

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

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April 2018

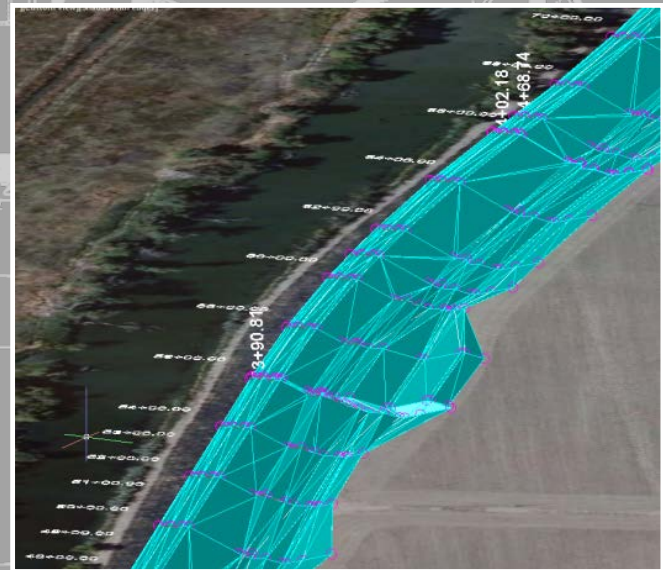
David Johnson, ERDC, CAD/BIM Technology Center

Eugene Hubbell - USACE POA

Patrick O'Connor, Charles Byerley, Kyle Smallegan – USACE SAM

Daniel Nelson – USACE NAP

Leo Lavayen – Advanced Solutions, Inc.



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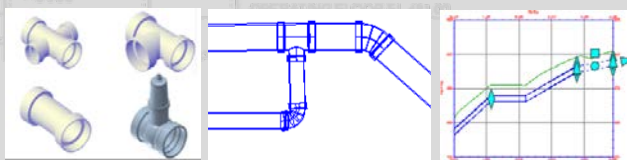
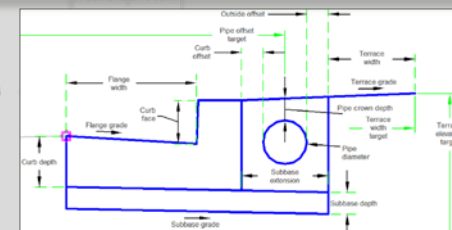
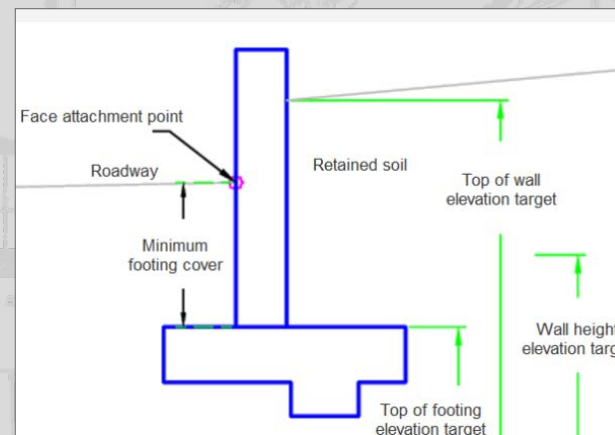
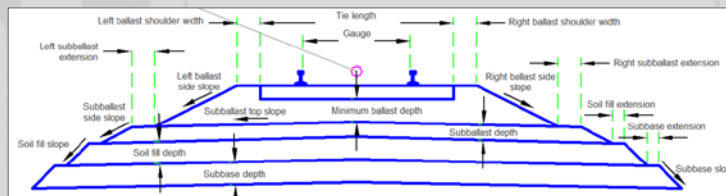
# CIM – CIVIL INFORMATION MODELING

## 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**



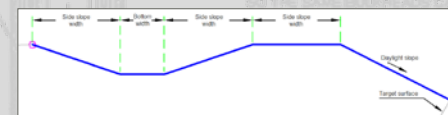
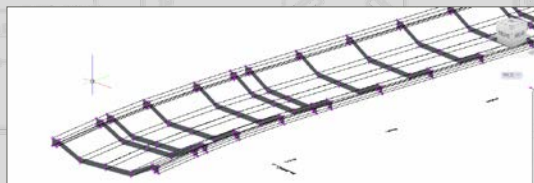
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# CIM: THE POWER OF SYSTEMS

