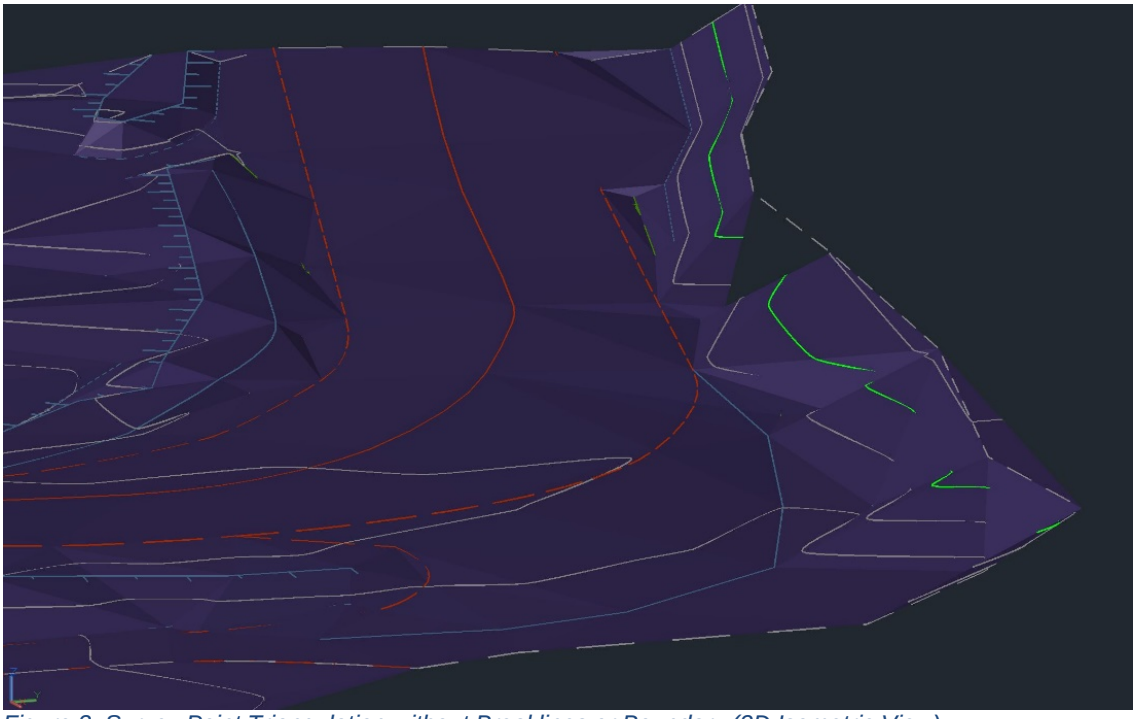

Figure 3: Survey Point Triangulation without Breaklines or Boundary (3D Isometric View)

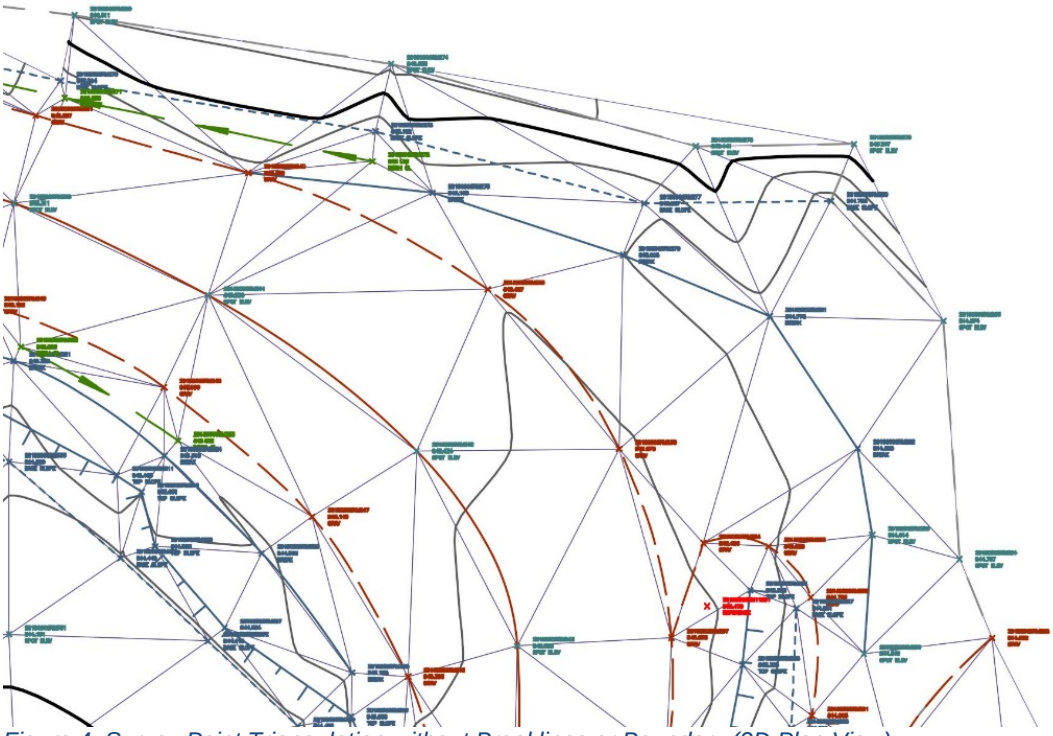

Figure 4: Survey Point Triangulation without Breaklines or Boundary (2D Plan View)

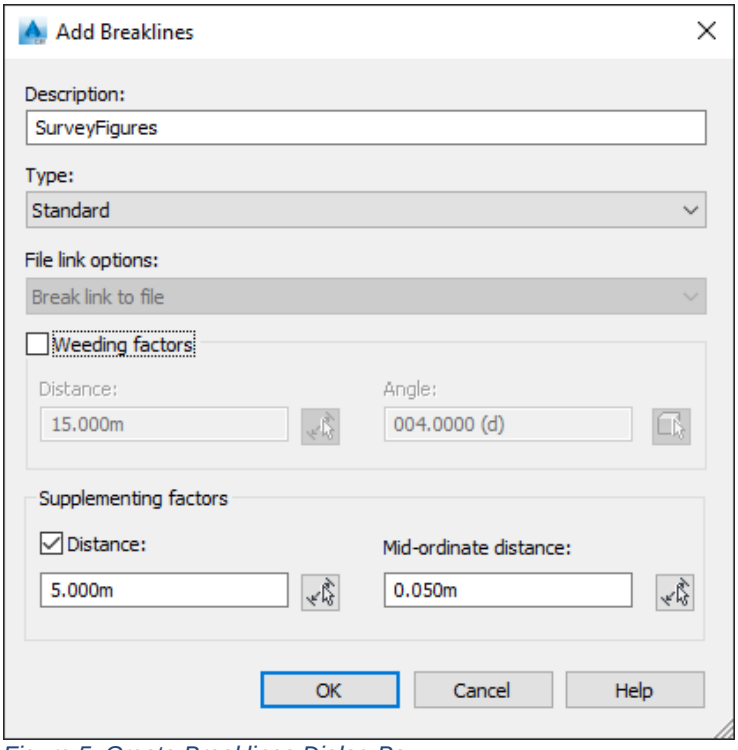

Figure 5: Create Breaklines Dialog Box

When adding breaklines manually in the Create Breaklines Dialog Box, mid-ordinate distance only applies when curved survey figures are being converted to breaklines. See Figure 5. A general rule is to use the required accuracy of the figures being curved as the distance you enter.

Supplementing factors can occasionally be used to densify the breaklines between figure vertices. This is particularly useful if curved breaklines are triangulating to linear breaklines, since the triangulation can be unbalanced.

It is good practice to compare the ground survey to redundant LiDAR collection to spot inconsistencies. Cross section views and surface-to-surface volume models can help to visualize and trap errors.

Minimize manual edits like “swap edge,” “delete line,” etc. by using the above techniques. It is rare that a model can’t be accurately defined by point groups, point files, breaklines and boundaries. The breakline (BZ) figure prefix is intended to help triangulation when a specific feature, such as toe or top of slope, is absent.

