

**Chapter Three**  
**PLAN PREPARATION (General)**

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## Chapter Three

# PLAN PREPARATION (General)

Other chapters in the Montana Traffic Engineering Manual provide the designer with uniform criteria and procedures for the geometric and traffic applications for a highway facility. These designs and applications must be incorporated into the construction plans so that they can be clearly understood by contractors, material suppliers and Department personnel assigned to supervise and inspect the construction of the project. To ensure a consistent interpretation of the contract plans, individual sheets should use a standard format and content, and the sequence of plan assembly should generally be the same. To provide this consistency, this Manual provides guidelines for the uniform preparation of contract plans including recommended plan sequence, drafting guidelines and plan sheet content. However, the Traffic Engineering Section consists of four Units that prepare construction plans — Electrical, Geometrics, Safety Design and Signing. Each of these Units have different requirements for what should be included in a set of construction plans (i.e., a traffic signal project will have different requirements than a signing project). Because there is significant overlap among these Units, [Chapter Three](#) provides the general information required to prepare a set of plans that is applicable to all Units. [Chapters Ten, Seventeen, Twenty-three](#) and [Thirty-five](#) of the Traffic Engineering Manual include a discussion on the plan preparation requirements for those elements that are unique to that particular Unit (i.e., Electrical, Signing, Geometrics, Safety).

### 3.1 GENERAL INFORMATION

#### 3.1.1 Working Sheets

The Department currently uses the following sheet sizes during project development:

1. 22 in x 34 in (559 mm x 864 mm) (D). This paper size is used for final plans. Where deemed necessary, this size may also be used for preliminary design reviews (e.g., complex drawings). A border around the sheet should be provided with a 2 in (51 mm) left-binding margin and with ½ in (13 mm) right, top and bottom margins.
2. 11 in x 17 in (279 mm x 432 mm) (B). This paper size is typically used for preliminary draft reviews, requests for permits and bid advertising. This plan

sheet is a half scale of the final plan size in Comment 1. This sheet size may also be used for plotting cross sections on the laser plotter.

For the preliminary design stage and for the final design stage of CADD-prepared plans, all sheets will be printed on white paper and will use the "B" paper size. Cross section sheets will be on "B" paper size. Prior to letting, the designer will submit plans electronically to the Contract Plans Section. Full-size plans and cross sections will be provided when requested.

### **3.1.2 Construction Plan Sheet Organization**

#### **3.1.2.1 Plan Sequence**

To provide consistency from project to project, the construction plan sheets should be assembled in the sequence listed below for the applicable unit. The designer should note that not all plans will have all sheets and that several sheets can be combined together (e.g., Table of Contents, Notes). If several sheets are combined, the sequences below still apply; that is, they should be listed in order from left to right on the sheet. The recommended plan sequences are:

#### **Geometric/Safety Design Projects**

1. Title Sheet
2. Table of Contents
3. Notes
4. Linear and Level Data
5. Control Diagram and Abstract Table
6. Typical Sections
7. Summaries
8. Hydraulic Data Summary
9. Detail Sheets:
  - a. drainage details (including storm drains)
  - b. special maintenance and protection of traffic through construction zone plans
  - c. miscellaneous details (including details for major approaches, interchanges, connections to existing pavement, etc.)
  - d. mass diagram

10. Plan and Profile Sheets
11. Sanitary Sewer Plans (if not included in Detail Sheets)
12. Water Plans (if not included in Detail Sheets)
13. Signing Plans:
  - a. Summary Signing and Delineation Quantities Sheet
  - b. Sign Location and Specifications Sheet
  - c. Signing Detail Sheets
  - d. Plan Sheets
14. Electrical Plans:
  - a. Electrical Quantity Summary Sheet
  - b. Electrical Detail Sheets
  - c. Plan Sheets
15. Bridge Plans:
  - a. Title/Quantity Sheet
  - b. General Layout and Structure Sheet
  - c. Footing Plan Sheet
  - d. Phase Construction Sequence (when applicable)
  - e. Bent/Pier Sheet
  - f. Erection Plan Sheet
  - g. Slab Detail Sheet
  - h. Beam/Girder Sheet
  - i. Detail Sheets
  - j. Standard Sheets
16. Cross Sections:
  - a. mainline (including detours)
  - b. approach cross sections
  - c. miscellaneous cross section items (e.g., berms, ditches, bike paths)
  - d. skewed culverts (i.e., cross section shown along the skew of the culvert)

