The Regional Municipality of Halton

SURVEY STANDARDS

Prepared by:
Technical & Design Services

Date:
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Version:
2.0

Abstract

This manual establishes the technical standards for land surveying deliverables required by Halton Region. It defines the specifications, accuracy requirements, and formatting guidelines for digital and hardcopy submissions, ensuring consistency and reliability in survey data. Adherence to these standards facilitates seamless integration with Halton Region's geospatial and engineering systems and ensures compliance with Halton CADD Standards. By following these guidelines, surveyors can produce deliverables that meet the region's expectations for quality, accuracy, and interoperability.

Disclaimer

This document serves as a reference for land surveying professionals, defining the technical standards required for compliance with respect to surveying for Halton Region and Halton CADD Standards. While every effort has been made to ensure accuracy and completeness, users are responsible for verifying compliance with all applicable laws, regulations, and professional standards. Halton Region assumes no liability for errors, omissions, or any consequences resulting from the application of this information.

Revision History – Survey Standard Manual

REV. NO.	ITEM CONTENT	RELEASE DATE	UPDATES BY
1.0	Standards & Procedures - Complete review & revision	March 2021	Survey Services
2.0	Document name change. New format. **New Sections added:** Introduction, Equipment, Datum Standard, Accuracy Standard, Survey CAD Standard, In-Construction Survey Capital Projects, As-Constructed Survey Capital Projects, As-Constructed Survey Development Projects, Deliverables	March 2025	Survey Services

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Industry and Halton Specific Acronyms

Acronym	Full Name
ABS	Acrylonitrile Butadiene Styrene Pipe
BM	Benchmark
CC	Cut Cross
CGVD 28:78	Canadian Geodetic Vertical Datum 1928 adjusted in 1978
CH	Conservation Halton
CL	Centerline
CP	Control Point
CPP	Concrete Pressure Pipe
CSP	Corrugated Steel Pipe
CSR	Control Station Report
CVCA	Credit Valley Conservation Authority
DBH	Diameter at Breast Height
DWG	AutoCAD Drawing format
E&C	Engineering and Construction
EMO	Engineering Management Office
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HDPE	High Density Polyethylene Pipe
IB	Iron Bar
IFC	Issued for Construction
IFT	Issued for Tender
LiDAR	Light Detection and Ranging
MAG	Mag Nail
NAD 83	North American Datum 1983
NW	Nail and Washer
OPSD	Ontario Provincial Standard Drawing
OPSS	Ontario Provincial Standard Specification
PDF	Portable Document Format
PI	Point of Intersection
PL	Property Line
PM	Project Manager
PVC	Polyvinyl Chloride Pipe
QA	Quality Assurance
QC	Quality Control
RFI	Request for Information
RFP	Request for Proposal
RFQ	Request for Quote
RFT	Request for Tender
RIB	Round Iron Bar
ROH	Region of Halton
ROW	Right of Way
RTK	Real Time Kinematic
RTN	Real Time Network
SIB	Standard Iron Bar
SSIB	Short Standard Iron Bar
UTM	Universal Transverse Mercator

1. Introduction

A topographic survey is typically conducted at the start of a project. It includes measurements of features and terrain, such as roads, buildings, vegetation, utilities, and services. This information is essential for designing, estimating, and constructing Halton infrastructure projects.

Purpose

This manual provides essential guidelines to ensure that survey work conducted for Halton Region is compliant, standardized, and consistent.

Scope

The Survey Standards Manual applies to all topographic data collected for Pre-Engineering, In-Construction, and As-Constructed survey work.

Authority

This manual was prepared by the Halton Survey Department for survey work conducted on Halton Region projects. All inquiries regarding this manual should be directed to the Supervisor of Technical & Design Services.

Public Relations

Survey crews working on regional projects must interact with the public respectfully. Concerns and information requests should be directed to the Project Ambassador and/or the Project Manager.

Planning

Planning ensures a streamlined workflow, meeting project timelines and budget constraints. A typical regional topographic survey may involve work in the following areas:

- Residential, collector, or arterial road rights-of-way
- Rail, hydro, gas, or other corridors (permissions required)
- Regional facilities
- Watercourses (major or minor)
- Private property (permissions required)
- Difficult-to-access areas

Topographic Survey Preparation

Preparation involves reviewing historical as-constructed documents, identifying underground infrastructure, preparing field files, assessing health and safety requirements, obtaining necessary permits, and notifying residents/property owners. Deliverables may include 2D/3D AutoCAD drawings, ASCII point files, underground infrastructure measurement spreadsheets, photographs, and Control Station Reports.

2. Health & Safety

Survey consultants must ensure compliance with all current policies, acts, and regulations related to health and safety.

Workplace Occupational Health & Safety

All survey work conducted for or by Halton Region must adhere to the Ontario Workplace Occupational Health and Safety Act and its regulations. This Act establishes the rights and responsibilities of all workplace parties and provides a legal framework for preventing injuries and illnesses.

Ontario Traffic Manual – Book 7

Survey work conducted within roadways must comply with the most recent version of the Ontario Traffic Manual – Book7 Temporary Conditions. The following documents may be required under this regulation:

- **TPP (Traffic Protection Plan)**
- **TCP (Traffic Control Plan)**

3. Equipment

Various types of survey equipment are accepted for use in Halton Region. Users must ensure all equipment is calibrated to the manufacturer's acceptable tolerance and be familiar with operational best practices and limitations of each equipment type used.

Total Stations

Manual and robotic total stations are standard optical-electronic instruments used for land surveying. They are typically paired with data collectors and used in conjunction with pole-mounted reflective prisms.

Levels

Levels are used to determine accurate elevations between physical points. Typically employed when establishing control or conducting elevation-critical work, they can be optical or digital and are used in conjunction with a graduated level rod.

GNSS/GPS

GNSS/GPS equipment is used to establish control points or collect topographic data. GPS receivers are typically paired with data collectors and mounted on a pole or tripod.

LiDAR Systems

LiDAR systems can supplement traditional topographic data acquisition methods. Care must be taken to ensure that features not visible to LiDAR are obtained through conventional methods.

- **Terrestrial LiDAR Scanning** – Typically mounted on a tripod.
- **Mobile LiDAR Scanning** – Typically mounted on a vehicle.
- **RPAS (Remote Piloted Aerial System) LiDAR Scanning** – Mounted on an unmanned aerial vehicle (UAV).

4. Datum Standard

Horizontal Datum

All spatial data collected and delivered by Halton Region internal surveyors or consultants shall be referenced to North American Datum 1983 (Original) [NAD83(Original)], using the 6-degree Universal Transverse Mercator (UTM) grid system, Zone 17 North.

Vertical Datum

Elevations shall be referenced to the Canadian Geodetic Vertical Datum (CGVD) 1928, adjusted in 1978 (CGVD28:78).

Scale Factor

An average ground-to-grid scale factor based on the Project Control Network, or an automatic scale-to-grid function, shall be used for all Halton Region surveys when collecting data with instruments that operate in ground distances but are occupying grid coordinates.

5. Accuracy Standard

Horizontal Accuracy

Project Control

GNSS repeatable solutions must be verified by Total Station stakeouts from any back sight orientation baseline:

- Distance variance: ±0.025 m
- Angle variance: ±0.025 m

Topographic & LiDAR Data

- **Hard Surfaces (relative to Project Control):**
  - Distance variance: ±0.025 m
  - Angle variance: ±0.025 m
- **Soft Surfaces (relative to Project Control):**
  - Distance variance: ±0.050 m
  - Angle variance: ±0.050 m

Vertical Accuracy

Project Control

Closure error for control level operations must fall within the following allowable misclosure limits:

Misclosure Criteria:

- 1st Order: $4(\sqrt{K})$
- 2nd Order: $8.4(\sqrt{K})$
- 3rd Order: $12(\sqrt{K})$

Example: For a 3 km level operation, the allowed closure error is:

- $12(\sqrt{3}) = 20.8$ mm
- If the closure error is 17 mm, it meets the 3rd Order criteria.

Topographic & LiDAR Data

- Hard Surfaces (relative to Project Control): ±0.025 m
- Soft Surfaces (relative to Project Control): ±0.050 m

6. Project Control Network

General

Every effort shall be made to establish accurate and permanent project control, referenced to the horizontal and vertical datum standards. This ensures survey data maintains alignment with its geographical position.

The project control network serves as the foundation for all projects. Control points within the network are relative to each other, forming the basis for pre-engineering data collection, construction layout, and as-constructed data throughout the project lifecycle.

Network Design

A series of control points shall be established at relatively equal distances along the length or perimeter of a project site to form a project control network. These points shall be placed within the municipal right-of-way or on municipal property. Control points shall be inter-visible and positioned in advantageous locations conducive to optical data collection.

Accepted types of permanent control point monumentation include, but are not limited to:

- RIB (Round Iron Bar) – 600mm length x 13mm diameter
- Mag Nail
- Cut Cross
- Brass Cap Monument (Shall not use published values; values must be established using GNSS/GPS)
- Other (Approval required from Halton Survey Department)

Control Point and Benchmark Numbering

The control point naming convention shall consist of the four-digit project number, followed by sequential numbering for all control points established within the project. Benchmarks shall follow the same convention but will include "BM" after the project number, followed by sequential lettering. If a project includes a phase letter/alpha designation, it shall not be included in the control point or benchmark numbering format.

Example – Control Point and Benchmark Numbering

All Control Points and Benchmarks for project PR1234 shall be numbered as follows:

- **Control Points:** PR1234 CPs start at 123401, 123402, ..., 1234100, etc.
- **Phase Control Points:** PR1234A CPs start at 123401, 123402, ..., 1234100, etc.
- **Benchmarks:** PR1234 BMs start at 1234BMA, 1234BMB, ..., 1234BMZ, etc.
- **Phase Benchmarks:** PR1234A BMs start at 1234BMA, 1234BMB, ..., 1234BMZ, etc.

Feature Codes

Feature codes are used to distinguish between control points and benchmarks within the project control network. The following feature codes shall be applied:

- **CP** – Control Points
- **BM** – Benchmarks

Horizontal Project Control

Horizontal control shall be established in accordance with the Horizontal Datum Standard and the Horizontal Accuracy Standard. All raw data and working files shall be retained for reference.

Establishing Horizontal Project Control

Horizontal Project Control shall be established using the following methods:

- GNSS RTN configured to the Horizontal Datum Standard to ensure consistency.
- The GNSS RTN base station with the shortest baseline to the project site shall be used.
- GNSS RTK may be used if the primary base point was established by a static survey post-processed solution or if GNSS RTN is configured to the Horizontal Datum Standard.
- GNSS RTK UHF baselines shall not exceed 2 km to maintain accuracy.
- Repeatable solutions shall be established using GNSS RTN/RTK time window averaging for each control point to ensure precision and reliability.
- Measures shall be taken to minimize random and systemic errors associated with RTN/RTK surveys.
- Published horizontal control monument values shall not be used; new values shall be established using the approved methods outlined above.

Vertical Project Control

Accurate vertical control shall be established in accordance with the Vertical Datum Standard and shall meet the Vertical Accuracy Standard. Project Control Networks created for regional projects shall be levelled, and all leveling field book notes shall be retained in the project folder for future reference.

Establishing Vertical Project Control

Vertical Project Control shall be established using the following methods:

- GNSS RTK/RTN combined with leveling to ensure accuracy.
- GNSS RTN configured to the Vertical Datum Standard for consistency.
- The GNSS RTN base station with the shortest baseline to the project site shall be used.
- GNSS RTK may be used if the main base point was established by a static survey with a post-processed solution or if GNSS RTK is configured to the Vertical Datum Standard.
- Repeatable solutions shall be established using GNSS RTN/RTK time window averaging for each control point to ensure accuracy and reliability.
- All vertical Project Control values must comply with the Accuracy and Datum Standard.
- Vertical Project Control may be conducted concurrently with horizontal project control establishment.

Propagation of Elevations

Once Vertical Project Control is established:

- Elevations shall be propagated throughout the Project Control Network via leveling operations or total station trigonometric leveling.
- A previously established point, as per the methods outlined above, shall be used as a control reference.
- Level run closure errors shall be calculated for all control level operations and verified to ensure compliance with accuracy standards.

Benchmarks

- A minimum of two benchmarks shall be set for regional projects, positioned at either extent of the project.
- For large projects, benchmarks shall be placed at 1 km intervals and shall be established using the approved methods outlined above.
- Benchmarks shall be set on structures that are:
    - Easily identifiable
    - Stable and unlikely to be disturbed
    - Not subject to settlement or heaving
- Control points shall not be considered substitutes for benchmarks.
- Benchmark elevations shall be established through leveling operations or total station trigonometric leveling and must comply with the Accuracy Standard.

LiDAR Quality Control Points

- **Relationship to Project Control Network**: LiDAR Quality Control Points shall be referenced to the Project Control Network to ensure accuracy and consistency.
- **Establishment of Quality Control Points**:
    - For drone, vehicle-mounted, terrestrial (tripod), or other LiDAR systems, Quality Control Points must be established:
        - For scans with a range of less than 100 meters, a Quality Control Point should be set for each scan.
        - For scans exceeding 100 meters, a Quality Control Point must be established at intervals not exceeding 100 meters, specifically for railway and road surveys.
- **Quality Control Plan for Challenging Areas**: In cases of difficult terrain, hard-to-access areas, or private property, a detailed LiDAR Quality Control Plan shall be submitted to the Supervisor of Technical & Design Services for approval before commencing the survey.

- **Visibility Requirements**:
    - LiDAR Quality Control Points must be clearly identifiable within the point cloud or scan data.
    - Points must remain visible in-situ for a minimum of two weeks following the completion of the LiDAR survey to allow Halton surveyors sufficient time to collect X, Y, Z coordinates for Quality Assurance (QA) purposes.

GNSS Project Control Network Localization

- Upon establishing the Project Control Network, a GPS localization relative to the network shall be performed for all Halton Region projects.
- GPS localization shall be used if control points are destroyed or when GPS equipment is utilized for layout or topographic data collection.

Pre-Construction

- Project control shall be verified before construction. If control points are destroyed, they shall be reinstated.

Control Point Database

- All control points established for a project shall be uploaded to the survey department's control point database by an authorized survey department member.

Control Point Data Requests

- Regional Control data shall not be provided to any agency, consultant, or contractor without approval from the Supervisor of Technical & Design Services.

7. Survey CAD Standard

General

Once the horizontal and vertical project control network is established, topographic field survey data collection can commence. This data serves as the foundation for base plans, profiles, and 3D models used in detailed design. Data collection for 3D modeling is conducted concurrently with data collection for 2D drawing production.

- Regardless of the method or system used to collect survey data, all final survey drawings must adhere to the Survey CAD Standard outlined in this section.
- While project scope and detail may vary, the primary objective is to provide clear, relevant, and accurate measurement data to support the detailed design of Halton Region projects.
- All work shall be completed to the satisfaction of Halton Region stakeholders.

Downloads

The Halton Region website provides access to various guides and manuals related to municipal infrastructure engineering. The *Download Engineering Design Guides & Manuals* page contains essential resources, including the *Survey Standards Manual* and the *CADD Standards Manual for Linear Design Drawings*, available for download via the links below.

Survey Standards and support files

The ZIP download includes the *Survey Standards Manual (March 2025 Edition)*, sample deliverables, templates, and all necessary support files.

CADD Standards and support files

The ZIP download includes the *CADD Standards Manual for Linear Design Drawings (March 2021 Edition)*, along with sample PDF drawings, templates, and all required support files.

Halton Survey Standards Directory Structure

- **SURVEY STANDARDS – MARCH 2025**
  - **SAMPLE DELIVERABLES**
    - **AS-CONSTRUCTED SURVEY – CAPITAL PROJECTS**
      - PHM-125
        - RURAL
        - URBAN
      - ROAD
      - WATERMAIN & WASTEWATER MAIN
    - **AS-CONSTRUCTED SURVEY – DEVELOPMENT PROJECTS**
      - WATERMAIN & WASTEWATER MAIN
    - **CONTROL STATION REPORT**
    - **IN-CONSTRUCTION SURVEY – CAPITAL PROJECTS**
      - QUANTITY
        - ASPHALT
        - STOCKPILE
      - ROAD
      - WATERMAIN & WASTEWATER MAIN
    - **PRE-ENGINEERING SURVEY**
      - 400 SERIES HIGHWAY
      - BRIDGE
      - CULVERT
      - DEFICIENT INFRASTRUCTURE MEASUREMENTS
      - GUARDRAIL
      - INTERSECTION IMPROVEMENTS
      - INTERSECTION SIGNALIZATION
      - RAIL CORRIDOR
      - RETAINING WALL
      - ROAD
      - ROAD LiDAR & CONVENTIONAL COMBINED
      - ROAD RESURFACING SURVEY
        - RURAL
        - URBAN
      - SOUND WALL
      - WATERMAIN & WASTEWATER MAIN
  - **SUPPORT FILES**
    - BLOCKS
      - AS-CONSTRUCTED
      - PRE-ENGINEERING
    - COLOR TABLES
    - FEATURE & LINE CODE TABLES
    - LOGO & STAMP
    - TEMPLATES
    - TITLE BLOCKS
  - **SURVEY STANDARDS MANUAL – MARCH 2025**

Drawing Templates

Halton provides standardized survey drawing templates for As-Constructed and Pre-Engineering surveys. These templates must be retained in their entirety, and no layers shall be removed during drawing production. They are designed to comply with Halton CADD standards and integrate seamlessly with associated support files.

The appropriate template is determined by the type of topographic data being collected:

- Pre-Engineering projects shall use the Pre-Engineering Drawing Template.
- As-Constructed projects shall use the As-Constructed Drawing Template.

Both templates define the required line types and layers for their respective survey types. These elements are structured for seamless insertion into Halton CADD templates, ensuring consistency across all projects.

Pre-Engineering Drawing Template	As-Constructed Drawing Template
PRE-ENGINEERING SURVEY TEMPLATE.dwt	AS-CONSTRUCTED SURVEY TEMPLATE.dwt

Survey Blocks

Halton has developed customized blocks for Pre-Engineering and As-Constructed surveys. These blocks are specifically designed to work with their respective drawing templates and must not be modified.

