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# CHAPTER 8 – Electronic Deliverables

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## TABLE OF CONTENTS

<b>CHAPTER 8</b> .....	<b>3</b>
<b>8.1 Policy and Procedures for Electronic Data Deliverables</b> .....	<b>3</b>
8.1.1 Introduction / Purpose .....	3
<b>8.2 Background</b> .....	<b>4</b>
<b>8.3 Scope</b> .....	<b>5</b>
<b>8.4 Descriptions of the Electronic Deliverables</b> .....	<b>6</b>
8.4.1 Design Data .....	6
8.4.2 Graphical Data .....	6
8.4.3 Digital Terrain Model (DTM).....	6
8.4.4 VDOT Standard Data.....	6
8.4.5 Text Files.....	6
8.4.6 Spread Sheet Data Files .....	6
8.4.7 Engineering Estimate.....	6
<b>8.5 Descriptions for Electronic Data Items</b> .....	<b>7</b>
8.5.1 GEOPAK Files .....	7
<b>8.6 Media for Electronic Data Items</b> .....	<b>10</b>
<b>8.7 Overview of Electronic Data Required at the Survey Stage</b> .....	<b>11</b>
8.7.1 Document Data .....	11
<b>8.8 Overview of Electronic Data Required at the Preliminary Field Inspection Review Stage</b> .....	<b>12</b>
8.8.1 Design Data .....	12
8.8.2 Graphical Data .....	12
8.8.3 DTM Data.....	12
8.8.4 Text Files.....	12
<b>8.9 Overview of Electronic Data Required at the Public Hearing Stage</b> .....	<b>13</b>
8.9.1 Design Data .....	13
8.9.2 Graphical Data .....	13
8.9.3 DTM Data.....	13
8.9.4 Text Files.....	13
8.9.5 Spreadsheet Data .....	13
<b>8.10 Overview of Electronic Data Required at the Field Inspection Stage</b> .....	<b>14</b>
8.10.1 Design Data .....	14
8.10.2 Graphical Data .....	14
8.10.3 DTM Data.....	14
8.10.4 Text Files.....	14
8.10.5 Spreadsheet Data .....	14
<b>8.11 Overview of Electronic Data Required at the Right of Way Acquisition Plans Stage</b> .....	<b>15</b>
8.11.1 Right of Way Plans (Total Takes or Partial Takes, if applicable).....	15
8.11.2 Graphical Data .....	15
8.11.3 DTM Data.....	15
8.11.4 Text Files.....	15

8.11.5	Spreadsheet Data .....	15
<b>8.12</b>	<b>Overview of Electronic Data Required at the Complete Road Construction Plans (Pre-Advertisement Conference) Stage.....</b>	<b>16</b>
8.12.1	Pre-Advertisement Conference.....	16
8.12.2	Plan Coordination Review.....	16
8.12.3	Graphical Data .....	16
<b>8.13</b>	<b>Overview of Electronic Data Required at the Complete Road Construction Plans (Advertisement Submission) Stage .....</b>	<b>17</b>
8.13.1	Advertisement Submission .....	17
8.13.2	Design Data .....	17
8.13.3	Graphical Data .....	17
8.13.4	DTM Data.....	17
8.13.5	Text Files.....	17
8.13.6	Spreadsheet Data .....	18
<b>8.14</b>	<b>VDOT Software License(s) Request Process .....</b>	<b>19</b>
8.14.1	Process for requests .....	19
8.14.2	Requirements for Justification of Additional License(s).....	19

# Chapter 8

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## 8.1 Policy and Procedures for Electronic Data Deliverables

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### 8.1.1 Introduction / Purpose

This document is the Virginia Department of Transportation's (hereafter referred to as VDOT) policy and procedures for required electronic (computer) data as it relates to engineering design project deliverables for Pre-Construction\*. VDOT will require supplementary electronic data delivery items. This data will be in the formats specified by this document. In general, design data is to be provided in OpenRoads/GEOPAK format, Original ground survey Digital Terrain Model (DTM) data is also to be provided in OpenRoads/GEOPAK format, and graphical data is to be provided in the MicroStation format. Organizations wishing to perform professional surveying and engineering services for VDOT are required to deliver electronic data as specified by this document. This policy and procedures also requires organizations to accept and utilize pertinent electronic input data as provided by VDOT.

