CHAPTER 7: ALIGNMENT

QUALITY MANAGEMENT

7.1 Description

Creation of an **additional alignment file** and a summary of the **total lane miles per lift** (rounded to the nearest hundredth) for the given material type requiring compaction and/or paving efforts (e.g., 2215 (SFDR), 2390 (CIR /CCPR), 2353, 2360, 2365) is required for jobs using (2016) "Quality Management" and (2016) "Quality Management Special". These specifications are required on traffic and auxiliary lanes as defined in section 7.2 "Definitions". Additionally, provide the **name of the county coordinate system** used to generate the design files, as this information is often requested by the Contractor.

A (2016) Quality Management Special – Intelligent Compaction (IC) Method

See **Section 7.3** for details outlining the complex shapes and file formats that are required with this special provision.

B (2016) Quality Management – Paver Mounted Thermal Profile (PMTP) Method

See **Section 7.4** for details outlining the alignment file features and file formats that are required with this special provision.

7.2 DEFINITIONS

A *Auxiliary Lane*—See MnDOT 1103 "Definitions". (2016) Quality Management and (2016) Quality Management Special is required only on continuous left turn lanes and passing lanes. Exclude auxiliary lane tapers, ramps, shoulders, cross-loops, non-continuous turn lanes, loops, bypass lanes, acceleration/deceleration lanes and intersecting streets.

B *Driving Lane*—See *Traffic Lane.*

C *Intelligent Compaction*—are compaction efforts completed by a self-propelled roller integrated with a global navigation satellite system and onboard documentation system that can display real-time color-coded maps of roller location, number of passes, roller speeds, and amplitude and vibration frequencies of the roller drum. Some systems are also equipped with drum vibration instrumentation, infrared temperature sensors, and/or Automatic Feedback Control. The onboard documentation system on these rollers would also display real-time color-coded maps of stiffness response or pavement surface temperatures, or both.

D *Paver Mounted Infrared Temperature Equipment*—this system continually monitors the temperature of the mat immediately behind the paver screed during placement operations.

E *Thru*—See *Traffic Lane*.

F *Traffic Lane*—See MnDOT 1103 "Definitions". (2016) Quality Management and (2016) Quality Management Special is required on all traffic lanes with the exception of traffic lane tapers and roundabouts (including the traffic lane between the roundabout and mainline transition prior to and after the radius point of the roundabout).

G *Veta*—is a standardized intelligent construction data management (ICDM) software that stores, maps and analyzes geospatial data resulting from intelligent compaction, thermal profiling and Spot Test Data (e.g., density, moisture). This software can perform standardized data processing, analysis and reporting to provide Project summary results quickly in the field from various intelligent compaction and thermal profiling manufacturers. In particular, the software can provide statistics, histograms, correlations for these measurements (e.g., speed, temperature, pass count, ICMV), document coverage area and evaluate the uniformity of compaction as part of the Project quality control operations. Veta can be downloaded from the Advanced Materials and Technology Website (http://www.dot.state.mn.us/materials/advancedmaterialsandtechnology.html).

7.3 BACKGROUND FILE: (2016) QUALITY MANAGEMENT SPECIAL – INTELLIGENT COMPACTION (IC) METHOD

A General Information

(2016) Quality Management Special – Intelligent Compaction (IC) Method requires the creation of **background and alignment files created with closed complex shapes where the edges of each Traffic Lane and Auxiliary Lane are closed at each end. Additionally, for projects containing exceptions, create a complex shape for each traffic and auxiliary lane on each side of the exception.** The background and alignment files are imported into Veta to allow for more detailed analyses with respect to given locations within the project limits and to allow for removal of miscellaneous data that is not associated with the given compaction efforts. Additionally, these background or alignment files are loaded on to the on-board display of each intelligent compaction roller to allow the roller operator to visually see the line-work of the production area(s) with respect to compaction efforts. This real-time view helps ensure that adequate and uniform compaction efforts occur across the production area.

In addition to a complex shape, ensure that the in-place centerline, station text and station tick marks are included in these files.

Save a copy of the background file in the following formats:

(1) **2D-DGN and 2D-KMZ Background File and**
(2) **LandXML Alignment File**

Section 7.3.B outlines the procedure for creating the complex shape(s) and the different saving requirements.

The following instructional videos are available on the Advanced Materials and technology Website (http://www.dot.state.mn.us/materials/amt/manualsguides&videos.html). Additional instructional videos will be added as needed.

(1) Creating Background Closed complex Shape
(2) Converting Complex Shapes to a B-Spline Curve
(3) Exporting to KMZ for Google Earth

B CREATING A BACKGROUND FILE WITH A COMPLEX SHAPE AND ALIGNMENT

(1) MICROSTATION FILE

(a) Copy a New Seed File

Copy the seed file to the project folder and rename to Functional Area **SP_IC.dgn** (e.g. d3408023_IC.dgn).

(b) Assign the County Coordinate System

This will only need to be completed once per file, as it is saved in the File Settings.

(b1) **Select Tools > Geographic > Select Geographic Coordinate System** from the MicroStation main menu.

(b2) If the County has already been defined it will be listed in the dialog. The dialog will be blank if it has not been defined. See figure 7.1.