#### Electrical Projects

1. Title Sheet
2. Table of Contents
3. Control Diagram

4. Electrical Quantity Summary Sheet
5. Electrical Detail Sheets
6. Plan Sheets

#### Signing Projects

1. Title Sheet
2. Table of Contents
3. Summary Signing and Delineation Quantities Sheet
4. Sign Location and Specifications Sheet
5. Signing Detail Sheets
6. Plan Sheets

#### **3.1.2.2 Sheet Numbering**

The title sheet will be considered as page one, but it will not be numbered. Number all other sheets sequentially. For US Customary designed plans, place the sheet numbers in the lower right-hand corner of the sheet. For metric designed plans, place the sheet numbers in the upper right-hand corner of the sheet.

Road plans will be numbered with separate, sequential whole numbers. Cross-section sheets will be numbered with separate, sequential whole numbers beginning with 1. Sanitary sewer, water, signing, electrical and bridge plans will be numbered separately within each group beginning with 1 and will have the following letter prefixes:

1. Sanitary Sewer Plans — SS\*
2. Water Plans — WS\*
3. Signing Plans — S
4. Electrical Plans — E
5. Bridge Plans — B

\* The Sanitary Sewer and Water Plans will only be designated by the SS and WS prefixes for new installations or extensive modifications to existing systems. The details for minor modifications or additions to existing systems will typically be included in the road plans without a prefix designation. The determination to separate the sanitary sewer and water line details from the road plan details will be made at the Plan-in-Hand.

### **3.1.3 MDT Detailed Drawings**

The MDT Detailed Drawings provide information on design elements that are consistent from project to project (e.g., sign mounting details). They are included in the contract by reference. [Section 4.2.4](#) provides additional information on the MDT Detailed Drawings.

### **3.1.4 Temporary Detours and Median Crossovers**

The need for separate maintenance of traffic through construction zone plans will vary from project to project. For crossovers or temporary detours, show the plan and profile views, the detour typical section and items of work included in the lump sum on a detail sheet.

Typically, a lump-sum bid item should be used for median crossovers and to construct, maintain and remove detours. [Section 4.1](#) provides additional information on lump-sum bid items.





## 3.2 DRAFTING GUIDELINES

Project drafting will typically be performed using CADD. [Section 3.3](#) provides information on the Department CADD system and file management. The following Sections provide information on the drafting criteria used by the Department.

### 3.2.1 General Guidelines

The following provides general guidelines for the plotting of survey data and design details on the plan sheets:

1. Scales. The scale for each sheet will vary according to the sheet or detail shown. For uniformity, roadway plan sheet scales should be consistent from sheet to sheet. However, the scales for detailed drawings will vary according to each drawing's needed clarity. The plan preparation chapters in this Manual for the individual units provide the scales that should be used for each sheet. Where deemed appropriate, show the scale on the plan or detail sheet.
2. Abbreviations. [Figure 3.2A](#) presents the common abbreviations that should be used where it is necessary to abbreviate elements within a set of plans.
3. Stationing. The following will apply:
  - a. US Customary. MDT uses 100 ft stations for US Customary plans. Show each station as a half tic and denote every tenth station with a full tic.
  - b. Metric. MDT uses 100 m stations for metric plans. Show the "tic" marks at 20 m intervals.
4. Cross Sections. The line work for cross sections will be drawn with the GEOPAK software program or other Department approved software. The topography will typically be CADD drafted onto the cross sections using MicroStation or GEOPAK.
5. Sheet Breaks. The following will apply:
  - a. US Customary. Each plan sheet should typically show 3000 ft of the project location with no overlap between sheets.
  - b. Metric. Each roadway design plan sheet should typically show approximately 700 m of the project location with no overlap.
  - c. Signing. For signing plans, the length of roadway shown on a sheet will vary according to the selected scale.