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\* Rev 2/18

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## **8.2 Background**

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VDOT is committed to the development of an advanced interactive graphic tool for highway design called Interactive Graphic Automated Engineering System (IGAES). The chosen approach for achieving the IGAES concept is based on the implementation of OpenRoads/GEOPAK\* as a Civil Engineering Design System including DTM functionality.

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\* Rev 2/18

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## 8.3 *Scope*

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Electronic data deliverables are required at the following Project Development Stages, archiving is required except where noted:

- Preliminary Field Inspection (PFI) Stage
- Public Hearing (PH) Stage
- Field Inspection (FI) Stage
- Utility Field Inspection (UFI) Stage
- Right-of-Way Acquisition (Partial Take) Stage
- Right-of-Way Acquisition (Total Take) Stage
- Right of Way Revision Submittals
- Pre-Advertisement Conference (PAC) Stage (***not archived***)
- Plan Coordination Review (***not archived***)
- Pre-Award Revisions
- Advertisement Plans Stage (Advertisement Submission)
- Construction Revision
- As Built (as needed)

Additional details for preparation of deliverables can be found at the following links: [Electronic Plan Submission Process Flow Chart](#) and [Form LD-436 QC checklist\\*](#).

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\* Rev 2/18

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## **8.4 Descriptions of the Electronic Deliverables**

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This section describes the kinds of electronic data delivery items which are required by one or more of the types of services included in the scope of the project.

### **8.4.1 Design Data**

This item refers to the collection of engineering data which is used to both specify the design (input data) and describe the final results (output data).

### **8.4.2 Graphical Data**

This item refers to the CADD (dgn) file(s) which depict design data as plan sheets, typical sections, summaries, etc.

It also refers to PDF Files which are required to be signed & sealed as the official plan documents\*.

### **8.4.3 Digital Terrain Model (DTM)**

This item refers to all data associated with the development and use of the DTM.

### **8.4.4 VDOT Standard Data**

This item refers to a group of files provided by VDOT which contain standard symbology, graphical file setup procedures, etc.

### **8.4.5 Text Files**

This item refers to files which contain reports, listings, etc.

### **8.4.6 Spread Sheet Data Files**

This item refers to structured computational worksheets such as Microsoft Excel.

### **8.4.7 Engineering Estimate**

This item refers to data input through Precon (old Trns-Port), VDOT's electronic estimating software.

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\* Rev 2/18

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## 8.5 Descriptions for Electronic Data Items

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The official PDF File(s) and Electronic data **MUST MATCH\***.

This section specifies the format for each kind of electronic data. Detailed file specifications and formats are included.

**DESIGN DATA:** Design data will be in **OpenRoads/GEOPAK** format.

### 8.5.1 GEOPAK Files

The following is a list of GEOPAK files and a description of their contents:

**job###.gpk File** - This binary file is created when the user starts a coordinate geometry (COGO) session for the first time or when created through Project Manager. The file may be appended during the design process. All coordinate geometry elements are stored in this file. Multiple users can access this file at the same time, and only one file should be created for each project. The "###" is the only variable in this filename. It represents a job number (up to 3 alphanumeric characters) unique to a project and is defined by the user upon creation.

**fname###.ioc File (Example: align999.ijd)** - ASCII input file for loading data during a COGO session. "###" represents the job number and "oc" is the operator code (users initials). User assigns filename characters as indicated with the example.

**fname###.ooc File (Example: align999.ojd)** - ASCII output file created by GEOPAK during a COGO session. Variables are the same as defined above. User assigns filename characters as indicated with the example.

**fname.inp File (Example: desxs.inp)** - Any ASCII input file for running GEOPAK processes. Name is user defined with an **'.inp'** extension.

