Chapter 4 Electronic Data Controllers

4-01 General

This chapter provides guidance on electronic data collection, conversion, and processing.

WSDOT uses total station equipment with electronic distance measuring capability and electronic data controllers to obtain field data. The data is imported and processed into WSDOT standard surveying and engineering software.

Full utilization of the power of electronic surveying relies on the concept of a three-dimensional digital terrain model. Significant terrain features are selected, surveyed, and coded so that the computer program can process the data and produce a representation of the existing ground.

Electronic surveying allows the survey team to record and process data, with hand written field notes, sketches and very little manual data entry. The instrument person must enter the WSDOT Standard Survey Code for each point with parameters and notes if needed into a data controller. The observation data is transferred directly by the total station to the data controller. The field crew downloads the survey data from the data controller to a folder on the hard drive of a personal computer and then processes the data in CAiCE software. Processing of the data includes editing, analysis, and visual inspection in 2-D and 3-D views in CAiCE, sometimes this is an iterative process. The field surveyor has the most knowledge of field conditions and with good field notes is the logical person to do the data processing. But cross training of processing duties is essential for all members of the survey team.

Members of the team review the project and select the most appropriate method or methods of data collection for the terrain and requirements of the job. The digital terrain modeling (DTM) method (also called selective point and breakline method) is the preferred method for collecting data that will be used to develop an accurate digital terrain model in CAiCE. The DTM method allows the most versatility for collecting data, keeping in mind that proper coding is critical.

The electronic surveying system is dependent on the use of appropriate surveying procedures in the field. It is a tool, which can enhance safety, efficiency, productivity, and accuracy.

The goal is to use an efficient process for obtaining raw data, transferring it to computers, and graphically displaying the resulting design.

4-02 Accuracy

The use of a data controller in the recording of field terrain information requires attention to standard survey practices to ensure accuracy.

Field Books shall be supplemental to the electronic data, regardless of the survey method.

The following guidelines apply.

1. Instrument setups must be stable and solid.
2. Check into backsights/benchmarks periodically and before changing instrument setup.
3. Close and adjust project control traverse before collecting DTM or cross section data.

4. Accurately measure height of prism and instrument.
5. Double check keyboard input of all angles, coordinates, and elevations.
6. Ensure that accuracy standards are appropriate for the type of work being done.
7. Use WSDOT standard survey codes.
8. Make supplemental notes to accurately describe nonstandard items.
9. Calibrate equipment regularly.

4-03 Data Controller Setup

The current, standard WSDOT data controller software is Carlson's SurvCE. This software can be installed on most Windows CE devices. For the latest information on the set up of this software please refer to the HQ – CAE website at the following address; http://www.wsdot.wa.gov/eesc/CAE/survey/equipment.htm. For those still using the previous WSDOT standard data collector, the SDR 33, read the rest of this section below.

The setup of the present standard data controller, the SDR-33 is extremely important in providing a uniform output without double corrections being applied. ***This is also true with any other brand of data controller***.

Check the following items in the data controller each time a job is created.

Job Create and make a supplemental note of the name you used. (Do not use spaces or periods in the name.)

Scale Factor See Chapter 6 for instructions about when and how to make a projection from Washington State Plane coordinates to project datum coordinates. Normally we do not use the Data Controller for projections. If you are using the Data Controller for projections, use the appropriate scale factor. If not using state plane coordinates, use 1.00000000.

Point ID (SDR-33 only) Set to **Alpha 14**.

Autopoint Number Default starts with 1000 or number(s) can be entered.

Record Elevation (SDR-33 only) Set to **YE**S. (check manufactures instructions)

Atmos Crn (atmospheric correction) Set to **YE**S. This will record the barometric pressure and temperature in your notes. Set the PPM on the instrument to **0** or a double correction will result.

C and R Crn (curvature and refraction correction) Set to **YES**. Turn on C and R in the instrument. This will not cause a double correction because the instrument only applies this correction on horizontal readings. This will assure that curvature and refraction corrections are applied whether a data controller is used or not.

For the coefficient of terrestrial refraction for Washington State use **0.14**.

Sea level Crn When using state plane coordinates and a scale factor, set to **YES.** You must also use real elevations. If a scale factor is not used or you are using assumed elevations then set to **N**O.

Tolerances Set tolerances in accordance with the manufacturer's specifications for the instrument being used.

Units The following units should be used:

Angle	**Degrees**
Distance	**US Survey foot** Also set the instrument to US Survey foot.
Pressure Inches	**Hg**
Temperature	**Fahrenheit**
Coordinates	**N-E-Elev.**

Prism Constant

2-way instruments: Set the data controller to the proper constant and it will control the instrument.

If a **Non 2-way instrument** is used, set the data controller to **0** and set the instrument to the proper constant. This will allow the instrument to measure distances properly without the controller attached..

4-04 Gathering Digital Terrain Model Data

When collecting DTM data, the most important person on the survey crew is the rod person. This person sets the pace for the crew and makes many of the decisions about what type of information the survey will provide to the design team. When selecting locations for shots, the rod person must look in all directions for terrain breaks.

Prior to beginning the survey, the crew should carefully plan which standard codes they are going to use for the break lines.

Here is an example of a normal roadway section showing the typical standard codes.

To gather digital terrain model data:

1. Meet with design team to discuss project limits, break lines, and special features.
2. Using total station equipment, run a control traverse with approximately 1500 ft legs. (For Control Survey Guidelines see Chapter 13)
3. Using a bar code level or standard rod and level, run a level circuit through all control points to determine elevations.
4. Set up job in data controller and record in supplemental notes the date, the beginning and ending point numbers, job name, and the crew.
5. Set up and orient the total station.
6. Collimation properly according to the equipment manufacturers instructions.
7. Gather crew together and discuss strategy for collection to prevent over or under coverage.
8. Begin to gather DTM data.
   (a) Check the configuration on the data controller to ensure that the auto point number is correct (do this daily). Let the data controller do the point numbering.
   (b) Paint a spot for the beginning or end of breaklines.
   (c) Collect break line data in the direction of increasing point numbers. (Do not jump back on the same break line.)
   (d) Use WSDOT standard survey codes and include Left or Right for plotting.

(e) Make supplemental notes to further describe topography items such as catch basins, guardrail anchors, etc.

(f) For accurate profiles, do not exceed 50 ft spacing on pavement.

(g) For accuracy and a dependable DTM, a maximum of 150 ft spacing is recommended.

(h) Do not take shots more than 750 ft away from the instrument.

(i) The computer will draw straight lines between points, so more shots must be taken on horizontal and vertical curves.

(j) Do not cross three dimensional break lines.

9. Daily download, edit, process, archive the data controller files. Print reports as needed

10. Hand-written field notes.

    It is useful to show the location of points relative to permanent objects. Note what the point is (spike, hub & tack, etc.), and how it is referenced.

    Make notes that are neat and accurate. Title and index the first page of each operation. On the first page of each day's work, show the date, crew, weather, and instrument by Serial number. Number and date every page. Notes written with the book turned are written with the right edge of the book toward the writer.

    Do not use "scratch" notes intending to put them in the book later.

    Field records are an important aspect in any survey. A well-executed surveying job is worthless unless it is well documented. Take the time necessary, in the field, to create good records on what you have done.