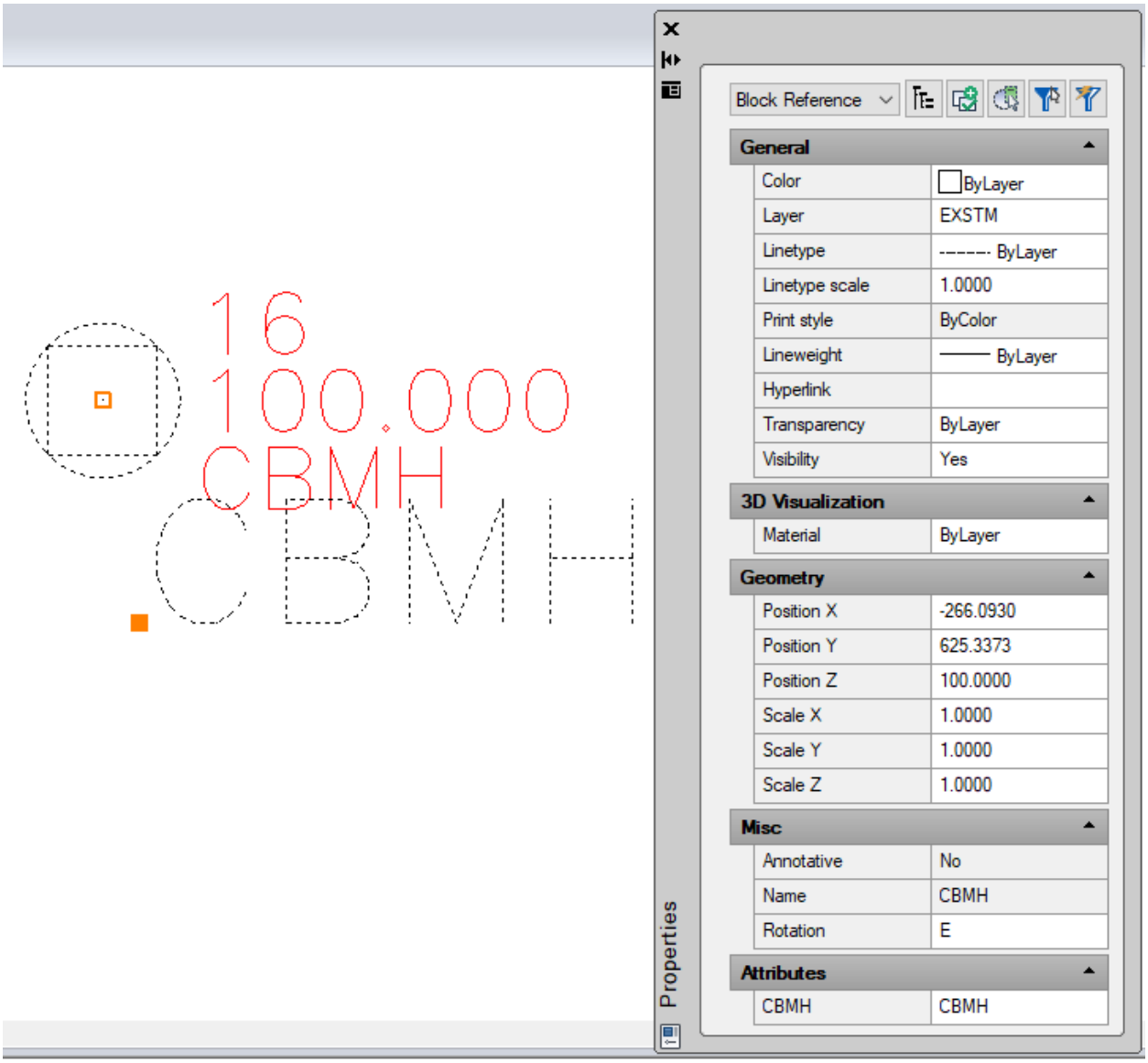
There are two types of survey blocks:

- **Standard Blocks** – Used for symbology and not drawn to true field-measured size.
- **Scaled Blocks** – Represent field measurements and are drawn to true field-measured size.

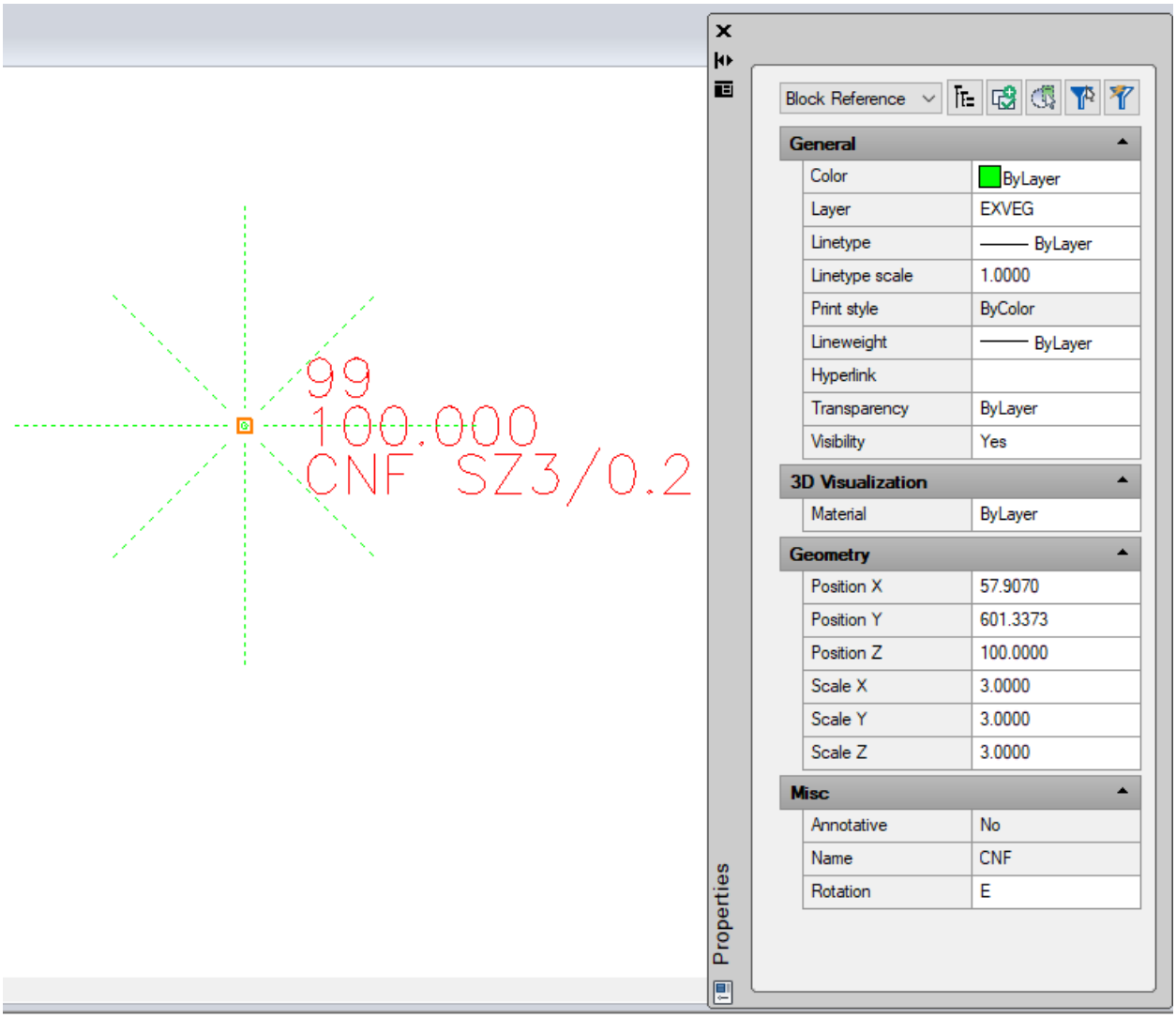
When using the Pre-Engineering Drawing Template or As-Constructed Drawing Template, the following rules apply:

- All standard blocks shall have a uniform scale of X = 1.0, Y = 1.0, Z = 1.0.
- All scaled blocks shall be proportionate to true field-measured size.

Standard Blocks

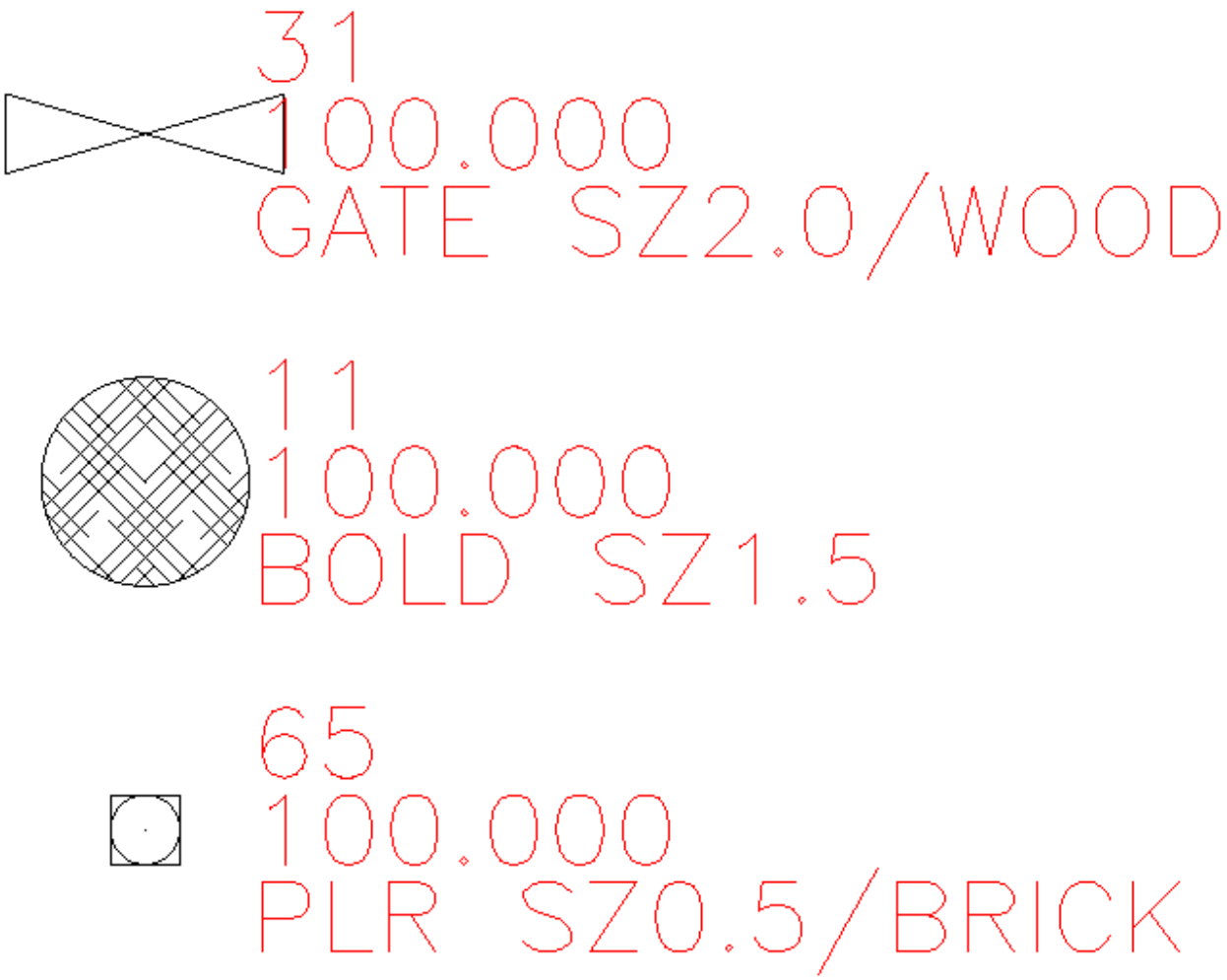


Scaled Blocks

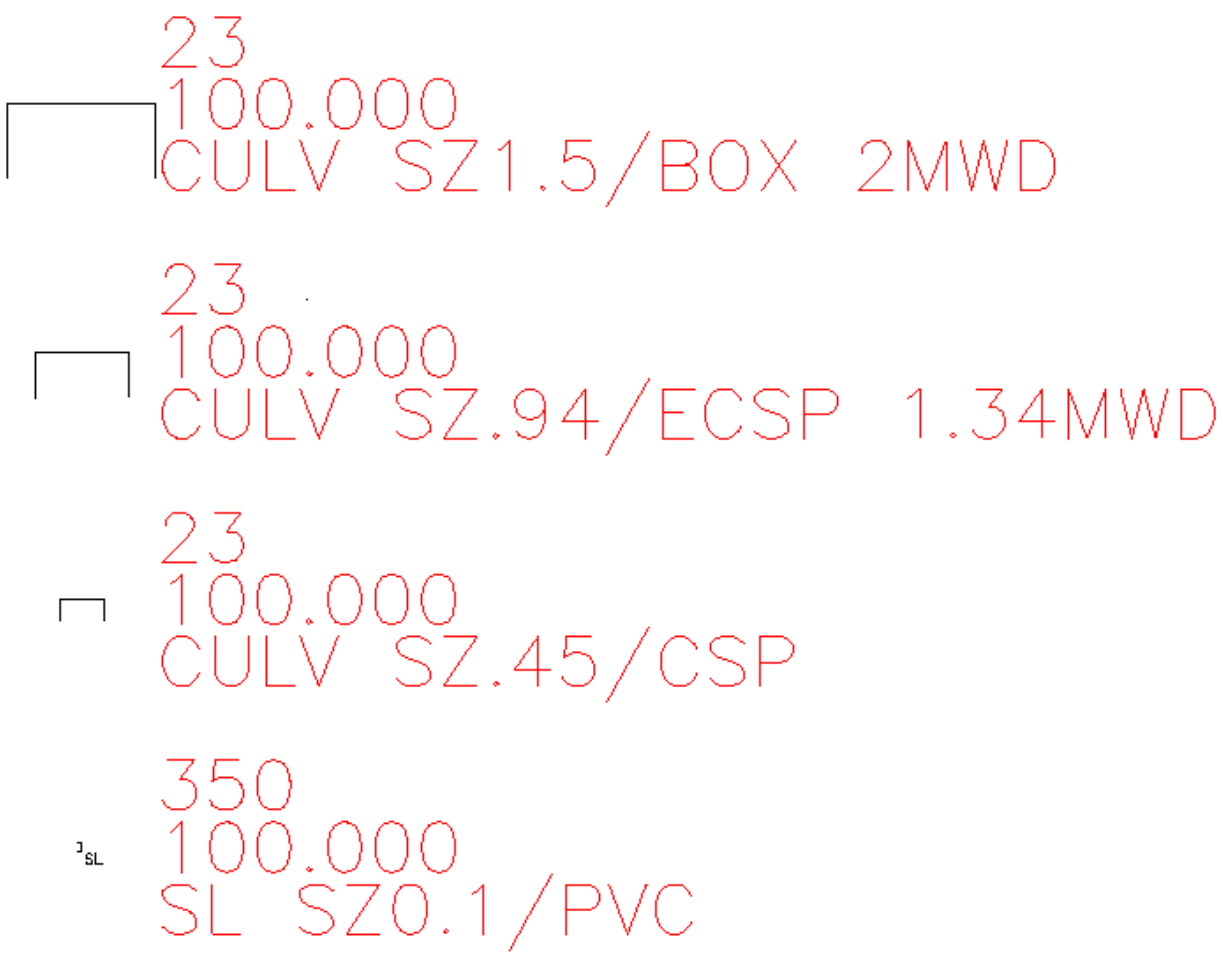


Examples of Scaled Blocks:

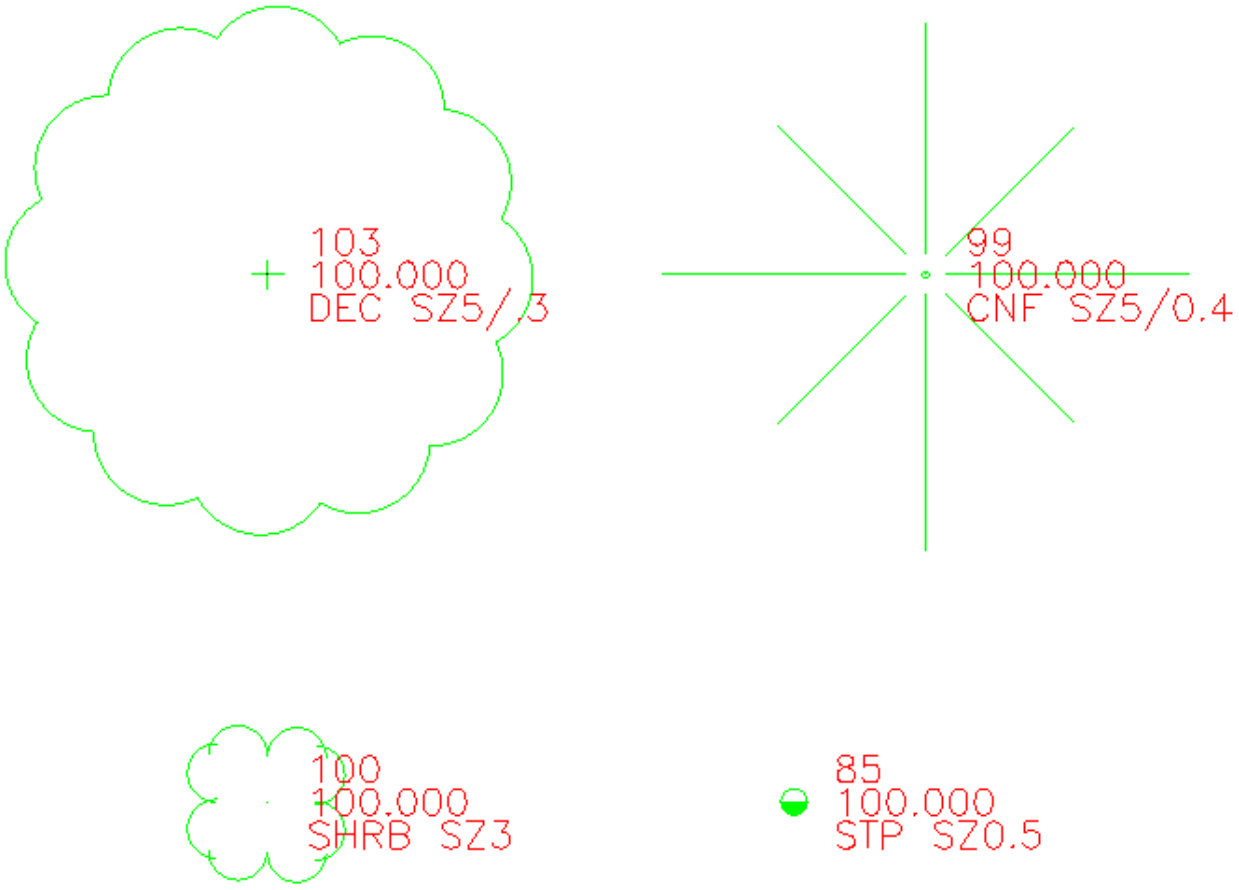
General Features



Culverts and Sump Lines

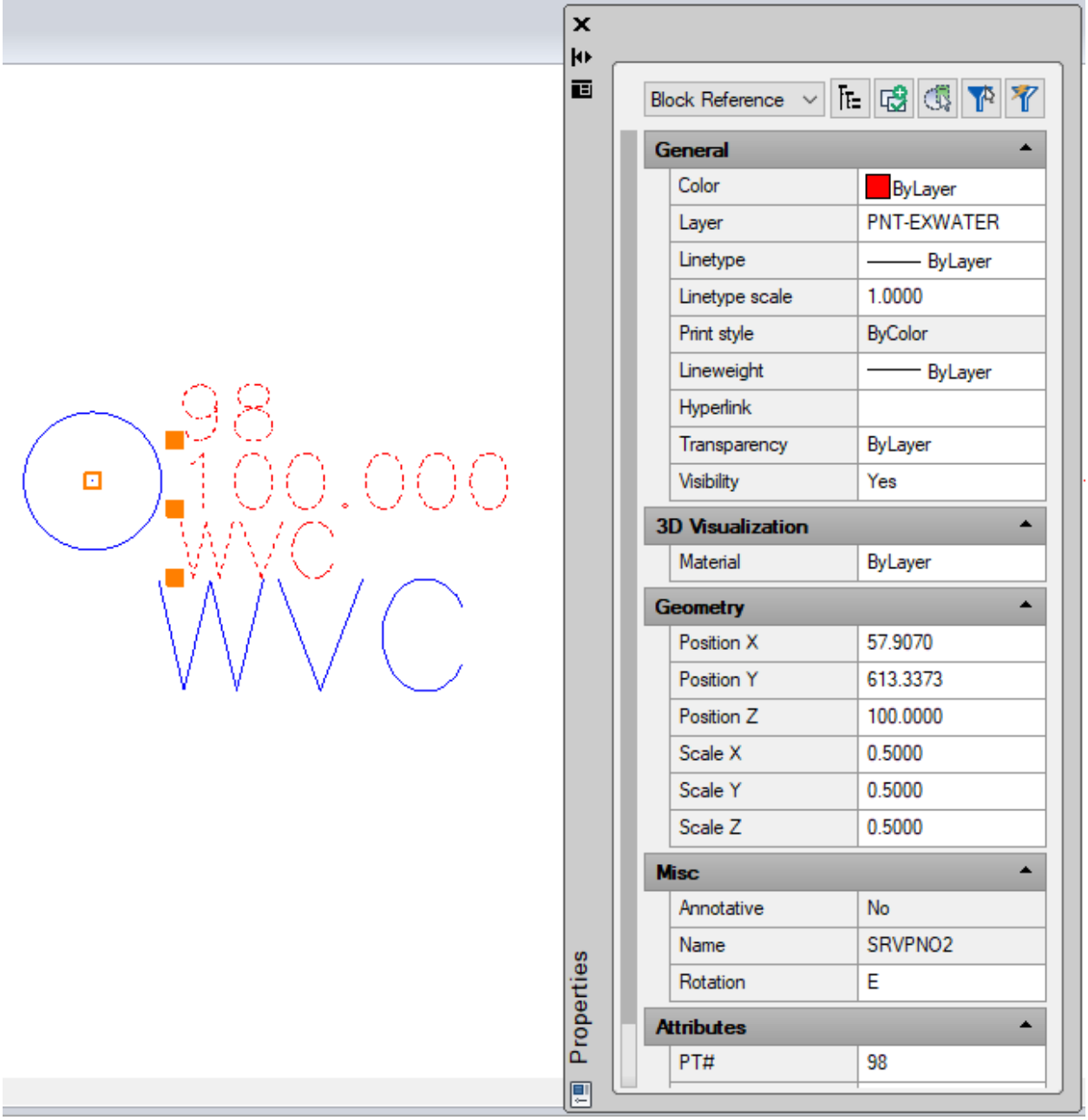


Vegetation


103
100.000
DEC SZ5/.3
99
100.000
CNF SZ5/0.4
100
100.000
SHRB SZ3
85
100.000
STP SZ0.5

Survey Point Attribute Blocks

- All point attribute blocks shall be scaled at X = 0.5, Y = 0.5, Z = 0.5.
- Point attribute blocks must be clearly visible on the final drawings, positioned beside each surveyed point, whether a standalone point or part of a line feature.



