Deliverables 5   *Survey*

D5.01   General

This chapter defines the electronic standard requirements for survey data collection, processing, and delivery. These standards are intended to support the *Highway Survey Manual* M 22-97.

All electronic project survey files and data shall be stored and organized as defined in this manual. See Deliverables 3 Work Area Structure and Deliverables 4 File Naming Conventions*.*

D5.01(1)   Initiating a Survey

A survey is initiated by completing the Survey Request Form No. 355-001 by the Project Manager or designee as defined in the *Highway Survey Manual* M 22-97 for instructions to complete the Survey Request Form and providing supporting information for the survey.

Upon receipt of the survey request, the surveyor should verify its completeness and adherence to survey request standards before proceeding.

D5.01(2)   Data Collection

Both the requester and the surveyor are required to adhere to the procedures for surveying defined in the *Highway Survey Manual* M 22-97.

The surveyor will use the standard field codes for OpenRoads Designer to identify field observations. See Symbology 2 Data Collection for information on use of field codes.

D5.02   Data Organization

Data Acquisition (DA) of field observed -and/or fixed- point data with assigned field codes are imported into an OpenRoads field book.

Each survey Field Book (FB) file will be created from the WSDOT_3D_Survey_Seed.dgn file. The file may contain multiple field book(s), each field book generates surveyed features as graphical elements. All the related survey information is contained and stored within the DGN and the graphical elements themselves, and an associated terrain model.

When data acquisition is from different sources, each source shall create their own FB DGN to keep the data segregated. Projects with bridges or tunnels will create a separated FB DGN for each, to provide design a terrain for bridge deck or tunnel roadway. Surveyed borrow pits or mitigation sites located outside of project footprint will be in their own FB DGN so the terrain is independent of the project terrain.

The terrain model contains the Triangle Irregular Network (TIN) generated per each survey feature with a Terrain Attribute except for Do Not Include. All other features with Terrain Attribute of *Breakline*, *Spot*, *Void*, etc. are used to determine the TIN.

The Complex Terrain Model contains references of both Terrain and Feature graphical element models to represent the project survey effort. No FB data shall be stored directly in this file. The Complex Terrain Model shall be created and used as the single point deliverable DGN from survey to design and other disciplines.