**fname.dat File** - A binary file that contains string and point information to be used for digital terrain model construction.

**fname.tin File** - A binary file containing triangular surfaces also known as the digital terrain model (DTM).

**Project-name.prj File** - Binary file resulting from the creation of a new project.

**fname.x File** - ASCII input files that define criteria data as well as redefinable variable data.

The following is a list of files with a description of their contents, when a user creates a run. These files are placed under the projdbs folder in the user's folder.

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\* Rev 2/18

**Project-name.002 File** - Resource file for running superelevation.

**Project-name.003 File** - Resource file for running proposed cross sections.

**Project-name.004 File** - Resource file for running earthwork.

**Project-name.005 File** - Resource file for running cross section sheets.

**Project-name.008 File** - Resource file for defining working alignment.

**Project-name.009 File** - Resource file for running existing ground profile.

**Project-name.010 File** - Resource file for running 3d modeling.

**Project-name.011 File** - Resource file for drawing pattern lines.

**Project-name.00a File** - Resource file for running vertical alignment.

**Project-name.00b File** - Resource file for running plan/profile sheets.

**Project-name.00c File** - Resource file for running limits of construction.

**Project-name.00d File** - Resource file for running existing ground (DTM).

**Project-name.00e File** - Resource file for running existing ground cross sections.

**Project-name.00f File** - Resource file for running reports and cross section quantities.

**GRAPHICAL DATA:** Graphical data will be in MicroStation DESIGN FILE format. Additionally, all graphical data must conform to VDOT graphics file and CADD standards in accordance with VDOT's policies and manuals, (i.e., CADD Manual, [Survey Manual](#), [Road Design Manual](#) and [I&M's](#).)

**DIGITAL TERRAIN MODEL DATA:** DTM data will be compiled by GEOPAK. The data files will represent the completed models with all required surfaces. Completed models will consist of:

- all survey data base segments (points and discontinuity lines)
- all surface data bases (terrain, subterranean)
- all design data

Each surface will be triangulated.



## 8.5.2 OpenRoads Files\*

**OpenRoads DATA:** MicroStation DESIGN FILES that contains civil data that includes Alignments, Profiles, Other Geometry, Terrain Surface, Civil Cells, Corridor Models and Final Surfaces. In addition the files could include Other MicroStation Element used in creation of the Corridor Model for Point Controls or Corridor References.

**ITL:** OpenRoads Template Libraries

**XML:** Output files that could contain Alignments, Profiles, Other Geometry, DTM for Terrain Surface, and Final Surfaces.

**DXF:** Output files that could contain DTM for Terrain Surfaces, and Final Surfaces.

**ICM:** Output files (Infrastructure Consensus Model) that is rich data exchange format using the Bentley i-model standard.

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\* Rev 2/18

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## **8.6 Media for Electronic Data Items**

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All delivery items will be provided to VDOT in one of the following media forms:

- VDOT's [Falcon Web Suite](#) is the preferred method\*. See [Chapter 7, Section 7](#) for instructions
- VDOT's FTP Site <ftp.vdot.virginia.gov> See [Chapter 7, Section 8](#) for instructions.

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\* Rev 2/18

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## 8.7 Overview of Electronic Data Required at the Survey Stage

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### 8.7.1 Document Data

**DOCUMENT OR README FILE: Example:** "SUPC#.doc" This file contains general information about the survey and may be ASCII or Microsoft Word format containing the following information:

- Route Number
- Project Number
- County and District
- Project description/description of all files
- Date of beginning and completion of survey
- Horizontal and Vertical control data
- Length of survey
- Field personnel
- Utility owners and addresses
- Description of VDOT control monuments and benchmarks
- List of control points used that are not in the file
- Survey report and transmittal memorandum
- Any notes or recommendations concerning unusual conditions affecting the survey

**ALIGNMENT FILE: Example:** "s(UPC#).dgn" - This file contains the alignments for the survey being conducted.

**PLANIMETRIC FEATURES and UTILITIES: Example:** "s(UPC#).dgn", MicroStation 2d file, (version 08.05 +) to current VDOT standards in accordance with VDOT's policies and manuals, (i.e., CADD Manual, [Survey Manual](#), [Road Design Manual](#) and [I&M's](#)).