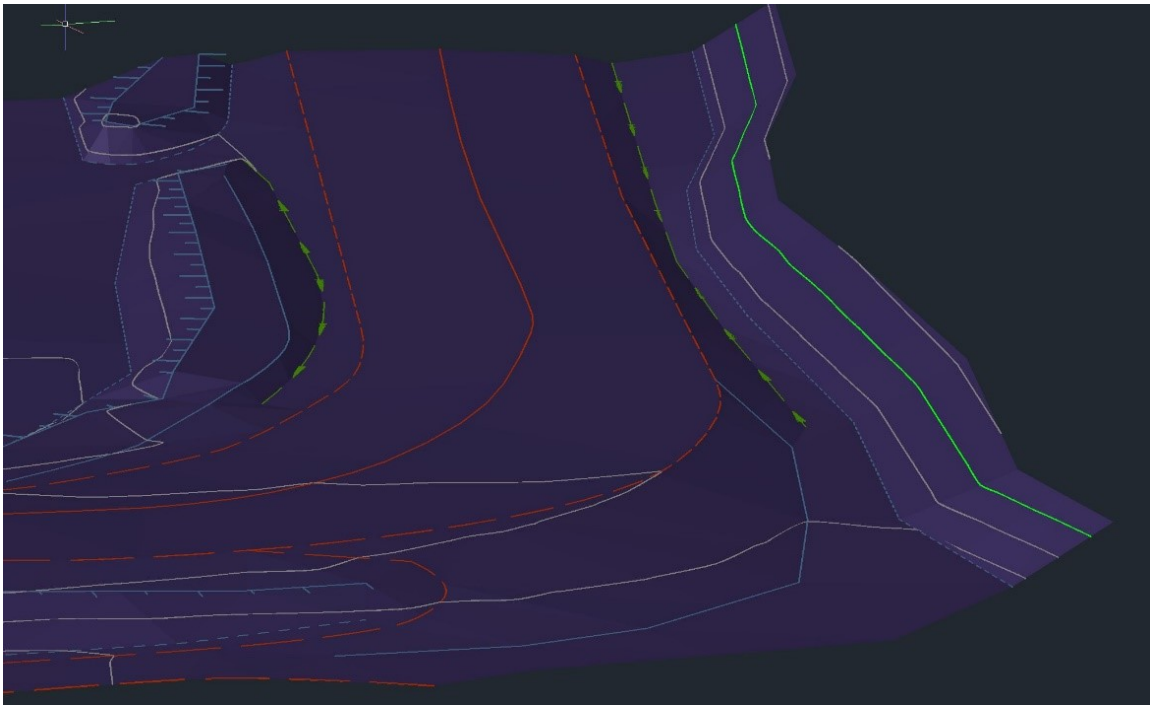

Figure 6: Survey Triangulation with Breaklines or Boundary (3D Isometric View)

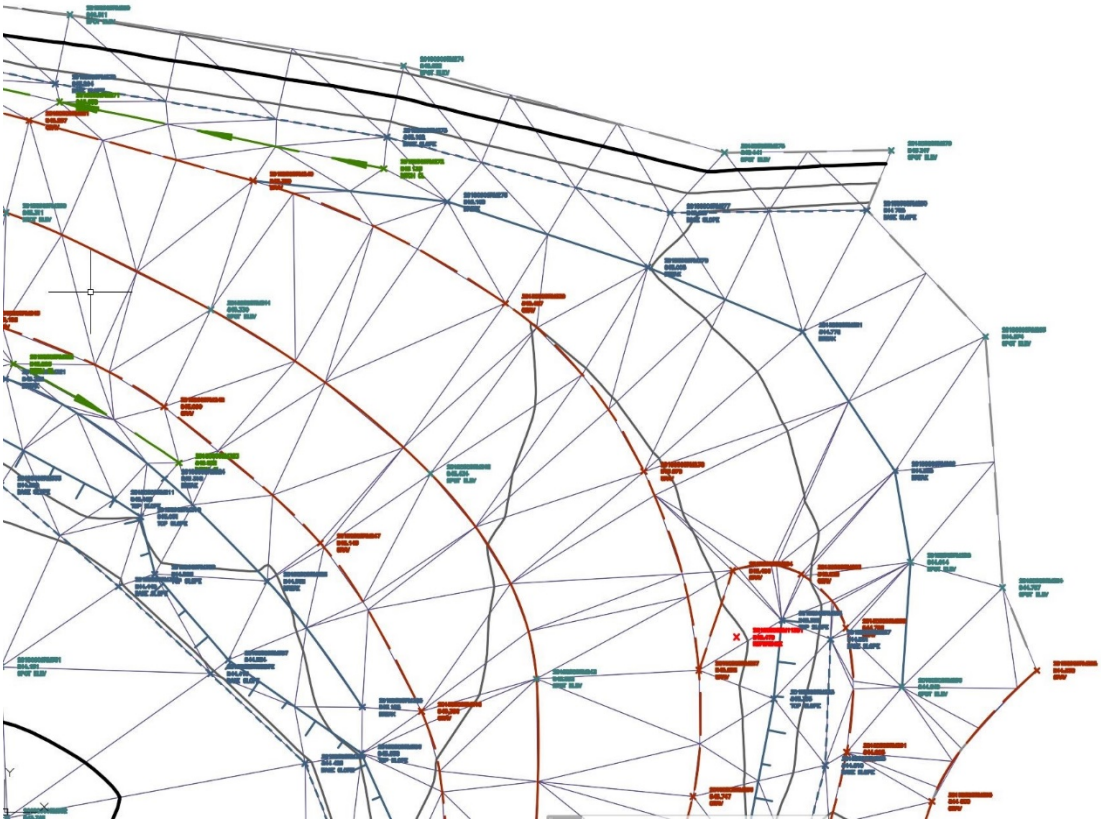

Figure 7: Survey Triangulation with Breaklines or Boundary (2D Plan View)

3.08 Standard Corridor Planimetric and Topographical Features

Supplement planimetric detail identified in the field with descriptive information (attributes) that applies to each feature. A comprehensive list of features and attributes required during ground survey can be found in Appendix E.

The Ministry representative can supply PDFs of the feature codes sorted by description upon request.

3.09 Cadastral Composite

Accurately represent all land title plans and Crown land information using enough permanent survey monumentation tied to the project grid. Include the plans and titles obtained for a project in the deliverable.

Draft each individual plan of a project in its native coordinate system and save it as a block within the drawing before it is rotated and combined with adjacent plans. Push any error in the individually drafted plans away from the highway right-of-way and note it on the drawing. The accuracy of the cadastre, relative to the project, must be high enough to ensure rights-of-way, encroachments, utility offsets, etc. are correct.

Make notes on the drawings in the event of any irregular cadastral occurrences including:

- Monuments found without any known cadastral relationship
- Suspected ancillary evidence (old rock walls, stone mounds, bearing trees, etc.)

GIS or other electronic cadastral composite overlays require approval from the Ministry representative, and their use must be stated clearly on all drawings, DWG or PDF.

The finished cadastral composite must show:

- Property lines with the proper legal description for all lots and easements. E.g. lot number, block, PID, etc.
- District lot lines, section lines, township lines, etc.
- Mineral claims and numbers
- First Nations Reserve boundaries, including internal subdivisions
- City, regional, and/or provincial boundaries
- Right-of-way boundaries for gas, hydro, highway, railroads, etc.
- Easements
- All legal plan numbers
- Agricultural Land Reserve parcels and boundaries with labels

3.10 Underground Utilities

The Ministry representative will determine the level of underground utility location required for each assignment. Regardless of the identified quality level, complete a BC One Call request for each assignment. Shaw Cable and Pacific Northern Gas (PNG) are not part of the BC One Call service and must be contacted individually if their infrastructure could be located within the project area.

Underground utility locations are defined by four distinct levels of quality:

- QL-D: The most basic level of information for utility locations, coming solely from existing utility records or verbal recollections. QL-D is useful primarily for project planning and route selection activities.
- QL-C: Involves surveying visible above ground utility facilities (e.g. manholes, valve boxes, etc.) with the option to correlate this information with existing utility records (QL-D

information). Measure storm and sanitary manhole inverts as part of this process if requested by the Ministry.

- QL-B: Uses appropriate geophysical equipment and methods to determine the physical existence, horizontal location, and depths of virtually all subsurface utilities within a project's limits.
- QL-A: Exposing utilities, typically by hand or hydro-vacuuming. This process is also known as "daylighting" and is the highest level of accuracy presently available.

All field marking should meet industry standards:

- Red – Electrical systems
- Yellow – Liquid and petroleum gas systems
- Orange – Telecom systems
- Blue – Water systems
- Green – Waste water systems

Survey accuracy when collecting all sub-surface evidence should meet the requirements of urban detail shown in Table 2.

When completing a QL-B and recording depths of the infrastructure, the depths must be used with caution. Depending on the technology being used and the composition of the ground, the stated depths may not be accurate. The locators should be able to provide a level of confidence of the recorded depths that should be included in the project notes.

State the level of quality on all plan drawings.

Refer to Section 6 - Quality Management.

3.11 Pictures

During a survey, take pictures of the site as well as objects or features that may require further explanation.

File sizes of high resolution images from camera phones and digital cameras are becoming an issue. Reduce picture file sizes to less than 500 KB to limit the deliverable size.

Within Civil 3D, it is possible to link text to an image with a relative path. The Ministry encourages implementing this feature into the digital base plans to provide a much better understanding of where a photo was taken and the direction the camera was facing. This can be very helpful in busy urban intersections with multiple signs on posts or complicated utility pole situations.

3.12 Deliverables

3.12.01 Hardcopy Deliverables

Hardcopy deliverables are not required but may be requested by the Ministry.

3.12.02 Electronic Data Deliverables

Deliver the completed project as per the B.C. Ministry of Transportation and Infrastructure Civil 3D terms of reference, unless otherwise specified by the Ministry representative. Download the terms of reference here or access them through the documentation macro on the EngTools ribbon of Civil 3D.

All collected survey data must be made available to the Ministry on request.

See also Section 7.09 – Survey Project Delivery & Report.

4 Site Plans

4.01 General

Prepare base site plans for all:

- River and major creek crossings
- Highway and road crossings where structures will be required
- Railway crossings
- Bridge alterations or relocations
- Major intersections

The survey contract terms of reference or the Ministry representative may define specific project limits for site plans.