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



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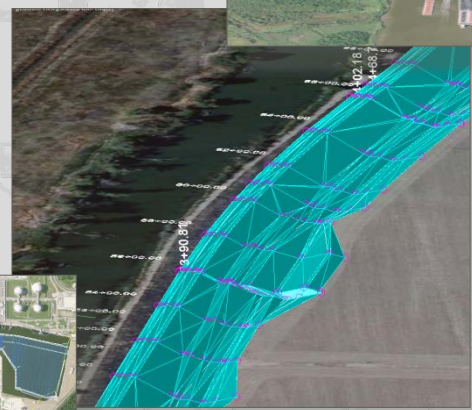
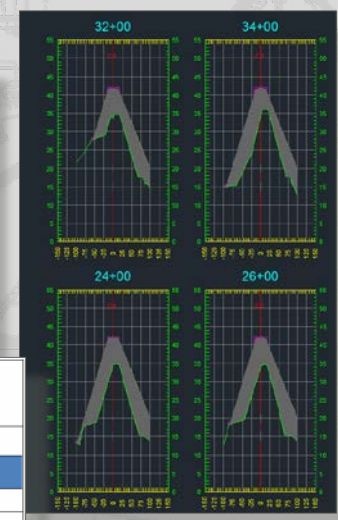
# CIVILIZING BIM- *USACE CIVIL 3D TEMPLATE*

*-thanks to Steve Hutsell*

USACE Template with Styles set for object modeling and national standards compliance.

Includes :

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



**USACE**

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**TEMPLATE FOR CIVIL 3D**

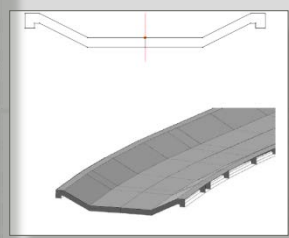
Templates based on the 2016 Autodesk Civil 3D Software

Manual : USACE Civil 3D 2016 Template v3.0  
 Configuration : - PART 1

September, 2017

**USACE CAD/BIM Technology Center**

Author: Lee Longdon, Advanced Solutions, Inc.  
 Special Thanks: RUSC, CALIBRE Team, Corbett, Eugene Mitchell, USACE P&A, Patricia O'Connell, Charles Boney, Kane Strickland, USACE S&E, Daniel Nelson, USACE S&E  
 Special Thanks and appreciation to: Mark, Steven and Ben Smith, Tom Stepan and Jacobia Turner.



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# VIRTUAL MODELING TEMPLATE FOR CIVIL

## Civil Object Configurations:

Alignment Styles

Profile Styles

Section Styles

Surface Styles

Sample Lines

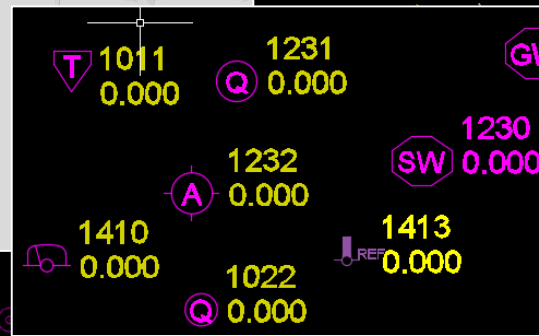
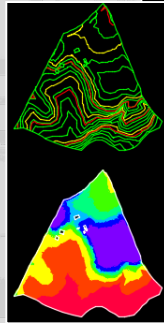
Corridor Styles

Point Styles

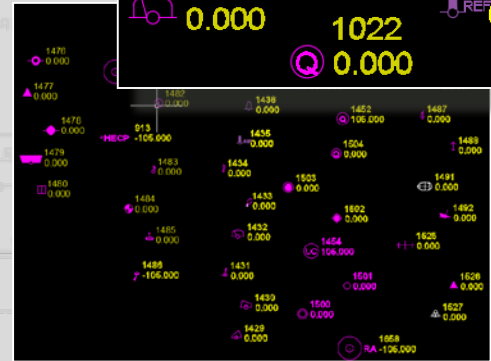
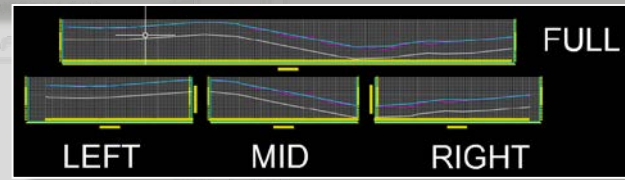
Survey

Pipe Styles

Piping Networks



Corridor - Link	
Name	CORR (2)
Style	G_NPLT_Corridor (USACE)
Layer	HM-CORR
Code Set Style	G_CORR_Simple (USACE)
Link Codes	Top, Pav



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# CIVIL 3D STYLES – the Heart of C3D