Figure D5-1   Survey Data Model Diagram
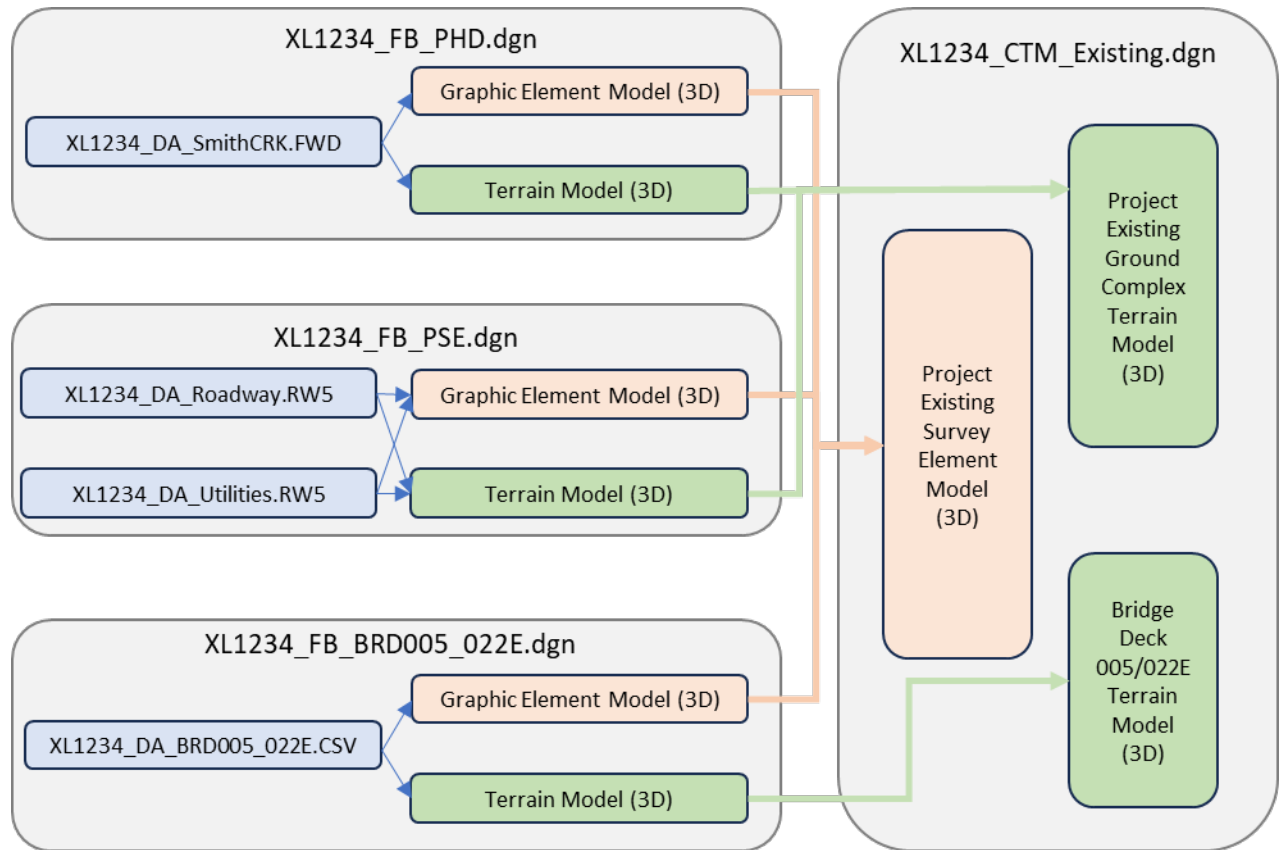
D5.03 Documentation

It is important to clearly communicate the needs prompting a field survey or data acquisition effort to ensure the deliverables meet those needs. It is equally important to distinguish between sources of data as well as iterations from the same source as well as understanding how control coordinates (for example) were determined in case of conflict. This section covers basic documentation requirements for clear communication between the customer and the surveyor.

D5.03(1) Survey Request Form

The Project Manager or designee shall use the Survey Request Form 355-001 as described in *Highway Survey Manual* Chapter 14 or for Preliminary Hydraulic Design survey request or South Central Region projects, the Project Manager or designee shall use the SCR Survey Request web page.

Each survey request form will be stored in the **Survey_Requests** project folder and an email sent to the Survey Party Chief with the PW link to the form.

The Survey Party Chief shall complete the Survey Request Form as described in *Highway Survey Manual* Chapter 14.

Research on Hand as identified in the form can be attached or combined with the form. They may be scanned, and the electronic scan can be treated as the source. PDF is the preferred format for scanned research documents, although .jpg and .tif files are also acceptable.

D5.03(2) Project Datum and Control

Documenting the Datum and control shall be the responsibility of the Survey Party Chief. See Deliverables 3 and Deliverables 4 for information on folder structure and file names.

Project Datum

Project Datum (PD) Combined Factor (CF) calculations will be completed per the methodology defined in the *Highway Survey Manual* Chapter 6. Before calculating a PD CF the surveyor shall check with region Right of Way office for historical PD CF in the project location.

The State Plane to Project Datum conversion or calculation report shall be in a universally readable format. ASCII Text, Microsoft Excel, or PDF file formats are acceptable.

Once the PD CF has been defined, a Geographic Coordinate System shall be requested from HQ CAE per the MS-Working with GCS (wa.gov) technote.

Project Control

All project control shall be documented. This is vital in maintaining history, translation, and alignment with other efforts as well as minimizing confusion when data sets do not align or conflict.