4.02 Bridge and Culvert Site Plans

Bridge and culvert site plans contain special requirements to satisfy environmental and hydrology concerns, in addition to roadway and structural design objectives. Environmental and hydrology specialists are often involved during the early stages of the design process. These specialists may flag areas of interest or suggest survey limits to benefit their tasks. The Ministry representative will share these requests.

Reference: BC Supplement to TAC - Section 1000 - Hydraulics Chapter
Sample: Example Bridge Site Plan AutoCAD Project

Typical Requirements

Survey the creek or river 150 m upstream and downstream or 10 times the width of the body of water (whichever is greater). The Ministry representative may adjust these limits at the request of hydrology specialists. Survey up to the top of bank or one shot above the high water mark to adequately capture the creek or river channel and surrounding area.

Follow a cross section pattern with point collection. The spacing will depend on the shape of a river or stream. Maximum spacing is 10 m with closer spacing near deflection points.

In water details, include the thalweg (deepest part of body of water) to the edge of water. Additional shots may be required depending on the size of body of water to ensure the creek channel is captured as accurately as possible. Represent streamflow direction on the base plan.

Survey the road at the crossing 150 m up and down the road right-of-way. Consider the shape of the road when determining where to end the road limits. Carry the road survey through any horizontal or vertical curves and end on a tangent, encompassing the full right-of-way width.

Document other areas of interest, including:

- Any large features producing scour. Note and tie them where possible
- Bridge details, such as abutments, decks, joints, piles, girders, etc.
- The lowest point of the underside of a bridge (to calculate clearances)
- Any tributaries to the main channel
- Size and condition of any rip rap
- Date when the edge of water was picked up
- Types and descriptions of vegetation

4.02.02 High Water Mark

Look for these indicators when identifying the high water mark:

- Top of bank, or wetted perimeter, defined as a change in vegetation (> 2 years old) from bare ground with no trees to vegetated ground, etc.
- A topographic break from vertical to flat floodplain, in cases where the floodplain is beyond the vertical break position
- A topographic break from steep bank to a gentler slope
- The highest elevation where no fine woody debris (needles, leaves, cones, or seeds) occurs
- A change in texture of deposited sediment (e.g. from clay to sand, or sand to pebbles, or boulders to pebbles)

4.02.03 Hydrographic Surveys

In some cases, you may use special hydrographic equipment to conduct surveys in larger bodies of water. Submit a proposal outlining methodologies and procedures to the Ministry representative for review and approval. Automated data collection methods are required in most scenarios.

4.02.04 Other Considerations

Minimize disturbance to the body of water. Conduct research to ensure the survey is conducted while fish or aquatic life are not spawning or while there is moderate to low impact on the body of water.

Wear proper personal protective equipment while working around water. Ensure employees have safe work plans for working near and in the water. Swift water courses are readily available online. In some circumstances, a water survey may require trained water experts to be present to ensure worker safety. Surveyors are responsible for decisions regarding safety and must liaise with the Ministry if the work is deemed too dangerous.

4.02.05 Deliverables

Deliverables include a standard Ministry Civil 3D deliverable, as per terms of reference, as well as:

- Creek or river channel profile at a 1:250 or 1:500 scale
- Creek or river channel cross sections at a 1:250 scale
- GeoTiff of surface for use in HECRAS or other hydrographic software. This will be in the same coordinate system as the project (Local or UTM).

The Ministry representative may request additional deliverables and will notify you prior to the start of fieldwork.

4.03 Railroad Underpass/Overpass Site Plans

If there are going to be any impacts to railroad infrastructure, all surveys must satisfy the railway's survey and design requirements. Discuss the level of detail required with the Ministry representative at the project initiation.

Obtain permission from the appropriate railroad company before beginning any work in railroad right-of-way corridors.

Reference: BC Supplement to TAC - Section 1110 - Railway Crossings & Utility Chapter

4.03.01 Typical Requirements

If the project affects the railroad in any way, survey the entire rail right-of-way for a minimum of 400 m on each side of the highway crossing. Additional width may be required to capture any obstacles such as hedges, trees, etc. within rail sight lines. Survey the entire road right-of-way for a minimum of 100 m on each side of the crossing.

If the project does not affect the railroad, but still needs to include the railroad on the base plan, then the entire rail right-of-way must be surveyed for 100 m on each side of the highway crossing.

Capture all railway infrastructure details, including mileage posts, utilities, switches, frogs, lights, etc. Include the top of each rail at 20 m intervals on tangents and 10 m intervals on curves with a vertical accuracy of 2 cm. Take shots to define ballast as per TAC specifications along the full length of the corridor.

The rest of the base plan should follow everything outlined in Section 3 – General Survey Requirements.

4.03.02 Deliverables

Deliverables include a standard Ministry Civil 3D project, as per terms of reference, as well as:

- Rail profile (top of low rail) at a minimum scale of 1:5000 Horizontal and 1:250 Vertical
- Typical road cross section at a minimum scale of 1:200
- Road profile at a minimum scale of 1:2000 Horizontal and 1:200 Vertical
- Crossing protection detail
- General notes:
    - Project datum
    - Road surface type
    - Crossing surface type
    - Posted vehicle speed
    - Railway subdivision and mileage (in title block)

5 Other Surveys

5.01 Monitoring (Slope Stability/Settlement/Structures)

Long term monitoring surveys require a sensible approach to collecting the information required to derive the differences between one set of monitoring data and the next. A thorough understanding of survey methodology is required to ensure reliable results. Provide documentation outlining the proposed methodology, schedule and procedures to complete the survey deliverable.

Include a visual representation of the data along with a spreadsheet, unless specified otherwise. For example, include graphs showing movement over time or a deformation model showing the differences between two surfaces.

5.02 Gravel Pits/Piles and Volume Calculations

5.02.01 Gravel Pit Control

Use a minimum of three control points located outside of the working area. One control point must be a primary control point as per Section 2.05 - Primary/Project Control Point.

5.02.02 Gravel Pit Survey Requirements

Provide survey detail as defined in Section 3 - General Survey Requirements. The survey must provide enough detail to define the gravel pit for volume analysis and pit development.

5.02.03 Gravel Pit Survey Processing/Deliverables

Provide the following:

- A logical interpolation of the pit floor if it is inaccessible due to a pile placement
- Civil 3D drawings (for plans production; drawings must include contours and volumes)
- Calculated volume reports

5.02.04 Gravel Pile Survey Requirements

Survey the pit base before gravel piles have been crushed and placed, if possible.

Provide enough detail of the gravel pit to ensure that piles will not fall outside the pit perimeter.

Provide a closed base of pile survey figure and a closed offset base of pile survey figure (survey information is required beyond the base of pile).

Classify the aggregate type and size (25 mm, 75 mm, SGSB etc.).

Provide enough detail to accurately define the pile and the base of the pile.

If the base of the pile is inaccessible due to pile placement, provide a logical interpolation of the base of the pile.

6 Quality Management

The Ministry may request evidence as outlined below to ensure the project meets the specifications of this guide, the objectives outlined in the terms of reference, and/or an audit.

6.01 Project Overview

Summarize the task, location, and purpose of the work completed. Include the office and contact information of the persons who did the work and the names of any persons from the company's other offices and any sub consultants who contributed to the project.

6.02 Methodology Employed

Summarize how each component of the job was completed, including information as noted below to document good quality management.

- Project Survey Control
  - As per Section 2 - Control Surveys

- GNSS/GPS/RTK Survey
  - Perform periodic checks or ties to known control points. Supply edited data files to the Ministry with the Civil 3D deliverable. Raw data must be supplied upon request.

- Total Station Survey
  - Describe which total station instruments were used. Provide explanations as to how each segment of work was verified. Each setup must be verified with ties to known points.
  - Supply edited data files to the Ministry with the Civil 3D deliverable. Raw data must be supplied upon request.

- Underground Utility Information
  - Summarize the sources of information and overall confidence level. For example, describe areas and utilities where field locations were performed; mention areas where utility location is in doubt.
  - Identify sources of information
    - BC One Call
    - Contacts
    - GIS sources
    - As-built drawings

- Cadastral
  - Summarize legal plans used and property markers found. Confirm overall confidence level of cadastral representation. Describe areas where the confidence level may be questionable and could potentially become an issue during design and right-of-way acquisition.

- Aerial and Ground Based LiDAR
  - Document how LiDAR data was integrated into the project deliverables. Describe QC measures taken to ensure compatibility with ground survey data.
  - Submit map check report with the Civil 3D deliverable.

- Aerial Mapping

    - Provide an explanation of the source, date, and scale of photos used. Include the scale of mapping compilation and provide assurance that ground checking was completed and that the results were within specifications. The Ministry representative may request ground check records.

- Civil3D Project
    - Provide an explanation of quality management procedures
    - Refer to Section 7 – Civil 3D
    - Complete and submit the BC MoTI QC Checklist. See Appendix F.

- Miscellaneous Components
    - Other components that may be included are a list of equipment used, records of soundings, monitoring records, or other data related to the survey. Include a description of any application of atypical methods and the equipment used.
    - Provide records proving that equipment has been maintained and calibrated for the task.