Point Attribute Block Layers

Pre-Engineering Drawing Template

- All point attributes shall be placed on the designated attribute layers unless otherwise specified.

Layer Name	Color	Linetype	On/Off	Lock/U...	Freeze/Th...	Lineweight	Transp...	Material	Print Style	Print	Description
PNTDESC	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
PNTELEV	red	Continuous				Default	0	Global	Color_1		Surveyed Point Elevation
PNTNO	red	Continuous				Default	0	Global	Color_1		Surveyed Point Number

- Separate point attribute layers are utilized to isolate attributes that fall on layers indicated after the **PNT-** prefix.
- This allows all point attributes to be turned off, while retaining visibility of selected attributes as needed.

Layer Name	Color	Linetype	On/Off	Lock/U...	Freeze/Th...	Lineweight	Transp...	Material	Print Style	Print	Description
PNT-EXCULVERTS	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
PNT-EXSAN	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
PNT-EXSAN-FORCEMAIN	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
PNT-EXSIGNAL COMPONENTS	red	Continuous				Default	0	Global	Color_1		
PNT-EXSTM	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
PNT-EXVEG	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
PNT-EXVEG-SIGNIFICANT	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
PNT-EXWATER	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description

As-Constructed Drawing Template

- All point attributes shall be placed on the designated attribute layers unless otherwise specified.

Layer Name	Color	Linetype	On/Off	Lock/U...	Freeze/Th...	Lineweight	Transp...	Material	Print Style	Print	Description
AC-PNTDESC	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
AC-PNTELEV	red	Continuous				Default	0	Global	Color_1		Surveyed Point Elevation
AC-PNTNO	red	Continuous				Default	0	Global	Color_1		Surveyed Point Number

- Separate point attribute layers are utilized to isolate attributes that fall on layers indicated after the **AC-PNT-** prefix.
- This enables point attributes to be selectively turned off, ensuring only relevant attributes remain visible when required.

Layer Name	Color	Linetype	On/Off	Lock/U...	Freeze/Th...	Lineweight	Transp...	Material	Print Style	Print	Description
AC-PNT-AC-CULVERTS	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
AC-PNT-AC-SAN	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
AC-PNT-AC-SAN-FORCEMAIN	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
AC-PNT-AC-SIGNAL COMPONENTS	red	Continuous				Default	0	Global	Color_1		
AC-PNT-AC-STM	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
AC-PNT-AC-VEG	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
AC-PNT-AC-VEG-SIGNIFICANT	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description
AC-PNT-AC-WATER	red	Continuous				Default	0	Global	Color_1		Surveyed Point Description

Feature & Line Code Table: Pre-Engineering and As Constructed

Refer to the end of this manual for the **Feature and Line Code Table**. Below are the headings found on the code table.

- **Code** (indicates field code)
- **Description** (indicates full name of field code)
- **Full Name** (where to acquire feature or line in the field)
- **Layer** (indicates the layer the feature or line code shall be on in either drawing template)
- **Line Type** (indicates what line type used with line code in either drawing template)
- **Symbol** (indicates name of the block)
- **Entity** (indicates whether code is a point or a line)

Feature and Line Codes

Halton has developed standardized feature and line codes for both pre-engineering and as-constructed surveys. The survey field codes remain consistent across both survey types; however, the drawing templates and corresponding survey blocks differ based on the type of survey being conducted.

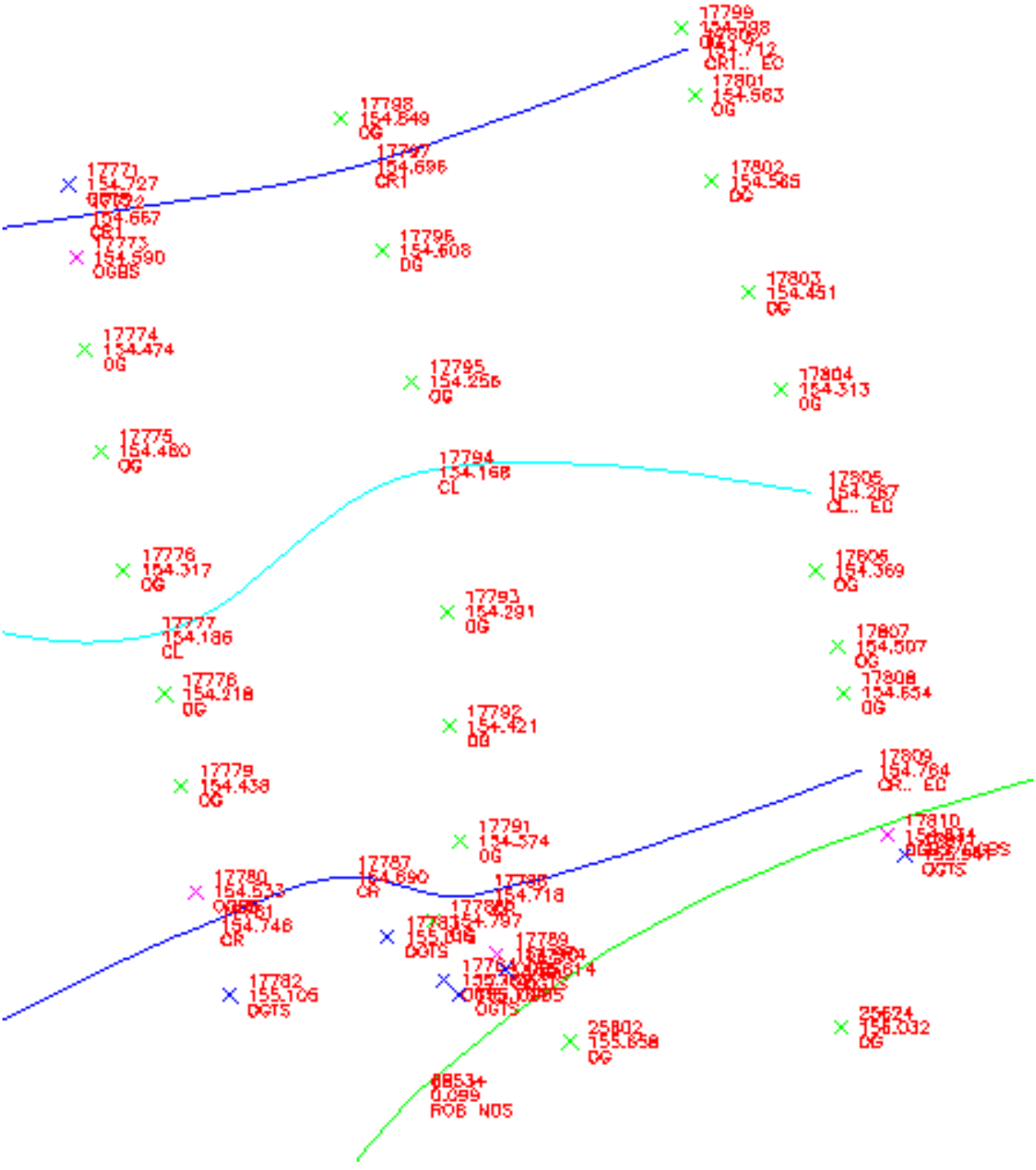
- The appropriate feature or line code must be used and must correspond to the correct block or line type.
- All blocks and lines shall be placed on the designated layers as specified in the **Feature and Line Code Table.**
- Consistency in coding ensures uniformity across all survey deliverables and compliance with Halton CADD standards.

Linework Coding Parameters

- **3D Polyline Representation**: Surveyed lines shall be represented as 3D polylines, as specified in the **Feature and Line Code Table.**
- **Line Start Indicator**:
  The start of a line will be denoted by a period **(.)** at the end of the line code description.
- **Line End Indicator**:
  The end of a line will be indicated by a double period **(..)** at the end of the line code description.

- **Curve Start Indicator**:
  The beginning of a curve will be marked by the addition of **BC** (Beginning of Curve) at the end of the line code description, separated by a space.
- **Curve Start at Line Start**:
  If the line begins at the same point where it starts to curve, the **BC** will follow the period indicating the start of the line, separated by a space.
- **Curve End Indicator**:
  The end of a curve will be denoted by **EC** (End of Curve) at the end of the line code description, with a space separating the code description from **EC**.
- **Curve End at Line End**:
  If the curve ends at the same point where the line ends, the **EC** will follow the double period indicating the line's end, separated by a space.
- **Sequential Point Numbering**:
  All point numbers for lines between the start and the end shall be sequential. Point numbers must consistently increase and not reverse within the line.
- **Differentiating Simultaneous Lines**:
  For multiple lines surveyed simultaneously that share the same line code description, a number will be appended to the line code description to differentiate between the lines.
- **Notes and Contextual Information**:
  A forward slash **(/)** following the line code description shall be used to include additional notes, such as material specifications or further context.

- **Example:**
  Refer to the line coding example below for a creek survey ending.



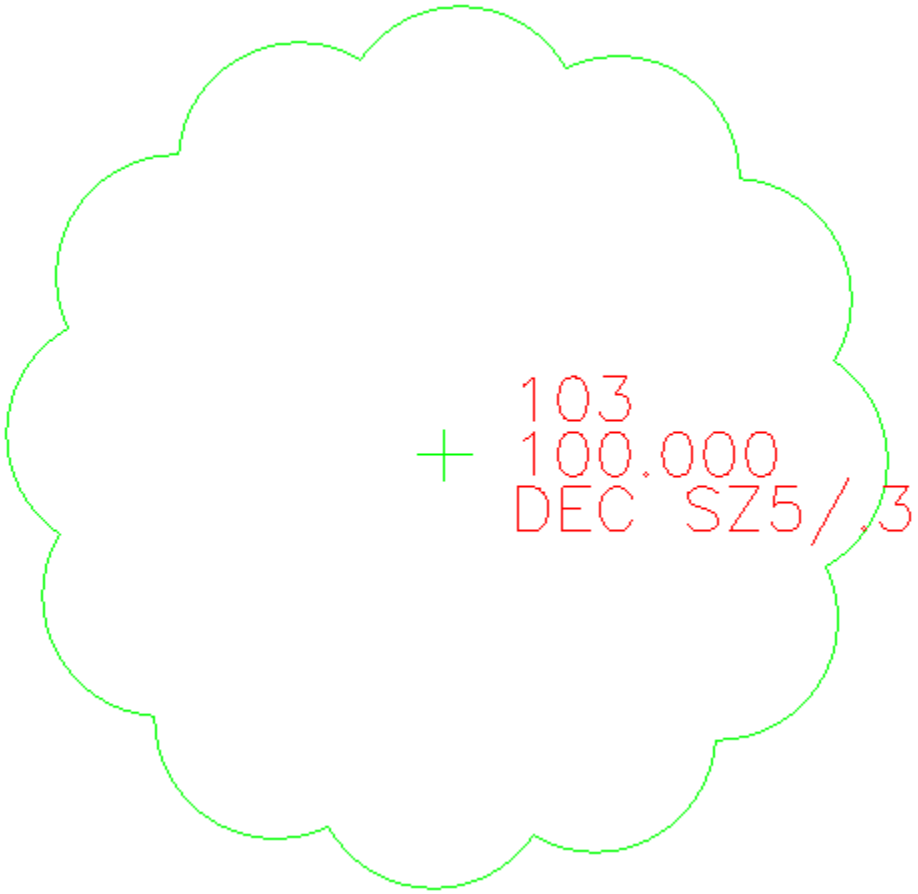
Standard Block Coding Parameters

- The feature/block insertion or field acquisition point is specified in the **Feature and Line Code Table.**
- A forward slash **(/)** after the feature code description denotes additional information, such as material type or further contextual details.

Scaled Block Coding Parameters

- The feature code description will be followed by a space and **SZ,** with the measurement value immediately after.
- **Example:**
    - *DEC SZ5/0.3* for a deciduous tree with a 10m canopy (block is scaled by drip radius) and a 0.3m trunk diameter.
- A forward slash (/) after the measurement may be used to indicate additional context, such as trunk size, material type or other relevant notes.
- Scaled features, blocks, and symbols will be inserted at true field-measured scale to ensure accuracy in survey drawings.

Examples of Survey Coding for Scaled Blocks



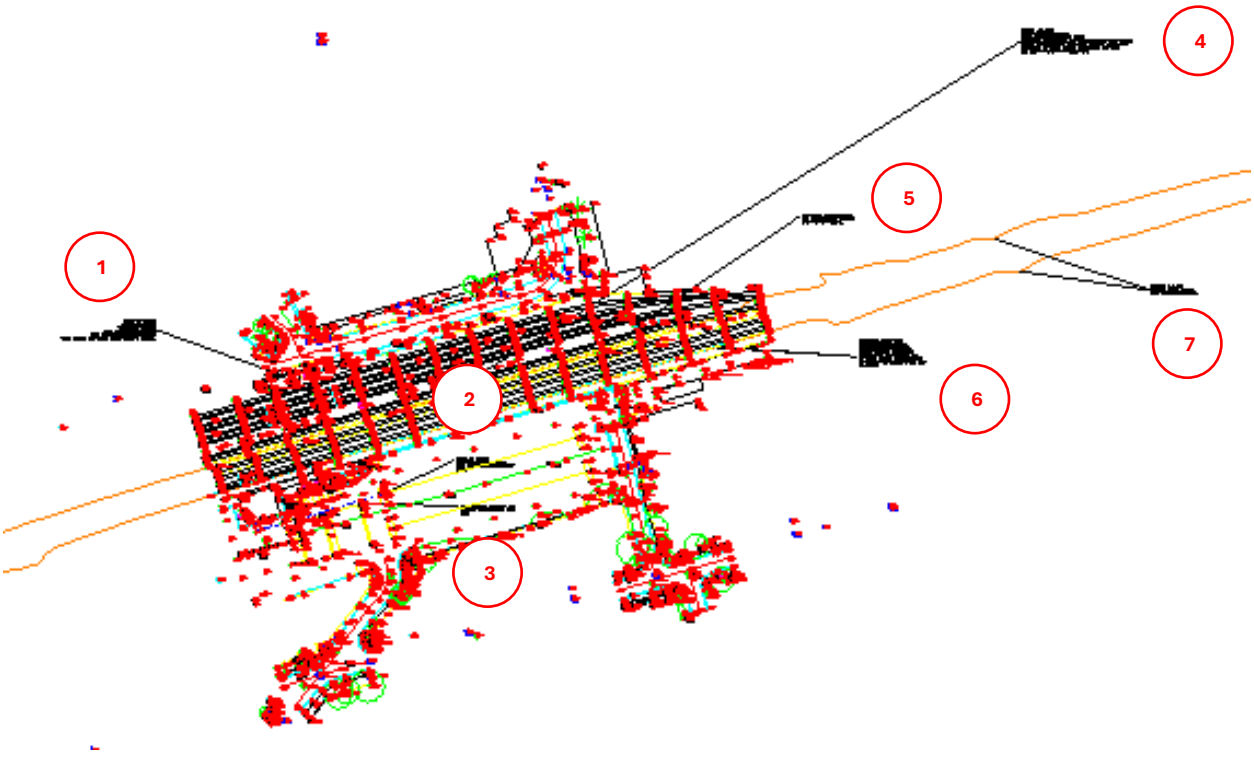
Topographic Field Notes

- Field notes shall be prepared directly on the completed 2D drawing using Layer 0 with standard text formatting.
- They must include relevant names for key features such as:
    - Streets/Roads
    - Rail corridors and subdivisions
    - Water features
    - Any other major features that traverse or run parallel to the project site
- Leaders shall be used to provide additional descriptions for features or areas where survey details may be too vague or complex for design staff to interpret accurately.
- Photos should be included where necessary to provide additional visual context.

Field Notes Example

- Notes are placed on Layer 0 using standard text formatting.
- Text height is proportionate to the drawing scale

Note: *Due to the text being too small to clearly indicate content in the capture, content representation has been provided separately following the capture.*



Field Notes Example

1. COULD NOT LOCATE CB AND CBMH THAT DRAINS INTO THIS MHS FROM EAST. POTENTIALLY PAVED OVER. THESE STRUCTURES ARE INDICATED ON AC DRAWING FOR WS2905 (DWG#G03096) IN PACKAGE.
2. FOUND OLD LOCATES DONE BY OTHERS IN POSSIBLE WATER SERVICE LOCATION. NO CBOX FOUND.
3. METAL DETECTOR READING IN THIS LOCATION. POSSIBLE PAVED OVER CBOX.
4. CN AND METROLINX CORRIDOR IS NOW COMPLETE AND IS BEING RESUBMITTED AS WHOLE UPON FINAL COMPLETION AS NOW THE CONTROL HAS BEEN VERIFIED AGAINST THE CONTROL SET OUTSIDE THE CORRIDOR AND A MINOR ADJUSTMENT TO THE CN PORTION COMPLETED IN JULY 2022 HAS BEEN INCLUDED IN THIS SUBMISSION.
5. REGION MAP VIEWER INDICATES TWO CBOXES ON THIS SERVICE? ONLY ONE CBOX FOUND.
6. ORANGE/RED LOCATE LINES IMPORTED FROM CN SUPPLIED KML FILE. CYAN BELL LINE WAS SHOT IN THE FIELD FROM LOCATE PAINT REMAINS. ON THE NORTH SIDE OF THE CN PORTION OF THE CORRIDOR PAINT WAS NO LONGER PRESENT AT TIME OF SURVEY.
7. IMPORTED KML FILE SUPPLIED BY CN. SEE KML FILES SUPPLIED IN PACKAGE.