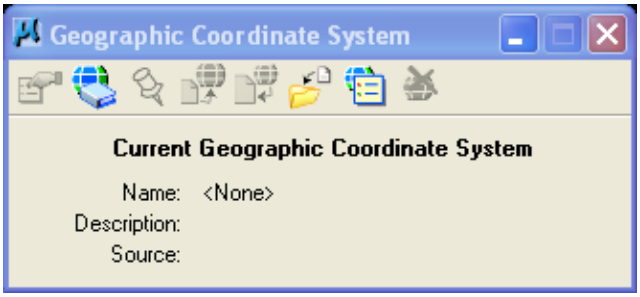


Figure 7.1. Snapshot of unassigned geographic coordinate system.

(b3) Click **Select from Library** (second icon from the left). While one can navigate through the Library tab to find the county, it is easier to use the Search tab.

(b4) Enter the county into the **Search Text** and select **Find Now** (see figure 7.2). As illustrated in figure 2, at least 3 lines for each county will appear. Select the **US Foot option**. Click **Add to Favorites** if it is a county that is often used.

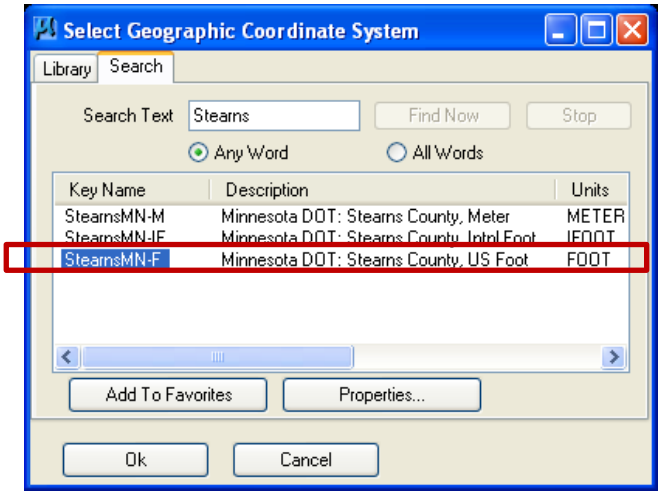


Figure 7.2. Snapshot of county coordinate search library.

(b5) Select **OK** to add the County to the Geographic Coordinate System dialog and to close the Select dialog.

(b6) Review the Coordinate System (see figure 7.3), and if everything is correct, close the dialog.

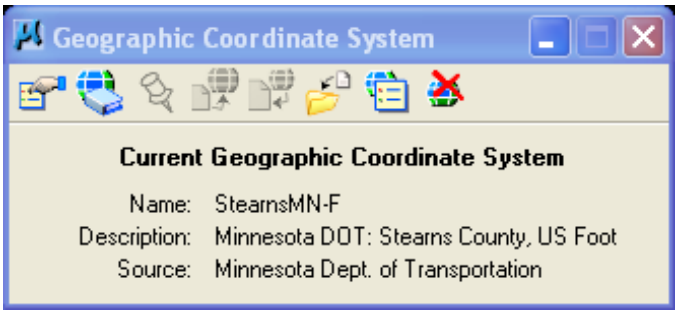


Figure 7.3. Snapshot of assigned geographic coordinate system.

(b7) Save these changes in MicroStation (**File > Save Settings** from the MicroStation menu to save the County Coordinate System), otherwise, exiting and opening the file again will lose the county coordinate system. Additionally, update the server copy to save in ProjectWise.

(2) CLOSED COMPLEX SHAPE

(a) Load/import the roadway alignment in the SP_IC.DGN. Do not reference in alignment file.

Only include Alignment Levels and User Defined Levels in this file (see figure 7.4).

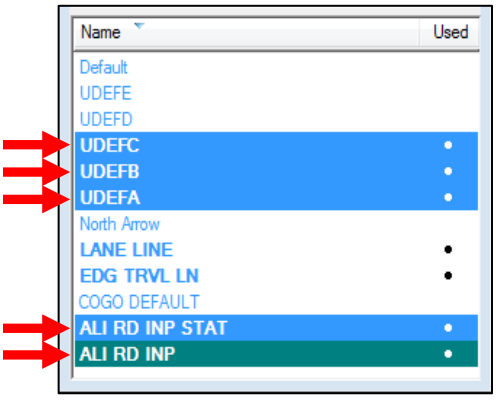


Figure 7.4. Example of Alignment and User Defined Levels.

(b) If the alignment contains Spirals, replace the Spirals with Arcs, as Veta cannot read the Spirals correctly (see figure 7.5). The horizontal position should be within 3 in (76 mm) when replacing Spirals with an Arc.

Verify that the Spirals are removed during the creation of the Arcs.