7 Civil 3D

Now that the Ministry has moved to Autodesk Civil 3D, most of this section will refer to the Civil 3D terms of reference (TOR) document.

7.01 Project Folders and Organization

Please refer to the Civil 3D TOR, Section 1280.11.02 Project Folder Structure.

The current folder structure can be installed directly to the computer via the EngTools ribbon in Civil 3D.

7.02 Drawing and File Naming Conventions

Please refer to the Civil 3D TOR, Section 1280.09.08 and Section 1280.11.02.01.

7.03 Raw Data Files

These are unaltered files transferred directly from the survey equipment. While not mandatory to include in the project deliverable, they must be made available upon request.

7.04 Processed and Edited Data Files

Processed files are raw data files that have been altered after being transferred from the survey equipment.

Edited data files are generally processed files that are ready for import into the Civil 3D survey database. Follow the criteria below for these files:

- Point naming convention as per Section 3.06.02
- File extension of CSV, TXT, or XML, preferably
- Formatted in a P, N, E, Z, D, DTM, ATT1, ATT2, ATT3, ATT4, ATT5 format
- Stored in the appropriate folder within \DesignModel\00_SurveyBase\SourceData

7.05 Civil 3D Figure Prefix Database – Automatic Figure Generation

Civil 3D's automatic figure generation feature requires the use of a Figure Prefix Database. A document provided in the download package for Civil 3D outlines the steps required to set up Civil 3D to use the included BC MoTI Figure Prefix Database. If the database needs to be rebuilt for some reason, a document with the required information can be found via the Documentation macro on the EngTools ribbon.

7.06 Merging Data from Different Sources

Refer to the Civil 3D TOR, Section 1280.09.07 Merging LiDAR and GPS/TS Data.

7.07 Surfaces

Refer to the Civil 3D terms of reference, Section 1280.09.09 Surface Modeling. This section provides some information related to the creation of surfaces in Civil 3D.

7.07.01 Surface Editing

Creating an accurate surface model requires special care and attention. Sections 3.06.04 and 3.07 outline the importance of breaklines and proper point collection in the field. While good ground survey lays the foundation, surface quality must be confirmed before delivery. Observing the surface in Object Viewer is a good way to obtain a 3D view of the surface model and makes deficiencies easier to notice. Different modelling views can be used if a triangle-based Surface Style is used. Adjusting the contour interval can sometimes point out anomalies in a surface model. Cutting temporary cross sections along an alignment is another method of checking the accuracy of the surface.

The following example illustrates the importance of good field work and inspection of the surface model. Figure 8 shows a simple gravel pile where the surface was created without any edits. Notice that the corner of the pile has been "cut off". In Figure 9 a swap edge was completed, and the results better reflect the true model of the pile. Look for these types of errors when tight curves and steep slopes are involved, such as gravel piles or ditches in intersections.

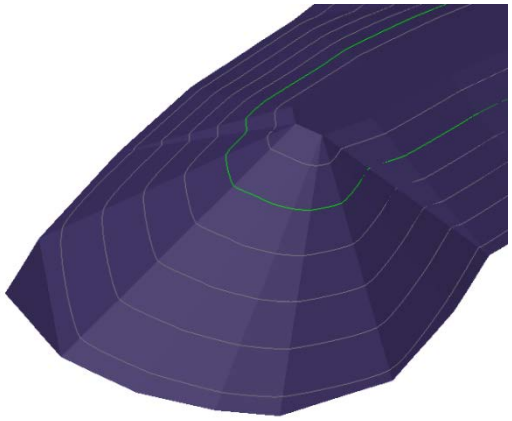

Figure 8: Unedited Surface Model

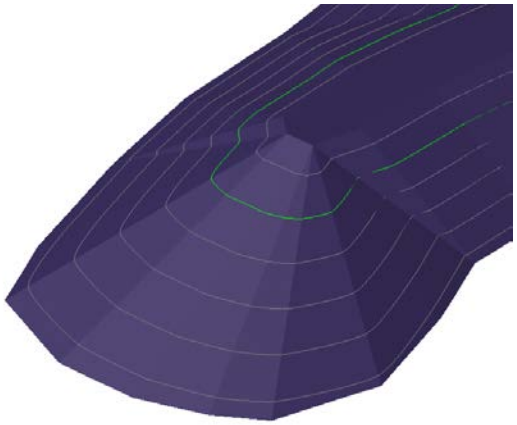

Figure 9: Surface Model with Swapped Edge

7.07.02 Bridges and Overhangs

Projects containing bridges or overhangs require an additional surface. Civil 3D cannot accurately produce a single surface that has two separate elevations for a single area. To accurately represent the project area, separate and remove the points from the existing surface and add them to a second surface.

7.08 Ministry Standard Codes, Tables, and the EngTools Ribbon

To fully use the functionality of Civil 3D, all survey codes had to be two characters in length. While most of the codes remained the same, some had to be changed. Use the Documentation macro on the EngTools ribbon in Civil3D to access an updated list of survey codes and their descriptions. Point Codes and Description Key Sets, accessed via the Documentation macro, provides a table showing the description keys and the attributes associated with each survey code.

The EngTools Ribbon contains several helpful macros. Some commonly used macros are:

- Grid Points – Used to create a cross with the Northing and Easting labels
- Culvert – Used only when a pipe network cannot be created
- Insert ECW – Used to insert multiple ECWs into a drawing
- Save Point Labels – Used to save point labels/rotations back to the survey database
- Xref Clip+ – Used for when multiple clipping boundaries are required

- Project Folders – Used to populate the BC MoTI folder structure used in project deliveries
- BCMAPCHECK – Used to compare multiple points to a surface

7.09 Survey Project Delivery and Report

Once the project is ready for submission to design, compress the entire folder structure into a zip file and submit it to the Ministry.

Include a survey report with all projects. This document should be one to five pages in length and include a summary of all the information outlined in Section 6 – Quality Management. Store the survey report in the Project Documentation folder.

7.10 Technical Support

For technical support, please contact the Geomatics Department at:

Email: moti.geomatics@gov.bc.ca

8 CAiCE

All CAiCE related content has been removed from the General Survey Guide. For information regarding CAiCE, please refer to the 2013 General Survey Guide. Please keep in mind that CAiCE is no longer supported and access to this information will be removed in the future.

9 Drawing Standards and Content

9.01 General

Include a title page, key plan, location map, legend, and plan drawings in all survey deliverables. Profile and cross sections drawings are not mandatory but may be requested by the Ministry for certain projects.

Reference: BC Supplement to TAC - Section 1200 - Contracts and Drawings Chapter
Sample: Civil 3D Sample Project (Coming Soon)
Drawing Production Sample

9.02 Title Page, Key Plan, Location Map, and Legend

Use the links below for information and examples regarding title pages, key plans, location maps, and legends.

Reference: BC Supplement to TAC - Section 1220.01 - Front Page
BC Supplement to TAC - Section 1220.02 - Key Plan
BC Supplement to TAC - Section 1220.03 - Legend
Sample: Sample Plan - Figure 1220.A, B, & C

9.03 Alignments

The Ministry representative may request a horizontal alignment. The alignment may be generated from several sources, as approved by the Ministry representative.

Reference: BC Supplement to TAC - Section 300 - Alignment Chapter
Sample: Sample Alignment - Figure 1220.D

9.04 Profiles and Sections

The Ministry representative may request a profile and sections drawing. These should include items as documented in the TAC Supplement.

Reference: BC Supplement to TAC - Section 1220.05 - Profiles
Sample: Sample Profile - Figure 1220.E

In addition, and as applicable, the following should be shown:

- Existing ground line with road edges and road name for all road crossings
- Pavement edges
- Lake/water course edges with current and high-water elevations (with date recorded). Include the time of day if the water level is affected by tide action.
- Swamps
- Railway track elevations
- Transmission line wire elevations
- Stationing at intersecting alignment crossing
- Benchmark and/or primary control points (vertical control point). Include descriptions and elevations.
- Culverts (with sizes, types and invert elevations)

9.05 Plans

Include items in plans as documented in the TAC Supplement.

Reference: BC Supplement to TAC - Section 1220.04 - Plan Plates
Sample: Sample Profile - Figure 1220.D

In addition, and as applicable, show the following on plans:

9.05.01 Drawing Scales

Determine drawing scales by the amount of drawing detail, size of project area, spacing and density of individual survey shots and/or purpose of the drawing. Multiple standard drawing scales may be required. PDF plots (drawn to scale) are required. The preferred drawing scale is 1:500.

9.05.02 Title Block

- Appropriate region labelling and shown on mini map of B.C.
- Plan title (Plan, Profile, etc.)
- Project name and location
- Stationing if applicable
- Drawn by, QA, QC initials and dates
- File Number (reserved for consultant job numbers)
- Project Number (Ministry supplied if one has been created)
- Region Number (1 for SCR, 2 for SIR, and 3 for NR)
- Revision Number (Starting at 0)

9.05.03 Grid markings

- Full grid required
- 200 m intervals for 1:1000
- 100 m intervals for 1:500

9.05.04 Control Points

- Primary control showing Point Name, Northing, Easting, and Elevation
- Secondary if requested by the Ministry representative

9.05.05 Control Table

A copy of the project's control table should be included on the Key Plan and/or the first page of the 100 series drawings. The preferred method is to copy and paste directly into the drawing from the Excel spreadsheet.