8. Pre-Engineering Survey – Standard Requirements

***Note:** If a survey is being conducted for an **Environmental Assessment (EA) study**, it shall adhere to the guidelines established for Pre-Engineering Surveys.*

CAD Details

The table below specifies the required support files for conducting this type of survey:

Drawing Template	Survey Blocks	Survey Code Table	Survey Examples
PRE-ENGINEERING DRAWING TEMPLATE	PRE-ENGINEERING SURVEY BLOCKS	Feature & Line Code Table	Sample Deliverables

Types of Pre-Engineering Surveys

- **400-SERIES HIGHWAY**
- **BRIDGE**
- **CULVERT**
- **DEFICIENT INFRASTRUCTURE MEASUREMENTS**

- **GUARD RAIL**
- **INTERSECTION IMPROVEMENTS**
- **INTERSECTION SIGNALIZATION**
- **RAIL CORRIDOR**
- **RETAINING WALL**
- **ROAD**
- **ROAD RESURFACING**
- **SOUND WALL**
- **WATERMAIN & WASTEWATER MAIN**

Survey Limits and Data Capture Frequency

- **Point Ranges:**
    - Data collection for features and linework will begin at point 1000 or 5000, depending on measured underground infrastructure.
    - 200-, 300-, and 400-point ranges will be used for smaller projects.
    - 2000-, 3000-, and 4000-point ranges will be used for larger projects, reserved for sanitary, water, and storm infrastructure appurtenances, respectively.
- **Survey Limits:**
    - Unless specified, full topographic survey limits extend property line to property line.
    - For water and wastewater projects, vegetation will be collected up to 5m beyond the property line.
    - For road projects, survey limits will extend 10m behind the property line on both sides, unless modified by the Project Manager or an Environmental Assessment.
    - Permission is required for any survey work on private property.
    - At crossroads and intersections, the survey will extend 60m from the centerline, unless specified otherwise.

- **Cross Section Frequency:**
    - Unless specified:
        - **Straight streets, roads, highways, and third-party corridors:** Every 20m.
        - **Drastic horizontal or vertical curves:** Every 10m or less.
        - Ensure all changes in terrain, linework, and features between cross sections are captured.
        - **Creeks:** Cross-sectioned every 5m, unless specified by the Conservation Authority.

Road Resurfacing

- **Rural:** Full topographic survey extends to the back of the ditch on either side of the ROW unless specified.
- **Urban:** Full topographic survey extends to the back of the sidewalk or multi-use path on either side unless specified.

LiDAR Data Collection

- **Soft Surfaces:**
    - In addition to cross sections, soft surfaces will be surveyed in a grid format, ensuring compliance with topographic accuracy standards.
    - Unless specified:
        - **Ground elevations:** 5m grid spacing, with top and bottom of slopes identified.
        - **Tablelands of watercourses or floodplains:** 1m grid spacing for ground elevations.
- **Hard Surfaces:**
    - Survey frequency for linework and features will follow Section 8: Pre-Engineering Survey - Standard Requirements, unless specified.
    - Linework and features must comply with topographic accuracy standards.

Typical Cross-Sections

Urban Street/Road/Highway

- **Centerline (Crown Line):** Roadway crown lines, including intersections at the Point of Intersection (PI) (typically the highest point in the intersection).
- **Edge of Pavement Lines:** Includes Island edge of pavement lines, where applicable.
- Top Back of Curb Lines.
- **Top Back of Kill Strip/Splash Pad Lines:** If present.
- Top Front and Back of Sidewalk/Multi-Use Path Lines.
- **Ground Elevation Points:** Extend to property line and beyond, if required.

Rural Street/Road/Highway

- **Centerline (Crown Line):** Roadway crown lines, including intersections at the Point of Intersection (PI).
- Edge of Pavement Lines.
- Top of Shoulder Rounding Line.
- **Ditch Elevation Points:**
    - Top of slope (front and back of ditch).
    - Bottom of slope (front and back of ditch).
    - Centerline of ditch.
- **Ground Elevation Points:** Extend to property line and beyond, if required.

Rail Corridor

- Top Centerline of Rail Tracks.
- **Ground Elevations:** Between all track lines, extending to the top of shoulder rounding.
- **Shoulder or Platform Elevations:**
    - Bottom of shoulder rounding line, or
    - Bottom and top of platform wall lines (if at a rail station).

- **Ditch Elevation Points (if present):**
    - Top of slope (front and back of ditch).
    - Bottom of slope (front and back of ditch).
    - Centerline of ditch.
- **Ground Elevation Points:** Extend to property line and beyond, if required.

Creek/Watercourse

- **Thalweg Line:** Deepest point of the channel or valley.
- Creek Bed Elevation Shots.
- **Slope Elevations:**
    - Bottom of slope on both sides of the creek bed.
    - Creek line where water meets the bank on both sides.
    - Top of bank elevations on both sides above the creek.
- **Floodplain Elevations:** Ground elevations extend up to 20m into the floodplain on both sides.

Lines and Breaklines

- **Straight Linework:** Acquired at the stated cross-section frequency, ensuring all relevant changes between cross-sections are captured.
- **Curved Linework:** Acquired at a frequency that accurately represents the true location without distortion.

Example

- **25m curb return arc length:** Collection frequency = 5m
- **Bullnose with 1m radius:** Collection frequency = 0.5m along arc length

Surveying Specific Features

- **Accessibility Devices:** Tactile pads shall be surveyed using the appropriate line code.
- **Concrete Pads:** All concrete pads, including infrastructure cabinet foundations and free-standing pads, shall be surveyed.
- **Loop Detectors:** If visible, loop detectors for red light cameras or traffic signals shall be obtained.

- **Utility Locates:** If locates are requested, they shall be surveyed using the appropriate line code. If no specific line code exists, a similar line code shall be used with a utility note.
- **Building Faces:**
    - Shall be surveyed if specified.
    - If within 3m of the ROW, the building face shall be surveyed.
    - At a minimum, the roof footprint shall be surveyed and noted.
    - Elevations shall not be used for building perimeter points unless gathered at ground level or otherwise specified.
- **Bus Shelters:** All perimeter lines shall be surveyed at ground level.
- **Fences:** Fence lines shall be surveyed at true center at ground level, with material noted.
- **Guardrails:** Surveyed at front face of rail at ground level.
- **Noise/Retaining Walls & Culvert Head/Wing Walls:** All breaklines shall be captured to accurately depict the structure as part of the terrain.
- **Bridges:**
    - If the survey crosses under a bridge, the underside edge lines of the bridge deck or the centerline/edge lines of a girder on either side of the bridge deck shall be captured for the width of the ROW unless otherwise specified.
    - Bridge piers or columns within the ROW shall be surveyed at ground level unless otherwise specified.
    - Bottom of abutment walls within the ROW shall be surveyed at ground level unless otherwise specified.
- **Box/Open Channel Culverts:** All breaklines shall be captured to accurately depict the structure as part of the terrain.
- **Unspecified Surveyable Lines:** If a surveyable line does not have a specific code in the feature and line code table, a similar line code shall be used with the line feature noted.
- **Rail Corridors:** If a rail corridor crosses the ROW, the top center of the rail track at the crossing shall be surveyed for the width of the ROW, following all appropriate safety and access protocols.

Road Resurfacing / Intersection Improvements / Intersection Signalization

- **Traffic Delineation:** Capture all traffic paint lines within the survey limits.
- **Pavement Match Lines:** Ensure previous pavement match lines at all project extents are captured, if present.

General Features

- **Utility Poles & Standards:**
    - All utility poles (hydro poles), traffic light standards, light standards, pedestrian push-button poles, pillars, and signs shall be surveyed at true center at ground level.
    - Utility poles with aerial-to-underground drops shall be noted.
- **Mounted Devices:**
    - If a sign, camera, communication, or traffic-related device is mounted to a pole, it shall be combined with the appropriate symbol or noted in the description.
    - Electrical signs shall be combined with the appropriate symbol or noted in the description.
- **Red Light Cameras & Flashes:**
    - Red light cameras and red-light flashes shall be surveyed at true center at ground level.
- **Utility Appurtenances:**
    - Electrical supply, traffic electrical, communication, and gas appurtenances shall be surveyed at true center at ground level.
- **Property Monumentation & Markers:**
    - Property monumentation shall be surveyed at true center. If leaning or bent, this shall be noted.
    - Utility markers or other markers shall be surveyed as road signs, with the type of marker noted.
    - The marker code shall only be used for rural address markers.
- **Accessibility Devices:**
    - Shall be surveyed using the appropriate symbol.

- **Postal Appurtenances:**
    - Shall be surveyed at true center at ground level.
- **Municipal Appurtenances:**
    - Bolted-down benches and garbage receptacles shall be surveyed at true center at ground level using the miscellaneous symbol, with the feature noted.
- **Ornamental Items:**
    - Planters, fountains, and statues shall be surveyed at true center at ground level, using the miscellaneous symbol, with the feature noted.
- **Unspecified Features:**
    - If a feature does not have a specific code in the Feature & Line Code Table, a similar feature code shall be used, with the feature noted.
    - If no similar feature code exists, the miscellaneous code shall be used.
- **Rail Corridor Crossings:**
    - If a rail corridor crosses the ROW, rail crossing features (e.g., wigwags, gates, etc.) shall be obtained following appropriate safety and access protocols.

Road Resurfacing / Intersection Improvements / Intersection Signalization

- **Traffic Delineation Paint Symbols:**
    - Capture all traffic paint symbols within the survey limits.

Scaled Features

- **Trees:**
    - Drip radius measured from trunk.
    - Trunk diameter measured at DBH (Diameter at Breast Height) and noted.
- **Shrubs:**
    - Drip diameter measured and sized.
- **Tree Stumps:**
    - Stump diameter measured and sized.

- **Pillars:**
  - Diameter/size measured.
  - Material noted.
- **Gates:**
  - Full length of gate measured, including double gates.
  - Material noted.
- **Boulders:**
  - Diameter measured and sized.
- **Culverts:**
  - Surveyed at invert level.
  - Pipe diameter measured and sized.
  - Material noted.
- **Sump Lines:**
  - Pipe diameter measured and sized.
  - Material noted.

Stormwater Features - Overland

- **Ditch/Swale Lines:**
  - Cross sections shall accurately depict the full footprint from top of bank to top of bank.
- **Culverts (Round, Elliptical, and Box Pipe):**
  - Scaled to size with material noted.
  - Surveyed at invert level.
  - If elliptical or box pipe, width shall be noted.
- **Obvert Measurement (When Invert is Unavailable):**
  - If the invert is not exposed or cannot be determined, the obvert shall be surveyed.
  - Pipe size, material, and obvert shall be noted using the culvert symbol.

- **Creeks:**
    - Survey shall accurately depict the full channel from top of bank to top of bank and floodplain.

Vegetation Features

- **Trees:**
    - Survey all trees with a trunk diameter > 0.1m using the tree symbol.
    - The symbol shall be scaled to the drip diameter.
    - Trunk diameter at DBH (Diameter at Breast Height) shall be noted.
    - Municipal Trees: If trunk diameter ≥ 0.05m, it must be surveyed.
- **Shrubs:**
    - Surveyed with a symbol scaled to the shrub diameter.
- **Tree Stumps:**
    - Surveyed, and the symbol scaled to the stump diameter.
- **Bush Lines:**
    - Captured at the dripline of the bush or overhanging tree.
    - Must be noted in the survey.
- **Hedge Lines:**
    - Captured at the drip line.
- **Flower Beds:**
    - Edge of the flower bed line shall be surveyed along the perimeter.

LiDAR Data – Vegetation

- Elevations will not be included when surveying vegetation unless specified.
- If elevations are included, they must be confirmed to be surveyed at ground level.

Linear Sanitary Infrastructure

Gravity Sewer Systems

- Sanitary sewer appurtenances shall be collected in the 200- or 2000-point range, unless specified.

- North-oriented (or indicated) photographs shall be taken of the lid, adjustment rings, and benching for all sanitary sewer manholes, correlated to the appropriate point number.
- Measurements shall be taken from the top of the frame and cover to all inverts and drop structures, with the true direction noted and correlated to the corresponding 200- or 2000-point range number.
- **Basement elevations (if required):**
    - Established by measuring vertically from the basement floor to a surveyed exterior reference point.
    - If the sanitary lateral exits above the basement floor through the wall, this measurement shall be noted (e.g., "Sanitary lateral exits 0.3m above floor").

Road Resurfacing

- Surveyed using the automatic point number range if measurements are not required.
- Ensure proper infrastructure appurtenance symbols are used.
- Invert measurements and photographs are not required unless specified.

Force Main Systems

- Force main appurtenances shall be collected in the 200- or 2000-point range, unless specified.
- North-oriented (or indicated) photographs shall be taken for all force main valve chambers, correlated to the appropriate point number.
- Measurements shall be taken from the top of the force main valve chamber frame and cover to:
    - Top of the main, with true direction noted, correlated to the 200- or 2000-point range number.
    - Top operating nut of the force main valve, with true direction of the main noted, correlated to the 200- or 2000-point range number.
- **Force Main Valve Chambers:**
    - If a force main valve is accessed through the chamber's frame and cover (without a dedicated lid), additional survey points shall be recorded to indicate its presence.

- **Direct Buried Force Main Valves:**
    - Surveyed in the 200- or 2000-point range.
    - Measured from the frame and cover to the top operating nut, with the corresponding point number noted.
- **Tracer Wire Access:**
    - Force main valve boxes used for tracer wire access shall be surveyed in the 200- or 2000-point range.
    - Measurements to the top of the main shall be recorded if no debris is present and noted as tracer wire access.

Road Resurfacing

- Surveyed using the automatic point number range if measurements are not required.
- Ensure proper infrastructure appurtenance symbols are used.
- Invert measurements and photographs are not required unless specified.

Linear Water Infrastructure

- Water main appurtenances shall be collected in the 300- or 3000-point range, unless specified.
- North-oriented (or indicated) photographs shall be taken for all water valve chambers, correlated to the appropriate point number.
- Measurements shall be taken from the top of the water valve chamber frame and cover to:
    - Top of the main, with true direction noted, correlated to the 300- or 3000-point range number.
    - Top operating nut of the water valve, with true direction of the main noted, correlated to the 300- or 3000-point range number.
- **Water Valve Chambers:**
    - If a water valve does not have a dedicated lid and is accessed through the chamber's frame and cover, additional survey points shall be recorded to indicate its presence.

- **Direct Buried Water Valves / Secondary Water Valves:**
    - Surveyed in the 300- or 3000-point range.
    - Measured from the frame and cover to the top operating nut, with the corresponding point number noted.
- **Individual Water Service Boxes:**
    - Address shall be noted and can be acquired in an automatic point number range.
- **Hydrants:**
    - Surveyed at true center at ground level and can be acquired in an automatic point number range.

Road Resurfacing

- Surveyed using the automatic point number range if measurements are not required.
- Ensure proper infrastructure appurtenance symbols are used.
- Top-of-main/nut measurements and photographs are not required unless specified.
- Water service boxes shall only be surveyed if they fall within resurfacing limits.

Linear Storm Infrastructure

- Storm sewer appurtenances shall be collected in the 400- or 4000-point range, unless specified.
- North-oriented (or indicated) photographs shall be taken for all storm manholes, including lids, adjustment rings, and benching, correlated to the appropriate point number.
- Measurements shall be taken from the top of the frame and cover to:
    - All inverts and drop structures, with true direction noted, along with pipe size and material, correlated to the 400- or 4000-point range number.
- **Catch Basins:**
    - Measurements shall be taken from the top of frame and cover to all inverts, with true direction noted, along with pipe size and material, correlated to the 400- or 4000-point range number.

- **Sloped, Bird Cage, and Beehive Lids:**
    - Measurements shall be taken from the most accessible reference point to the inverts.
    - The reference point shall be surveyed for accuracy.

Road Resurfacing

- Surveyed using the automatic point number range if measurements are not required.
- Ensure proper infrastructure appurtenance symbols are used.
- Invert measurements and photographs are not required unless specified.

Deficient Infrastructure Measurements

- Infrastructure that cannot be measured or obtained due to the following issues shall be documented:
    - Unable to locate
    - Paved over or buried
    - Flooded with water
- A deficiency report shall be compiled, including:
    - Feature type
    - Location details/address
    - Issue to be resolved
- The report shall be submitted to the Supervisor of Technical & Design Services.
- Once the issue is remedied, the infrastructure shall be surveyed and/or measured accordingly.

9. In-Construction Survey – Capital Projects

CAD Details

The table below indicates the required support files for conducting this type of survey:

Drawing Template	Survey Blocks	Survey Code Table	Survey Examples
SPECIFIED	SPECIFIED	Feature & Line Code Table	Sample Deliverables

Types of In-Construction Surveys – Capital Projects

- **QUANTITY SURVEY**
- **ROAD CONSTRUCTION**
- **WATERMAIN & WASTEWATER MAIN CONSTRUCTION**

Typical In-Construction Survey Requests

- Field verification prior to infrastructure installation
- Field verification during infrastructure installation
- Field verification of installed infrastructure
- Material quantity surveys

Survey Limits and Data Capture Frequency

- The survey limits will be defined by a member of the project team.
- If topographic detail is required, data collection shall follow the alignment used for infrastructure construction, ensuring cross-sections align with the stationing specified in the issued-for-construction contract drawings.
- Refer to **Pre-Engineering Survey – Standard Requirements, Survey Limits and Data Capture Frequency** for applicable requirements.

Typical Cross-Sections

- If required, refer to **Pre-Engineering Survey – Standard Requirements, Typical Cross-Sections**, as data collection follows the same principles for roads, streets, and highways.

Lines and Breaklines

- Refer to **Pre-Engineering Survey – Standard Requirements, Lines and Breaklines**, as data collection follows the same principles.
- Data shall be collected based on the alignment used for infrastructure construction, ensuring cross-sections align with stationing specified in the issued-for-construction contract drawings.

General Features

- Refer to **Pre-Engineering Survey – Standard Requirements, General Features**, as data collection follows the same principles.

Scaled Features

- Refer to **Pre-Engineering Survey – Standard Requirements, Scaled Features**, as data collection follows the same principles.

Stormwater Features – Overland

- Refer to **Pre-Engineering Survey – Standard Requirements, Stormwater Features – Overland**, as data collection follows the same principles.
- If a creek or watercourse has been realigned or reconstructed, data capture frequency shall follow the alignment specified in the issued-for-construction contract drawings.
- Key elevation points indicated in the issued-for-construction contract drawings shall be captured, particularly at constructed water features critical to water conveyance through the channel or ditch.

Vegetation Features

- Refer to **Pre-Engineering Survey – Standard Requirements, Vegetation Features**, as data collection follows the same principles.

Linear Sanitary Infrastructure

Gravity

- Refer to **Pre-Engineering Survey – Standard Requirements, Linear Sanitary Infrastructure**, as data collection follows the same principles.
- Photographs are not required unless specified.
- Item numbers used to identify structures in the contract drawings shall be recorded in the description of the surveyed point within the 200- or 2000-point range.

Force Main

- Refer to **Pre-Engineering Survey – Standard Requirements, Linear Sanitary Infrastructure**, as data collection follows the same principles.
- Photographs are not required unless specified.
- Item numbers used to identify structures in the contract drawings shall be recorded in the field of the surveyed point within the 200- or 2000-point range.

Linear Water Infrastructure

- Refer to **Pre-Engineering Survey – Standard Requirements, Linear Water Infrastructure**, as data collection follows the same principles.
- Photographs are not required unless specified.
- Item numbers used to identify structures in the contract drawings shall be recorded in the description of the surveyed point within the 300- or 3000-point range.

Linear Storm Infrastructure

- Refer to **Pre-Engineering Survey – Standard Requirements, Linear Storm Infrastructure**, as data collection follows the same principles.
- Photographs are not required unless specified.
- Item numbers used to identify structures in the contract drawings shall be recorded in the description of the surveyed point within the 400- or 4000-point range.