6. North Arrow. The North arrow on finished plans should be uniform within each set of plans. The standard North arrow CADD cell should be used.
7. Project Block. All sheets, except the Title Sheet, should have a standard block indicating the State, project number and sheet number. For US Customary designed projects, place the project block in the lower right-hand corner of the sheet. For metric designed projects, place the project block in the upper right-hand corner of the sheet.
8. Combination Scale Factor (CSF). For projects designed using the State Plane Coordinate System and US Customary units, place the CSF in the lower right-hand corner. For metric projects, place the CSF in the upper right-hand corner.

### **3.2.2 Plotting Survey Data**

For surveys conducted by aerial survey, the Photogrammetry and Survey Section will be responsible for plotting the survey data. For data collection surveys, the surveyor will provide a 3D map file and a digital terrain model (DTM). A 2D MicroStation map file is created by the lead section with the topography information to be used as a base map. For manually conducted surveys, the designer or consultant will be responsible for plotting the survey data using the Department or approved compatible CADD system. In addition to the field notes, the designer should obtain a copy of the as-built plans (if available) for informational purposes. The as-built plans may be obtained at the MDT Central Office in Helena.

The MDT Surveying Manual provides the Department's criteria for plotting the survey field notes. For road design projects, the survey should be plotted 700 ft (200 m) beyond the proposed project limits.

For project surveys, an established point is typically assigned a set of coordinate values, and the coordinates for all other points are calculated from these assumed values. Global Positioning System (GPS) surveys use the NAD 83 State Plane Coordinate System. Coordinates should be provided at all major control points on the linear and level data sheet; for additional information, see Chapter 4 of the MDT Road Design Manual.

&	And	C	Cut
@	At	C&G.	Curb & Gutter
∅	Phase	C/A	Control of Access
AASHTO	American Association of State Highway and Transportation Officials	C/L	Centerline
AB.	Abrupt	CALC.	Calculated
A.C.	Aluminum Cap/Asphalt Cement	C.A.P.	Corrugated Aluminum Pipe
ADD. EXC.	Additional Excavation	CATV	Cable TV
A.A.D.T.	Annual Average Daily Traffic	CB.	Curb
A.D.T.	Average Daily Traffic	C.B.	Catch Basin
ADJ.	Adjusted	C.B.W.	Concrete Block Wall
AGG.	Aggregate	C.C.	Closing Corner
AH.	Ahead	CDTN.	Condition
APP.	Approach	CEM.	Cement
APPL.	Application	CH.	Channel or Chain
APPROX.	Approximate	CH.CH.	Channel Change
ASPH.	Asphalt	CHD.	Chord
ASTM	American Society for Testing Materials	CHIS. "x"	Chiseled Cross
AVE.	Avenue	C.I.	Curb Inlet
AVG.	Average	CIR.	Circle
AWG	American Wire Gauge	CL.	Class or Clearance
AZ.	Azimuth	CL-1.2F,1.5F	Chain Link Fence (w/height)
BBLS.	Barrels	C.M.P.	Corrugated Metal Pipe
B.C.	Brass Cap	C.N.	Concrete Nail
B.C.R.	Begin Curb Return	CO.	County or Company
BEG.	Begin	C.O.	Clean Out
B.E.	Bridge End	COMP.	Compaction
BIT.	Bituminous or Bitumen	CONC.	Concrete
BK.	Back or Bank	COND.(TEL.)	Conduit (specify type)
BLDG.	Building	CONN.	Connection
BLK.	Block	CONST.	Construction
B.L.M.	U.S. Bureau of Land Management	CONST. PMT.	Construction Permit
BLVD.	Boulevard	COR.	Corner
B.M.	Bench Mark	CORR.	Corrected
BNDRY.	Boundary	COV.	Cover
BOT.	Bottom	C.P.	Catch Point
BR.	Bridge	CR.	Crushed or Creek
B.R.	Base of Rail	CRS.	Course
BRG.	Bearing	C.S.	Curve to Spiral
B.S.	Backsight	C.S.P.	Corrugated Steel Pipe
B.S.T.	Bituminous Surface Treatment	C.S.P.A.	Corrugated Steel Pipe Arch
B.W.FE.	Barbed Wire Fence	CT.	Court
		C.T.B.	Cement Treated Base
		CTR.	Center
		CULV.	Culvert