## Civil 3D is controlled by *Styles Settings*

- *Sets display information*
- *Controls layers*
- *Controls labels*

The image shows a screenshot of the AutoCAD Civil 3D software interface. On the left, the 'Drawing Settings View' tree is visible, showing a hierarchy of styles under 'Surface'. The 'Contours 2' and 10' (Background)' style is selected. On the right, the 'Surface Style - Contours 2' and 10' (Background)' dialog box is open, showing the 'Component display' tab. This tab contains a table with columns for Component, Visible, Layer, Color, Linetype, LT Scale, Lineweight, and Plot Style. The table lists various components like Points, Triangles, Border, Major Contour, Minor Contour, User Contours, Gridded, Directions, Elevations, and Slopes, each with its corresponding settings.

Component...	Visible	Layer	Color	Linetype	LT Scale	Lineweight	Plot Style
Points	<input checked="" type="checkbox"/>	C-TINN	BYLAYER	ByLayer	1.0000	ByLayer	ByBlock
Triangles	<input checked="" type="checkbox"/>	C-TINN-VIEW	BYLAYER	ByLayer	1.0000	ByLayer	ByBlock
Border	<input checked="" type="checkbox"/>	C-TINN-BNDY	BYLAYER	ByLayer	1.0000	ByLayer	ByBlock
Major Contour	<input checked="" type="checkbox"/>	C-TOPO-MAJR	BYLAYER	ByLayer	1.0000	ByLayer	ByBlock
Minor Contour	<input checked="" type="checkbox"/>	C-TOPO-MINR	BYLAYER	ByLayer	1.0000	ByLayer	ByBlock
User Contours	<input checked="" type="checkbox"/>	C-TOPO-USER	BYLAYER	ByLayer	1.0000	ByLayer	ByBlock
Gridded	<input checked="" type="checkbox"/>	C-TINN	BYLAYER	ByLayer	1.0000	ByLayer	ByBlock
Directions	<input type="checkbox"/>	0	BYLAYER	ByBlock	1.0000	ByLayer	ByBlock
Elevations	<input type="checkbox"/>	0	BYLAYER	ByBlock	1.0000	ByLayer	ByBlock
Slopes	<input type="checkbox"/>	0	BYLAYER	ByBlock	1.0000	ByLayer	ByBlock



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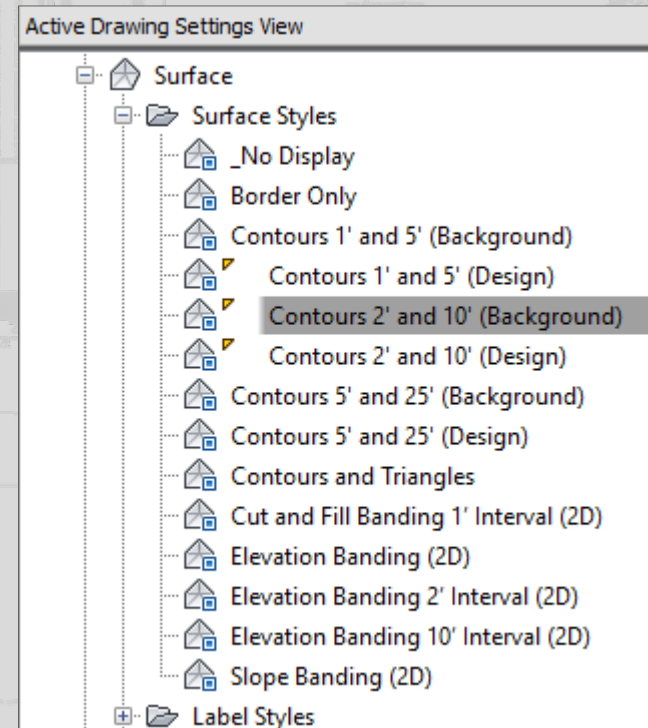