9.05.06 Caveats

Provide information about the compiled survey data on the plan drawings. There could be many caveats depending on the type of survey completed. The list below shows some of the information that may be required to be shown on the plan:

- Who completed the LiDAR and when it was flown
- Who completed the ground survey (including the surveyor's initials) and the date it was completed
- A note about the coordinate system and datum/geoid used in the survey
- Whether a BC One Call was completed

- The level of underground utility pick up, as out lined in Section 3.10
- A note about the cadastral composite. E.g.: GIS only or compiled from LTO plans.

Some caveat examples are show below:

“LIDAR COMPLETED BY TRSI AND WAS FLOWN JUNE 2006.”

“MOTI GROUND SURVEY COMPLETED BY SM & BJ ON AUGUST 20, 2018”

“ALL COORDINATES ARE LOCAL, BASED ON NAD83 (CSRS) DATUM WITH ELEVATIONS CALCULATED USING THE HT2.0 GEOID MODEL.”

“A BC ONE CALL WAS COMPLETED PRIOR TO THIS SURVEY. THE UTILITES PLOTTED ARE QL-B AND SHOULD BE USED ACCORDINGLY. “

“PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL IDENTIFY LOCATIONS OF ALL EXISTING UTILITIES AND ADVISE THE OWNER OF POTENTIAL CONFLICTS.”

“THE PROPERTY BOUNDARIES SHOWN ARE COMPILED FROM LTO PLANS AND A SUFFICIENT AMOUNT OF FIELD TIED LEGAL EVIDENCE. THEY SHOULD BE USED ACCORDINGLY.”

“THIS DRAWING AND DESIGN IS THE PROPERTY OF THE MINISTRY OF TRANSPORTATION & INFRASTRUCTURE, AND SHALL NOT BE USED, REUSED OR REPRODUCED WITHOUT THE CONSENT OF THE SAID COMPANY. THE MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE WILL NOT BE HELD RESPONSIBLE FOR THE IMPROPER OR UNAUTHORIZED USE OF THIS DRAWING AND DESIGN.”

Appendix A – H0224

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

NOTICE OF POSSIBLE ENTRY ON PROPERTY FOR HIGHWAY IMPROVEMENT INVESTIGATION PURPOSES

[name of recipient] [date]
[address of recipient]

Dear Sir or Madam:

Re: *Insert Project Name or Description of Highway Improvement*

This letter is to advise you that the Ministry of Transportation and Infrastructure is carrying out work in your area connected with planning, designing, or carrying out investigations related to the above highway improvement project.

As part of this work, crews [*employed/engaged/contracted*] by the Ministry and on behalf of the Ministry will be conducting [*insert specific nature of investigations: i.e., survey, sub-surface, soil tests, appraisal of land value*] investigations and it may be necessary to enter your property located at [*insert address*] and legally described as

Parcel Identifier(s): [*insert PID#s*]
[*Insert Legal Descriptions(s)*]

for these purposes on or before [*insert date*].

Some clearing of vegetation and/or disturbance of your land may be necessary. Ministry staff have been instructed to contact all residents prior to entry and, if you wish, a supervisor will discuss plans with you or your representative on site. Care will be used to minimize damage and the site will be restored as close as reasonably possible to its original condition, but where restoration is not practical, compensation will be paid.

A copy of [*insert either "section 8 of the Transportation Act" or "section 9 of the Expropriation Act" as applicable*] which provides the Ministry with the authority to enter on property for the above purposes is attached for your reference.

Should you have any questions, please contact:
[Contact Name]
[Contact Title]
[Contact phone number(s)]

Sincerely,
[Name of sender]
[Title of sender]

[Enclosure/attachment if applicable]

This section to be filled out after work referenced on Page 1 is complete

NOTICE OF COMPLETION OF HIGHWAY IMPROVEMENT INVESTIGATION WORK

Date [current date]

Further to the letter on the reverse of this page, dated [date of letter],
I wish to advise you that the Ministry of Transportation and Infrastructure has now completed its [*insert specific nature of investigations: i.e., survey, sub-surface, soil tests, appraisal of land value*] work on your property.

Sincerely,

Instructions for Use of Form H0224 - Notice of Possible Entry on Property for Highway Improvement Investigation Purposes

Form H0224 is to be completed for work potentially requiring entry onto private property. Section 8 of the *Transportation Act* authorizes the minister to enter on land without consent for the purposes of carrying out work connected with planning or designing a provincial public undertaking. Where the land will likely be expropriated by MoTI, the *Expropriation Act* authorizes entry on land, either before or after service of an expropriation order, for the purposes of making surveys, inspections, examinations, soil tests or doing other things necessary to determine the location of the proposed works or the description of the land or for completing an appraisal of the value of the land (s. 9 EA).

A copy of the completed form is to be placed on file and a copy is to be provided to the property owner.

Upon completion of the work, the back page of Form H0224 is to be completed by the person who has issued the original Form H0224. A copy is to be placed on file and a copy provided to the property owner.

Responsibility for the initiation of Form H0224 rests with Project Managers. Ownership of Form H0224 lies with Properties and Land Management Branch and any concerns about the Form should be directed to that Branch.

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE POLICY

SUBJECT **RIGHT OF ENTRY ONTO PRIVATE LAND**

Approved By:	ADM - Highways Operations
Initiating Director:	Director, Properties
Manager/Supervisor:	Chief Property Agent
Working Contact:	Manager, Property Services

PURPOSE

1. To prohibit unauthorized entry upon private property by Ministry personnel and those acting on behalf of the Ministry.

2. To clearly state the prohibition against entry upon private property without written authorization and the liability for consequences of the offender.

It is incumbent on all Ministry personnel, and those acting on behalf of the Ministry, to treat owners of property who may be affected by any Ministry project in a fair, equitable and competent manner.

SCOPE

This policy applies to all Ministry activities in which trespass upon private property could occur.

Entry

The authority provided under section 8 of the *Transportation Act* and section 9 of the *Expropriation Act* to enter onto private lands for limited purposes, must be exercised with full respect for the rights of the land owner; in addition:

- Ministry staff, and those acting on behalf of the Ministry, will provide landowners with written notice prior to entry onto their property.
- Written notice will be provided for each task requiring entry (e.g. design survey, geotechnical investigation, property survey),
- Written notice will be provided at the conclusion of each task requiring entry (e.g. design survey, geotechnical investigation, property survey).

Note that section 9 of the *Expropriation Act* may only be used where the land or an interest in the land is intended to be expropriation.

Trespass

1. Entry onto private land without the consent of the owner may be granted by the Minister or delegate (for the purposes of s. 8 *Transportation Act*, this means Regional Directors, District Managers, Transportation Manager Project Management, Director Field Services, Manager Engineering) for specific purposes as authorized under the following legislation:

- Expropriation Act (Section 9 (1))
- Transportation Act (Sections 8(2)(d))

  [Note: Contact Legal Services Branch with respect to a proposed entry under section 16 of the *Transportation Act* (entry where owner fails to carry out remedial work)].

2. Entry onto private property without written consent from the owner or authorization in accordance with policy statement 1 of this Policy (or under other express authority such as that provided to a surveyor under s. 59.1 of the *Land Surveyors Act*) is a trespass and will not be condoned by the Ministry.

3. Ministry personnel, and those acting on behalf of the Ministry, involved in a trespass situation will:
   - terminate the trespass immediately upon becoming aware of it and
   - advise their Property Services Manager and Project Manager at the earliest opportunity**.**

4. Consequences - Ministry personnel and those acting on behalf of the Ministry involved in a trespass situation will be held responsible for their actions with respect to trespass.

REFERENCES

Legislation:

Expropriation Act

- Section 9 (1)

Transportation Act

- Sections 8(2)(d)

Ministry Form:

H0224 – Notice of Possible Entry on Property for Highway Improvement Investigation Purposes and Notice of Completion of Highway Improvement Investigation Work

Appendix B – Form H0461X

WORK ORDER

Ministry of Transportation and Infrastructure

CONTRACT IDENTIFICATION NUMBER
356 CS XXX

The Contractor:

.

Phone:
Fax:
Contact:

Shall:

Complete survey assignments on an “as and when required” basis as described on form H0461a, in contract ID# 356CSXXX. All service requests under this contract shall be under the direction of the Ministry Representative identified in the contract. The Consultant shall not perform services as requested by any other Ministry Representative unless the Consultant receives prior approval from the Ministry Representative identified in the contract.

Future individual works/services schedules will be assigned as separate work orders on this form.