## PLAN ABBREVIATIONS

Figure 3.2A

D	Distribution of Traffic	F.	Fill
DBL.	Double	F.A.	Federal Aid
D.D.	Down Drain	F.C.	Flood Control
DE	Difference in Elevation	FD.	Found
DEFL.	Deflection	FDN.	Foundation
DESC.	Description	FE.	Fence
DEST.	Destroyed	FERT.	Fertilizer
DET.	Detour/Detail	F.E.T.S.	Flared End Terminal Section
DETC.	Detector	F.G.	Finished Grade
D.H.	Drill Hole	F.G.S.	Finished Grade Stake
D.H.V.	Design Hourly Volume	F.H.	Fire Hydrant
D.I.	Drop Inlet	FIN.	Finish
DIA.	Diameter	FL.	Flush
DIST.	Distance or District	F.L.	Flow Line
DN.	Down	F.P.	Fence Post
DP.	Deep	FR.	Frontage
DR.	Drain or Drive	FR. RD.	Frontage Road
DT.	Ditch	F.S.	Foresight
DWG.	Drawing	FTG.	Footing
DY.	Daylight	FUT.	Future
E	East/External Distance	FWY.	Freeway
EASE.	Easement	G	Grading
E.B.	Eastbound	g	Gram
E.C.R.	End Curb Return	GALV.	Galvanized
E.D.M.	Electronic Distance Measurement or Measurer	GAR.	Garage
E.G.	Edge of Gutter	GEOD.	Geodetic
ELEV. or EL.	Elevation	G.L.	Gas Line
ELONG.	Elongated	G.L.O.	General Land Office
ELY.	Easterly	G.P.S.	Global Positioning System
EMB.	Embankment	G.R.	Guardrail
EMUL.	Emulsified	GR.	Grade
E.O.	Edge of Oil	GRD.	Grid
E.P.	Edge of Pavement	GRND.	Ground
EQ.	Equation	GR.SEP.	Grade Separation
E <sub>s</sub>	External Distance	G.S.	Gravel Surfacing
E.S.	Edge of Shoulder	G.S.P.	Galvanized Steel Pipe
ESMT.	Easement	GTR.	Gutter
E.T.W.	Edge of Traveled Way	G.V.	Gas Valve
EW.	End Wall	ha	Hectare
EX.	Existing	H&T	Hub & Tack
EXC.	Excavation	HDWL.	Headwall
EXT.	Extension	HG.	Headgate
EXWY.	Expressway	H.I.	Height of Instrument
		HO.	House

### PLAN ABBREVIATIONS

(Continued)

Figure 3.2A

HOR.	Horizontal	MKR.	Marker
H.P.	Hinge Point	M.L.	Mainline
H.P.S.V.	High Pressure Sodium Vapor	MNCPL.	Municipal
HT.	Height	M.O.	Mid Ordinate
HWY.	Highway	MON.	Monument
H.W.	High Water	M.P.C.	Mid-Point of Curve
I	Interstate	N	North
I.C.	Incidental Construction	N.B.	Northbound
I.D.	Inside Diameter	N.C.	Normal Crown
I.E.	Invert Elevation	N.E.	Northeast
IMSA	International Municipal Signal Association	NEMA	National Electrical Manufacturers Association
INC.	Incorporated	N.G.	Natural Gas
INCL.	Included	N.G.S.	National Geodetic Survey
INSTR.	Instrument	NL.	Nail
INT.	Intersection	NLY.	Northerly
INTCH.	Interchange	NO. or #	Number
INV.	Invert	N.W.	Northwest
I.P.	Iron Pin	N.W.EL.	Normal Water Elevation
IRR.	Irrigation	O. or O/S	Offset
JCT.	Junction	O.C.	On Centers or Overhead Crossing
J.P.	Joint Use Pole	O.D.	Outside Diameter
kg	Kilogram	O.G.	Old Ground or Original Ground
km	Kilometer	OH.	Overhang or Overhead
L	Length of Curve, Liter, Loop	O'PASS	Overpass
L.C.	Long Chord	P	Power Cable or Pipe
L <sub>C</sub>	Length of Circular Curve	P. or PG.	Page
L.D.	Loop Detector	PAVT.	Pavement
LENG.	Length - Lengthen	P.B.	Pull Box
L.N.	Lane	P.C.	Point of Curve (Beginning)
L.S.	Land Surveyor	P.O.C.	Point on Curve
L <sub>S</sub>	Length of Spiral	P.C.C.	Point of Compound Curve or Portland Cement Concrete
LT.	Left	P.C.S.	Project Control System
m	Meter	P.E.	Preliminary Engineering
mm	Millimeter	PED.	Pedestrian
m <sup>2</sup>	Square Meter	PEN.	Penetration
m <sup>3</sup>	Cubic Meter	PERF.	Perforated
mm <sup>2</sup>	Square Millimeter	P.I.	Point of Intersection
MATL.	Material	P.L.	Property Line
MAX.	Maximum	PL.	Place or Plate
M.C.	Medium Curing	PLAS.	Plastic
MEAS.	Measured	P.M.	Principal Meridian or Punch
MED.	Median	Mark	
MH.	Manhole	P.M.B.	Plant Mix Base
MIN.	Minimum, Mineral or Minute		
MISC.	Miscellaneous		