**DTM:** files are required as follows:

**Example:** "s(UPC#).tin", GEOPAK (version 2004+) "TIN" file.

This file contains a completed triangulated surface database. It will also be embedded within the s(UPC#).dgn file in a 3D model named stin(UPC#).\*

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\* Rev 2/18

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## ***8.8 Overview of Electronic Data Required at the Preliminary Field Inspection Review Stage***

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### **8.8.1 Design Data**

- Baseline Alignments
- Construction Alignments (proposed)
- Grades
- Design Data Shapes (templates, side-slopes, medians) - preliminary
- Design Data Stations (preliminary)
- Earthwork Parameters (input data)
- Geometric Data
- Original Cross Sections
- Design Cross Sections

### **8.8.2 Graphical Data**

- Design Graphical Data File
- Plan Sheet (roll)
- Profile Sheet (roll)
- Cross Section Plot
- Plot File (roll)

### **8.8.3 DTM Data**

- NONE

### **8.8.4 Text Files**

- GEOPAK Quantities Report
- Design Data and Alignment Reports

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## **8.9 Overview of Electronic Data Required at the Public Hearing Stage**

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### **8.9.1 Design Data**

- Baseline Alignments
- Construction Alignments
- Grades
- Design Data Shapes (templates, side-slopes, medians)
- Design Data Stations
- Earthwork Parameters
- Geometric Data
- Original Cross Sections
- Design Cross Sections

### **8.9.2 Graphical Data**

- Design Graphical Data File
- Plan Sheets
- Profile Sheets
- Cross Section Plot Sheets
- Entrance Sheets
- Drainage Design
- PDF Files (Title, Plan, Profile, Typical, etc.)

### **8.9.3 DTM Data**

- GEOPAK Original Ground tin file
- Intermediate Surfaces
- Final Design Surface

### **8.9.4 Text Files**

- GEOPAK Design Cross Section Listing
- GEOPAK Quantities Report
- Design Data and Alignment Reports

### **8.9.5 Spreadsheet Data**

- Hydrology/Hydraulics (as required)
- ROW Data Sheet

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## **8.10 Overview of Electronic Data Required at the Field Inspection Stage**

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### **8.10.1 Design Data**

- Baseline Alignments
- Construction Alignments
- Grades
- Design Data Shapes (templates, side-slopes, medians)
- Design Data Stations
- Earthwork Parameters
- Geometric Data
- Original Cross Sections
- Design Cross Sections

### **8.10.2 Graphical Data**

- Design Graphical Data File
- Plan Sheets
- Profile Sheets
- Cross Section Plot Sheets
- Entrance Sheets
- Drainage Design
- PDF Files (Title, Plan, Profile, Typical, etc.)

### **8.10.3 DTM Data**

- GEOPAK Original Ground tin file
- Intermediate Surfaces
- Final Design Surface

### **8.10.4 Text Files**

- GEOPAK Design Cross Section Listing
- GEOPAK Quantities Report
- Design Data and Alignment Reports

### **8.10.5 Spreadsheet Data**

- Hydrology/Hydraulics (as required)
- ROW Data Sheet

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## **8.11 Overview of Electronic Data Required at the Right of Way Acquisition Plans Stage**

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### **8.11.1 Right of Way Plans (Total Takes or Partial Takes, if applicable)**

VDOT personnel see [Electronic Submission of Right of Way](#) (Total Takes or Partial Takes, if applicable).