Work Assignment:

Scope – Terms of Reference:

Schedule:

Approved Disbursements:

Estimated Costs for this Assignment:_____ _____ ___

Contractor	Ministry Official
Initials	Initials

Appendix C – Survey Control Table

Date: July 24, 2018			**Origin:** GCM 80C026 confirmed with NRCAN PPP Solution on TACK12								
Project: MoTI Sample Control Table			**Tack Point:** TACK12		**ACSF:** 0.999790 (6 places)						
Horizontal Datum: UTM Z10 NAD 83 CSRS			**Vertical Datum:** *See Notes								
Point ID	**Local**		**Orthometric Height**		**UTM**		**Ellipsoidal Height**	**C.S.F.**	**Class**	**Type**	
	Northing	**Easting**	**CGG2013a**	**HT2_0**	**Northing**	**Easting**					
80C026					6204094.507	649042.531	646.886	0.999771	Origin	GCM	
GEORGE-08	195689.472	660115.569	793.230	793.221	6195690.085	660114.615	778.574	0.999793	Corridor	Mon	
RD237-08	196885.230	657636.335	715.553	715.553	6196885.591	657635.902	700.932	0.999795	Corridor	Mon	
RICH-08	200711.962	653788.005	743.655	743.671	6200711.520	653788.380	729.100	0.999776	Corridor	Mon	
SM12-08	194917.085	661371.622	801.341	801.330	6194917.860	661370.405	786.667	0.999796	Corridor	Mon	
TACK-12	198608.002	655575.954	688.509	688.520	6198608.002	655575.954	673.918	0.999791	Corridor	Rebar	
G1800-15	194246.177	661955.054	797.006	796.995	6194247.093	661953.714	782.324		Project	Conc. Nail	
G1801-15	194643.924	661610.080	798.736	798.724	6194644.756	661608.813	784.058		Project	Conc. Nail	
K1802-15	195249.397	660732.788	802.045	802.035	6195250.102	660731.705	787.380		Project	Rebar	
K1803-15	195499.619	660295.267	796.563	796.554	6195500.272	660294.276	781.905		Project	Rebar	
P1789-18	199512.933	654745.914	698.566	698.581					Project	8" Spike	
P1788-18	199982.974	654388.334	726.473	726.489					Project	8" Spike	
P1787-18	200378.139	654087.753	739.325	739.341					Project	Rebar	

All local coordinates are derived by first scaling from the Tack Point and then removing the millionth digit from the Northing

Notes:

* The CGG2013a Geoid uses the CGVD2013 vertical datum and the HT2_0 Geoid uses the CGVD28 vertical datum
* Corridor control can be derived from robust network adjustments using sources such as Mascot, active, and/or PPP for valid absolute accuracies.
* Project control originates from a corridor point and closes to a network confined within the specific project to provide survey grade relative accuracies.
* "Name" Static Brass Cap Monuments-Year. "G" Static Tag #-year. "K" Multi Epoch RTK. "T"Closed Total Station Traverse. "S" Total Station Secondary

Appendix D – UAS100 Form

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

AUTHORIZATION TO COMPLETE UAS OPERATIONS WITHIN PRIVATE PROPERTY

Address _____

I, _____ authorize the Ministry of Transportation & Infrastructure to complete unmanned aerial systems (UAS) operations within my property. I acknowledge the UAS may fly over structures and other personal property.

As per Transport Canada Regulations, the Ministry's pilot in charge (PIC) has notified me of the operational details. This includes:

1. The UAS being used
2. The operational limits of the operation
3. The approximate flight times
4. Any risks associated with the operation

Signature: _____ Date: _____
Property Owner

Signature: _____ Date: _____
Pilot in Charge

Appendix E – Feature Codes & Attributes

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Abutment	BU	Y	Notes 1				
Abutment - Concrete	CA	Y	Notes 1				
Abutment - Wooden	AW	Y	Condition	Notes 1			
Active Flood Plain	AF	Y	Notes 1				
Aluminum Post	AP	N	Condition	Notes 1			
Anchor	AN	N	Dimensions	Notes 1			
Archaeology Site	AY	Y	Notes 1	Notes 2			
Area of Exclusion	AE	N	Notes 1				
Asphalt Curb	AC	Y	Notes 1				
Asphalt Milling	AM	Y	Notes 1				
Asphalt Pavement Cutting	AT	Y	Notes 1				
Asphalt Spillway	AS	N	Number				
Auger Hole	AH	N	Name	Notes 1			
Base of Stockpile	SK	Y	Notes 1				
Benchmark	BM	N	Name	Condition	Notes 1		
Berm in Cut or Fill	BE	Y	Notes 1				
Borehole	BT	N	Name	Notes 1			
Borrow	BV	Y	Notes 1				
Bottom of Curb	CF	Y	Notes 1				
Boulder	BO	N	Diameter	Notes 1			
Brace Pole	BY	N	Notes 1				
Brass Cap Monument	BC	N	Name	Notes 1			
Break in Ground-Line	BZ	Y	Notes 1				
Brick	BK	Y	Notes 1				
Bridge	BB	N	Notes 1				
Bridge Expansion Joint	BJ	N	Notes 1				
Bridge Parapet Wall	WB	N	Notes 1				
Building	BG	Y	Notes 1				
Building - Roof Line	BF	Y	Notes 1				
Building - Support Post	BP	Y	Notes 1				
Bush Line	BH	N	Notes 1				
Catch Basin - Existing	CB	N	Diameter	Type	Condition	Notes 1	
Catch Basin - Lawn	LB	N	Diameter	Type	Condition	Notes 1	

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Catch Basin / Manhole	CM	N	Diameter	Type	Condition	Notes 1	
Cattle Guard	CG	N	Notes 1				
Centerline - Existing	CL	Y	Notes 1				
Centerline - L-Line	LL	Y	Notes 1				
Change to Gravel	XG	Y	Notes 1				
Change to Original Ground	XO	Y	Notes 1				
Change to Riprap	XR	Y	Notes 1				
Change to Stripping	XS	Y	Notes 1				
Change to Type A	XA	Y	Notes 1				
Change to Type B	XB	Y	Notes 1				
Change to Type C	XC	Y	Notes 1				
Change to Type D	XD	Y	Notes 1				
Change to Waste	XW	Y	Notes 1				
Check Shot	CX	N	Name	Notes 1			
Clearing and Grubbing	GC	N	Notes 1				
Cobbles	EB	Y	Notes 1				
Compost Blanket	HZ	Y	Notes 1				
Concrete	CC	Y	Notes 1				
Concrete Median Barrier	MI	N	Notes 1				
Concrete Pad	CE	Y	Notes 1				
Concrete Pillar	CN	N	Diameter	Notes 1			
Concrete Roadside Barrier	RB	Y	Notes 1				
Control Monument - Geodetic	LM	N	Name	Condition	Notes 1		
Crosswalk	CW	Y	Type	Condition			
Crown of Road	CR	Y	Notes 1				
Culvert (Point)	CV	N	Diameter	Type	Condition	Performance	Notes 1
Culvert Inlet	CI	N	Diameter	Type	Condition	Performance	Notes 1
Culvert Kink	KK	N	Bend Angle	Notes 1			
Culvert Outlet	CO	N	Diameter	Type	Condition	Performance	Notes 1
Curb - Concrete	CU	Y	Notes 1				
Curb - Letdown	LE	Y	Notes 1				
Curb - Top	TU	Y	Notes 1				
Deadman	DM	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Deceleration Lane	LD	Y	Notes 1				
Decorative Boulder	DB	N	Diameter	Notes 1			
Decorative Tree	DT	N	Diameter	Notes 1			
Delineator Post	DO	N	Notes 1				
Dike, Dam, Levee, Flood Control	DK	N	Notes 1				
Direction Arrow	DA	Y	Notes 1				
Dominion Iron Post	DP	N	Condition	Notes 1			
Drain - Storm / Sewer	DS	N	Diameter	Notes 1			
Drainage Grate	DG	N	Dimensions	Location			
Drill Hole (Blasting)	LH	N	Name	Notes 1			
Driveway - Concrete	CD	Y	Notes 1				
Driveway - Gravel	GD	Y	Notes 1				
Driveway - Pavement	DV	Y	Notes 1				
Eave, Soffit or Overhang	EV	N	Notes 1				
Edge of Erosion / Washout	EE	Y	Notes 1				
Electrical Conduit	EC	N	Diameter	Notes 1			
Electrical Outlet	EO	N	Notes 1				
Electrical Pedestal	ED	N	Notes 1				
Electrical Vault	EL	N	Notes 1				
Erosion Control Mat	EM	N	Notes 1				
Fence	FE	N	Type	Condition	Notes 1		
Fence Post	FP	N	Notes 1				
Filler Cap	FC	N	Notes 1				
Fire Hydrant	FH	N	Shot Location	Notes 1			
Flag Pole	PF	N	Notes 1				
Flagging	FG	N	Color	Notes 1			
Flower Box	FB	Y	Notes 1				
Flume	FL	N	Notes 1				
Foundation	FN	Y	Notes 1				
Fuel / Gas Pump	FU	N	Notes 1				
Fuel Tank	FT	N	Type	Notes 1			
Garage	GG	Y	Notes 1				
Garden	GN	Y	Notes 1				