**PLAN ABBREVIATIONS**  
(Continued)

**Figure 3.2A**

P.M.P.	Perforated Metal Pipe	S	Rate of Full Superelevation,
P.M.S.	Plant Mix Surfacing		Slope in ft per ft (m per m),
P.O.L.	Point on Line		Span or South
P.O.V.C.	Point on Vertical Curve	SA.	Satellite (for traverse use)
PP.	Pages	SAN. SEW.	Sanitary Sewer
P.P.	Power Pole	S.B.	Southbound
P.P.B.	Pedestrian Push Button	S C	Slow Curing
PREST.	Prestressed	S.C.	Spiral to Curve
PROC.	Processing	SCH.	Schedule
PROJ.	Project or Projected	SDWK.	Sidewalk
PROT.	Protect, Protector or Protection	S.E.	Southeast
P.O.S.	Point on Spiral	SEC.	Section or Second
P.O.S.T.	Point on Semi-Tangent	S.G.	Subgrade
P.O.T.	Point on Tangent	SH.	Shoulder
PT.	Point	SHT.	Sheet
P.T.	Point of Tangent (End of Curve)	SIG.	Signal
		SIP.	Siphon
P.T.W.	Present Traveled Way	S.L.D.	Sea Level Datum
PVC.	Polyvinyl Chloride	SLOT DR.	Slotted Drain
PVT.	Private	SLP.STK.	Slope Stake
PWR.	Power (Lines)	SLY.	Southerly
Q	Peak Discharge (Water)	S.P.	Stand Pipe or State Plane
R	Range, Radius, Rise	SPEC. PROV.	Special Provision
RAD.PT.	Radius Point	S.P.H.P.	Steel Pipe, High Pressure
REC.	Record	SPK.	Spike
R <sub>c</sub>	Spiral Curve Radius	S.S.	Emulsified Asphalt
R.C.	Rapid Curing	S.S.P.P.	Structural Steel Plate Pipe
R.C.B.	Reinforced Concrete Box	S.S.P.P.A.C.	Structural Steel Plate Pipe Arch
R.C.P.	Reinforced Concrete Pipe		Culvert
R.C.P.A.	Reinforced Concrete Pipe Arch	S.T.	Spiral to Tangent
RD.	Road	ST.	Street
RDL.	Radial	STA.	Station
RDWY.	Roadway	STD.	Standard
REF.	Reference	STD. SPEC.	Standard Specifications
REINF.	Reinforcement	STK.	Staked or Stake
RET.W.	Retaining Wall	STL.	Steel
RIV.	River	STM.	Storm Drain
R.M.	Reference Monument	STPD.	Stamped
R.P.	Reference Point	STR.	Structure
R.R.	Railroad	SUBD.	Subdivision
RT.	Right	SUBGR.	Subgrade
RTE.	Route	SURF.	Surface or Surfacing
R/W	Right of Way	SURV.	Survey
RY.	Railway	S.W.	Southwest or Sidewalk
S-1	Service #1		Township, Tangent Length or Percent Trucks

