



INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

Design Memorandum No. 13-16 **Technical Advisory**

August 15, 2013

TO: All Design, Operations, and District Personnel, and Consultants

FROM: /s/ Eric N. Banschbach, P.L.S.
Eric N. Banschbach, P.L.S
Manager, Land and Aerial Survey Office

SUBJECT: Survey Transmittal Deliverables Related to Geo-Coordinated Survey

REVISES: *Indiana Design Manual Section 26-1.01*

EFFECTIVE: Immediately

In an effort to efficiently and effectively geo-coordinate various data provided as part of all survey file deliverables, INDOT now requires additional files as part minimum survey requirements. These files include the following:

- 1) .dgn geo-coordinated seed file. The .dgn geo-coordinated seed file will utilize the standard naming convention for InRoads survey files, as defined in said Section 26-1.01, and be appropriately named for the project it relates to (i.e. Des#_SRxx_seed.dgn).
- 2) IN_GeoCS.dty file. The IN_GeoCS.dty file is the base customized geo-coordination library to be used with Bentley Map and the creation of geo-coordination survey seed files. This file should be used with the MicroStation MS_GEOCOORDINATE_USERLIBRARIES variable. The delivered file will contain the appropriate coordinate systems. The provided template file will be edited as necessary, and then saved.
- 3) esri_cad.wld file. The esri_cad.wld file contains the necessary parameters to transform the dgn to the State Plane Coordinate (SPC) system. This allows the data in the files to be re-projected on-the-fly to its appropriate location on the ground in the real world. The data in the .wld file will consist of the Local Ground Coordinates for two well-established control points and the corresponding SPC for the same two points. The two control points should be located such that one is outside the limits of construction at the start of the project, and the other will be at a similar location beyond the end of the project construction.

The creation of these files allows for any CAD file, based on the created seed file, to be instantly consumed by the ESRI ArcGIS products and made available for a variety of other uses. The instructions for creating

these required files are contained in *DOTWise 3.2 MicroStation, InRoads, and ProjectWise for Survey and Design* Section 6.3. This manual is available on the [INDOT CAD Support](#) webpage under Documents.

The required template files referenced in *DOTWise 3.2* are available on the [INDOT CAD Support](#) webpage under Geocoordination.

Indiana Design Manual Section 26-1.01 has been revised to reflect these requirements and is attached to this memo.

ENB:ewp

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26-1.01 InRoads Format [Rev. Aug. 2013]

Considering that INDOT has adopted Microstation and InRoads as its standard drafting and design software applications, respectively, the CAD Support Team has developed standard resource files such as design templates (seed files) and survey-data processing (.xin) files. The most current INDOT *seed.dgn* and *survey.xin* files made available through the CAD Support Team shall be used.

The Department has established a standard naming convention for all InRoads survey files to make the data more portable so that all users can easily recognize and use the files created by others. The conventions also provide information on file contents at a glance. Each InRoads survey file submitted to INDOT shall use the format and provide the content as described below.

DES#_SRxx Name.extension

Key:

DES#: designation number for project as provided by INDOT

SRxx: route number of project, for example: SR37, SR162, I64, US150

Name: descriptive name of information in file, for example: Topo, LCRS Plat

Extension: file extension name, for example, .xin, .dgn, .fwd

The files to be submitted to INDOT for each survey are as follows:

1. Des #_SRxx Control Points.fwd
2. Des #_SRxx LCRS Plat.pdf
3. Des #_SRxx LCRS Plat.dgn
4. Des #_SRxx Survey Alignment.alg
5. Des #_SRxx Survey Book.docx
6. Des #_SRxx Survey Surface.dtm
7. Des #_SRxx Survey Surface Boundary.dtm
8. Des #_SRxx Survey.xin
9. Des #_SRxx Topo.dgn
10. Des #_SRxx Topo.fwd
11. Des #_SRxx seed.dgn

26-1.01(01) Minimum File Requirements [Rev. Aug. 2013]

Each file shall include, at a minimum, the data described below.