Deficient Infrastructure Measurements

- Only required if specified by the inspector or project manager.
- Applies only to recently installed infrastructure.
- Refer to **Pre-Engineering Survey – Standard Requirements, Deficient Infrastructure Measurements** only if the infrastructure has been assumed by Halton System Operations.

10. As-Constructed Survey – Capital Projects

CAD Details

The table below indicates the required support files for conducting this type of survey:

Drawing Template	Survey Blocks	Survey Code Table	Survey Examples
As-Constructed Drawing Template	As-Constructed Survey Blocks	Feature & Line Code Table	Sample Deliverables

Types of As-Constructed Surveys – Capital Projects

- **PHM-125** Provincial Highway Management drawings are legal documents mandated by the Ministry of Transportation Ontario (MTO) and are specified by various sections of the Highway Traffic Act. Details are specified by Ontario Traffic Manual Book 12 – Traffic Signals
- **ROAD**
- **WATERMAIN & WASTEWATER MAIN**

Survey Limits and Data Capture Frequency

- The alignment used to construct the infrastructure shall be used to gather topographic data, ensuring cross-sections fall on the stations indicated in the issued for construction contract drawings.
- Refer to **Pre-Engineering Survey - Standard Requirements, Survey Limits and Data Capture Frequency**, as the requirements are the same.
- Survey limits will be determined by the project limits.

PHM-125

  - The survey extends to the back of the sidewalk or multi-use path if present on either side.
  - In rural areas, the survey extends to the top of the shoulder rounding on either side.
  - The detail shall show the intersection on all approaches for a minimum of 50 m (on the main road) or more if needed to include turning lanes, whether formed by curbing or by paint lines, and 30 m for secondary streets or more if turning lanes exist.

- Where tapers and/or turn lanes are present, whether curbed or painted, the limits shall extend 10 m beyond the start of the taper or turn lane.
- Where advance loops are present, the loops (or diamonds) and roadway details shall be tied in for 10 m +/- upstream and downstream, covering the full width of the roadway.

Typical Cross-Sections

- If required, refer to **Pre-Engineering Survey - Standard Requirements, Typical Cross-Sections**, as data collection would follow the same principles as Road/Street/Highway surveys.

Lines and Breaklines

- Refer to **Pre-Engineering Survey - Standard Requirements, Lines and Breaklines**, as data collection would follow the same principles.
- If available, the alignment used to construct the infrastructure shall be used to gather line and breakline data, ensuring cross-sections fall on the stations indicated in the issued for construction contract drawings.

PHM-125

- All traffic lane delineation paint line markings shall be surveyed.
- Care shall be taken to locate the Point of Intersection (PI) along the road centerline to determine the high point of the intersection. This will be used to establish the relative heights of the signal heads to the PI.
- The PI shall be determined either visually or by projection of the centerline.
- Accessibility devices, such as tactile pads, shall be surveyed using the appropriate line code.

General Features

- Refer to **Pre-Engineering Survey - Standard Requirements, General Features**, as data collection would follow the same principles.

PHM-125

- Will only include traffic-related infrastructure, such as:
  - Traffic light standards with or without luminaires.
  - Utility poles (Hydro Poles) only if verified to provide power to the traffic signal controller. If a meter is attached, it shall be noted in the description.

- Utility poles (Hydro Poles) or traffic light standards with mast arms for traffic infrastructure (signal heads and signs).
- Traffic electrical infrastructure, including manholes, handholes, vaults, traffic signal controllers, and power supplies.
- Regulatory signs related to traffic signals or intersection configuration, as well as street/road name signs.
- Traffic delineation paint symbols.
- At noticeably sloped intersections, elevations shall be recorded below each signal head to determine the relative height of the signal head above the traveled roadway.

Scaled Features

- Refer to **Pre-Engineering Survey - Standard Requirements, Scaled Features**, as data collection would follow the same principles.

Stormwater Features – Overland

- Refer to **Pre-Engineering Survey - Standard Requirements, Stormwater Features – Overland**, as data collection would follow the same principles.
- If a creek or watercourse has been realigned or reconstructed, data capture frequency shall follow the alignment in the issued-for-construction contract drawings.
- Care shall be taken to ensure that elevations at key points indicated in the issued-for-construction contract drawings are captured, particularly for constructed water features designed to assist in the conveyance of water through the channel or ditch.

Vegetation Features

- Refer to **Pre-Engineering Survey - Standard Requirements, Vegetation Features**, as data collection would follow the same principles.

Linear Sanitary Infrastructure

Gravity

- Refer to **Pre-Engineering Survey - Standard Requirements, Linear Sanitary Infrastructure**, as data collection follows the same principles.
- Photographs are not required.
- Item numbers used to identify structures in the contract drawings shall be noted in the description of the surveyed point in the 200- or 2000-point range.

Force Main

- Refer to **Pre-Engineering Survey - Standard Requirements, Linear Sanitary Infrastructure**, as data collection follows the same principles.
- Photographs are not required.
- Item numbers used to identify structures in the contract drawings shall be noted in the field of the surveyed point in the 200- or 2000-point range.

Linear Water Infrastructure

- Refer to **Pre-Engineering Survey - Standard Requirements, Linear Water Infrastructure**, as data collection follows the same principles.
- Photographs are not required.
- Item numbers used to identify structures in the contract drawings shall be noted in the description of the surveyed point in the 300- or 3000-point range.

Linear Storm Infrastructure

- Refer to **Pre-Engineering Survey - Standard Requirements, Linear Storm Infrastructure**, as data collection follows the same principles.
- Photographs are not required.
- Item numbers used to identify structures in the contract drawings shall be noted in the description of the surveyed point in the 400- or 4000-point range.

Deficient Infrastructure Measurements

- Only if specified by the Inspector or Project Manager.
- Only on recently installed infrastructure.
- Only refer to **Pre-Engineering Survey – Standard Requirements, Deficient Infrastructure Measurements** if the infrastructure has been assumed by Halton System Operations.

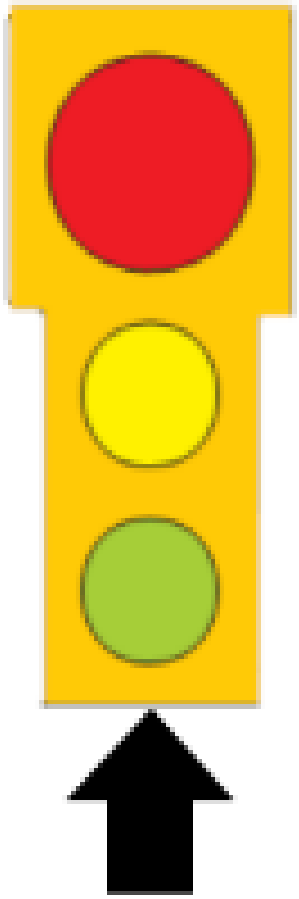
PHM-125 Key Requirements

Traffic Light Standards or Utility Poles (Hydro Poles) with Mast Arms Holding Traffic Signal Heads

(Typically documented on a detail sheet.)

- Determine the diameter of the traffic light standard mast as close to the concrete pole base as possible.
- Note in descriptions if third-party utilities are attached.
- Determine types and lengths of poles relative to the pole base *(Refer to Ontario Traffic Manual – Book 12)*.
- Measure the distance from the bottom of the signal head surround relative to the PI elevation of the intersection.
- Identify types of signal heads used in the intersection *(Refer to Ontario Traffic Manual – Book 12)*.
- Determine the types and lengths of pole mast arms from where it attaches to the pole to the end of the signal head *(Refer to Ontario Traffic Manual – Book 12)*.
- Measure the distance from the bottom of the mounting brackets for pedestrian signal heads to the top of the pole base.
- Identify types of pedestrian signal heads used in the intersection *(Refer to Ontario Traffic Manual – Book 12)*.
- For pedestrian signal heads, determine:
    - Configuration
    - Arm direction
    - Crossing direction
    - Sections
    - Audible signal push button
- Ensure all attached devices on traffic light standards are noted, including:
    - Vehicle detection radars
    - Cameras
    - Emergency vehicle pre-emptors
- Determine direction of intersecting roads.

- Photograph all intersection approaches, ensuring:
    - Road name and direction are indicated.
    - All traffic light standards, their devices, and signage are captured.

Bottom of Signal Head Surround	Bottom of Mounting Bracket, Pedestrian
	

11. As-Constructed Survey – Development Projects

Only sanitary and water infrastructure will be measured for depths. Topographic features will be obtained for sanitary, water, and storm appurtenances.

CAD Details

The table below indicates which support files to use when conducting this type of survey.

Drawing Template	Survey Blocks	Survey Code Table	Survey Examples
As-Constructed Drawing Template	As-Constructed Survey Blocks	Feature & Line Code Table	Sample Deliverables

Types of As-Constructed Surveys – Development Projects

- Watermain & Wastewater Main

Survey Limits and Data Capture Frequency

- Dictated by the subdivision or phase of subdivision engineering drawings.
- Data capture includes only sanitary, water, and storm infrastructure in an urban area.

Typical Cross-Sections

- Not required for a development survey.

Lines and Breaklines

- Not required for a development survey.

General Features

- Not required for a development survey.

Scaled Features

- Only storm system culvert outlet pipes.
- No other scaled features are required for a development survey.

Stormwater Features – Overland

- Only storm system culvert outlet pipes shall be scaled to size, with material noted and surveyed at the invert in the 7000-point range.
    - If an elliptical pipe, the width shall be noted.

- Only culverts built as part of the development shall be surveyed.
- If the invert is not exposed or cannot be determined, the obvert shall be surveyed with obvert noted using the culvert symbol.
- Item numbers used to identify structures in the contract drawings shall be noted in the description of the surveyed point in the 7000-point range.

Vegetation Features

- Not required for a development survey.

Linear Sanitary Infrastructure

Gravity

- Refer to **Pre-Engineering Survey - Standard Requirements, Linear Sanitary Infrastructure**, as data collection follows the same principle.
- Photographs are not required.
- Item numbers used to identify structures in the development contract drawings shall be noted in the description of the surveyed point in the 200- or 2000-point range.
- Basement elevations are not required.

Force Main

- Refer to **Pre-Engineering Survey - Standard Requirements, Linear Sanitary Infrastructure**, as data collection follows the same principle.
- Photographs are not required.
- Item numbers used to identify structures in the development contract drawings shall be noted in the description of the surveyed point in the 200- or 2000-point range.

Linear Water Infrastructure

- Refer to **Pre-Engineering Survey - Standard Requirements, Linear Water Infrastructure**, as data collection follows the same principle.
- In addition to top of main and top operating nut measurements, water valve chamber floor measurement is also required.
- Photographs are not required.

- Item numbers used to identify structures in the development contract drawings shall be noted in the description of the surveyed point in the 300- or 3000-point range.
- Water service boxes shall be collected in the 5000-point range.
- Fire hydrants shall be collected in the 6000-point range.

Linear Storm Infrastructure

- Refer to **Pre-Engineering Survey - Standard Requirements, Linear Storm Infrastructure**, as data collection follows the same principle.
- Photographs are not required.
- Item numbers used to identify structures in the contract drawings shall be noted in the description of the surveyed point in the 400- or 4000-point range.

Deficient Infrastructure Measurements

- Only if specified by the Inspector or Project Manager.
- Only for recently installed infrastructure.
- Only refer to **Pre-Engineering Survey – Standard Requirements, Deficient Infrastructure Measurements** process if infrastructure has been assumed by Halton System Operations.

12. Deliverables

General

Sample deliverables, support files, and this manual are available for download at the *Download Engineering Design Guides & Manuals* page.

All project files shall be stored in the appropriate project directory folder, following proper naming conventions and adhering to the network drive structure. The main project folder shall be named using the following format:

PR####X Street Name/Area or an appropriate description.

Where:

- **PR####** = Project Number
- **X** = Phase identifier, using an alpha character (e.g., *A, B, C*)
- **Street Name/Area** = Relevant location description

Example:

📁 *PR1234A Main Street*

Sample Deliverables

Sample deliverables are provided as references to illustrate the expected format and content upon submission. The following table identifies which Sample Deliverable to review based on the type of survey being conducted.

Survey Type	Relevant Sample Deliverable (Located in Survey Standards Download)
Pre-Engineering Survey	
• **400 Series Highway**	✅ 400 SERIES HWY
• **Bridge**	✅ BRIDGE
• **Culvert**	✅ CULVERT
• **Deficient Infrastructure Measurements**	✅ DEFICIENT INFRASTRUCTURE MEASUREMENTS
• **Guard Rail**	✅ GUARD RAIL
• **Intersection Improvements**	✅ INTERSECTION IMPROVEMENTS
• **Intersection Signalization**	✅ INTERSECTION SIGNALIZATION
• **Rail Corridor**	✅ RAIL CORRIDOR
• **Retaining Wall**	✅ RETAINING WALL
• **Road**	✅ ROAD
• **Road Resurfacing**	✅ ROAD RESURFACING
• **Road LiDAR & Conventional Combined**	✅ ROAD LiDAR & CONVENTIONAL COMBINED
• **Rural**	✅ RURAL
• **Urban**	✅ URBAN
• **Sound Wall**	✅ SOUND WALL
• **Watermain & Wastewater Main**	✅ WATERMAIN & WASTEWATER MAIN
In-Construction Survey – Capital Projects	
• **Quantity**	✅ QUANTITY
• **Asphalt**	✅ ASPHALT
• **Stockpile**	✅ STOCKPILE

Survey Type	Relevant Sample Deliverable (Located in Survey Standards Download)
• **Road**	✅ ROAD
• **Watermain & Wastewater Main**	✅ WATERMAIN & WASTEWATER MAIN
As-Constructed Survey – Capital Projects	
• **PHM-125**	✅ PHM-125
• **Rural**	✅ RURAL
• **Urban**	✅ URBAN
• **Road**	✅ ROAD
• **Watermain & Wastewater Main**	✅ WATERMAIN & WASTEWATER MAIN
As-Constructed Survey – Development Projects	
• **Watermain & Wastewater Main**	✅ WATERMAIN & WASTEWATER MAIN

Consultants

Halton Region reserves the right to audit submitted deliverable packages for compliance with the standards outlined in this document. If a deliverable is deemed non-compliant, it will be returned for remediation and resubmission.

Consultants performing survey work on behalf of Halton Region must include the following in their deliverable submission, in addition to the required deliverables:

- All supplementary files used to complete the survey.
  Examples: *LiDAR scan data, orthographic photos, quality control points*
- Raw survey data.
  Examples: *ASCII point files, survey raw data files, project control points, and benchmarks*

LiDAR Data

LiDAR Integration into Conventional Workflow

- Extracted LiDAR survey data must be seamlessly integrated with conventional survey data in the final drawing deliverable.
- The appearance of LiDAR data shall be indistinguishable from conventional survey data once incorporated into the final drawing.
- All LiDAR data—features, points, or lines—must be extracted as surveyed points.

- LiDAR data must follow the same coding methodology as conventional survey data.

LiDAR Submission Parameters

- Clean LiDAR scan data in LAS or LAZ format, referenced to the Project Control Network
- Colorized LiDAR scan data
- LiDAR scan data must be supplied in the following classifications:
    - Low Ground
    - Non-Ground
    - Low Vegetation
    - Medium Vegetation
    - High Vegetation
    - Buildings
    - Bridges
    - Walls
    - Concrete
    - Asphalt
- PNEZD (comma-delimited) ASCII point file of LiDAR quality control points
- Orthographic photograph in TIFF file format

Project Control Network

Consultants must submit the following documentation related to project control:

- **Project Control Data:**
    - All level notes, raw data, and working files
    - ASCII point file in PNEZD (comma-delimited) format for all project control points
- **Control Station Report (CSR):**
    - A digital CSR is required for every Halton Region project
    - Must be bounded by a Halton Region title block (Sheet size: Arch D – 24" x 36")

- Depicts the location of all permanent project control points and benchmarks
- Control points are overlaid on GIS mapping within the drawing area
- Contains a table with general control information and tabulated control points, including:
  - Point ID
  - Coordinates
  - Control point location descriptions, including type of monumentation set
- If multiple CSR drawings are required due to project size, each drawing must contain:
  - General information
  - Control points or benchmarks (BMs) specific to that sheet

CSR Formatting Requirements

- Halton Region title block, color table, and logo must be applied as per survey standards
- Design Only Stamp is required for CSR preparation
- Required CSR elements can be found in the Survey Standards Support Files

Pre-Construction CSR Guidelines

- If the original project control points remain intact, the original CSR will be issued for construction with the Design Only Stamp removed
- If project control points have been reinstated, a revised CSR must be created and issued for construction

Example: CSR Title Block

1	01/12/2023	DSL	CREATED	
NO.	DATE	BY	REVISIONS	
DESIGN	DSL	CH'KD		DATE: DEC 1, 2023
DRAWN	DSL	CH'KD		

Halton REGION

SCALE N.T.S.