### PLAN ABBREVIATIONS

(Continued)

Figure 3.2A

t	Metric Ton	U.S.G.S.	U.S. Geological Survey
TAN.	Tangent	U.S.P.L.S.	U.S. Public Land Survey
T.B.C.	Top Back of Curb	V	Design Speed or Velocity
T.B.M.	Temporary Bench Mark	V.A.B.M.	Vertical Angle Bench Mark
TBR.	Timber	V.C.	Vertical Curve
TEL.	Telephone	V.C.CORR.	Vertical Curve Offset Correction
TEL.C.	Telephone Cable	V.C.M.	Vertical Control Monument
TELG.	Telegraph	V.C.P.	Vitrified Clay Pipe
TEL.P.	Telephone Pole	VEH.	Vehicle, Vehicular
TEMP.	Temperature/Temporary	VERT. or VT.	Vertical
THK.	Thickness	VIT.	Vitrified
TK.	Tack	V.P.	Vent Pipe
TOPOG.	Topographic	V.P.C.	Vertical Point of Curve
T.P.	Turning Point	V.P.I.	Vertical Point of Intersection
TR.	Tract	V.P.T.	Vertical Point of Tangency
TRANS.	Transmission Line or Transition	W	West
TRAV.	Traverse	W/	With
TRIA.	Triangulation	W.B.	Westbound
T <sub>s</sub>	Length of Tangent (Curve with Spirals)	W.C.	Witness Corner
T.S.	Tangent to Spiral	W.L.	Water Line
T.T.	Transmission Tower	WLY.	Westerly
TYP.	Typical	W.P.	Wing Point
U	Unit	W.S.	Water Service or Warped or Variable Slope
U.G.	Underground	W.T.	Water Table
UNCL.	Unclassified	WT.	Weight
U'PASS	Underpass	W.V.	Water Valve
U.S.C. & G.S.	U.S. Coast & Geodetic Survey	W.W.	Wing Wall or Woven Wire
U.S.C.E.	U.S. Corps of Engineers	XING.	Crossing
U.S.F.S.	U.S. Forest Service	XSEC.	Cross Section

## PLAN ABBREVIATIONS

(Continued)

**Figure 3.2A**

### **3.2.3 CADD Drafting**

The Department uses the MicroStation CADD software package. For specific drafting standards and detailed procedures, the designer should review the MDT CADD Standards Manual. Copies of this document may be obtained from the CADD Coordinator or viewed on the Department's website. To ensure uniformity from project to project and among designers, the following sections provide some of the Department guidelines for the drafting of construction plan sheets using MicroStation.

#### **3.2.3.1 Cell Libraries**

Cell libraries are developed to allow the CADD user to call up a symbol, figure, form, etc., without redrawing the figure each time. The MDT CADD Standards Manual lists the cell libraries that are available for the designer's use.

To obtain a copy of these cell libraries, MDT employees should contact the CADD Coordinator or their section's lead CADD operator. Outside consultants should request a copy of the cell libraries from the Consultant Services Bureau or download them from the Department's website.

#### **3.2.3.2 Drafting Levels**

MicroStation allows the user to use a variety of different levels to input data. The MDT CADD Standards Manual provides guidelines for what type of information should be provided on each level. Because units other than the Traffic Engineering Section use the information contained on the various levels, placement of data on the correct level is essential. Presenting the project data on different levels allow the user to see or print only the desired data by turning on or off the various levels.



### **3.3 COMPUTERIZED DESIGN**

Computers have significantly changed the Department's mode of preparation for its highway plans. Computer-aided drafting and design packages have both simplified and complicated the designer's plan production procedures. Computers have assumed the tedious tasks of drawing cross sections, plotting mass diagrams, calculating grading quantities, etc. They also allow the designer the freedom to develop and evaluate alternatives. On the other hand, they require that the designer to be well versed in how to use complex hardware and software. This Section briefly discusses the computer hardware and software MDT uses to prepare its construction plans and MDT's CADD file management.