1. Des #_SRxx Control Points.fwd. This file includes all centerlines, a partial list of fly stations (random control points), bench marks, and United States Public Land Survey

(USPLS) subdivision corners, including corners of properties not within USPLS areas, necessary to describe acquisition parcels.

a. Centerline. All centerline points of each survey line within the survey shall be included in this file.

(1) The code for centerline points shall be "PSSA".

(2) Notes for each "PSSA" shall include location (e.g., POT, PC, POST, etc.) stationing, line letter, PI information (delta angle, degree of curve or radius length, tangent length, arc length, and external length), description of monument, and location of top of monument relative to ground surface or pavement surface.

b. Fly station. All fly stations traversed through, during establishment or reestablishment of survey lines, shall be included in this file. All fly locations set during topographic collection shall not be in this file, but shall be included in the "Des #_SRxx Topo.fwd" file.

(1) The code for fly station shall be "FLY".

(2) Notes for "FLY" shall include the description of the monument and location of top of monument relative to ground surface or pavement surface for each point.

c. Bench Marks. These used for survey data collection shall be included in this file.

(1) Monuments shall be coded in accordance with the .xin file provided by INDOT.

(2) Bench-mark notes shall include the name and description of each monument, a description of the structure that the monument is placed in or on, the station and offset from the survey line, and the survey-line letters.

Examples: BM#1, Boat Spike in root of 21-in. oak tree, 125 ft left of Station 123+45, Line "A". INDOT BM 19 V 1030, disc in north end of concrete headwall, 55 ft right of Station 35+25, Line "S-1-A".

d. USPLS Corners. These, or corners of properties not within USPLS areas, necessary to describe acquisition parcels, shall be included in this file.

- (1) Monuments shall be coded in accordance with the .xin file provided by INDOT.
- (2) Notes for monuments shall include the location of the corner.

Example for area within USPLS: "N ¼ Corner of Section 34, T2N, R2W".
Example for area not within USPLS: "NE Corner of Division "C" of the Vincennes Commons Lands".

- (3) Notes shall include a description and location of each monument relative to the ground surface or pavement surface.

2. Des # SRxx LCRS Plat.pdf. This file is a copy of the Location Control Route Survey Plat (LCRS) as recorded in the County Recorder' office, for the survey project. This copy shall have the seal and signature of the Licensed Land Surveyor in responsible charge, and all recording information placed on the LCRS by the County Recorder.
3. Des # SRxx LCRS Plat.dgn. This Microstation file shall include multiple models of the following.
 - a. The LCRS used to generate that for recording with the County Recorder. This shall be provided for design reference and use.
 - b. Survey control points and references, which include the following:
 - (1) description of point along alignment (e.g., POT, PC, POST, etc.);
 - (2) stationing of survey-line point (e.g., 123+45.67, etc.);
 - (3) line letter (e.g., "A", "S-1-A", etc.);
 - (4) description of monument (e.g., 5/8 in. rebar with cap stamped INDOT 0005, Mag Nail with washer stamped INDOT 0005, etc.);
 - (5) location of top of monument relative to ground surface (e.g., Flush with surface, 0.1 ft below ground surface, protruding 0.4 ft above ground surface, etc.);
 - (6) description of reference monument (e.g., Nail in Bottle Cap in 15-in. Maple, Nail in Bottle Cap in Corner Fence Post, X Cut in Concrete Headwall, etc.); and

- (7) azimuth to nearest degree, and distance to nearest 0.01 ft, from control monument to reference monument.
 - c. USPLS corners, or corners within areas not part of the USPLS, and references, including, at a minimum, the following:
 - (1) descriptions of USPLS corners (e.g., W ¼ Corner of Section 24, T3N, R5W);
 - (2) descriptions of monuments not within USPLS areas (e.g., NE Corner of Division “C” of the Vincennes Commons Lands);
 - (3) description of monument (e.g., 9” x 6” stone with “S 24 W ¼” cut on side of stone);
 - (4) location of top of monument relative to ground surface (e.g., Flush with surface, 1.5 ft below ground surface, protruding 0.7 ft above ground surface, etc.);
 - (5) description of reference monument (e.g., Nail in Bottle Cap in 15-in. Maple, Nail in Bottle Cap in Corner Fence Post, X Cut in Concrete Headwall, etc); and
 - (6) Azimuth, to the nearest degree, and distance, to the nearest 0.01 ft, from control monument to reference monument.
4. Des # SRxx Survey Alignment.alg. This file includes all alignments of the survey project.
 - a. In writing Survey (“Des #_SRxx Control Points.fwd”) to Geometry, in the “Project Name” box, enter “Survey Alignment“.
 - b. In creating alignment, in “Name” box, enter “A” for Line “A”, etc.
 - c. If there is an “S” line, under “Survey Alignment”, name alignment “S-1-A”, “S-SRxx-A”, etc.
 - d. For the description of each alignment, use the applicable route name (e.g., SR 1, CR 250 W, etc.).
 - e. The alignment shall have the correct stationing applied.

