USACE Corps of Engineers
Virtual Design Modeling
Autodesk Civil 3D Template

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US Army Corps of Engineers.
CIM – CIVIL INFORMATION MODELING

Real Objects:
- Levees
- Channels
- Floodwalls
- Roads
- Pipes

CIM Objects:
- Levees
- Channels
- Floodwalls
- Berms
- Retaining Wall
- Roads
- Railroads
- Pressure Piping

With the process of advanced Modeling, you are modeling with Objects that behave like real world objects.
The power of Advanced Modeling CIM is its ability to use the Objects in “Systems”

- **Channel System**
  - **The Alignment** – path of the channel
  - **The Profile** –
    - **Existing**
      - what the channel vertical elevation is currently
      - Follows existing 3D surface elevations
      - Relationship to the existing ground surfaces
    - **Designed**
      - what the channel vertical elevation (depth) needs to be

- **The Section/Assembly** –
  - the required depth and min/max slopes of the channel sides

- **The Corridor** –
  - Assign Section of channel to follow Alignment
  - Allow channel object to connect to existing grade based on rules:
    - Min/max slopes, distances
USACE Template with Styles set for object modeling and national standards compliance.

Includes:

- .DWT Template
- Support files
  - .LIN - Linestyles
  - Pipes Catalog
  - .STB & .CTB
  - .SHX – SHAPE files
- Survey File sample
- Manuals

CIVILIZING BIM - USACE CIVIL 3D TEMPLATE
-thanks to Steve Hutsell
VIRTUAL MODELING TEMPLATE FOR CIVIL

Civil Object Configurations:
- Alignment Styles
- Profile Styles
- Section Styles
- Surface Styles
- Sample Lines
- Corridor Styles
- Point Styles
- Survey
- Pipe Styles
- Piping Networks
CIVIL 3D STYLES – the Heart of C3D

Civil 3D is controlled by Styles Settings

- Sets display information
- Controls layers
- Controls labels

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CIVIL 3D STYLES – the Heart of C3D

Object Style Settings

- Each Object has style settings set up:
  - Point Styles
  - Surface Styles
  - Point Cloud Styles
  - Alignment Styles
  - Profile Styles
  - Section Styles
  - Corridor Styles
CIVIL 3D STYLES – the Heart of C3D

Styles Settings

- **Different style Types:**
  - Surface Styles
  - Profile View Styles
  - Label Styles
    - Contour
    - Slope
    - Navigation Aids
    - Obstruction Data
    - Project Limits
  - Band Styles
  - Table Styles
Annotation Settings

- Default Civil 3D Annotation:
  - Set as *Arial* Style
  - *Arial* font
  - Non-annotative
    - *Note: Civil 3D will adjust non-annotative text based on the view scale*
  - Height = 0'-0”
  - This keeps standard requirements as well as makes a simple check of making sure *Arial* style is *Arial* font

- Tables, Labels, Point styles
  - ‘*Arial*’ Style
- Line Styles

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USACE CIVIL 3D SETTINGS

Dimension Settings

• Civil 3D Dimension Styles:
  • AEC_Civil_Arrow
    • Arrow – closed /filled marker
    • Text height : 0.1”
    • Precision - 0.00 (hundredths)
    • Primary units – Decimal
  • AEC_Civil_Slash
    • Architectural tick - slash marker
    • Text height : 0.1”
    • Precision - 0.00 (hundredths)
    • Primary units – Decimal
## ABBREVIATIONS

Shortcut Abbreviations set:

### Alignment Geometry Point Text

<table>
<thead>
<tr>
<th>Point Text</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station Equation Increasing</td>
<td>Increasing</td>
</tr>
<tr>
<td>Curve Mid Point</td>
<td>Mid</td>
</tr>
<tr>
<td>Reverse Curve-Curve Intersect</td>
<td>PRC</td>
</tr>
<tr>
<td>Spiral-Tangent Intersect</td>
<td>ST</td>
</tr>
<tr>
<td>Alignment End</td>
<td>EP</td>
</tr>
<tr>
<td>Tangent-Curve Intersect</td>
<td>PC</td>
</tr>
<tr>
<td>Compound Curve-Curve Intersect</td>
<td>PCC</td>
</tr>
<tr>
<td>Alignment Beginning</td>
<td>BP</td>
</tr>
<tr>
<td>Curve-Spiral Intersect</td>
<td>CS</td>
</tr>
<tr>
<td>Tangent-Tangent Intersect</td>
<td>PI</td>
</tr>
<tr>
<td>Spiral-Spiral Intersect</td>
<td>SS</td>
</tr>
<tr>
<td>Reverse Spiral Intersect</td>
<td>SPI</td>
</tr>
<tr>
<td>Curve-Tangent Intersect</td>
<td>PT</td>
</tr>
<tr>
<td>Spiral-Curve Intersect</td>
<td>SC</td>
</tr>
<tr>
<td>Station Equation Decreasing</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Tangent-Spiral Intersect</td>
<td>TS</td>
</tr>
</tbody>
</table>

### Profile

<table>
<thead>
<tr>
<th>Profile</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile Start</td>
<td>BVP</td>
</tr>
<tr>
<td>Profile End</td>
<td>EVP</td>
</tr>
<tr>
<td>Point Of Vertical Intersection</td>
<td>PVI</td>
</tr>
<tr>
<td>Grade Break</td>
<td>BREAK</td>
</tr>
<tr>
<td>Vertical Tangent-Curve Intersect</td>
<td>BVC</td>
</tr>
<tr>
<td>Vertical Tangent-Curve Intersect Station</td>
<td>BVCS</td>
</tr>
<tr>
<td>Vertical Tangent-Curve Intersect Elevation</td>
<td>BVCE</td>
</tr>
<tr>
<td>Vertical Curve-Tangent Intersect</td>
<td>EVC</td>
</tr>
<tr>
<td>Vertical Curve-Tangent Intersect Station</td>
<td>EVCS</td>
</tr>
<tr>
<td>Vertical Curve-Tangent Intersect Elevation</td>
<td>EVCE</td>
</tr>
<tr>
<td>Vertical Compound Curve Intersect</td>
<td>VCC</td>
</tr>
<tr>
<td>Vertical Compound Curve Intersect Station</td>
<td>VCCS</td>
</tr>
<tr>
<td>Vertical Compound Curve Intersect Elevation</td>
<td>VCCCE</td>
</tr>
<tr>
<td>Vertical Reverse Curve Intersect</td>
<td>VRC</td>
</tr>
<tr>
<td>Vertical Reverse Curve Intersect Station</td>
<td>VRCS</td>
</tr>
<tr>
<td>Vertical Reverse Curve Intersect Elevation</td>
<td>VRCE</td>
</tr>
<tr>
<td>High Point</td>
<td>HP</td>
</tr>
<tr>
<td>Low Point</td>
<td>LP</td>
</tr>
<tr>
<td>Curve Coefficient</td>
<td>K</td>
</tr>
<tr>
<td>Grade Change</td>
<td>A</td>
</tr>
<tr>
<td>Overall High Point</td>
<td>Overall HP</td>
</tr>
<tr>
<td>Overall Low Point</td>
<td>Overall LP</td>
</tr>
</tbody>
</table>

[US Army Corps of Engineers]
CIVIL 3D VIRTUAL OBJECTS

Civil 3D Object Settings

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POINT STYLES

Included Point Styles

- Point Marker assigned
- Layer settings assigned
- Symbols are scaled with the view scale-
  - Change view scale
  - Marker size changes
  - Marker text scales correctly
- Can be assigned to imported survey point key
- Automatic linking
Consistent Settings

‘Tables’ format is set:
- G_SCHD_Slope_Arrow_Table (USACE)
- G_SCHD_User_DEFINED_Contour_Table (USACE)
- G_SCHD_Watershead_Table (USACE)
- G_SCHD_Direction_Table (USACE)
- G_SCHD_Elevation_Table (USACE)
- G_SCHD_Contour_Table (USACE)
- G_SCHD_Slope_Table (USACE)
TABLE SETTINGS

Table Objects:

• Read information from model
• Extract data and format the data based on table settings
• Layers assigned to separate components
• Data settings can be changed for specific table requirements
USACE CIVIL 3D TABLES

Tables are Objects

**DRAINAGE STRUCTURE TABLE: SSWR-A**

<table>
<thead>
<tr>
<th>STR NO</th>
<th>TYPE</th>
<th>TO</th>
<th>FC (OUTFL)</th>
<th>NORTING</th>
<th>DASHING</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRU (7)</td>
<td>Cylindrical Junction Structure NF</td>
<td>190.23</td>
<td>183.85</td>
<td>37557110.51</td>
<td>112825480.89</td>
</tr>
<tr>
<td>STRU (8)</td>
<td>Cylindrical Junction Structure NF</td>
<td>190.80</td>
<td>181.12</td>
<td>37557141.08</td>
<td>112825409.28</td>
</tr>
<tr>
<td>STRU (9)</td>
<td>Cylindrical Junction Structure NF</td>
<td>185.14</td>
<td>181.12</td>
<td>3756840.08</td>
<td>112825133.71</td>
</tr>
</tbody>
</table>

**DRAINAGE PIPE TABLE: SSWR-A**

<table>
<thead>
<tr>
<th>OPEN</th>
<th>TYPE</th>
<th>LENGTH (FT)</th>
<th>TF</th>
<th>FLDS</th>
<th>SCOPE (CFS)</th>
<th>DESIGN FLOW (CFS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPE (6)</td>
<td>12&quot; DIP</td>
<td>104.70</td>
<td>108.34</td>
<td>192.14</td>
<td>2.72%</td>
<td>0.000</td>
</tr>
<tr>
<td>PIPE (7)</td>
<td>30&quot; PVC</td>
<td>170.05</td>
<td>181.67</td>
<td>174.44</td>
<td>4.37%</td>
<td>0.000</td>
</tr>
<tr>
<td>PIPE (8)</td>
<td>4&quot; DIP</td>
<td>192.70</td>
<td>192.70</td>
<td>192.70</td>
<td>0.48%</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**STRUCTURE TABLE: SSWR-A**

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>STATION</th>
<th>MIN IN</th>
<th>MAX IN</th>
<th>TOP</th>
<th>MIN/OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRU(7)</td>
<td>8+98.50</td>
<td>183.14 (12&quot; DIP)</td>
<td>183.19 (12&quot; DIP)</td>
<td>190.87 (14&quot; DIP)</td>
<td>190.87 (14&quot; DIP)</td>
</tr>
<tr>
<td>STRU (8)</td>
<td>9+91.51</td>
<td>183.14 (12&quot; DIP)</td>
<td>183.19 (12&quot; DIP)</td>
<td>190.87 (14&quot; DIP)</td>
<td>190.87 (14&quot; DIP)</td>
</tr>
<tr>
<td>STRU (9)</td>
<td>11+01.55</td>
<td>174.44 (30&quot; PVC)</td>
<td>190.87 (14&quot; DIP)</td>
<td>190.87 (14&quot; DIP)</td>
<td>190.87 (14&quot; DIP)</td>
</tr>
</tbody>
</table>

**PIPE TABLE: SSWR-A**

<table>
<thead>
<tr>
<th>PIPE</th>
<th>O.D.</th>
<th>MATERIAL</th>
<th>LENGTH</th>
<th>SCOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPE (6)</td>
<td>12&quot; DIP</td>
<td>104.70</td>
<td>2.72%</td>
<td></td>
</tr>
<tr>
<td>PIPE (7)</td>
<td>30&quot; PVC</td>
<td>170.05</td>
<td>4.37%</td>
<td></td>
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<tr>
<td>PIPE (8)</td>
<td>4&quot; DIP</td>
<td>192.70</td>
<td>0.48%</td>
<td></td>
</tr>
</tbody>
</table>
ALIGNMENTS

Alignment Objects
- Various types of objects
  - Roads
  - Pipe networks
  - Channels
  - Levees

Alignment Components
- Offset
- Curb return

Label styles for alignments

Table Styles

Alignment Label Styles
- Stations – Minor, Major
- Station Offset
- Line, Curve, Spiral
- Tangent Intersection
AEC Standards Profile View Settings