CONTROL STATION REPORT
MIDTOWN
PROPOSED WM & WWM
VARIOUS LOCATIONS
TOWN OF OAKVILLE

CONSULTANT FILE NO.	REGIONAL DRAWING NO.
CONTRACT NO. WS-3547-23	DRAWING NO. CSR 1 OF 1

Example: CSR Title Block Left Margin

WS-3547-23 1 OF 1
Drawing: R:\0000000. FIELD SURVEY 2023\1.0 2023 PRE-ENG\PR3447 TRAFALGAR_CORNWALL AREA\PR3447_TRAFALGAR & CORNWALL_WORKING_DSL\CONTROL\PR3547 MIDTOWN CSR.DWG
Layout Tab: LAYOUT1
Date: 12/01/2023 Time: 05:54:56 PM

Example: CSR Table

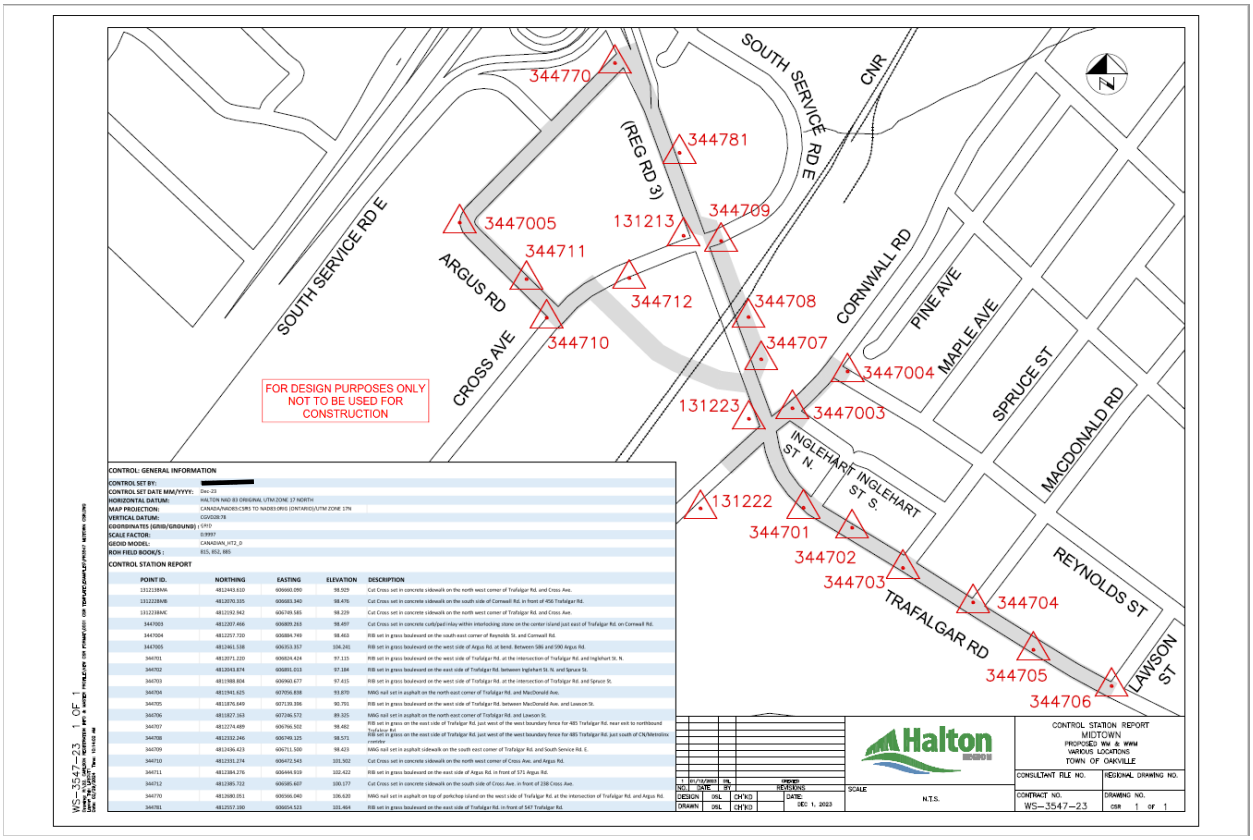
CONTROL: GENERAL INFORMATION

CONTROL SET BY:	[redacted]
CONTROL SET DATE MM/YYYY:	Dec-23
HORIZONTAL DATUM:	HALTON NAD 83 ORIGINAL UTM ZONE 17 NORTH
MAP PROJECTION:	CANADA/NAD83:CSRS TO NAD83:ORIG (ONTARIO)/UTM ZONE 17N
VERTICAL DATUM:	CGVD28:78
COORDINATES (GRID/GROUND) :	GRID
SCALE FACTOR:	0.9997
GEOID MODEL:	CANADIAN_HT2_0
ROH FIELD BOOK/S :	815, 852, 885

CONTROL STATION REPORT

POINT ID.	NORTHING	EASTING	ELEVATION	DESCRIPTION
1312138MA	4812443.610	606660.090	98.929	Cut Cross set in concrete sidewalk on the north west corner of Trafalgar Rd. and Cross Ave.
1312228MB	4812070.335	606683.340	98.476	Cut Cross set in concrete sidewalk on the south side of Cornwall Rd. in front of 456 Trafalgar Rd.
1312238MC	4812192.942	606749.585	98.229	Cut Cross set in concrete sidewalk on the north west corner of Trafalgar Rd. and Cross Ave.
3447003	4812207.466	606809.263	98.497	Cut Cross set in concrete curb/pad inlay within interlocking stone on the center island just east of Trafalgar Rd. on Cornwall Rd.
3447004	4812257.720	606884.749	98.463	RIB set in grass boulevard on the south east corner of Reynolds St. and Cornwall Rd.
3447005	4812461.538	606353.357	104.241	RIB set in grass boulevard on the west side of Argus Rd. at bend. Between 586 and 590 Argus Rd.
344701	4812071.220	606824.424	97.115	RIB set in grass boulevard on the west side of Trafalgar Rd. at the intersection of Trafalgar Rd. and Inglehart St. N.
344702	4812043.874	606891.013	97.184	RIB set in grass boulevard on the east side of Trafalgar Rd. between Inglehart St. N. and Spruce St.
344703	4811988.804	606960.677	97.415	RIB set in grass boulevard on the west side of Trafalgar Rd. at the intersection of Trafalgar Rd. and Spruce St.
344704	4811941.625	607056.838	93.870	MAG nail set in asphalt on the north east corner of Trafalgar Rd. and MacDonald Ave.
344705	4811876.649	607139.396	90.791	RIB set in grass boulevard on the west side of Trafalgar Rd. between MacDonald Ave. and Lawson St.
344706	4811827.163	607246.572	89.325	MAG nail set in asphalt on the north east corner of Trafalgar Rd. and Lawson St.
344707	4812274.489	606766.502	98.482	RIB set in grass on the east side of Trafalgar Rd. just west of the west boundary fence for 485 Trafalgar Rd. near exit to northbound Trafalgar Rd
344708	4812332.246	606749.125	98.571	RIB set in grass on the east side of Trafalgar Rd. just west of the west boundary fence for 485 Trafalgar Rd. just south of CN/Metrolinx corridor
344709	4812436.423	606711.500	98.423	MAG nail set in asphalt sidewalk on the south east corner of Trafalgar Rd. and South Service Rd. E.
344710	4812331.274	606472.543	101.502	Cut Cross set in concrete sidewalk on the north west corner of Cross Ave. and Argus Rd.
344711	4812384.276	606444.919	102.422	RIB set in grass boulevard on the east side of Argus Rd. in front of 571 Argus Rd.
344712	4812385.722	606585.607	100.177	Cut Cross set in concrete sidewalk on the south side of Cross Ave. in front of 238 Cross Ave.
344770	4812680.051	606566.040	106.620	MAG nail set in asphalt on top of porkchop island on the west side of Trafalgar Rd. at the intersection of Trafalgar Rd. and Argus Rd.
344781	4812557.190	606654.523	101.464	RIB set in grass boulevard on the east side of Trafalgar Rd. in front of 547 Trafalgar Rd.

Example: CSR Complete



Pre-Engineering Survey

Note: *If a survey is being conducted for an* ***Environmental Assessment (EA) study****, it shall adhere to the guidelines established for Pre-Engineering Surveys.*

Drawings and Point Files

Consultants must submit the following files in accordance with Halton Region standards:

- **AutoCAD Drawings:**
  - Two-dimensional drawing in AutoCAD 2018 format
  - Three-dimensional drawing in AutoCAD 2018 format
- **ASCII Point File:**
  - Provided in PENZD (comma-delimited) format
- **PDF Drawing:**
  - Generated from the 2D AutoCAD drawing, with:
    - Field notes included

        - Point attribute layers turned off
        - North arrow inserted
    - Halton Region color table (Halton Region.ctb) applied
    - Sheet size: ARCH D (24" x 36")
- **CAD Standards:**
    - Pre-engineering drawing template and survey blocks must be used
    - Appropriate symbols and lines must be placed on the correct layers
    - Project Control Points must be omitted from the final topographic drawings and instead provided in the Control Station Report (CSR)
    - Drawings must adhere to the **Survey CAD Standard**.

Tables

All sanitary, water, and storm infrastructure measurements must be documented in Microsoft Excel on separate sheets. Each table must include:

- **Surveyed Point Number:**
    - 200-, 300-, or 400- range (or 2000-, 3000-, 4000-range) based on feature type (Sanitary, Water, Storm)
- **Sanitary Infrastructure Asset/Operating Number:**
    - Recorded under the 200- or 2000-point number (obtained from operating maps)
- **Feature Type:**
    - Sanitary, Water, or Storm infrastructure
- **Elevations:**
    - Top of frame and cover elevation (Sanitary, Water, Storm)
    - Invert/drop elevations (Sanitary, Storm)
    - Top of main/top of nut elevation (Water, Sanitary force main)
- **Field Measurements:**
    - **Sanitary & Storm:**
        - Measured from top of frame/cover to invert or drop

- **Water & Sanitary Force Main:**
  - Measured from top of frame/cover to top of main or top of nut

- **Directional References:**
  - **Sanitary & Storm:** Directions relative to true north for measured structures
  - **Water & Sanitary Force Main:** Directions relative to true north noted in remarks

- **Additional Details:**
  - Pipe sizes (Storm)
  - Notes or remarks as required

Examples of submitted sanitary, water, and storm infrastructure measurement tables will be provided for reference.

Sanitary Measurement Data Sheet

Street	Neyagawa		PR Number:	PR3514	Revisions:	
Direction	Compass		Job Type:	Road		
Entry:	Name		City/Town:	Oakville		
Checked:	Name		Crew:	5773		
Review:	Name		Date: mm/dd/yea	1/13/2025		
Point Number	Description	Elev. of Lid	Lid to Invert	Direction	Invert Elev	Note
200	MH	177.489	4.340	SE	173.149	
OP# 59169			4.300	NW	173.189	
201	MH	179.384	5.790	SE	173.594	
OP# 59170			5.770	W	173.614	
202	MH	180.945	6.410	E	174.535	
OP# 310060			6.370	SW	174.575	
203	MH	180.558	5.680	NE	174.878	
OP# 310061			5.520	S	175.038	
204	MH	180.425	6.300	SE	174.125	
OP# 59172			6.180	W	174.245	
205	MH	179.768	5.820	E	173.948	
OP# 59171			5.790	NW	173.978	

Water Measurement Data Sheet

Street	Neyagawa		Project Number:	PR3514	Revisions:
Direction	Compass		Job Type:	Road	
Entry:	Name		City/Town:	Oakville	
Checked:	Name		Crew:	5772	
Review:	Name		Date: mm/dd/yea	1/13/2025	
Point Number	Description	Elevation of Lid	Lid to TON/Main	TON / MAIN ELEV	Note
300	SECV	180.050	0.560	179.490	TOP EX ROD
301	WVC ARC	179.949	0.000	Not Obtained	FLOODED
302	WV	180.044	1.010	179.034	TOP EX ROD
303	WV	180.025	0.680	179.345	TOP EX ROD
304	WVC ARC	179.997	0.000	Not Obtained	FLOODED
305	WV	179.997	0.680	179.317	TOP EX ROD
306	WV	179.997	0.910	179.087	TOP EX ROD
307	WV	180.191	2.490	177.701	TON
308	WV	181.581	2.790	178.791	TON
309	WVC	179.186	2.230	176.956	NE-SW TOM
310	WV	179.194	1.650	177.544	TON
311	WV	179.177	1.650	177.527	TON

Storm Measurement Data Sheets

Street	Neyagawa		Project Number:	PR3514	Revisions:		
Direction	Compass		Job Type:	Road			
Entry:	Name		City/Town:	Oakville			
Checked:	Name		Crew:	5772			
Review:	Name		Date:mm/dd/yea	1/13/2025			
Point Number	Description	Elev. of Lid	Lid to Invert	Direction	Invert Elevation	Size(mm)/Pipe Material	Note
400	MHS	177.379	3.140	SE	174.239	975 CONC	
			2.540	W	174.839	150 PVC	
			2.710	NW	174.669	975 CONC	
			0.000	NE	Not Obtained		N/A TOO RECESSED
401	MHS	179.413	3.320	SE	176.093	975 CONC	
			2.880	W	176.533	150 PVC	
			2.810	NW	176.603	975 CONC	
402	CB/SI	180.340	1.620	SW	178.720	300 PVC	
403	MHS	180.639	2.910	SE	177.729	975 CONC	
			2.880	NW	177.759	975 CONC	
404	CB/SI	181.412	1.630	NW	179.782	300 PVC	
405	MHS	181.345	1.700	NE	179.645	300 PVC	
			1.680	SE	179.665	300 PVC	
			1.670	NW	179.675	300 PVC	

Photographs

All photographs must adhere to the following guidelines:

- **Orientation:**
  - Photographs must be oriented with the top facing north.
- **Identification:**
  - Each photograph must include the project number and the corresponding surveyed point number in the description.
  - The description must end with one of the following indicators:
    - Lid – Infrastructure lid
    - Mod – Adjustment rings
    - Str – Benching or bottom
- **File Naming Convention:**
  - Example for Sanitary Infrastructure:
    - *ProjectNumber_PointNumber_Lid.jpg*
    - *ProjectNumber_PointNumber_Mod.jpg*
    - *ProjectNumber_PointNumber_Str.jpg*
- **Folder Organization:**
  - All photographs must be stored in a single folder and categorized into subfolders by infrastructure type:
    - Sanitary
    - Water
    - Storm
- **Photograph Content:**
  - The following examples illustrate the types of infrastructure details that must be captured:
    - Sanitary and Storm Manholes
    - Water Valve Chambers

Lid Photo (Sanitary or Storm)

Adjustment Ring Photo (Sanitary or Storm)

Structure Photo (Sanitary or Storm)

Lid Photo (Water)

Adjustment Ring Photo (Water)

Structure Photo (Water)

Deficient Infrastructure Measurements

If infrastructure measurements cannot be obtained due to obstructions, burial, or inaccessibility during the survey, efforts should be made to retrieve this information. For assistance with remediation, contact the Supervisor of Technical & Design Services.

In-Construction – Capital Projects

Drawings and Point Files

- Determine whether the survey reflects existing or as-constructed conditions to select the appropriate drawing template.
- Refer to **Deliverables – Pre-Engineering Survey,** Drawings and Point Files for formatting and submission requirements.

Tables

- Only required if requested.
- If conducting verification checks before or after infrastructure installation, a table shall be produced.
- For sanitary, storm, or water infrastructure measurements, refer to **Deliverables – Pre-Engineering Survey,** Tables, as requirements are similar.
- Structure identification numbers from the contract drawings shall be documented in the table under Notes or Remarks.
- **Example:** Verification check (prior to curb placement) table.

Right Side of Chainage

12+180 Right to 12+754.87Right (String Line Measurements)															
South Island Edge of Pavement (String Line)						Overall Pavement Width Actual and Proposed					South Edge of Pavement (String Line)				
Point #	Station	Notes	String Line O/S EP (1m	String Line Elevati	Proposed EP Elevatio	String Line Cut to EP (0.5	Actual Width Based on String Line (1mos/ep) @ STN	Proposed Width @ STN (R3309A_Ca	Point #	Station	Notes	String Line O/S EP (1m	String Line Elevation	Proposed EP Elevation	Sring Line Cut to EP (0.5m)
NA	12+180		NA	NA	NA	NA	NA	12.300	2001	12+180		0.931	194.642	194.14	0.502
NA	12+200		NA	NA	NA	NA	NA	12.300	2002	12+200		0.916	194.754	194.26	0.494
2011	12+220		1.0424	195.369	194.87	0.499	12.242	12.300	2003	12+220		0.900	194.877	194.38	0.497
2014	12+240		1.0678	195.507	195.01	0.497	12.279	12.300	2004	12+240		0.911	195.090	194.59	0.500
2015	12+260		0.9213	195.653	195.15	0.503	12.114	12.300	2005	12+260		0.893	195.349	194.84	0.509
2018	12+280	Assumed to	1.0453	195.790	195.29	0.500	12.320	12.300	2006	12+280	Assumed	0.976	195.587	195.09	0.497
2019	12+300	be	1.0755	195.934	195.44	0.494	12.367	12.300	2007	12+300	to be	0.992	195.844	195.34	0.504
2022	12+320	Completed	1.0666	196.052	195.55	0.502	12.365	12.300	2008	12+320	Complete	0.999	196.070	195.57	0.500
2023	12+340		1.0431	196.095	195.59	0.505	12.293	12.300	2009	12+340	d	0.951	196.205	195.71	0.495
2026	12+360		1.0268	196.040	195.54	0.500	12.299	12.300	2010	12+360		0.973	196.272	195.78	0.492
2036	12+380		1.0507	195.970	195.46	0.510	12.329	12.300	2033	12+380		0.979	196.318	195.81	0.508
2039	12+400		1.0443	195.896	195.39	0.506	12.319	12.300	2034	12+400		0.977	196.341	195.84	0.501
2040	12+420		1.0662	195.791	195.29	0.501	12.337	12.300	2035	12+420		0.972	196.293	195.79	0.503
Break In String Line															
2053	12+480		1.0702	195.484	194.99	0.494	12.346	12.300	2070	12+480		0.976	195.991	195.49	0.501
2054	12+500		1.0711	195.386	194.89	0.496	12.348	12.300	2071	12+500		0.977	195.899	195.39	0.509
2057	12+520		1.053	195.289	194.79	0.499	12.340	12.300	2072	12+520		0.987	195.788	195.29	0.498
2058	12+540		1.0353	195.187	194.69	0.497	12.330	12.300	2073	12+540		0.994	195.688	195.19	0.498
2061	12+560	Assumed to	1.0283	195.086	194.59	0.496	12.369	12.300	2074	12+560		1.041	195.579	195.09	0.489
2062	12+580	be	1.0624	194.985	194.49	0.495	12.350	12.300	2075	12+580		0.988	195.491	194.99	0.501
2065	12+600	Completed	1.0201	194.879	194.39	0.489	12.393	12.300	2076	12+600	Only Main	1.075	195.377	194.89	0.487
2066	12+620		1.027	194.773	194.28	0.493	12.331	12.300	2077	12+620	Pins Set	1.004	195.185	194.70	0.485
2069	12+640		1.0271	194.649	194.15	0.499	12.344	12.300	2078	12+640		1.017	194.938	194.47	0.468
2085	12+660		1.0289	194.499	193.99	0.509	14.061	14.026	2079	12+660		0.993	194.714	194.22	0.494
2088	12+680		1.0551	194.322	193.82	0.501	15.799	15.777	2080	12+680		0.944	194.479	193.96	0.519
NA	12+700		NA	NA	NA	NA	NA	17.562	2081	12+700		0.912	194.317	193.81	0.507
NA	12+720		NA	NA	NA	NA	NA	18.500	2082	12+720		0.978	194.101	193.61	0.491
NA	12+740		NA	NA	NA	NA	NA	18.500	2083	12+740		0.982	193.906	193.41	0.496
NA	12+754.87		NA	NA	NA	NA	NA	18.501	2084	12+754.8		0.978	193.765	193.27	0.495

Left Side of Chainage

12+180 Right to 12+754.87Right (String Line Measurements)

			South Island Edge of Pavement (String Line)				Overall Pvement Width Actual and Proposed					South Edge of Pavement (String Line)			
Point #	Station	Notes	String Line O/S EP (1m	String Line Elevati	Proposed EP Elevatio	String Line Cut to EP (0.5	Actual Width Based on String Line (1mos/ep) @ STN	Proposed Width @ STN (R3309A_Ca	Point #	Station	Notes	String Line O/S EP (1m	String Line Elevation	Proposed EP Elevation	Sring Line Cut to EP (0.5m)
NA	12+180		NA	NA	NA	NA	NA	12.300	2001	12+180		0.931	194.642	194.14	0.502
NA	12+200		NA	NA	NA	NA	NA	12.300	2002	12+200		0.916	194.754	194.26	0.494
2011	12+220		1.0424	195.369	194.87	0.499	12.242	12.300	2003	12+220		0.900	194.877	194.38	0.497
2014	12+240		1.0678	195.507	195.01	0.497	12.279	12.300	2004	12+240		0.911	195.090	194.59	0.500
2015	12+260		0.9213	195.653	195.15	0.503	12.114	12.300	2005	12+260		0.893	195.349	194.84	0.509
2018	12+280	Assumed to	1.0453	195.790	195.29	0.500	12.320	12.300	2006	12+280	Assumed	0.976	195.587	195.09	0.497
2019	12+300	be	1.0755	195.934	195.44	0.494	12.367	12.300	2007	12+300	to be	0.992	195.844	195.34	0.504
2022	12+320	Completed	1.0666	196.052	195.55	0.502	12.365	12.300	2008	12+320	Complete	0.999	196.070	195.57	0.500
2023	12+340		1.0431	196.095	195.59	0.505	12.293	12.300	2009	12+340	d	0.951	196.205	195.71	0.495
2026	12+360		1.0268	196.040	195.54	0.500	12.299	12.300	2010	12+360		0.973	196.272	195.78	0.492
2036	12+380		1.0507	195.970	195.46	0.510	12.329	12.300	2033	12+380		0.979	196.318	195.81	0.508
2039	12+400		1.0443	195.896	195.39	0.506	12.319	12.300	2034	12+400		0.977	196.341	195.84	0.501
2040	12+420		1.0662	195.791	195.29	0.501	12.337	12.300	2035	12+420		0.972	196.293	195.79	0.503
Break In String Line															
2053	12+480		1.0702	195.484	194.99	0.494	12.346	12.300	2070	12+480		0.976	195.991	195.49	0.501
2054	12+500		1.0711	195.386	194.89	0.496	12.348	12.300	2071	12+500		0.977	195.899	195.39	0.509
2057	12+520		1.053	195.289	194.79	0.499	12.340	12.300	2072	12+520		0.987	195.788	195.29	0.498
2058	12+540		1.0353	195.187	194.69	0.497	12.330	12.300	2073	12+540		0.994	195.688	195.19	0.498
2061	12+560	Assumed to	1.0283	195.086	194.59	0.496	12.369	12.300	2074	12+560		1.041	195.579	195.09	0.489
2062	12+580	be	1.0624	194.985	194.49	0.495	12.350	12.300	2075	12+580		0.988	195.491	194.99	0.501
2065	12+600	Completed	1.0201	194.879	194.39	0.489	12.393	12.300	2076	12+600	Only Main	1.075	195.377	194.89	0.487
2066	12+620		1.027	194.773	194.28	0.493	12.331	12.300	2077	12+620	Pins Set	1.004	195.185	194.70	0.485
2069	12+640		1.0271	194.649	194.15	0.499	12.344	12.300	2078	12+640		1.017	194.938	194.47	0.468
2085	12+660		1.0289	194.499	193.99	0.509	14.061	14.026	2079	12+660		0.993	194.714	194.22	0.494
2088	12+680		1.0551	194.322	193.82	0.501	15.799	15.777	2080	12+680		0.944	194.479	193.96	0.519
NA	12+700		NA	NA	NA	NA	NA	17.562	2081	12+700		0.912	194.317	193.81	0.507
NA	12+720		NA	NA	NA	NA	NA	18.500	2082	12+720		0.978	194.101	193.61	0.491
NA	12+740		NA	NA	NA	NA	NA	18.500	2083	12+740		0.982	193.906	193.41	0.496
NA	12+754.87		NA	NA	NA	NA	NA	18.501	2084	12+754.8		0.978	193.765	193.27	0.495

Photographs

- Only required if requested.
- Refer to **Deliverables – Pre-Engineering Survey**, Photographs for formatting and submission requirements.

