

5 Survey

5.1 Location Survey

5.1.1 General Requirements

WSDOT is currently transitioning its main design application from CAiCE to InRoads. Until CAiCE is phased out of use completely, the requester must identify the design application that will be used on the project and the surveyor will use that application to process the survey data and prepare the appropriate deliverables. Separate guidance for InRoads and CAiCE is included in this section.

5.1.1.1 Initiating a Location Survey

A location survey is initiated by completion of the Survey Request Form by the Project Manager or designee. Sections 14 in the WSDOT *Highway Survey Manual* has instructions for completing the Survey Request Form and providing supporting information for the survey such as; monumentation information including source files for known monumentation; project datum calculations; and any other project-specific information that may impact the surveyor. Upon receipt of the survey request, the surveyor should verify its completeness and adherence to survey request standards before proceeding.

5.1.1.2 Data Collection and Processing

Both the requester and the surveyor are required to adhere to the procedures for surveying defined in the WSDOT *Highway Survey Manual*.

The surveyor will use the current WSDOT standard feature codes for InRoads or CAiCE to identify field observations. See sections 5.1.3.1 and 5.1.4.1 for more information on use of feature codes.

The raw data file generated from field observations must be processed and delivered to the requestor in either InRoads or CAiCE format and comply with the specific requirements defined in Section 5.1.3 (InRoads) or Section 5.1.4 (CAiCE).

5.1.1.3 Data Organization

All electronic project files and data will be organized as defined in Sections 3 and 4 of this manual.

5.1.1.4 Incremental Delivery of Survey Data

When incremental transfer of survey data is necessary, each incremental package should include the entire survey dataset (all survey points and survey chains) collected by the surveyor to date. The requester will then overwrite the survey data in their project with the complete, updated survey dataset.

Each package should include all checklist items that apply to the latest dataset, if different from or in addition to the original package.

5.1.2 Documentation

5.1.2.1 Survey Request Form

The surveyor shall fill out the Surveyor portion of the Survey Request Form as described in Section 14 of the WSDOT *Highway Surveying Manual* and place the completed form in the **SurveyRequests** folder.

5.1.2.2 Project Spreadsheet

A CAiCE Project Documentation Spreadsheet (see Section 8.4) or an InRoads Project Spreadsheet (see Section 8.7) whichever is appropriate must be completed for the project.

The project spreadsheet will be named **projname_InRoads.xls** or **projname_CAiCE.xls** and will be stored in the **Survey/SurveyDocumentation** project folder

5.1.2.3 Existing Monumentation

Information on existing monuments that are applicable to the survey/project limits will be provided by the designer or collected by the surveyor. This documentation will be included in the final project documentation package in the **SurveyDocumentation** folder of the project directory structure

Monument documentation must include source documentation such as WSDOT Monument Database Report of Survey sheets or county reports of survey documentation. These documents must indicate the monument designation, latitude and longitude coordinates, current legal State Plane Coordinate (SPC) system coordinates (NAD 83/91), current North American Vertical Datum (NAVD 88) elevation (if measured), method of collection, accuracy, units, and scale.

Monumentation documentation will remain in its original format and retain its original name as provided by the source. Monumentation maps may be scanned and the electronic scan treated as the source. PDF is the preferred format for scanned monumentation maps though jpg and tif files are also acceptable.

All existing monuments used in the establishment of the project control network must have documentation as described above and have an entry recorded in the project spreadsheet.

5.1.2.4 Project Control

Documentation on the project's control should be stored in **Survey/SurveyDocumentation**.

All control points for the project must have an entry in the project spreadsheet.

Project control points must have traverse adjustment notes to document the ties with primary control monumentation, boundary monumentation, section corners, project control, and any other points included in development of the project control network.

Traverse documentation shall be compiled in either an ASCII text or Microsoft Office-compatible format and shall be named *projname_segname_description*.

Example:

L1234_Traverse documentation.txt

Project control points should be named using an alpha-numeric three-digit numeric value representing the documented source designation. When entering these points into InRoads or CAiCE, the designation should be typed into the point description field along with the referenced State Route (or other street designation) and milepost. For example:

The point GP20097-15 was recorded by WSDOT Geographic Services using GPS methods. The name used in the project datum documentation will be **GPS15**. The point will have a description of "**GP20097-15 SR97 MP 24.659**."