- Layer and label settings are built in
- Assign style

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## PROFILES

### AEC Standards Profile View Settings
- Profile Styles can be assigned to a profile
- Copy and Modify for different uses if needed
- Graph, Grid, Title Annotation, Horizontal & Vertical Axes, Display

<table>
<thead>
<tr>
<th>PROFILE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_GRID_Projection (USACE)</td>
<td>Object Display - As Drawn</td>
</tr>
<tr>
<td>C_GRID_STA_Ex_Only_Majr_Minr (USACE)</td>
<td>Station &amp; Ex ONLY @ Major &amp; Minor Grids 0.5&quot; height box Rememeber to set Profile 1 in Profile View Properties <strong>Ex text is Hard Coded Italic</strong></td>
</tr>
<tr>
<td>C_GRID_STA_Ex_Only_Majr_ONLY (USACE)</td>
<td>Station &amp; Ex ONLY @ Major Grids ONLY 0.5&quot; height box Rememeber to set Profile 1 in Profile View Properties <strong>Ex text is Hard Coded Italic</strong></td>
</tr>
<tr>
<td>C_GRID_STA_FG_Offset_Majr_Minr (USACE)</td>
<td>EXTRA &quot;FG&quot; 3rd ROW - Profile 2 @ Major &amp; Minor Grids 0.5&quot; height box - set to NO PLOT <strong>Band Offest will Have to be shifted -.5 Offset</strong></td>
</tr>
<tr>
<td>C_GRID_STA_FG_Offset_Majr_ONLY (USACE)</td>
<td>EXTRA &quot;FG&quot; 3rd ROW - Profile 2 @ Major ONLY Grids 0.5&quot; height box - set to NO PLOT <strong>Band Offest will Have to be shifted -.5 Offset</strong></td>
</tr>
<tr>
<td>C_GRID_STA_Only_Majr_Only (USACE)</td>
<td>Station ONLY @ Major Grids ONLY 0.5&quot; height box <strong>For Use when NO Bands are Necessary</strong></td>
</tr>
</tbody>
</table>
SURFACE DATA

PRECONFIGURED SURFACE VISUAL SETTINGS
SURFACE STYLES

Create surface from survey, point cloud
Assign visual appearance
  • Contours
  • Analysis – Slopes
  • Analysis – Elevation
  • Hydrography
  • Watershed
  • TIN – Blue lines
  • 3D Styles
Take the USACE Civil 3D template and apply this to an actual project using design data provided
DEMONSTRATION OF THE DESIGN PROCESS

• Objectives:
  • Use the **USACE Civil 3D Template**
  • Use an existing design project as a base
  • Demonstrate the **Workflow** recommended to produce a design and construction documents

  • Project set-up
  • Shortcuts
  • Best practices
THE DEMO OF THE DESIGN PROCESS

• Work processes demonstrated:
  • Basic project set-up processes
    • Shortcuts
  • Survey
  • Geotechnical
  • GIS data incorporation

• Data used:
  • XML Surface data (from XML text file)
  • LIDAR surface data
  • GIS Shape files
  • CAD Data
THE CIM OBJECTS

• CIM Civil Objects demonstrated:
  • ALIGNMENTS
  • PROFILES
  • CORRIDORS

• Civil processes demonstrated:
  • Create Surfaces
    • Existing
    • Proposed
  • Grading
  • Geotechnical
  • Building Pad
  • Sidewalks
BIM PROCESSES

- SURVEY Data:
  - Import data
  - Apply Point styles
- Create Alignments
- Create Profiles
  - Existing grades
  - Proposed grades
- Create Corridors
- Create Sections
  - Existing
  - Proposed
CIVIL 3D TRAINING SITE : USACE

Online CAC training for USACE:

Course Materials & Data

Instruction Manuals  Data, Materials  Videos

Template  Image  DWG  LandXML  Text

Step by step videos of the process of completing the tutorials.
SURVEY AUTOMATION

From Site
- to Surveyor
- to Survey
- to DESIGN
- To CAD