- Baseline Alignments
- Construction Alignments
- Grades
- Design Data Shapes (templates, side-slopes, medians)
- Design Data Stations
- Earthwork Parameters
- Geometric Data
- Original Cross Sections
- Design Cross Sections

### **8.11.2 Graphical Data**

- Design Graphical Data File
- Plan Sheets
- Profile Sheets
- Cross Section Plot Sheets
- Entrance Sheets
- Drainage Design
- PDF Files (Title, Plan, Profile, Typical, etc.)

### **8.11.3 DTM Data**

- GEOPAK Original Ground tin file
- Intermediate Surfaces
- Final Design Surface

### **8.11.4 Text Files**

- GEOPAK Design Cross Section Listing
- GEOPAK Quantities Report
- Design Data and Alignment Reports

### **8.11.5 Spreadsheet Data**

- Hydrology/Hydraulics (as required)
- Right of Way Data Sheet with metes and bounds on appropriate properties
- Areas of Take

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## ***8.12 Overview of Electronic Data Required at the Complete Road Construction Plans (Pre-Advertisement Conference) Stage***

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### **8.12.1 Pre-Advertisement Conference**

VDOT personnel see [Electronic Submission of Pre-Advertisement Conference \(PAC\)](#) for instructions.

### **8.12.2 Plan Coordination Review**

VDOT personnel see [Electronic Submission of Plan Coordination Review](#) for instructions.

### **8.12.3 Graphical Data**

- PDF Files of Complete Plan assembly and Cross Sections



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## ***8.13 Overview of Electronic Data Required at the Complete Road Construction Plans (Advertisement Submission) Stage***

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### **8.13.1 Advertisement Submission**

VDOT personnel see [Electronic Advertisement Submission](#) for instructions.

### **8.13.2 Design Data**

- Baseline Alignments
- Construction Alignments
- Grades
- Design Data Shapes (templates, side-slopes, medians)
- Design Data Stations
- Earthwork Parameters
- Geometric Data
- Original Cross Sections
- Design Cross Sections

### **8.13.3 Graphical Data**

- Design Graphical Data File
- Plan Sheets
- Profile Sheets
- Cross Section Plot Sheets
- Entrance Sheets
- Drainage Design
- Summary Sheets
- All Plans as Specified by the Contract
- PDF Files of Complete Plan assembly and Cross Sections

### **8.13.4 DTM Data**

- GEOPAK Original Ground tin file
- Intermediate Surfaces
- Final Design Surface
- Construction Staking Data

### **8.13.5 Text Files**

- Alignment Listing
- Grade Listing
- Toe of Slope Listing
- Construction Stakeout Report
- Design Cross Section Listing

### **8.13.6 Spreadsheet Data**

- Quantities
- Summary Sheets (as required)
- Index of Files

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## **8.14 VDOT Software License(s) Request Process**

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### **8.14.1 Process for requests**

- Consultant requests license(s) from VDOT if they have been awarded a VDOT project. Download, fill out and submit [VDOT Software License Request Form](#) (LD-893). All License requests **must** be made only by Prime Consultant/Contractor.
- Consultant Coordinator verifies project and forwards form to **CADD Support Section**.
- **CADD Support Section** reviews form and sends a license key that activates all Design software to the Consultant/Contractor directly.
  - ❖ Licenses issued are for the life of the contract.
  - ❖ The Consultant/Contractor will then submit a list of the Computers and primary users' names to VDOT.

### **8.14.2 Requirements for Justification of Additional License(s)**

Consultants are to use above Form to request additional licenses.

- Need additional license s) for sub consultant/contractor.
  - ❖ The request should be instigated by the Prime; however, the sub may also request a license key if Consultant Coordinator verifies project. The same procedure as above must be followed for sub-contractors.
- Need additional license(s) for additional work.
  - ❖ The request should be instigated by the Prime; however, the sub may also request a license key if Consultant Coordinator verifies that additional work requires different software or additional sub contractors. The same procedure as above must be followed for sub-contractors

**Please indicate on the Request Form if you already have a license. A form must be submitted for each project/contract that software is needed for. The license will remain active as long as you have an active contract with VDOT.**

**Use of this licensed software is limited to work on VDOT Contracts.**