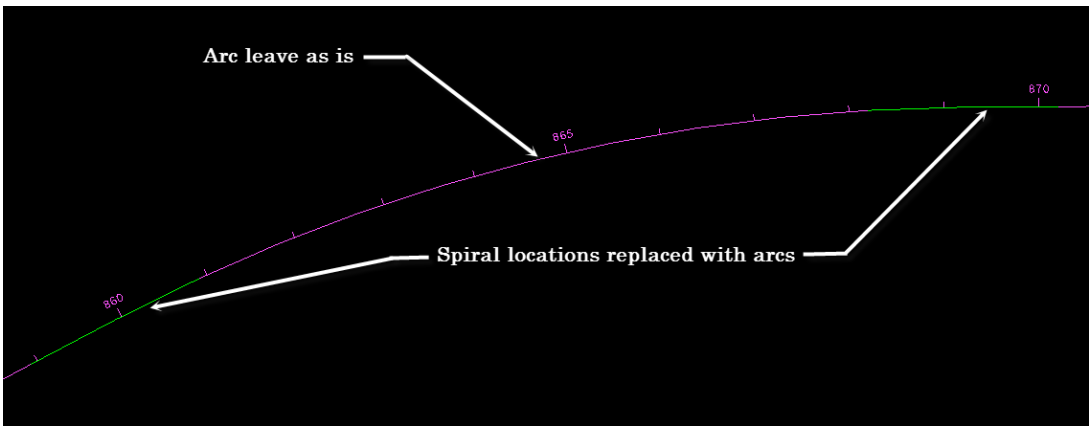


Figure 7.5. MicroStation snapshot of Spiral locations replaced with Arcs.

(c) Creation of Complex Shape

(c1) Use the MicroStation drafting tool (e.g., Copy Parallel, Place Line, Create Complex Shape) to create elements to make a closed complex shape, **for each Traffic and Auxiliary Lane**, where the edges of the lanes are closed at each end.

(c2) Exclude all taper areas by ending the complex shape at beginning of the taper where lane width begins to change.

(c2) Differentiate each Lane by using the user defined levels (UDEF [A, B, C, D, etc.]) for associated shape(s) (see figure 7.6). Figures 7.7, 7.8 and 7.9 provide examples of common complex shapes that are often needed.

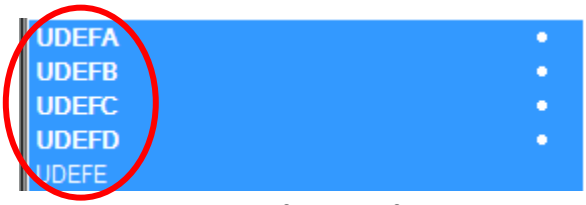


Figure 7.6. Image of user defined levels.

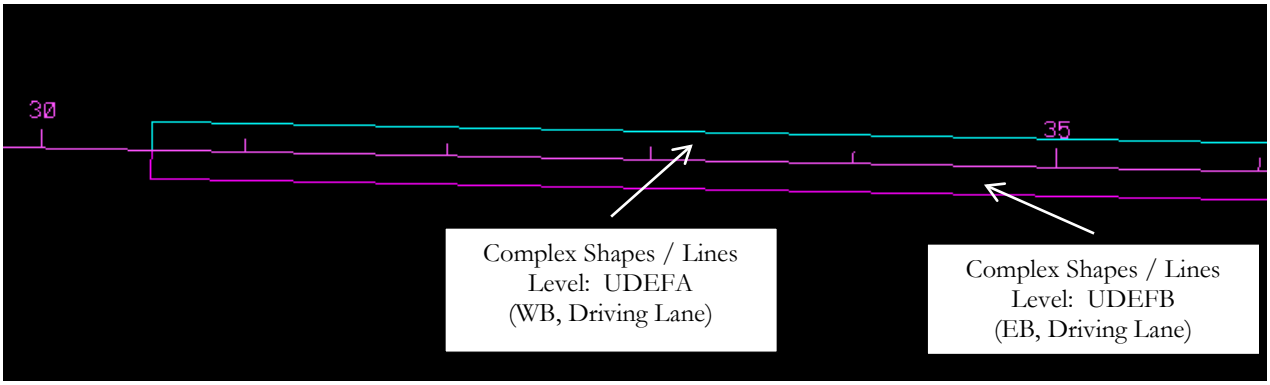


Figure 7.7. Snapshot of two (2) complex shapes / lines for a 2-lane highway.