#### **3.3.1 Computer Hardware**

##### **3.3.1.1 Equipment**

The Department is presently using MicroStation as its computer-aided drafting and design (CADD) package. MicroStation is used with Windows-based PCs. MicroStation files developed on one platform can be directly read by the other platform without the need for translating. All workstations and PC's are connected to file server computers in the Central and District Offices. See [Section 3.3.1.2](#) for more information on the Statewide network.

For information on how to purchase, upgrade, replace, maintain or repair CADD workstations or PC's, the designer should contact the Department's CADD Coordinator in the Central Office.

##### **3.3.1.2 Network**

All MDT workstations and PC's have been networked or interconnected to the Central and District Offices file server computers. The information on District file server computers are downloaded to the Central Office file server computer on a daily basis. This allows designers across the State to access the same information regardless of their location or which machine they are using. To accomplish this, all project files must be saved on the Central or District Office file server computer. The designer is required to download the project files from the file server to their PC or workstation at the beginning of each work session. At the end of each work session, the designer is required to upload all project files back to the Central file server Document Management System (DMS). For instructions on how to upload and download files, the designer should review the DMS. Copies of this document are provided to each design crew, or it can be obtained from the CADD Coordinator or viewed on the MDT internet website.

The Information Services Division is responsible for backing up all files on the file server computer and for maintaining the network system. The designer is responsible for maintaining the files in the working directories of the individual computers (e.g., removing out-of-date files) and for backing up files that are not saved to the file server computer (i.e., the Document Management System (DMS)).

### **3.3.2 Computer Software**

All users outside of the Department network should consult with the MDT CADD Coordinator to determine which version(s) of the software programs are acceptable to the Department. All consultants submitting CADD contract plans to the Department must use the same version as the Department.

#### **3.3.2.1 MicroStation**

MDT has selected MicroStation for its Department-wide computer-aided drafting and design software package, which is used for the drafting of most contract plans. The MDT CADD Standards Manual and [Section 3.2.3](#) provide the Department's CADD criteria for plan development (e.g., cell libraries, levels, text sizes, fonts). Using MicroStation's levels and reference files allows various users within the Department to work on the same set of plans without interfering with each other's design work (e.g., Signing, Right-of-Way, Electrical). By integrating or linking MicroStation with other software packages (e.g., GEOPAK, databases), the designer can use the computer to perform the actual design and layout of a project.

MicroStation is a complex program with many features. If problems or questions occur when using the software, the user should first contact the Lead CADD Operator within each MDT unit or the CADD Coordinator for information on how to use the software.

#### **3.3.2.2 GEOPAK**

GEOPAK is a comprehensive, proprietary roadway design package that works as an interactive program within MicroStation. GEOPAK allows the designer to lay out design centerlines and profiles, calculate superelevation, generate cross sections, compute quantities, generate mass diagrams, complete plan labeling, etc. By providing GEOPAK with the minimum/maximum design criteria and other design control points, the designer can command the software to generate all line work for plan views, profiles and cross sections. GEOPAK can also be used to produce 3D model images of the design. Although GEOPAK can generate most roadway quantities, special care must

be devoted to the design to ensure that the appropriate symbols, cells and MDT rounding criteria are used.

For more information on GEOPAK, the designer should review the MDT GEOPAK User's Manual or contact the Lead CADD Operator in each MDT unit, the MDT CADD Coordinator or the manufacturer.

### **3.3.3 File Management**

#### **3.3.3.1 File Setup**

See the MDT CADD Standards Manual for standard file naming conventions.

#### **3.3.3.2 Reference Files**

Reference files allow the various users to integrate several files together from several sources and to view the result from all the files in one view. The project strip map is an example of a reference file that is used by the various designers to develop the project (e.g., Right-of-Way, Electrical, Road Design, Signing). Reference files allow the designers to see how their design will interact with the various other unit designs. Although reference files allow designers to review other unit's files, the designer is unable to make changes to these other files. The designers can only make changes to their own files. It should be noted that, where deemed appropriate, the designer may copy elements from the reference file to their own file. The designer should take full advantage of these reference files when developing a set of construction plans. For more information on reference files, the designer should review the MDT CADD Standards Manual or contact their section lead CADD operator or the CADD Coordinator.