Information on project control points shall be provided by the Designer or Survey. If Primary Control Points are needed contact WSDOT - Geographic Services - Survey and Mapping.

Primary Control Points will consist of the points in the WSDOT Primary Reference Network see Survey Monument Database and will be named using the Monument ID number or Designation. If a different naming convention is used, the OpenRoads Designer point description shall reference the monument id # or designation.

If the Primary Control is provided by National Geodetic Survey, Online Positioning User Service (OPUS), County, or City, the documentation must include:

- Monument designation
- Washington plane coordinate system with datum and epic
- Latitude and Longitude coordinates
- Washington plane coordinate Northing and Easting
- Current North American Vertical Datum (NAVD 88) elevation (if measured)
- Method of collection
- Horizontal and vertical accuracy
- Units, scale factor and convergence angle

Monumentation documentation will remain in its original format and retain its original name as provided by the source.

Secondary Control Points will be set in support of the project, the points can be named with numeric or alpha-numeric value, documentation shall contain:

- Control point name/designation
- Northing, Easting, and Elevation coordinate values in the project datum
- Description

Control and or monuments observed by traverse must include the traverse adjustment and report as applicable to document the project control, boundary monumentation, and section corners. Final adjusted coordinates shall be reflected in the documentation and survey data.

D5.04   Data Processing

Data collection export formats such as raw data, ASCII, and proprietary binary formats used to directly import into ORD Field Book shall be stored in the work area Survey\Data folder by the surveyor (see Deliverables 3 and Deliverables 4)*.*

When collecting field data with Total Station Survey (TSS) or Global Navigation Satellite System (GNSS), the surveyor will collect the field data as raw observations.

The preferred format for exporting ASCII data from vendor software or directly from the data controller is WSDOT ASCII Survey format as defined below.

> PointNumberOrAlphaName,Northing,Easting,Elevation,Code,NoteOrDescription

This WSDOT ASCII Survey format is supported in the Field Book > Import > File command using a file extension of .txt or .csv.

Other ASCII files not using the WSDOT ASCII Survey format shall use the Field Book > Import > File Using Text Import Wizard.

D5.04(1)   Field Code Use

The surveyor will use the WSDOT Field Codes for OpenRoads Designer to identify field observations. See Symbology 2 Data Collection.

If an observed feature cannot be defined by the standard WSDOT field code, the surveyor will use the nonstandard codes NSP (Non-Standard Point) or NSL (Non-Standard Line) and assign a note/description to the observation point that describing the nonstandard feature.

D5.04(2)   Field Book

A OpenRoads field book provides a graphical, and when applicable a terrain, of the collected field data. When creating a new field book the *WSDOT_3D_Survey_Seed.dgn* seed file is used.

Raw or ASCII field data can be imported into the field book. Each unique contributor to the project existing field data collection should create a fieldbook, this will segregate the data from each unique contributor. See Figure D5-1 Survey Data Model Diagram. Bridges and tunnels will also have their own field book to provide graphics and independent Terrain.

Fieldbook audit files default.log will be generated to document modifications and adjustments made to the fieldbook information.

Each fieldbook is required to use the same datum as defined for the project. The appropriate Geographic Coordinate System file must be attached to the dgn. It is the surveyor's responsibility to ensure the correct datum is used.

D5.04(3)   Existing Complex Terrain Model File

A Complex Terrain Model (CTM)file will be created to contain field data collected for the project and provide an existing terrain and any other field graphics and terrain for the project needs. The CTM file shall be stored and organized as defined in this manual (see Deliverables 3 and Deliverables 4)*.*

The appropriate Geographic Coordinate System file must be attached to the CTM file.

D5.05   Survey Deliverables

A complete OpenRoads Designer survey deliverables consists of the following:

- Documenting Datum and Control
- Creating Field Books to importing and processing field data
- Creating the Complex Terrain Model and any other terrains the project requires

See Deliverables 3 and Deliverables 4 for information on project structure and file names.