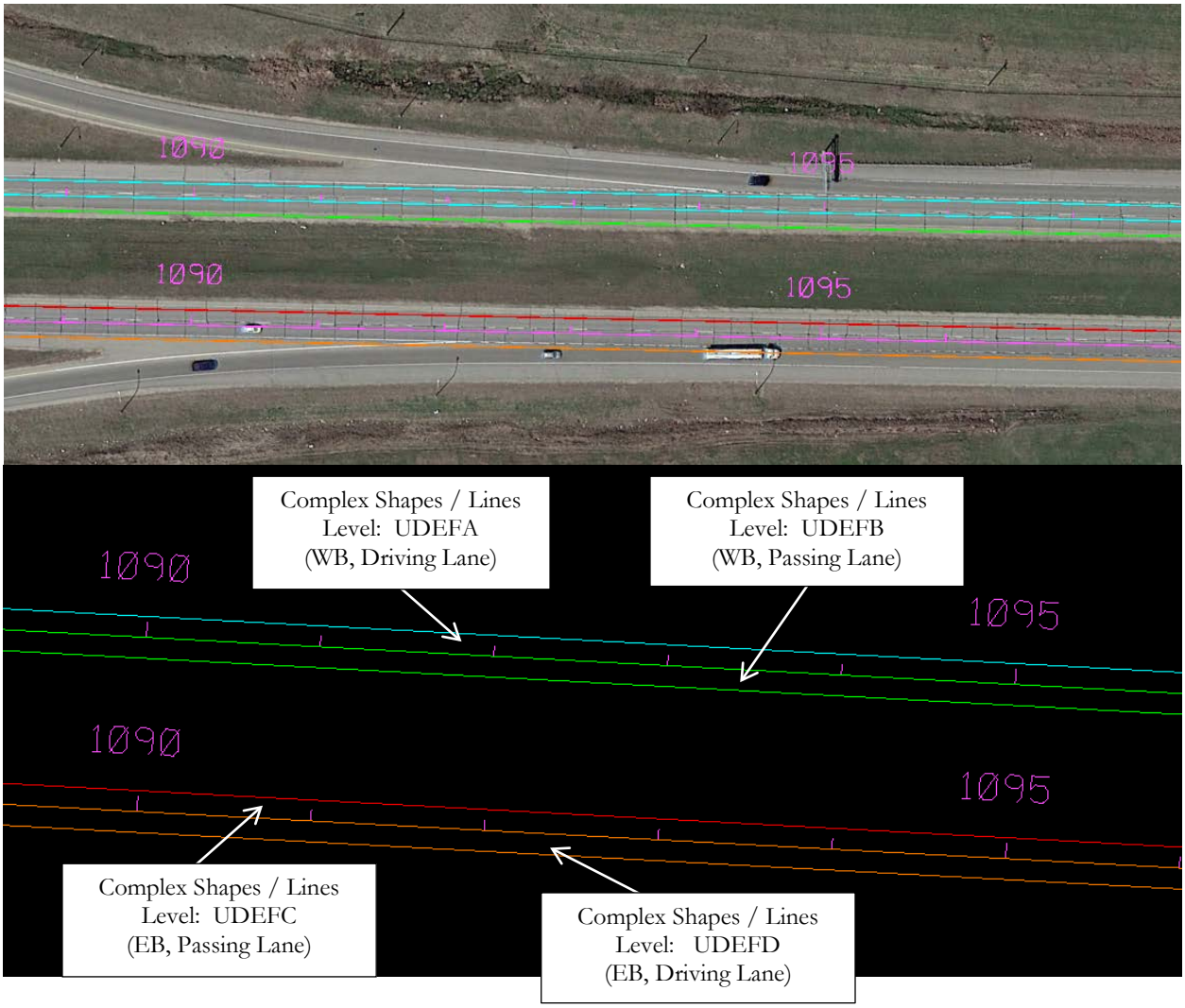


Figure 7.8. Snapshot of four (4) complex shapes / lines for a 4-lane, divided highway.