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Gas Main	GM	N	Notes 1				
Gas Valve	GV	N	Type	Notes 1			
Gate	GA	N	Type	Condition	Notes 1		
Geogrid	GO	Y	Notes 1				
Geotextile Cloth	FF	Y	Notes 1				
Gravel	GL	Y	Notes 1				
Gravel - BEF	EF	Y	Notes 1				
Gravel - Edge of Gravel	EG	Y	Notes 1				
Gravel - IGB	IG	Y	Notes 1				
Gravel - IGSB	IU	Y	Notes 1				
Gravel - OGB	OO	Y	Notes 1				
Gravel - OGSB	OU	Y	Notes 1				
Gravel - SGSB	GZ	Y	Notes 1				
Gravel - WGB	WG	Y	Notes 1				
Gravel Horizon	ZG	Y	Notes 1				
Ground - Original Material	OM	Y	Notes 1				
Ground Crack or Sawcut	GK	Y	Notes 1				
Guard Rail with Posts	GS	Y	Notes 1				
Gutter	GU	Y	Notes 1				
Guy Pole - Power	GE	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Guy Pole - Power / Telephone	GY	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Guy Pole - Telephone	GT	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Guy Wire	GW	N	Notes 1				
Hedge Line	HG	N	Notes 1				
High Tension Pole	HV	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
High Tension Tower	HT	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Hog Fuel	HF	N	Notes 1				
House	HO	Y	Notes 1				
Hub - Detail / Traverse Hub	DH	N	Name	Notes 1			
Hydro Seeding	HY	Y	Notes 1				
Ice	IC	N	Notes 1				
Iron Pin - Capped	CP	N	Condition	Notes 1			
Iron Pin - Standard	IP	N	Condition	Notes 1			

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Iron Post - Angle Iron	AI	N	Condition	Notes 1			
Irrigation - Junction Box	IJ	N	Notes 1				
Irrigation - Pipeline	IR	N	Diameter	Depth	Notes 1		
Irrigation - Sprinkler Head	IH	N	Notes 1				
Island	IL	N	Notes 1				
Junction Box	JB	N	Type	Dimensions	Notes 1		
Lagoon	LG	Y	Notes 1				
Lamp Standard	LA	N	Notes 1				
Lawn	LW	Y	Notes 1				
Lead Plug	LP	N	Condition	Notes 1			
Lock Block Wall	LK	N	Notes 1				
Log Jam	LJ	N	Notes 1				
Mailbox	MB	N	Address	Condition			
Manhole	MH	N	Diameter	Type	Condition	Notes 1	
Manhole - Power	ME	N	Diameter	Type	Condition	Notes 1	
Manhole - Sanitary or Storm Cleanout	MY	N	Diameter	Type	Condition	Notes 1	
Manhole - Sanitary Sewer	MX	N	Diameter	Type	Condition	Notes 1	
Manhole - Storm Sewer	MC	N	Diameter	Type	Condition	Notes 1	
Manhole - Telephone	MT	N	Diameter	Type	Condition	Notes 1	
Manhole - Unknown	MU	N	Diameter	Type	Condition	Notes 1	
Manhole - Vault	MV	N	Diameter	Type	Condition	Notes 1	
Manhole - Water	MO	N	Diameter	Type	Condition	Notes 1	
Manhole/Catch Basin - Drywell	DW	N	Diameter	Type	Condition	Notes 1	
Marsh / Swamp	MS	Y	Notes 1				
Material/Density Test Locations	TM	N	Elevation	Offset	Station		
Meter - Service Meter	SV	N	Type	Notes 1			
Meter - Water Meter	WM	N	Notes 1				
Miscellaneous - Line	ZL	N	Notes 1	Notes 2	Notes 3	Notes 4	Image #
Miscellaneous - Point	ZZ	N	Notes 1	Notes 2	Notes 3	Notes 4	Image #
Monitor Point (Horizontal, Vertical or H+V)	MR	N	Name	Type	Notes 1		
Monument - Concrete Post	MN	N	Condition	Notes 1			
Non-Standard Round Iron Post	IO	N	Condition	Notes 1			
Non-Standard Square Iron Post	IS	N	Condition	Notes 1			

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
OG Horizon	ZO	Y	Notes 1				
Oil Line	OL	N	Diameter	Depth	Notes 1		
Organic Soil / Peat	OR	Y	Notes 1				
Original Ground	OG	Y	Notes 1				
Outhouse	OH	Y	Notes 1				
Overbreak	OB	Y	Notes 1				
Overhang	OV	Y	Notes 1				
Park Bench/Table/Shelter or Bus Bench/Shelter	BX	N	Type	Notes 1			
Patio	PA	Y	Notes 1				
Pavement	PV	Y	Notes 1				
Pavement Crack	PK	Y	Notes 1				
Pavement Edge	EP	Y	Notes 1				
Pedestal - Utility	PD	N	Type	Condition	Notes 1		
Pier	PE	N	Notes 1				
Piezometer	PZ	N	Name	Notes 1			
Piling	PG	N	Notes 1				
Pipeline	PN	N	Diameter	Depth	Notes 1		
Pipeline - Cast Iron	CT	N	Diameter	Notes 1			
Pipeline - Corrugated Steel	CS	N	Diameter	Notes 1			
Pipeline - Plastic	PC	N	Diameter	Depth	Notes 1		
Pool - Swimming Pool	MP	Y	Notes 1				
Post - Guard Post	PO	N	Notes 1				
Post - Witness Post	WP	N	Name	Notes 1			
Post - Wooden Post	WN	N	Name	Notes 1			
Power / Telephone Pole	PT	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Power / Telephone Pole with Transformer	PH	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Power Pole	PP	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Power Pole with Transformer	PS	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Pump House	PU	Y	Notes 1				
Railway	RR	Y	Notes 1				
Railway - Top of Rail	RL	N	Notes 1				
Railway Ballast	BA	Y	Notes 1				
Reference Point	RP	N	Name	Type	Condition		

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Remeasure Gravel	KG	Y	Notes 1				
Remeasure Original Ground	KO	Y	Notes 1				
Remeasure Riprap	KR	Y	Notes 1				
Remeasure Stripping	KS	Y	Notes 1				
Remeasure Type A	KA	Y	Notes 1				
Remeasure Type B	KB	Y	Notes 1				
Remeasure Type C	KC	Y	Notes 1				
Remeasure Type D	KD	Y	Notes 1				
Remeasure Waste	KW	Y	Notes 1				
Rest Area	RA	Y	Notes 1				
Riparian Zone	RZ	N	Notes 1				
Riprap	RI	Y	Size	Notes 1			
Riprap Horizon	ZR	Y	Notes 1				
Road	RD	Y	Notes 1				
Road - Dirt Road	DR	Y	Notes 1				
Road - Edge of Travelled Road	ET	Y	Notes 1				
Road - Gravel	GR	Y	Notes 1				
Rock - Base of Rock	BR	Y	Notes 1				
Rock - Broken Rock	BN	Y	Notes 1				
Rock - Loose Rock	LR	Y	Notes 1				
Rock - Solid Rock	SR	Y	Notes 1				
Rock - Top of Rock	TR	Y	Notes 1				
Rock Anchor / Bolt	RN	N	Notes 1				
Rock Post Monument	RM	N	Condition	Notes 1			
Sand	SA	Y	Notes 1				
Sanitary Sewer Line	SU	N	Diameter	Depth	Notes 1		
Scarp	RC	Y	Notes 1				
Scour	RO	Y	Notes 1				
Seismic Profile Line	SQ	N	Notes 1				
Septic Drain Field	SX	Y	Notes 1				
Septic Tank	ST	N	Notes 1				
Settlement Plate (Pipe)	SP	N	Name	Notes 1			
Shoulder - Gravel Shoulder	SH	Y	Notes 1				

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Sidewalk / Walkway	SW	Y	Notes 1				
Sign - Commercial Sign	SC	N	Type	Notes 1	Notes 2	Notes 3	Image #
Sign - Marker	MK	N	Notes 1				
Sign - Overhead Sign	HS	N	Type	Notes 1	Notes 2	Notes 3	Image #
Sign - Road Sign - One Post	SI	N	Type	Notes 1	Notes 2	Notes 3	Image #
Signal - Traffic Signal	SN	N	Notes 1				
Slide, Sluff (Scarp) Line	SF	Y	Notes 1				
Slope - Base of Slope	BS	Y	Notes 1				
Slope - Top of Slope (Embankment)	TB	Y	Notes 1				
Slope Indicator	GI	N	Notes 1				
Sound Barrier / Wall	SB	Y	Notes 1				
Spot Elevation	SE	Y	Notes 1				
Sta. on Offset Line	OS	N	Name				
Staircase / Steps	SZ	Y	Notes 1				
Standpipe - Water Blowoff	SD	N	Notes 1				
Stop Bar Line	SO	Y	Notes 1				
Stripping	VS	Y	Notes 1				
Stripping Horizon	ZS	Y	Notes 1				
Sub Excavation	EX	Y	Notes 1				
Survey Stake	SS	Y	Notes 1				
Tack Coat	TK	N	Notes 1				
Talus Deposits	TD	Y	Notes 1				
Telephone Booth	PB	N	Notes 1				
Telephone Pole	TP	N	Wires 1	Wires 2	Pole/Grid ID	Notes 1	Image #
Tension Cracks	TN	Y	Notes 1				
Test Hole	TH	N	Name	Notes 1			
Test Pit	TT	N	Name				
Toe	TO	Y	Notes 1				
Traffic Counter	TA	N	Notes 1				
Traffic Signal Control Box	TX	N	Notes 1				
Trail	TI	Y	Notes 1				
Trash/Garbage Bin	HB	N	Notes 1				
Trash/Garbage Can	TC	N	Notes 1				