- f. Save as “Des #_SRxx Survey Alignment.alg”
5. Des #_SRxx Survey Book.docx. This file includes all supplemental survey information not found in other files. The .docx format is preferred. However, .doc or .pdf is also acceptable. It shall include the following:
- a. front page notations, i.e., Des No., Route No., Terminal Points of Project, County, brief description of each line;
 - b. title page and completed Table of Contents;
 - c. dates of survey start and survey completion;
 - d. names of survey crew members;
 - e. Des number and page numbers at top of each page;
 - f. Surveyors Report, in accordance with IAC-865, as a minimum requirement;
 - g. start and end of each line shown with equations and cross references to other surveys;
 - h. control points labeled, with location (e.g., POT, PC, POST, etc.), stationing, line letters, location relative to surface (e.g. flush, 0.1’ below ground level, etc.), and coordinates shown;
 - i. alignment data shown and checked;
 - j. references shown and checked, if LCRS not prepared. If an LCRS was prepared, this information will be on the recorded LCRS;
 - k. source of bearings described;
 - l. utility ownerships within limits of survey, with mailing addresses, with a notation of utilities not within limits;
 - m. Underground Utility Reference Number placed on Utilities page;
 - n. high-water elevation and date, with source and date of information;
 - o. source of level datum;

- p. bench-mark descriptions completed;
- q. level notes for all bench marks used for survey;
- r. legal flow-line elevations of county ditches; and
- s. level equations with other surveys shown, and explained.

6. Des #_SRxx Survey Surface.dtm.

- a. In writing Survey to Surface, in “Surface Name” box, enter “Survey Surface” and save as “Des #_SRxx Survey Surface.dtm”.
- b. For more than one surface within a survey project, use “Survey Surface A”, etc. (see “Des #_SRxx Topo.fwd” below).
- c. All string crossings shall be resolved.
- d. Upon completion of the survey, with all corrections of field data completed, a “Survey Surface” shall be created. After determining this surface to be correct, create a boundary string named “Boundary” by connecting all points and strings along the exterior of the survey that are to be included in the triangulation. “Survey Surface” will contain the survey surface and the exterior “Boundary” feature. This surface shall be saved as “Des#_SRxx Survey Surface.dtm”.

7. Des #_SRxx Survey Surface Boundary.dtm.

- a. After creating the boundary string around the survey perimeter, as described in item 6d above, such boundary shall be saved in a separate surface file as “Des #_SRxx Survey Surface Boundary.dtm”, which shall include only that feature.
- b. For more than one boundary around a survey project, use “Survey Surface Boundary A” for the boundary of “Survey Surface A”, etc. (see “Des #_SRxx Topo.fwd” file, item 9, below).

8. Des #_SRxx Survey.xin. This is the InRoads “xin” file used for the survey project. InRoads standards for survey data processing have been set up in this file. This file includes the INDOT standards for Feature Codes, Feature Styles, and Feature Filters, Dialog Box Settings, Linestyles, Lineweights, colors, and other settings. This file is critical for use in the InRoads Survey Process, and for accurate DTM and geometry object creation. Additional Names Symbology or Styles should not be added in order for

the .xin file to be consistent with the current MicroStation settings. Utilities will therefore function properly.