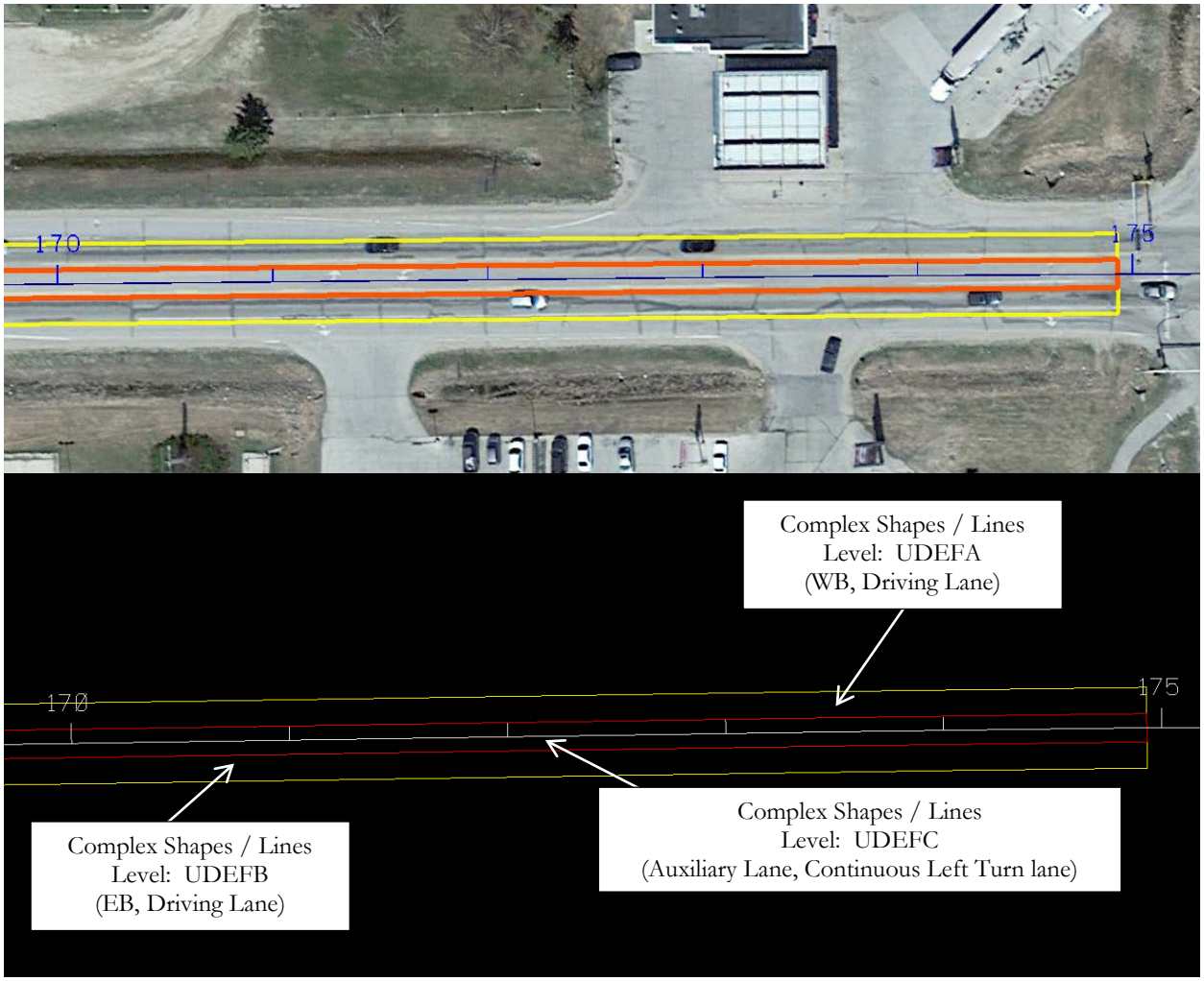


Figure 7.9. Snapshot of three (3) complex shapes / lines for a 2-lane highway with an auxiliary lane (continuous left turn lane).

(c3) Automatic Method – Maximum Gap Value

Increase the maximum gap value from the default value of 0.0100 ft to 0.1 ft when using the Automatic Method (see figure 7.10). Overlaps and gaps on the outside edges of the shape elements occur when the complex shape does not include all of the elements (e.g., for instances with curve less PIs).

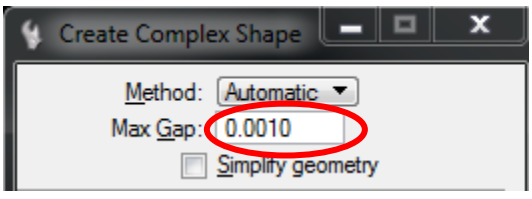


Figure 7.10. Image of selection screen for setting the maximum gap of the complex shape.

(c4) Projects with Exceptions

For projects containing **exceptions**, create a separate complex shape for each Traffic and Auxiliary Lane on each side of the exception (see figure 7.11).