Conventional Survey Control Documentation shall include the following data:

- Names and coordinates of known primary control (Project Datum per above) to which traverse ties
- Raw, unedited observations file (or report) as collected in the field
- Horizontal Least Squares adjustment report
- Resultant adjusted coordinates

5.1.2.5 Project Datum

Project datum calculations will be completed per the methodology defined in Chapter 6 of the WSDOT *Highway Survey Manual*. The project datum may be calculated by the designer or the surveyor depending on the project requirements. Where multiple combined factors are required, a map of the project datum areas will be provided and (if necessary) impacted control must be documented. The method and decision path of determining project datum coordinates for impacted control must be included in the documentation.

The State Plane to Project Datum conversion report should be in a universally readable format. ASCII Text, Microsoft Excel, or Word are acceptable formats. This report will be stored in the project network file structure in **Survey/SurveyDocumentation**.

The report should use a projname_description naming convention.

Example:

L1234_State Plane to Project Datum.rpt

5.1.3 Data Processed with InRoads

The surveyor will collect the field data and generate a raw data file. After downloading, the raw data files must be processed. Survey data processed with InRoads shall conform to the format and procedures outlined in Section 5.1.3.

5.1.3.1 Feature Code Use

The surveyor will use the current WSDOT standard codes for InRoads to identify field observations. All InRoads fieldbook feature codes that are used must be in the current WSDOT standard feature table (Survey_WSDOT.fwf). If an observed feature cannot be defined by the standard WSDOT feature table, the surveyor will revise the nonstandard code to a similar standard code and assign a note to the observation point describing the nonstandard feature.

The surveyor may submit feature codes that are not in the WSDOT standard feature table to WSDOT CAE Support for possible addition to the standard code list.

5.1.3.2 Fieldbooks

Raw data files will be imported into InRoads Survey fieldbooks (*.fwd files). Each surveyor should create one fieldbook and import all their data files into it.

Fieldbook audit files (*.log files) will be generated to document modifications and adjustments made to the fieldbook information. This file is initiated using the Tools => Survey Options dialog. Once this dialog has been revised, the survey preferences should be saved.

5.1.3.3 Graphic Files

The final survey planimetrics will be written to graphics to produce a MicroStation DGN file. All survey view options must be selected. This file will be named per Section 4.1.2 and stored in **Survey\Deliverables**.

5.1.3.4 Surface Files

A surface will be created and the final survey fieldbook information will be written to it and reviewed for accuracy. This file will be named per Section 4.1.2 and stored in **Survey\Deliverables**.

5.1.3.5 Geometry Project Files

Two geometry projects will be created.

- A geometry project that contains the control points and monuments used in the survey. This file will be named per Section 4.1.2 and stored in **Survey\Deliverables**.
- A geometry project that contains the complete final survey fieldbook dataset and will be saved to an ALG file in the **Survey\Deliverables** folder. This file will be named P1234_PCid_Survey.alg.

5.1.3.6 Raw Survey Data

All survey data collected for the project needs to be included in its raw, unedited format. Any modifications or edits prior to import into InRoads must be done on copies of the raw files and noted in the survey documentation.

5.1.3.7 InRoads Survey Package Deliverables

A complete InRoads survey package consists of all the electronic data in the project's Survey subfolder. This folder contains all files and data necessary for the requester to import and use the survey dataset in InRoads, and the supporting documentation for the survey. The items listed below must be included in the correct directories:

\Survey\Deliverables

- Completed InRoads Survey Dataset Checklist (see Section 8.3)
- Processed survey data in fieldbooks (*.fwd)
- MicroStation graphics file
- InRoads Surface file
- InRoads Geometry Project file

\Survey\Requests

- Survey Request Form (with Surveyor's section completed)

\Survey\SurveyDocumentation

- InRoads Project Spreadsheet
- Project Control & Monumentation Documentation
- Project Datum Documents
- Control Traverse Documents

\Survey\RawData

- Raw survey data files

The Survey\Deliverables folder contains all the electronic data necessary for the designer to use the survey in InRoads. This is the only data that will be used directly in the design phase. Access to the other subfolders under the Survey project folder is necessary for backup and overall project documentation.

5.1.4 Data Processed with CAiCE

The surveyor will collect the field data and generate a raw data file. After downloading, the raw data files must be processed. Survey data processed with CAiCE shall conform to the format and procedures outlined in Section 5.1.4.

5.1.4.1 Feature Table

The surveyor will use the current WSDOT standard Feature Table for CAiCE, (the name should be consistent across all resources) to collect field observations. If nonstandard codes are required to accurately represent features, the standard code Feature Table (WA_0003.FTB) will be copied and renamed to a project-specific code list. Project-specific codes will be included in the renamed feature table.

The surveyor will document the name of the project Feature Table used to collect field information and list the nonstandard codes that have been added.