As-Constructed Survey – Capital Projects

Drawings and Point Files

- Use the As-Constructed Drawing Template.
- Refer to **Deliverables – Pre-Engineering Survey**, Drawings and Point Files for formatting and submission requirements.

Tables

- Refer to **Deliverables – Pre-Engineering Survey**, Tables, as requirements are similar. However:
    - Structure identification numbers from the contract drawings shall be documented under Notes or Remarks.

Photographs

- Only required if requested.
- Refer to **Deliverables – Pre-Engineering Survey**, Photographs for formatting and submission requirements.

As-Constructed Survey – Capital Projects (PHM-125)

Drawings and Point Files

- Use the As-Constructed Drawing Template.
- Refer to **Deliverables – Pre-Engineering Survey,** Drawings and Point Files for formatting and submission requirements.

Tables

- Not required.

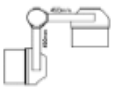
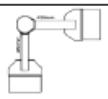
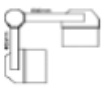
Photographs

- Refer to **As-Constructed Survey – Capital Projects (PHM-125) Key Requirements**.

Special Detail Sheets

- Refer to **As-Constructed Survey – Capital Projects (PHM-125) Key Requirements**.
- The following examples illustrate:
    - A typical detail sheet for submission.
    - A detail sheet used as a field working copy.

Completed detail sheet for each traffic light standard is for submission.

	PHM Detail Sheets						
	Location:	Ford@Cornwall Rd					
	Direction held:	Ford held as North - South					
	Point #:	1000					
	Pole Details	TL (HD)					
	Type	Length (Height)	Conc Base (Y/N)	Push Button (Y/N)	Audible (Y / N)	Signage	
	TP19-1080E-AB-406	5.8m	Yes	Yes	Yes (Talks)		
	Signal Head Arm Details						
	Direction	Arm Length	Arm Type	Radar / Camera ((Y / N) Specify)	Preemptor (Y / N)	Mast Arm Signs (Y / N)	
	SOUTH	6.1m	TR20SMA	Yes CAMERA on	Yes	Yes	
				pole	GPS Pre emptor		
				WiFi antenna on			
				pole			
	Signal Heads Details						
	Mounting Height relative to CL intersection of road						
	Direction	Mounting Height	Signal Head Type				
	EAST	5.20 m	HWY 300				
	Pedestrian Head Details						
	Mounting Height relative to surface mounted above						
	Pedestrian Arm Direction	Pedestrian Crossing Direction	Mounting Height	Arm Length	Arm Type	Countdown (Y / N)	Sections
	EAST	N/S	2.69 m	0.45m	EDA	Yes	2
	NORTH	E/W	2.69 m		EDA	Yes	2
	Configuration		A	B	C	D	
	A						

Completed field/working copy of detail sheet. Not for submission.

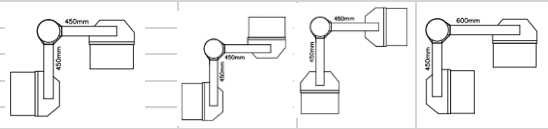
Type	Length (Height)	Conc Base	Push Button (Y/N)	Audible (Y / N)	Signage
PDP-550B-AB-190	1.5m	Yes	Yes	Yes	RB and WA
TP10-423A-AB-150	3.3m	No	No	No	series of signs
TP15-645C-AB-242	4.5m				
TP19-866C-AB-292	5.8m				
TP19-1080E-AB-406	6.1m LD				
TP24-866C-AB-406	6.1m HD				
ET35-1055E-AB-406	7.3m				
E35-845E-AB-292	9.8m				
UTS 615.010 OCTAGONAL					

Direction	Arm Length	Arm Type	Radar / Camera	Preemptor	Mast Arm
NORTH	0.45m	EDA	No	Yes	Yes
EAST	1.2m	R4-JA	Yes CAMERA	No	No
WEST	1.8m	TR6SMA	Yes RADAR		
SOUTH	2.4m	TR8SMA			
	3.0m	TR10SMA			
	3.6m	TR12SMA			
	4.6m	TR15SMA			
	5.5m	TR18SMA			
	6.1m	TR20SMA			
	6.7m	TR22SMA			
	7.3m	TR24SMA			
	7.6m	TR25SMA			
		OPSD 2524.01			

Direction	Mounting	Signal Head
		HWY
		HWY 300
		1
		2
		3
		4
		5
		6
		7
		8
		8A
		9
		9A
		10
		10A
		11
		11A

Direction	Mounting	Arm Length	Arm Type	Countdown	Sections	Ped Crossing Direction
		0.45m	EDA	Yes	1	N/S
		0.65m	OPSD 2524.01	No	2	E/W

A B C D



As-Constructed – Development Projects

Drawings and Point Files

- Use the As-Constructed Drawing Template.
- Refer to **Deliverables – Pre-Engineering Survey**, Drawings and Point Files for formatting and submission requirements.
- Use appropriate point numbering for as-constructed development projects:
    - Linear Sanitary Infrastructure
    - Linear Water Infrastructure
    - Linear Storm Infrastructure
- Drawings will not be submitted for developments but will be retained as a survey record for statistical purposes.
- Only a PENZD (comma-delimited) ASCII point file containing all surveyed points shall be submitted.
- A PDF copy of the development drawings used to complete the survey must be included in the submission package.

Tables

- Refer to **Deliverables – Pre-Engineering Survey**, Tables, as requirements are similar. However:
    - Structure identification numbers from the development drawings shall be documented under Notes or Remarks.
- Use appropriate point numbering for as-constructed development projects:
    - Linear Sanitary Infrastructure
    - Linear Water Infrastructure
    - Linear Storm Infrastructure

Photographs

- Not required.

13. Feature & Line Code Table

(click here to return to Survey Cad Standard)

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
11	11.25 DEGREE BEND	@ center of bend in trench		AC-WATER	BYLAYER		AC-BEND11	Point
22	22.5 DEGREE BEND	@ center of bend in trench		AC-WATER	BYLAYER		AC-BEND22	Point
45	45 DEGREE BEND	@ center of bend in trench		AC-WATER	BYLAYER		AC-BEND45	Point
5	5 DEGREE BEND	@ center of bend in trench		AC-WATER	BYLAYER		AC-BEND5	Point
300ST	300x450mm SHARKS TOOTH	where the two equal sides meet	EXPMARKS	AC-PMARKS	BYLAYER	EX300X450 SHARK TOOTH	AC-300X450 SHARK TOOTH	Point
600ST	600x900mm SHARKS TOOTH	where the two equal sides meet	EXPMARKS	AC-PMARKS	BYLAYER	EX600X900 SHARK TOOTH	AC-600X900 SHARK TOOTH	Point
AFS	AUTOMATIC FLUSHING STATION	@ center of AFS @ ground	EXWATER	AC-WATER	BYLAYER	AFS	AC-AFS	Point
ARC	AIR RELEASE CHAMBER	@ center of ARC lid	EXWATER	AC-WATER	BYLAYER	ARC	AC-ARC	Point
ARCV	AIR RELEASE CHAMBER VENT	@ center of ARC vent upright pipe @ ground	EXWATER	AC-WATER	BYLAYER	ARCV	AC-ARCV	Point
ASP	ASPHALT	on ASP surface to indicate material	OG	AC-OG	BYLAYER	ASP	AC-ASP	Point
B	BELL	on B locate line	EXBELL	AC-BELL	BYLAYER			3DPline
BBOX	BUFFALO BOX	@ center of BBOX	EXWATER-SERVICE	AC-WATER-SERVICE	BYLAYER	BB	AC-BB	Point
BFO	BELL FIBER OPTIC	BFO locate line	EXBELL-FO	AC-BELL-FO	BYLAYER			3DPline
BH	BORE HOLE	@ center of BH	BOREHOLES-PLAN	AC-BOREHOLES-PLAN	BYLAYER	BH	AC-BH	Point
BK	BIKE SYM FOR BIKE LANE	@ bike pedals	EXPMARKS	AC-PMARKS	BYLAYER	BIKE	AC-PRBIKE	Point
BL	BASELINE	on Baseline	EXREFPT	AC-REFPT	BYLAYER			3DPline

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
BLDG	BUILDING	@ BLDG corners (Use no elevation unless required)	EXBLDGS	AC-BLDGS	BYLAYER			3DPline
BM	BENCHMARK	on referenced BM height	EXREFPT	AC-REFPT	BYLAYER	BM	AC-BM	Point
BMH	BELL MANHOLE	@ center of BMH lid	EXBELL	AC-BELL	BYLAYER	BMH	AC-BMH	Point
BOL	BOLLARD	@ center of BOL @ ground	EXDETAIL	AC-DETAIL	BYLAYER	BOL	AC-BOL	Point
BOLD	BOULDER	@ center of Boulder	EXDETAIL	AC-DETAIL	BYLAYER	BOLD	AC-BOLD	Point
BP	BELL POLE	@ center of BP @ ground	EXBELL	AC-BELL	BYLAYER	BP	AC-BP	Point
BPED	BELL PEDASTAL	@ center of BPED @ ground	EXBELL	AC-BELL	BYLAYER	BPED	AC-BPED	Point
BS	BUS SHELTER	@ BS corners (Use no elevation unless required)	EXBLDGS	AC-BLDGS	BYLAYER			3DPline
BWALL	BOTTOM WALL	@ bottom of retaining wall @ ground	EXWALL	AC-WALL	BYLAYER			3DPline
C	CABLE	on C locate line	EXTV	AC-TV	BYLAYER			3DPline
CAB	CABLE CABINET FOR BELL,ROGERS,COGECO,HYDRO, ETC	@ center of CAB at ground	EXMISC	AC-MISC	BYLAYER	CAB	AC-CAB	Point
CB	CATCH BASIN	@ center of CB lid	EXSTM	AC-STM	BYLAYER	CB	AC-CB	Point
CBMH	CATCB BASIN MANHOLE	@ center of CBMH lid	EXSTM	AC-STM	BYLAYER	CBMH	AC-MHCB	Point
CBOX	CURB BOX	@ center of CBOX	EXWATER-SERVICE	AC-WATER-SERVICE	BYLAYER	CBOX	AC-CBOX	Point
CC	CUT CROSS	@ center of CC	EXREFPT	AC-REFPT	BYLAYER	CC	AC-CC	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
CFO	CABLE TV FIBER OPTIC	on CFO locate line	EXTV-FO	AC-TV-FO	BYLAYER			3DPline
CL	CENTER LINE	on Thalweg (Deepest) point in water course or valley	EXREFPT	AC-REFPT	BYLAYER			3DPline
CM	CONC. MON.	@ center of CM	EXREFPT	AC-REFPT	BYLAYER	CM	AC-CM	Point
CMB	COMMUNITY MAILBOX	@ center of CMB at ground	EXDETAIL	AC-DETAIL	BYLAYER	CMB	AC-CMB	Point
CNF	CONIFEROUS TREE	@ center of CNF @ ground and SZ drip Rad and note trunk dia.	EXVEG	AC-VEG	BYLAYER	CNF	AC-CNF	Point
CO	SANITARY CLEAN OUT- AT OR AROUND PROPERTY LINE (PVC STYLE)	@ center of CO	EXSAN	AC-SAN	BYLAYER	CO	AC-CO	Point
CONC	CONCRETE	on CONC surface to indicate material	OG	AC-OG	BYLAYER	CONC	AC-CONC	Point
CP	CONTROL POINT	@ center of CP	EXREFPT	AC-REFPT	BYLAYER	CP	AC-CP	Point
CPED	CABLE PEDISTAL	@ center of CPED @ ground	EXTV	AC-TV	BYLAYER	CPED	AC-CPED	Point
CR	EDGE OF CREEK	where water meets bank	EXDRAIN	AC-DRAIN	BYLAYER			3DPline
CULV	CULVERT	@ center of invert of box pipe, round, or elliptical pipe	EXCULVERTS	AC-CULVERTS	BYLAYER	CULV	AC-CULV	Point
CV	CABLE VAULT-BELL, ROGERS, COGECO, HYDRO,ETC	@ center of CV	EXMISC	AC-MISC	BYLAYER	CV	AC-CV	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
D	DITCH	@ center of Ditch line	EXDITCH	AC-DITCH	BYLAYER		AC-DCB	3DPline
DCB	DOUBLE CATCH BASIN	@ center of DCB (between both lids)	EXSTM	AC-STM	BYLAYER	DCB	AC-DCBMH	Point
DCBMH	DOUBLE CATCH BASIN MANHOLE	@ center of DCBMH (between both lids)	EXSTM	AC-STM	BYLAYER	DCBMH	AC-DEC	Point
DEC	DECIDUOUS TREE	@ center of DEC @ ground and SZ drip Rad and note trunk dia.	EXVEG	AC-VEG	BYLAYER	DEC		Point
DFL	H &/OR V DEFLECTION INDICATE IN NOTE	@ center of deflection in trench		AC-WATER	BYLAYER		AC-DEFLECTION	Point
DICB	DITCH INLET CATCH BASIN	@ reference point used to measure invert	EXSTM	AC-STM	BYLAYER	DICB	AC-DICB	Point
DMD	DIAMOND SYM FOR BIKE LANE	@ center of DMD	EXPMARKS	AC-PMARKS	BYLAYER	DIAMOND	AC-DIAMOND	Point
DRC	DRAIN RELEASE CHAMBER	@ center of DRC lid	EXWATER	AC-WATER	BYLAYER	DC	AC-DC	Point
DWY	EDGE OF DRIVEWAY	@ edge of driveway	EXDWY	AC-DWY	BYLAYER			3DPline
E	ELECTRICAL ITEMS-RECEPTICLE, JUNCTION BOX ETC.	@ center of E item @ ground	EXDETAIL	AC-DETAIL	BYLAYER	EOUTLET	AC-EOUTLET	Point
EB	ELEVATION BREAKLINE	@ crown or crest line of EB	OG	AC-OG	BYLAYER			3DPline
EHH	ELECTRICAL HANDHOLE	@ center of EHH lid	EXHYDRO	AC-HYDRO	BYLAYER	EHH	AC-EHH	Point
EP	EDGE OF ROAD	on curb where Asphalt meets or edge of Asphalt when no curb	EXROAD	AC-ROAD	BYLAYER			3DPline
FB	FLOWER BED	along perimeter of FB	EXVEG	AC-VEG	BYLAYER			3DPline