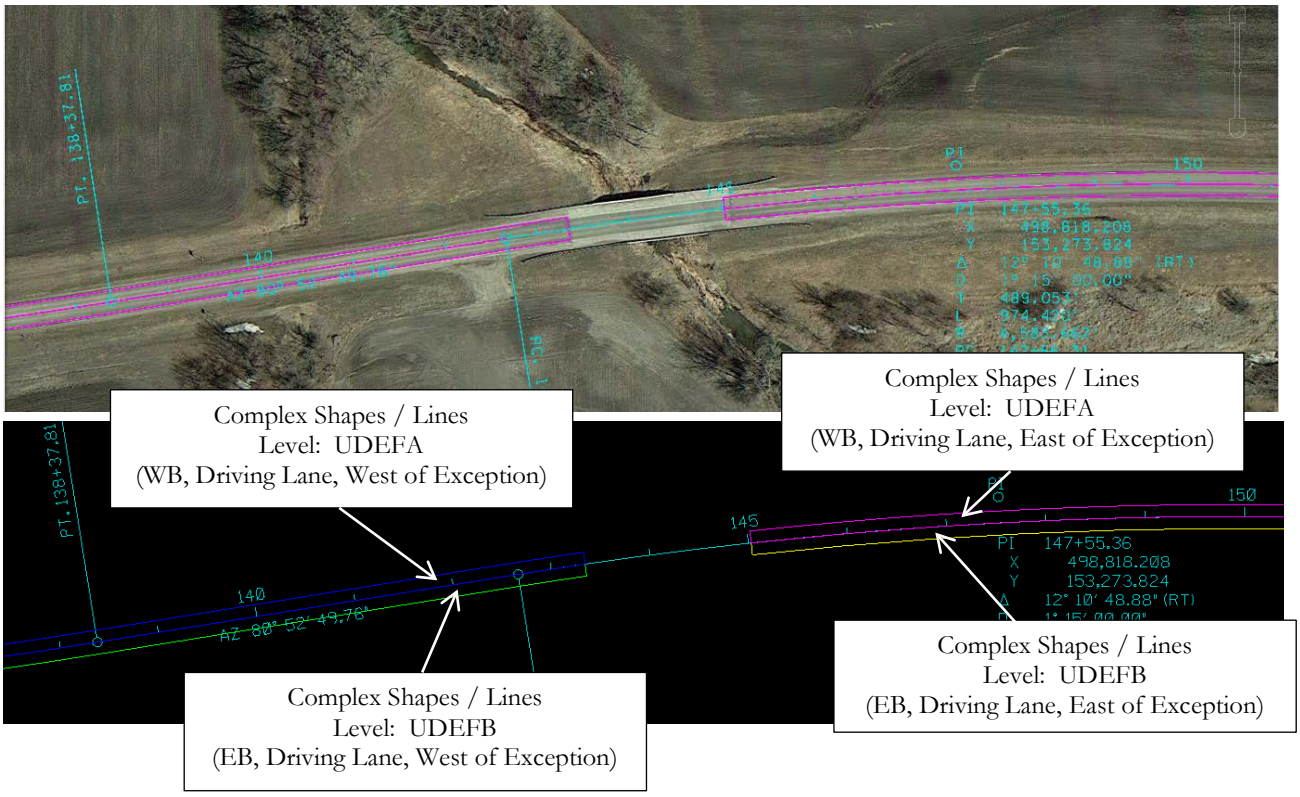
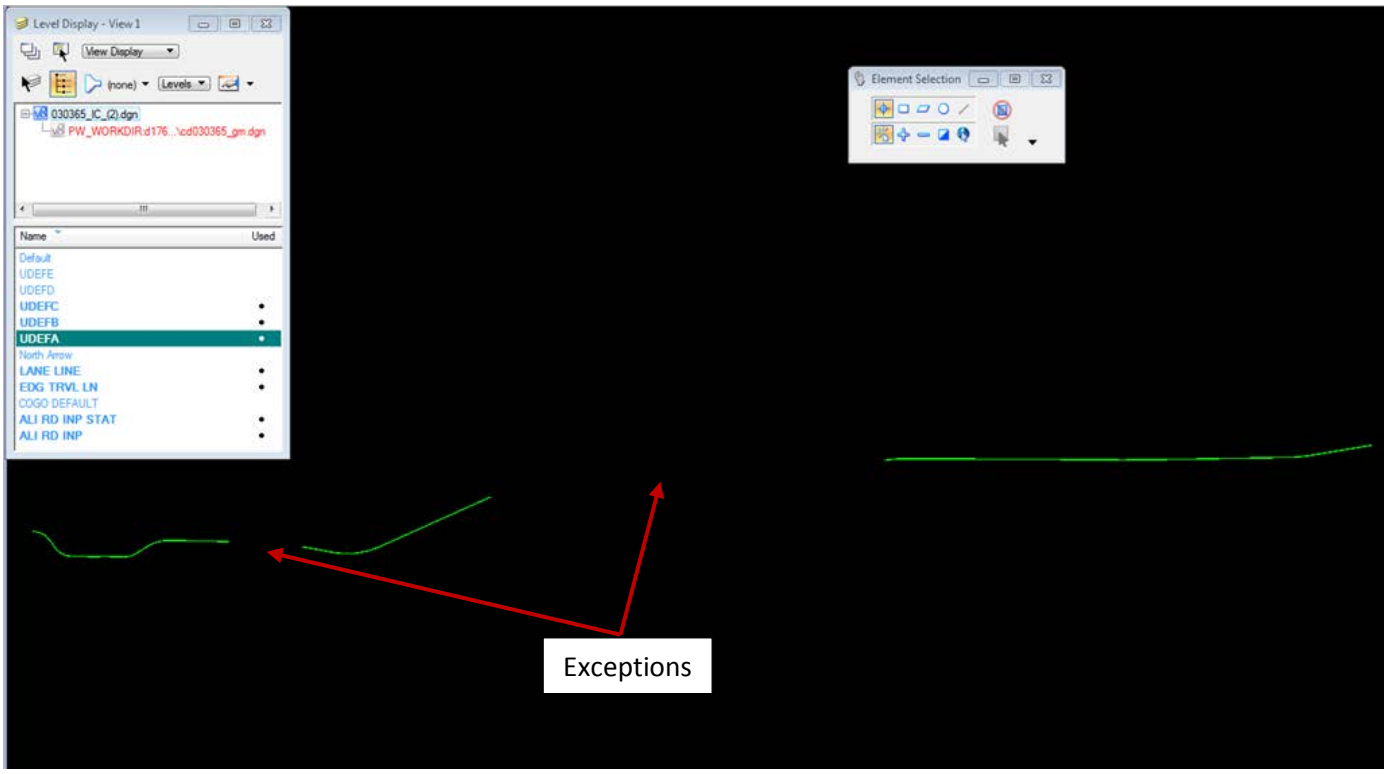
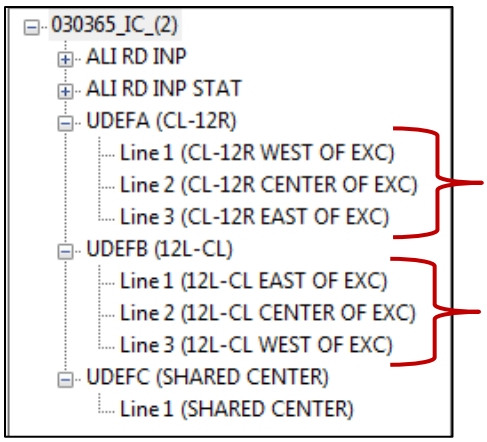


Figure 7.11. Snapshot of four (4) complex shapes / lines for an 2-lane highway with an exception.