Alphabetical by Description

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Traverse PI	PI	N	Name				
Tree	TE	N	Trunk	Species	Drip Line		
Tree - Safety Hazard	TS	N	Notes 1				
Tree Line	TL	N	Notes 1				
Turf Reinforcement Mat	TF	N	Notes 1				
Type A Horizon	ZA	Y	Notes 1				
Type B Horizon	ZB	Y	Notes 1				
Type C Horizon	ZC	Y	Notes 1				
Type D Horizon	ZD	Y	Notes 1				
Underground Electrical Power	UE	N	Diameter	Depth	Notes 1		
Underground Electrical Transformer	UX	N	Notes 1				
Underground Fibre Optic	FO	N	Diameter	Depth	Notes 1		
Underground Gas Service Line	US	N	Diameter	Depth	Notes 1		
Underground Marker	UM	N	Type	Notes 1			
Underground Miscellaneous	UG	N	Diameter	Depth	Notes 1		
Underground Telephone	UT	N	Diameter	Depth	Notes 1		
Unmarked Measured Point	PM	N	Notes 1				
Urban Paintline	UW	Y	Notes 1				
Utility Kiosk	KI	N	Type	Dimensions	Notes 1		
Utility Pole	UP	N	Type	Condition			
Valve	VV	N	Type	Notes 1			
Valve - Air Release Valve	AR	N	Notes 1				
Valve - Water Valve	WV	N	Notes 1				
Vegetation	VN	N	Notes 1				
Vegetation - Orchard	OC	N	Notes 1				
Vent Pipe - Breather / Vent Pipe	VP	N	Dimensions	Notes 1			
Wall - Back of Wall	WA	Y	Notes 1				
Wall - Base of Wall	BW	Y	Notes 1				
Wall - Bin Wall	BI	Y	Notes 1				
Wall - Face of Wall	FW	Y	Notes 1				
Wall - Head Wall	HD	Y	Type	Notes 1			
Wall - Retaining Wall	RE	Y	Notes 1				
Wall - Top of Wall	TW	Y	Notes 1				

Description	Code	DTM	ATT1	ATT2	ATT3	ATT4	ATT5
Wall - Wing Wall	WW	Y	Notes 1				
Waste	WE	Y	Notes 1				
Waste Horizon	ZW	Y	Notes 1				
Water - Creek, Stream Center - Narrow Waters	CK	Y	Notes 1				
Water - Ditch Block	DD	N	Notes 1				
Water - Ditch Center	DC	Y	Notes 1				
Water - Ditch Edge	DE	Y	Notes 1				
Water - Edge of Water - Wider Waters	EW	Y	Notes 1				
Water - Estimated Water Table Elevation	ES	Y	Time	Notes 1			
Water - Extreme High Water Mark	EH	N	Notes 1				
Water - High Water Mark	HW	N	Notes 1				
Water - Measured Water Table Elevation	MW	Y	Time	Notes 1			
Water - Reservoir Tank	WT	N	Notes 1				
Water - Seepage	SG	Y	Notes 1				
Water - Stream	SM	Y	Notes 1				
Water - Subdrains	DZ	N	Notes 1				
Water - Water Main	WR	N	Notes 1				
Weigh Scale	WS	Y	Notes 1				
Well	WZ	N	Type	Notes 1			
Well - Observation Well	OW	N	Name	Notes 1			
White Line - Broken	BL	Y	Notes 1				
White Line - Solid	WL	Y	Notes 1				
Wire Height	WH	N	Notes 1				
Yellow Line - Double	DL	Y	Notes 1	Notes 2			
Yellow Line - Passing	YP	Y	Notes 1				
Yellow Line - Single	YL	Y	Notes 1				

Appendix F – BC MoTI QC Checklist

CIVIL3D SURVEY QUALITY CONTROL CHECKLIST

1.0 Project Details	
1.1 Project Name	
1.2 Civil3D Version	
1.3 Survey Organization	
1.4 Project Manager	
1.5 Phone/Email	
1.6 Name of File Delivered	
1.7 Date of File Delivered	

Ministry Reviewer	
Ministry Review Date	

2.0 Project Folder Structure	YES	NO	NA	MR	Comments
2.1 Project Folder Structure Compliant with BC MoTI Civil 3D TOR					
2.2 Survey Model Drawings Compliant with Naming Standards					
2.3 Production Drawings Compliant with Naming Standards					
2.4 Survey Database Included					
2.5 Survey Source Data Included in Correct Folders					
2.6 Survey Control Table					
2.6.1 In BC MoTI Format					
2.6.2 Correct Datum					
2.6.3 Correct Date					
2.6.4 Correct CSF (to 6 Places)					
2.6.5 Correct Project Name					
2.6.6 Correct Origin & Tack Point					
2.7 Sheet Set Manager (.dst)in Place for Production Drawings					
2.8 Project Transformation Document Completed					

3.0 EXSURF Drawings (LOG, SOG, COG)	YES	NO	NA	MR	Comments
3.1 Drawings use BC MoTI Template					
3.2 Surface Drawings Contain Points and Figures					
3.3 Surface Names Compliant with Naming Standards					
3.4 Surface is Complete and Correct (No Spikes, No Holes, etc)					
3.5 Data Shortcuts Created					
3.6 Point Files in Source Data (Eg. NEZ.xyz)					
3.7 BCMAPCHECK Completed					
3.8 Drawing Purged and Audited					

REVISION DATE: August 1, 2019

CIVIL3D SURVEY QUALITY CONTROL CHECKLIST

4.0 SURVBASE Drawings (LOG, SOG, COG)	YES	NO	NA	MR	Comments
4.1 Drawings use BC MoTI Template					
4.2 Xrefs are Relative and Attached/Overlaid Where Appropriate					
4.3 Correct Coordinate System with Transformation Parameters					
4.4 Point Groups Sorted and Updated Correctly					
4.5 Drawings Contain all Relevant Information					
4.6 Text & Symbols					
4.6.1 On Correct Layers					
4.6.2 Uses Correct Symbols					
4.6.3 Rotated and Easy to Read					
4.7 Control in Drawing Matches Control Table					
4.8 Drawing Purged and Audited					
4.9 AutoCAD 2D Drawings Created					
5.0 SURVPROP	**YES**	**NO**	**NA**	**MR**	**Comments**
5.1 Parcel Fabric Complete and Current					
5.2 Text					
5.2.1 Lots, Plans, PID's, etc…					
5.2.2 Correct Size					
5.2.3 Correct Layers					
5.2.4 Rotated & Easy to Read					
5.3 Individually Drafted Plans Stored as Blocks					
6.0 SURVUTIL	**YES**	**NO**	**NA**	**MR**	**Comments**
6.1 BC One Call Only					
6.2 Correct Linetypes and Layers Used					
6.3 Level of Detail Specified (eg. BCOneCall, GIS, etc.)					
6.4 Drawing Purged and Audited					
7.0 SURVORTH	**YES**	**NO**	**NA**	**MR**	**Comments**
7.1 Images are Scaled and Inserted Correctly					
7.2 Images are Xref'd as Relative and Attachment					
7.3 Drawing Purged and Audited					
8.0 SURVGEOM	**YES**	**NO**	**NA**	**MR**	**Comments**
8.1 Contains Alignments and Profiles					
8.2 Contains Viewframes					
8.3 Data Shortcuts Created and Names are MoTI Compliant					

CIVIL3D SURVEY QUALITY CONTROL CHECKLIST

9.0 SURVPLAN, SURVPROF, and SURVSECT Drawings	YES	NO	NA	MR	Comments
9.1 Data Shortcuts Referenced					
9.2 Scale Bar Inserted and Correct					
9.3 Grid Ticks MoTI Standard (Deleted if Obscured)					
9.4 North Arrow Orientated and Correct Size					
9.5 Direction to Nearest Community is Labelled					
9.6 Disclaimers and Notes are Relevant and Complete					
9.6.1 Field Survey Completed by…on (Date)					
9.6.2 LiDAR Flown by…on (Date)					
9.6.3 Datum…					
9.6.4 BC One Call…					
9.6.5 Prior to Construction…					
9.6.6 Property Boundaries Shown…					
9.7 Control Table is Inserted and MoTI Compliant					
9.8 Title Block					
9.8.1 Map Location & Region					
9.8.2 Plan/Profile/Section					
9.8.3 Title and Location					
9.8.4 Stationing					
9.8.5 File Number					
9.8.6 Project Number					
9.8.7 Region					
9.8.8 Drawing Number					
9.8.9 Revision Number					
9.8.10 Drawn.. Date…					
9.8.11 Viewport Scale Correct					
9.9 Match Lines Correspond to Correct Drawing Number					
9.10 Title Page					
9.10.1 Ministry Logo					
9.10.2 Legend					
9.10.3 Location/Key Map					
9.10.4 Drawing Index					
9.11 PDF's are Created					

CIVIL3D SURVEY QUALITY CONTROL CHECKLIST

Additional Comments

Ministry Use Only			
	YES	NO	NA
Does the submission accurately represent the project?	☐	☐	☐
Was a field level inspection required?	☐	☐	☐
Ministry Reviewer Sign Off			☐
By checking the following box, I hereby digitally sign off on the project quality control check list			☐

Print _____ Sign _____ Date _____

REVISION DATE: August 1, 2019