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
FL	FENCE LINE	@ center of fence @ ground	EXFENCE	AC-FENCE	BYLAYER			3DPline
FM	SANITARY FORCEMAIN	on FM locate line	EXSAN-FORCEMAIN	AC-SAN-FORCEMAIN	BYLAYER			3DPline
FO	FIBER OPTIC (UNKNOWN)	on FO locate line	EXMSC-FO	AC-MSC-FO	BYLAYER			3DPline
FP	FLAGPOLE	@ center of FP @ ground	EXDETAIL	AC-DETAIL	BYLAYER	FP	AC-FP	Point
FST	FLAG STONE MATERIAL	on FST surface to indicate material	OG	AC-OG	BYLAYER	FST	AC-FST	Point
G	GAS LINE	on G locate line	EXGAS	AC-GAS	BYLAYER			3DPline
GATE	GATE	@ center of gate and SZ gate and note material	EXDETAIL	AC-DETAIL	BYLAYER	GATE	AC-GATE	Point
GB	GABIAN BASKET or WALL (RAP FILLED CAGES)	on top corners of GB wall or pads	EXWALL	AC-WALL	BYLAYER			3DPline
GFT	GAS FARM TAP	@ center of GFT @ ground	EXGAS	AC-GAS	BYLAYER	GFT	AC-GFT	Point
GH	GRAVE HEADSTONE	@ center of GH @ ground	EXDETAIL	AC-DETAIL	BYLAYER	GH	AC-GH	Point
GP	GUY POLE	@ center of GP @ ground	EXGP&GW	AC-GP&GW	BYLAYER	GP	AC-GP	Point
GR	GUIDE RAIL	@ front face of rail @ ground	EXGDRAIL	AC-GDRAIL	BYLAYER			3DPline
GRV	GRAVEL	on GRV surface to indicate material	OG	AC-OG	BYLAYER	GRV	AC-GRV	Point
GTP	GAS TEST POST	@ center of GTP @ ground	EXGAS	AC-GAS	BYLAYER	GTP	AC-GTP	Point
GUT	GUTTER LINE OF CURB	where face of curb meets gutter pan	EXGUTTER	AC-GUTTER	BYLAYER			3DPline
GV	GAS VALVE	@ center of GV lid	EXGAS	AC-GAS	BYLAYER	GV	AC-GV	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
GW	GUY WIRE	where GW enters ground	EXGP&GW	AC-GP&GW	BYLAYER	GW	AC-GW	Point
H	UNDER GROUND HYDRO	on H locate line	EXHYDRO	AC-HYDRO	BYLAYER			3DPline
HDG	HEDGE	along drip line of hedge @ ground	EXVEG	AC-VEG	BYLAYER			3DPline
HFO	HYDRO FIBER OPTIC	on HFO locate line	EXHYDRO-FO	AC-HYDRO-FO	BYLAYER			3DPline
HH	HAND HOLE	@ center of HH lid	EXSIGNALS-INGROUND	AC-SIGNALS-INGROUND	BYLAYER	HH	AC-HH	Point
HMH	HYDRO MANHOLE	@ center of HMH lid	EXHYDRO	AC-HYDRO	BYLAYER	HMH	AC-HMH	Point
HOT	HUB ON TANGENT	at center of HOT	EXREFPT	AC-REFPT	BYLAYER	HOT	AC-HOT	Point
HP	HYDRO POLE	@ center of HP @ ground	EXHYDRO	AC-HYDRO	BYLAYER	HP	AC-HP	Point
HPLS	HYDRO POLE WITH LUMINARE	@ center of HPLS @ ground	EXHYDRO	AC-HYDRO	BYLAYER	HPLS	AC-HPLS	Point
HR	PEDESTRIAN HANDRAIL	at top center of HR	EXDETAIL	AC-DETAIL	BYLAYER			3DPline
HT	HYDRO TOWER	@ center of HT @ ground	EXHYDRO	AC-HYDRO	BYLAYER	HT	AC-HT	Point
HV	HYDRO VALT	@ center of HV @ ground, if underground HV please note	EXHYDRO	AC-HYDRO	BYLAYER	HV	AC-HV	Point
HYD	HYDRANT	@ center of HYD @ ground	EXWATER	AC-WATER	BYLAYER	HYD	AC-HYD	Point
IB	IRON BAR	@ center of IB, note leaning or bent direction	EXREFPT	AC-REFPT	BYLAYER	IB	AC-IB	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
ILS	INTERLOCKING STONE	on ILS surface to indicate material	OG	AC-OG	BYLAYER	ILS	AC-ILS	Point
IP	IRON PIPE	@ center of IP, note leaning or bent direction	EXREFPT	AC-REFPT	BYLAYER	IP	AC-IP	Point
KS	CONCRETE KILL STRIP	on back line of kill strip	EXROAD	AC-ROAD	BYLAYER			3DPline
LBKP	LEFT BIKE PATH	@ edge of bike path	EXBKPATH	AC-BIKEPATH	BYLAYER			3DPline
LC	LEFT CONC.CURB & GUTTER	@ top back line of curb	EXROAD	AC-ROAD	BYLAYER			3DPline
LCR	LEFT EDGE OF CREEK	where water meets bank	EXDRAIN	AC-DRAIN	BYLAYER			3DPline
LD	LEFT DITCH	Acquire @ center of ditch	EXDITCH	AC-DITCH	BYLAYER			3DPline
LDWY	LEFT DRIVEWAY	@ edge of driveway	EXDWY	AC-DWY	BYLAYER			3DPline
LEP	LEFT EDGE OF PAVEMENT	on curb where Asphalt meets or edge of Asphalt when no curb	EXROAD	AC-ROAD	BYLAYER			3DPline
LFL	LEFT FENCE LINE	@ center of fence @ ground	EXFENCE	AC-FENCE	BYLAYER			3DPline
LKS	LEFT CONCRETE KILLSTRIP	on back line of kill strip	EXROAD	AC-ROAD	BYLAYER			3DPline
LS	LIGHT STANDARD	@ center of LS @ ground	EXHYDRO	AC-HYDRO	BYLAYER	LS	AC-LS	Point
LSHLD	LEFT SHOULDER	@ edge of shoulder prior to rounding	EXSHLD	AC-SHLD	BYLAYER			3DPline
LSW	LEFT SIDEWALK	@ edge of sidewalk	EXSWK	AC-SWK	BYLAYER			3DPline
LTA	EX. LEFT TURN ARROW	@ arrow point of LTA	EXPMARKS	AC-PMARKS	BYLAYER	EXLTARROW	AC-LTARROW	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
LWALL	LEFT WALL	@ top corners/along edge of retaining wall	EXWALL	AC-WALL	BYLAYER			3DPline
MB	MAILBOX	@ center of MB @ ground	EXDETAIL	AC-DETAIL	BYLAYER	MB	AC-MB	Point
MH	MANHOLE	@ center of MH lid	EXSAN	AC-SAN	BYLAYER	MH	AC-MH	Point
MHS	MANHOLE STORM	@ center of MHS lid	EXSTM	AC-STM	BYLAYER	MHS	AC-MHS	Point
MISC	MISCELLANEOUS CODE	@ center of MISC item @ ground	OG	AC-DETAIL	BYLAYER	MISC	AC-MISC	Point
MKR	911 MARKER	@ MKR center @ ground, only used for rural Address markers	EXDETAIL	AC-DETAIL	BYLAYER	911MARKER	AC-911MARKER	Point
MW	MONITORING WELL	@ center of MW @ ground	EXDETAIL	AC-DETAIL	BYLAYER	MWELL	AC-MWELL	Point
NW	NAIL N WASHER	@ center of NW	EXREFPT	AC-REFPT	BYLAYER	NW	AC-NW	Point
OG	ORIGINAL GROUND	on ground/earth material	OG	AC-OG	BYLAYER	OG	AC-OG	Point
OGBS	ORIGINAL GROUND BOTTOM SLOPE	@ bottom of slope	OGBS	AC-OGBS	BYLAYER	OGBS	AC-OGBS	Point
OGCL	ORIGINAL GROUND CENTRE LINE	on crown line of road	OGCL	AC-OGCL	BYLAYER	OGCL	AC-OGCL	3DPline
OGS	OIL, GRIT SEPARATOR MANHOLE	@ center of OGS lid	EXSTM	AC-STM	BYLAYER	OGSMH	AC-MHOGS	Point
OGTS	ORIGINAL GROUND TOP SLOPE	@ top of slope	OGTS	AC-OGTS	BYLAYER	OGTS	AC-OGTS	Point
OLTSTA	ROUNDABOUT-LEFT TURN, STRAIGHT THROUGH ARROW	@ straight through arrow point	EXPMARKS	AC-PMARKS	BYLAYER	EXLTSTRTHRU	AC-LTSTRTHRU	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
ORTSTA	ROUNDABOUT-RIGHT TURN, STRAIGHT THROUGH ARROW	@ straight through arrow point	EXPMARKS	AC-PMARKS	BYLAYER	EXRTSTRTHRU	AC-RTSTRTHRU	Point
OSTA	ROUNDABOUT-STRAIGHT THRU ARROW	@ straight through arrow point	EXPMARKS	AC-PMARKS	BYLAYER	EXSTRTHRU	AC-PRSTRTHRU	Point
PAD	CONCRETE PAD	@ top of pad corners	EXDETAIL	AC-DETAIL	BYLAYER			3DPline
PCONC	PATTERN CONCRETE	on surface of PCONC to indicate material	OG	AC-OG	BYLAYER	PCONC	AC-PCONC	Point
PI	POINT OF INTERSECTION	@ center of PI	EXREFPT	AC-REFPT	BYLAYER	PI	AC-PI	Point
PIV	POST INDICATOR VALVE (SMALL HYDRANT USED IN INDUSTRY/SAN LIFT STATIONS	@ center of PIV @ ground	EXWATER	AC-WATER	BYLAYER	PIV	AC-PIV	Point
PK	PK NAIL	@ center of PK nail	EXREFPT	AC-REFPT	BYLAYER	PK	AC-PK	Point
PL	PROPERTY LINE	on center of property Bars	PROPERTY	PROPERTY	BYLAYER			3DPline
PLR	PILLAR	@ center of PLR @ ground add SZ and note material	EXDETAIL	AC-DETAIL	BYLAYER	PILLAR	AC-PILLAR	Point
PLS	PRIVATE LIGHT POLE	@ center of PLS @ ground	EXDETAIL	AC-DETAIL	BYLAYER	PLP	AC-PLP	Point
PM	PARKING METER	@ center of PM @ ground	EXDETAIL	AC-DETAIL	BYLAYER	PM	AC-PM	Point
PO	EDGE OF POND	where water meets bank	EXDRAIN	AC-DRAIN	BYLAYER			3DPline
PS	POWER SUPPLY CABINET	@ center of PS @ ground	EXSIGNALS-ABOVE	AC-SIGNALS-ABOVE	BYLAYER	EXPSC	AC-PSC	Point
PSW	PAINT SOLID WHITE	@ center of solid white traffic lane paint line	EXPMARKS	AC-PMARKS	CONTINUOUS			3DPline

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
PSY	PAINT SOLID YELLOW	@ center of solid yellow traffic lane paint line	EXPMARKS	AC-PMARKS	CONTINUOUS			3DPline
RAP	RIP RAP AREA (5' CRUSHED OR RIVER ROCK)	along perimeter of RAP	EXDETAIL	AC-DETAIL	BYLAYER			3DPline
RBKP	RIGHT BIKE PATH	@ edge of bike path	EXBKPATH	AC-BIKEPATH	BYLAYER			3DPline
RC	RIGHT CONC. CURB & GUTTER	@ top back line of curb	EXROAD	AC-ROAD	BYLAYER			3DPline
RCS	RAILWAY CROSS SIGN	@ center of RCS @ ground	EXDETAIL	AC-DETAIL	BYLAYER	RCS	AC-RCS	Point
RD	RIGHT DITCH	@ center of ditch	EXDITCH	AC-DITCH	BYLAYER			3DPline
RDWY	RIGHT EDGE DRIVEWAY	@ edge of driveway	EXDWY	AC-DWY	BYLAYER			3DPline
REP	RIGHT EDGE PAVEMENT	on curb where Asphalt meets or edge of Asphalt when no curb	EXROAD	AC-ROAD	BYLAYER			3DPline
RFL	RIGHT FENCE LINE	@ center of fence @ ground	EXFENCE	AC-FENCE	BYLAYER			3DPline
RIB	ROUND IRON BAR	@ center of RIB	EXREFPT	AC-REFPT	BYLAYER	RIB	AC-RIB	Point
RKS	RIGHT CONCRETE KILLSTRIP	on back line of kill strip	EXROAD	AC-ROAD	BYLAYER			3DPline
RLC	RED LIGHT CAMERA ON POLE	@ center of RLC @ ground	EXSIGNALS-ABOVE	AC-SIGNALS-ABOVE	BYLAYER	RLCP	AC-RLCP	Point
RLF	RED LIGHT CAMERA FLASH ON POLE	@ center of RLF @ ground	EXSIGNALS-ABOVE	AC-SIGNALS-ABOVE	BYLAYER	RLCFP	AC-RLCFP	Point
ROB	ROW OF BUSH	along drip line of bush or trees	EXVEG	AC-VEG	BYLAYER			3DPline

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
ROW	RIGHT OF WAY	on center of property bars	PROPERTY	PROPERTY	BYLAYER			3DPline
RRX	EX. RAILWAY CROSSING ROAD MARKING	@ center of RRX	EXPMARKS	AC-PMARKS	BYLAYER	EXRRX	AC-RRX	Point
RS	ROAD SIGN	@ center of RS @ ground	EXRDSIGNS	AC-RDSIGNS	BYLAYER	RS	AC-RDSIGN	Point
RSHLD	RIGHT SHOULDER	@ edge of shoulder prior to rounding	EXSHLD	AC-SHLD	BYLAYER			3DPline
RSW	RIGHT SIDEWALK	@ edge of sidewalk	EXSWK	AC-SWK	BYLAYER			3DPline
RTA	EX. RIGHT TURN ARROW	@ RTA arrow point	EXPMARKS	AC-PMARKS	BYLAYER	EXRTARROW	AC-RTARROW	Point
RWALL	RIGHT WALL	@ top corners/along edge of retaining wall	EXWALL	AC-WALL	BYLAYER			3DPline
RWW	RAILROAD WIG-WAG	@ center of RWW @ ground	EXDETAIL	AC-DETAIL	BYLAYER	RWW	AC-RWW	Point
RWY	RAILWAY LINE (TOP OF RAIL)	@ center top of rail	EXDETAIL	AC-DETAIL	BYLAYER			3DPline
S	SWALE	@ center of swale	EXDITCH	AC-DITCH	BYLAYER			3DPline
SAN	SANITARY SEWER	on SAN locate line	EXSAN	AC-SAN	BYLAYER			3DPline
SCNF	CONIFEROUS TREE SIGNIFCANT	@ center of CNF @ ground and SZ drip Rad and note trunk dia.	EXVEG-SIGNIFICANT	AC-VEG-SIGNIFICANT	BYLAYER	SCNF	AC-SCNF	Point
SCON	SIAMESE CONNECTION	@ center of SCON @ ground	EXWATER	AC-WATER	BYLAYER	SCON	AC-SCON	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
SDEC	DECDIDUOUS TREE-SIGNIFICANT	@ center of DEC @ ground and SZ drip Rad and note trunk dia.	EXVEG-SIGNIFICANT	AC-VEG-SIGNIFICANT	BYLAYER	SDEC	AC-SDEC	Point
SECV	SECONDARY VALVE	@ center of SECV lid	EXWATER	AC-WATER	BYLAYER	SECV	AC-SECV	Point
SFV	SANITARY FORCEMAIN VALVE	@ center of SFV lid	EXSAN-FORCEMAIN	AC-SAN-FORCEMAIN	BYLAYER	SFV	AC-SFV	Point
SFVB	SAN FORCEMAIN VALVE BOX ONLY TO DENOTE CHANGE IN DIR/TRACER WIRE ACCESS	@ center of SFVB lid	EXSAN-FORCEMAIN	AC-SAN-FORCEMAIN	BYLAYER	EXSFVB	AC-SFVB	Point
SFVC	SANITARY FORCEMAIN VALVE CHAMBER	@ center of SFVC lid	EXSAN-FORCEMAIN	AC-SAN-FORCEMAIN	BYLAYER	SFVC	AC-SFVC	Point
SHRB	SHRUB	@ center @ ground and SZ drip dia.	EXVEG	AC-VEG	BYLAYER	SHRB	AC-SHRB	Point
SIB	STANDARD IRON BAR	@ center of SIB, note leaning or bent direction	EXREFPT	AC-REFPT	BYLAYER	SIB	AC-SIB	Point
SL	SUMP LINE-OUTLET LOCATION IN DITCH	@ center of invert of SL add SZ and note material	EXDETAIL	AC-DETAIL	BYLAYER	SL	AC-SL	Point
SLTA	EX. STRAIGHT THRU, LEFT TURN ARROW	@ left turn arrow point	EXPMARKS	AC-PMARKS	BYLAYER	EXSTRLTARROW	AC-STRLTARROW	Point
SO	SIGN-OTHER	@ center of SO @ ground	EXDETAIL	AC-DETAIL	BYLAYER	SO	AC-SO	Point
SPRK	SPRINKLER HEAD	@ center of SPRK @ ground	EXDETAIL	AC-DETAIL	BYLAYER	SPRK	AC-SPRK	Point
SRTA	EX. STRAIGHT THRU, RIGHT TURN ARROW	@ right turn arrow point	EXPMARKS	AC-PMARKS	BYLAYER	EXSTRRTARROW	AC-STRRTARROW	Point
STA	EX. STRAIGHT THRU ARROW	@ STA arrow point	EXPMARKS	AC-PMARKS	BYLAYER	EXSTRARROW	AC-STRARROW	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
STK	WOODEN STAKE	@ top center of STK	EXREFPT	AC-REFPT	BYLAYER	STK	AC-STK	Point
STM	STORM SEWER	on STM locate line	EXSTM	AC-STM	BYLAYER			3DPline
STOP	STOP BAR	@ center of STOP bar	EXPMARKS	AC-PMARKS	CONTINUOUS			3DPline
STP	STUMP	@ center of STP and add SZ	EXVEG	AC-VEG	BYLAYER	STP	AC-STP	Point
SW	SIDEWALK	@ edge of sidewalk	EXSWK	AC-SWK	BYLAYER			3DPline
T	TRAFFIC U/G	on T locate line	EXSIGNALS-INGROUND	AC-SIGNALS-INGROUND	BYLAYER			3DPline
TB	TELEPHONE BOOTH	@ center of TB @ ground	EXBELL	AC-BELL	BYLAYER	TB	AC-TB	Point
TCP	TEMP CONTROL POINT	@ center of TCP	EXREFPT	AC-REFPT	BYLAYER	TCP	AC-TCP	Point
TEE	WM TEE	@ center of TEE in trench		AC-WATER	BYLAYER		AC-TEE	Point
TEMH	TRAFFIC ELEC. MH	@ center of TEMH lid	EXSIGNALS-INGROUND	AC-SIGNALS-INGROUND	BYLAYER	TEMH	AC-TMH	Point
TFO	TRAFFIC FIBER OPTIC	on TFO locate line	EXSIGNALS-INGROUND-FO	AC-SIGNALS-INGROUND-FO	BYLAYER			3DPline
TL	TRAFFIC LIGHT STANDARD	@ center of TL @ ground	EXSIGNALS-ABOVE	AC-SIGNALS-ABOVE	BYLAYER	TL	AC-TL	Point
TLP	TRAFFIC LOOPS	@ corners of TLP	EXSIGNALS-INGROUND	AC-SIGNALS-INGROUND	dashed			3D & 2D
TLS	TRAFFIC LIGHT W/LUMINAIRE	@ center of TLS @ ground	EXSIGNALS-ABOVE	AC-SIGNALS-ABOVE	BYLAYER	TLS	AC-TLS	Point
TP	TELEGRAPH POLE	@ center of TP @ ground	EXMSC	AC-MSC	BYLAYER	TP	AC-TP	Point

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
TPAD	TACTILE PAD ACCESIBILITY FEATURE	@ corners of TPAD	EXDETAIL	AC-DETAIL	BYLAYER			3DPline
TSC	TRAFFIC SIGNAL CONTROLLER	@ center of TSC @ ground	EXSIGNALS-ABOVE	AC-SIGNALS-ABOVE	BYLAYER	TC	AC-TC	Point
TW	TEST WELL	@ center of TW @ ground	EXDETAIL	AC-DETAIL	BYLAYER	TWELL	AC-TWELL	Point
TWALL	TOP OF RETAINING WALL	@ top corners/along edge of retaining wall	EXWALL	AC-WALL	BYLAYER			3DPline
UA	UTURN ARROW	@ UA arrow point	EXPMARKS	AC-PMARKS	BYLAYER	EXU-TURN	AC-U-TURN	Point
VCI	VALVE CHAMBER-IRRIGATION SYSTEMS	@ center of VCI lid	EXDETAIL	AC-DETAIL	BYLAYER	VCI	AC-VCI	Point
VF	VERTICAL FACE	@ edge of VF, note top or bottom	EXDETAIL	AC-DETAIL	BYLAYER			3DPline
W	WATER MAIN	on W locate line	EXWATER	AC-WATER	BYLAYER			3DPline
W11	WHITE, 1m LINE 1m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT11			3DPline
W33	WHITE. 3m LINE 3m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT33			3DPline
W36	WHITE. 3m LINE 6m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT36			3DPline

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
W37	WHITE. 3m LINE 7m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT37			3DPline
W39	WHITE. 3m LINE 9m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT39			3DPline
WALL	RETAINING WALL	@ top corners and along edge of retaining wall	EXWALL	AC-WALL	BYLAYER			3DPline
WELL	WELL	@ center of well head @ ground	EXDETAIL	AC-DETAIL	BYLAYER	WELL	AC-WELL	Point
WL	WATER LEVEL	on surface of water and note date	EXDRAIN	AC-DRAIN	BYLAYER	OG	AC-OG	Point
WMC	WATER METER CHAMBER	@ center of WMC lid	EXWATER	AC-WATER	BYLAYER	WMC	AC-WMC	Point
WV	WATER VALVE	@ center of WV lid	EXWATER	AC-WATER	BYLAYER	WV	AC-WV	Point
WVC	WATER VALVE CHAMBER	@ center of WVC lid	EXWATER	AC-WATER	BYLAYER	WVC	AC-WVC	Point
Y11	YELLOW. 1m LINE 1m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT11			3DPline
Y33	YELLOW. 3m LINE 3m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT33			3DPline
Y36	YELLOW. 3m LINE 6m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT36			3DPline

Code	Description	Full Name Field Acquisition	Layer Pre-Eng-DWG Template	Layer AC-DWG Template	Linetype	Symbol Pre-Eng-DWG Template	Symbol AC-DWG Template	Entity
Y37	YELLOW. 3m LINE 7m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT37			3DPline
Y39	YELLOW. 3m LINE 3m GAP	Lane paint. Start acquiring @ start of skip line, end acquire @ end of skip line	EXPMARKS	AC-PMARKS	PAINT39			3DPline