- a. It shall be a copy of INDOT.xin, as provided by the CAD Support Team, at the time of project inception.
 - b. All modifications to .xin shall not affect the ability of submitted files (.dtm, .alg, .fwd) to interact with later versions of .xin in an error-free manner. Feature names, symbology, etc. shall not be changed.
9. Des # SRxx Topo.dgn. Secondary display items, such as Contours, Triangles, and Survey Graphics, may be written to additional .dgn files and provided as references.
- a. MicroStation files shall be used with InRoads for the survey project.
 - b. It shall be in accordance with the appropriate unitary system for the survey, i.e., US Survey Feet, see files as provided by CAD Support.
 - c. The features to be displayed on separate levels, as defined by INDOT.xin, shall be as follows:
 - (1) DTM features;
 - (2) existing contours;
 - (3) existing triangulation;
 - (4) survey alignment with annotation;
 - (5) survey field-book data written to graphics, including symbols, names, elevations, notes, and codes.
10. Des # SRxx Topo.fwd. This file includes all topographic data for the survey project.
- a. All topographic data shall be included in one field book (i.e., Des #_SRxx Topo.fwd”). An exception is if there are isolated survey locations in a lengthy project, for example structure replacements in a resurface project, as discussed below.
 - b. Under “Survey Data” in InRoads, create a new book named “Des #_SRxx Topo”.

- c. Import the data collector (controller) or text file into InRoads to create a field book. Save the created field book as “Des #_SRxx Topo.fwd”.
- d. Data imported from a collector (controller) or a text file shall not have a file name containing more than 15 characters. A file name longer than this will be truncated within InRoads to 15 characters after the field book is saved and then loaded again at the next session. This is not the name of the field book as required in item 10c above, but it is the name of the data file used to create the field book.
- e. If more than one survey site is included in the survey project, for sites that are not near each other, create a different .fwd file for each site. For example, for two or more small structure replacements in a resurface project, use “Des #_SRxx Topo A” for the first site (south to north, or west to east) and “Des #_SRxx Topo B” for the second site, and continue using the same procedure.

11. Des #_SRxx seed.dgn This file, in combination with the IN_GeoCS.dty and esri_cad.wld files, will be used for geo-coordination of CAD files by GIS products through the project lifecycle.

- a. Procedures for the creation of this file are provided in the current version of the *DOTWiseX.X MicroStation, InRoads & ProjectWise for Survey and Design Manual* available on the [INDOT CAD Support](#) webpage.
- b. Required template files referenced in the above instructional documentation are available on [INDOT CAD Support](#) webpage under the Geo-Coordination tab.

26-1.01(02) Additional Geo-Coordination Files [Added Aug. 2013]

Two additional files that are directly correlated with the DGN geo-coordination seed file shall also be included in the survey transmittal as follows:

- 1. IN_GeoCS.dty The delivered file will contain the appropriate coordinate systems.
 - a. This is the base customized geo-coordination library to be used with Bentley Map and the creation of geo-coordination survey seed files.
 - b. This file should be used with the MicroStation `MS_GEOCOORDINATE_USERLIBRARIES` variable.
 - c. The template file will be edited as necessary, and then saved.
- 2. esri_cad.wld This file contains the necessary parameters to transform the DGN to the State Plane Coordinate (SPC) system.

- a. The data in this file allows the file to be re-projected on-the-fly to its appropriate location on the ground in the real world.
- b. The data in the WLD file will consist of the Local Ground Coordinates for two well-established control points and the corresponding SPC for the same two points. The two control points should be located such that one is outside the limits of construction at the start of the project, and the other will be at a similar location beyond the end of the project construction.

Procedures for accessing, properly editing, and creating the above described files can be found in the current version of *DOTWiseX.X MicroStation, InRoads & ProjectWise for Survey and Design Manual* available on the [INDOT CAD Support](#) webpage. The required templates referenced in the instructional documentation are also available on the [INDOT CAD Support](#) webpage and are located under the Geo-Coordination tab.

26-1.01(03) Aerial-Survey File Requirements

1. All files created by an aerial survey shall follow the established InRoads survey file naming and technical conventions.
2. In naming these files, they shall have the suffix “_Aerial” appended at the end of the file name, prior to the file extension, i.e., “Des #_SRxx Topo_Aerial.fwd”.
3. If a combination of aerial and ground surveys is submitted, they shall be combined into a single .dtm survey surface.