(c5) Lanes containing one or more exceptions are the only instance where there is more than one element on a User Defined Level (see figure 7.12).





More than one element on each User Defined Level.

Figure 7.12. Example of lanes containing two (2) exceptions and the corresponding User Defined Levels.

(c5) Variations in required Complex Shape Boundaries

Slight variations of the required boundaries for the closed complex shapes may occur at the request of the Contractor. For instance, construction staging may be setup for grading work to be completed across the entire embankment width, in lieu of constructing one lane at a time. This would require the creation of one closed complex shape to include (enclose) all adjacent Traffic and Auxiliary Lanes (see figure 7.13). Additionally, there may be instances for paving applications where there is a continuous left turn lane and the Contractor paves 1.5 lanes (18-ft passes) instead of each lane separately. This case would require the complex shapes to be created for 1.5 lanes, in lieu of 3, separate 12-ft lanes (see figure 7.14).

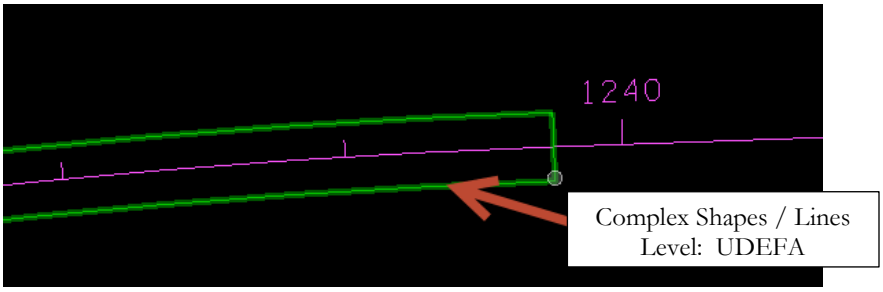


Figure 7.13. Snapshot of one (1) complex shape / line containing adjacent Traffic Lanes.

Figure 7.14. Snapshot of complex shapes / lines for 18-ft paving (1.5 lanes).

(c6) Converting Complex Shapes to B-Spline Curve

Convert all complex shapes to a B-spline curve as follows (see figure 7.15):

Select Tools > Curves > Curve Utilities > Convert to b-spline curve

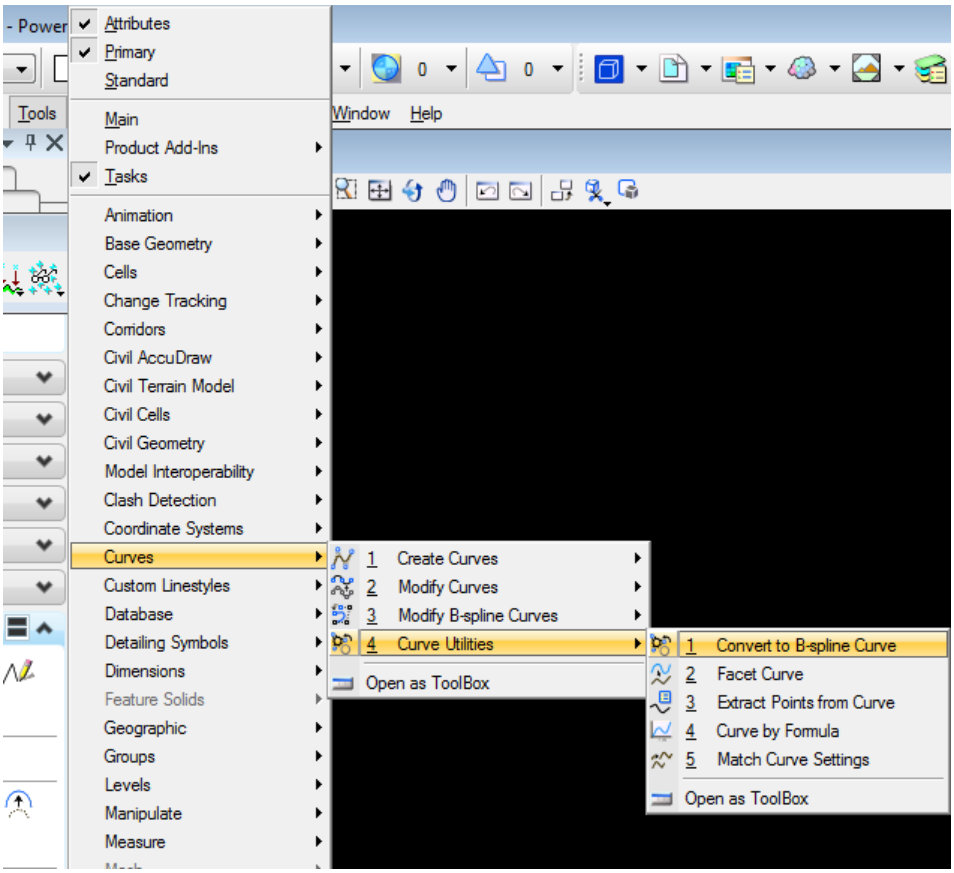


Figure 7.15. Snapshot of converting complex shape to a b-spline curve.