Project-specific standard Feature Table files will be renamed from the standard "WA_0003.FTB" to projname.FTB where projname is the project name (e.g., L1234.FTB).

When nonstandard codes are used, a text file listing of those codes will be provided with a description for each code in the form.

Example:

<u>Non-std code</u>	<u>Description</u>
DIRP	Direction of Pipe
BENCH	Park Bench, Fixed

5.1.4.2 Segments

Segments should be utilized to organize the survey data, as well as to separate individual survey datasets in the project.

The suggested format for naming segments is:

C01, C02, C03...	C ontrol traverse segments
DM1, DM2, DM3	CEAL application DMM segments
P01, P02, P03...	P hotogrammetry segments
S01, S02, S03...	S urvey segments
T01, T02, T03...	T opography segments
TR1, TR2, TR3...	Survey control TR averse segments
All other prefixes	Available for other surveys

The processed survey data shall be compiled in a KCM file and named projname_includedsegments.kcm.

Example:

L1234_S01-S15_TR1.kcm

The above file includes survey segments S01 through S15 and traverse segment TR1.

5.1.4.3 Processed Survey Data

The processed data to be delivered shall be extracted from the surveyor's CAiCE project into a KCM file. The KCM file will always contain all survey data for the project to date.

5.1.4.4 Digital Terrain Model Image

The surveyor shall provide a CDG image file representing the complete surveyed terrain surface (Digital Terrain Model) to the requester for topographic survey projects. This file provides a graphical check of the survey dataset after the requester has included the information in their project. Supplemental images are acceptable, but the final and complete survey dataset will be represented by a final CDG file.

To create a CDG file in CAiCE, clear the graphics screen. View the DTM surface. Select **File => Save => CDG**.

The CDG file shall be named projname_surface_DTM_segments.

Example:

L1234_EXIST_DTM_S01-S15_T01.CDG

The above file is a graphic image of the EXIST DTM surface that was developed using survey segments S01 through S15 and T01.

5.1.4.5 Raw Survey Data

All survey data collected for the project needs to be included here in its raw, unedited format. Any modifications or edits prior to import into CAiCE must be done on copies of the raw files and noted in the survey documentation.

5.1.4.6 CAiCE Survey Package Deliverables

A complete CAiCE survey package consists of all the electronic data in the project's Survey subfolder. This folder contains all files and data necessary for the requester to import and use the survey dataset in CAiCE, and the supporting documentation for the survey. The items listed below must be included in the correct directories.

\Survey\Deliverables

- Completed CAiCE Survey Dataset Checklist (see Section 8.2)
- Processed survey data in KCM file format
- Project-specific Feature Table and documentation (if one was created)
- CDG file of DTM surface

\Survey\Requests

Survey Request Form (with Surveyor's section completed)

\Survey\SurveyDocumentation

CAiCE Project Documentation Sheet

Project Control and Monumentation Documentation

Project Datum Documents

Control Traverse Documents

\Survey\RawData

Raw survey data files

The Survey\Deliverables folder contains all the electronic data necessary for the designer to use the survey in CAiCE. This is the only data that will be used directly in the design phase. Access to the other subfolders under the Survey project folder is necessary for backup and overall project documentation.

5.1.5 Project Closure and Transition

5.1.5.1 Delivery of Final Package

General requirements for the transfer, review and acceptance of the data are detailed in Section 2.

The surveyor will prepare a complete survey package as described in Sections 5.1.3 (InRoads) or 5.1.4 (CAiCE) by preparing all the appropriate electronic information in the **Survey** subfolder and notifying the requestor that the survey has been finalized.

On projects with multiple surveys delivered independently, each set of files prepared for design will either be in its own zip archive or its own subfolder within the **Survey/Deliverables** subfolder. Each separate design file set will include the submittal/revision number in its zip filename or subfolder.

Delivery can be accomplished by providing the requester access to the entire Survey folder if both surveyor and requester share a network resource and can both reference the same project folder.

If a shared network location is not an option, the surveyor will provide the requestor with a copy of the project's Survey subfolder. This can be accomplished using any medium that can reliably contain the entire folder structure. (e.g., an email, an FTP site, a compact disk or a DVD).

5.1.5.2 Data Archival

On projects where the surveyor is internal to WSDOT, it is the surveyor who is responsible for archival of the final electronic survey data per the region's policy for archival of electronic project data. When the surveyor is external to WSDOT, it is the requester who is responsible for archival of the final electronic data per the region's policy.

If no regional archival policy exists, the responsible party needs to ensure the data is appropriately archived for future reference.