(3) Google Earth File (KMZ)

Also save the design file as a **KMZ** (google earth) file. This file will be used with MnDOT's intelligent construction data management tool "Veta".

(a) In the Background DGN, Turn off the weights, which are normally too heavy within Google Earth (see figure 7.16).

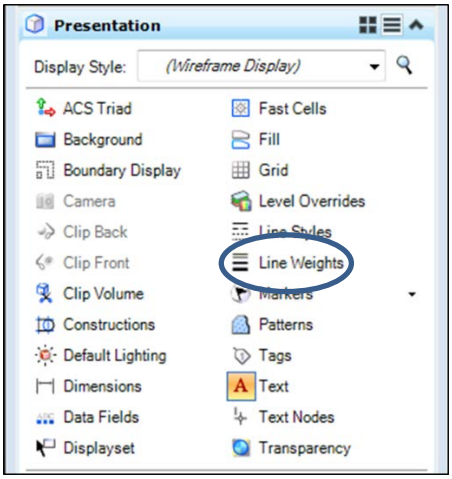


Figure 7.16. Modification of line weights in MicroStation (Attributes).

(b) Set the view to the area of interest. Please note that the larger the area, the fuzzier Google Earth is when using the zoom feature.

(c) Select **Tools > Geographic > Export Google Earth (KML) File** from the main MicroStation menu. Or File > Export > Google Earth

(d) A dialog will open where one can name the Google Earth file.

Please note that it is creating a KMZ file, not KML as seen in the tool tip. Use the default name if a KMZ file has not already been created from this MicroStation file. Otherwise, change the name in order to save . Click **Save**.

(e) The following are some miscellaneous details related to the use of Google Earth.

(e1) Google Earth opens and moves to the location of the file. One will see the Google Earth background, with the MicroStation drawing on top (see figure 7.17).

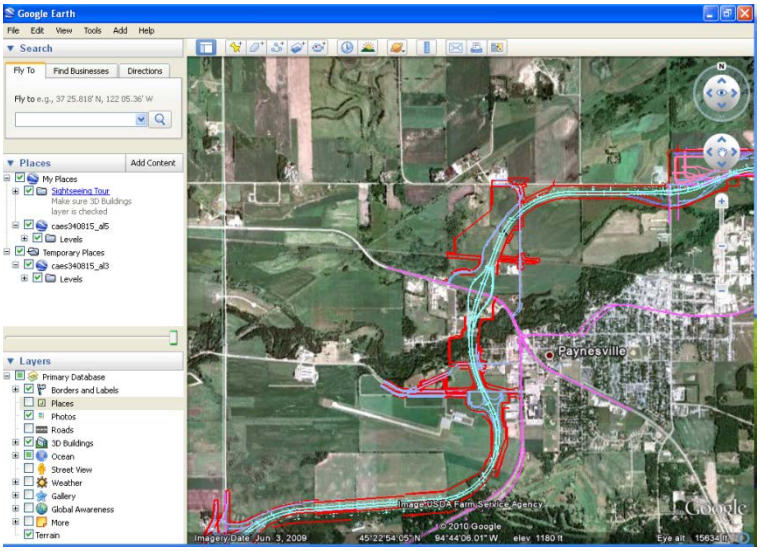


Figure 7.17. Snapshot of alignment file on google earth background.

(e2) If the MicroStation Elements appear dis-jointed or incomplete, toggle OFF then ON the location in the Places area of the side bar. This will “refresh” the elements to allow them to display properly.

(e3) Zoom in and out using the wheel on the mouse.

(e4) Pan by holding down the data point button on the mouse.

(e5) If the view is “drifting”, click a data point on the screen.

(e6) If the sidebar menu is not displayed, select **View > Sidebar**. Here one can turn off/ on the levels in the MicroStation File (e.g., Street Names, etc).

(e7) To see the "videolog" tool, toggle on Street View" in the lower left section of the sidebar (Layers section). Small cameras appear in the drawing. Click on one to open to Street view. To get back to the Top view, click the design file in the Places section in the Sidebar menu.

7.4 BACKGROUND FILE: (2016) QUALITY MANAGEMENT – PAVER MOUNTED THERMAL PROFILE (PMTP) METHOD

A General Information

(2016) Quality Management – Paver Mounted Thermal Profile Method requires the creation of a **background file**. The background file is used to assist with determination of the monetary price adjustment for thermal coverage and to assist construction personnel with locating areas with medium to high levels of thermal segregation during the asphalt paving operation.

B Requirements

Use the background file generated for (2016) Quality Management Special – Intelligent Compaction (IC) Method for projects where IC is also required. The IC background file can be used for both (2016) Quality Management and (2016) Quality Management Special.

If IC is not required on the given project, the background file (at a minimum) must include the **centerline, station text, station tick marks and labeling for exceptions**.

Save a copy of the background file in both a **2D-DGN and 2D-KMZ format**.

See section 7.3.B(3) for instructions on how to save the file in a KMZ format.