# CIVIL 3D STYLES – the Heart of C3D

## 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*



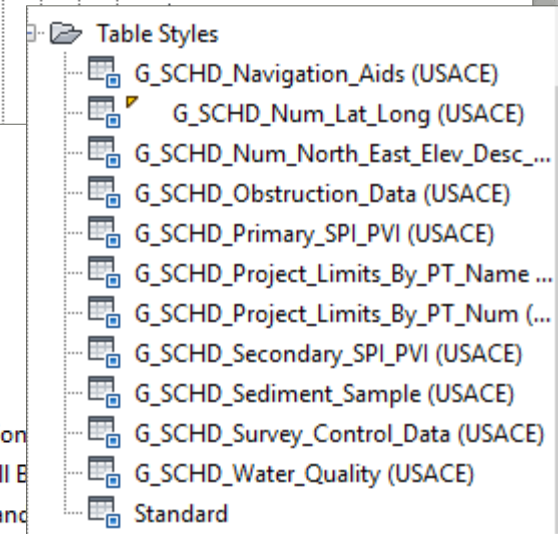
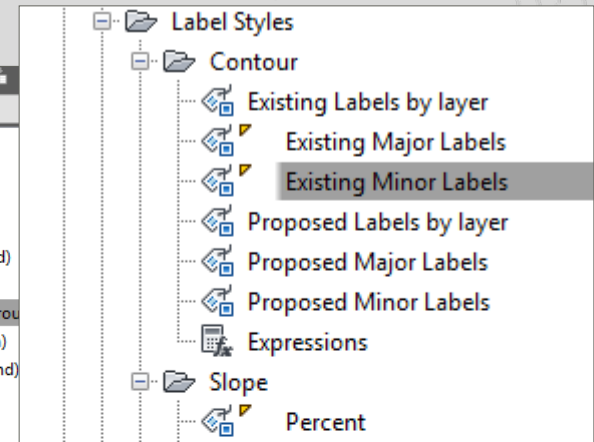
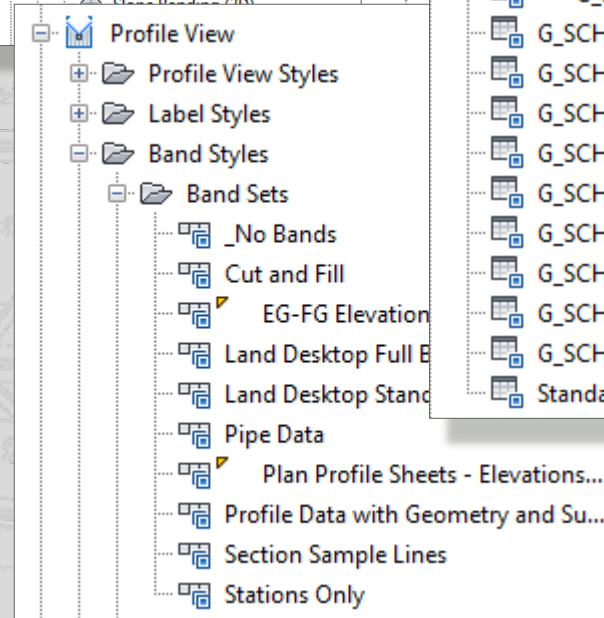
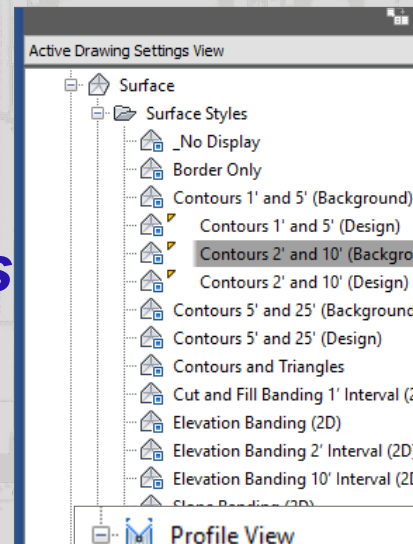
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# CIVIL 3D STYLES – the Heart of C3D

## Styles Settings

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





# USACE CIVIL 3D SETTINGS

## 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*

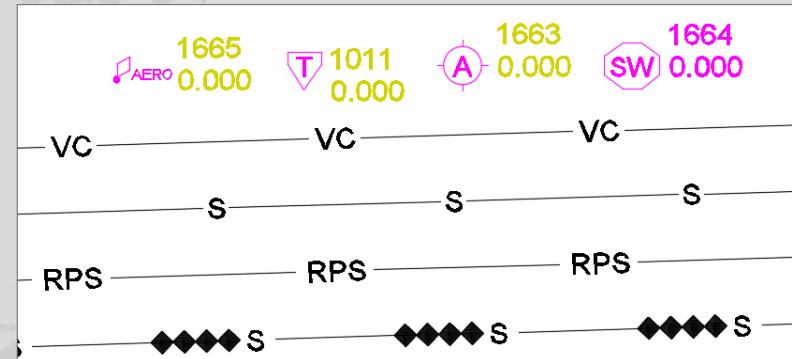
- Height = 0'-0"

- 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



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# ABBREVIATIONS

Shortcut Abbreviations set:

Alignment Geometry Point Text	
Station Equation Increasing	Increasing
Curve Mid Point	Mid
Reverse Curve-Curve Intersect	PRC
Spiral-Tangent Intersect	ST
Alignment End	EP
Tangent-Curve Intersect	PC
Compound Curve-Curve Intersect	PCC
Alignment Beginning	BP
Curve-Spiral Intersect	CS
Tangent-Tangent Intersect	PI
Spiral-Spiral Intersect	SS
Reverse Spiral Intersect	SPI
Curve-Tangent Intersect	PT
Spiral-Curve Intersect	SC
Station Equation Decreasing	Decreasing
Tangent-Spiral Intersect	TS

Profile	
Profile Start	BVP
Profile End	EVP
Point Of Vertical Intersection	PVI
Grade Break	BREAK
Vertical Tangent-Curve Intersect	BVC
Vertical Tangent-Curve Intersect Station	BVCS
Vertical Tangent-Curve Intersect Elevation	BVCE
Vertical Curve-Tangent Intersect	EVC
Vertical Curve-Tangent Intersect Station	EVCS
Vertical Curve-Tangent Intersect Elevation	EVCE
Vertical Compound Curve Intersect	VCC
Vertical Compound Curve Intersect Station	VCCS
Vertical Compound Curve Intersect Elevation	VCCE
Vertical Reverse Curve Intersect	VRC
Vertical Reverse Curve Intersect Station	VRCS
Vertical Reverse Curve Intersect Elevation	VRCE
High Point	HP
Low Point	LP
Curve Coefficient	K
Grade Change	A
Overall High Point	Overall HP
Overall Low Point	Overall LP

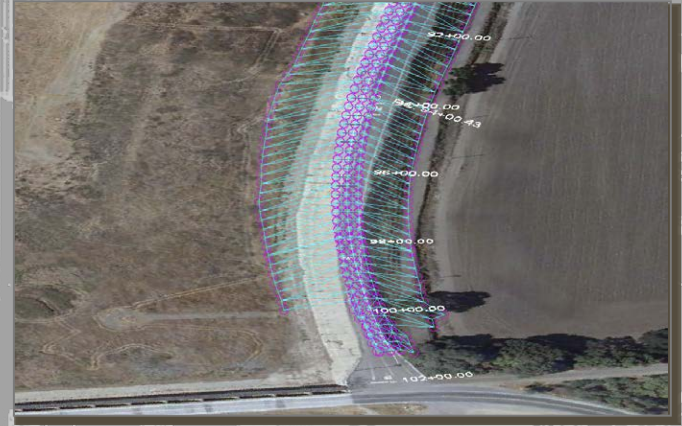
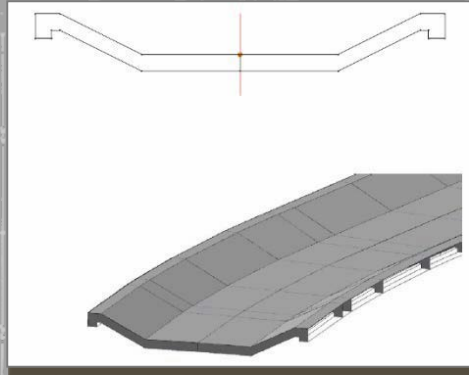
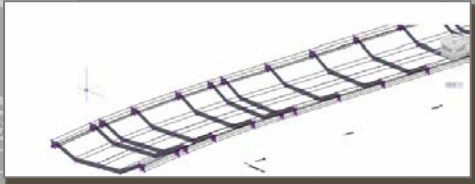


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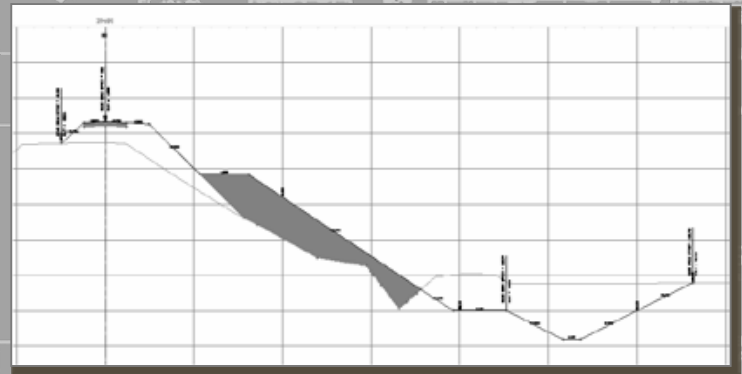




# CIVIL 3D VIRTUAL OBJECTS



## Civil 3D Object Settings



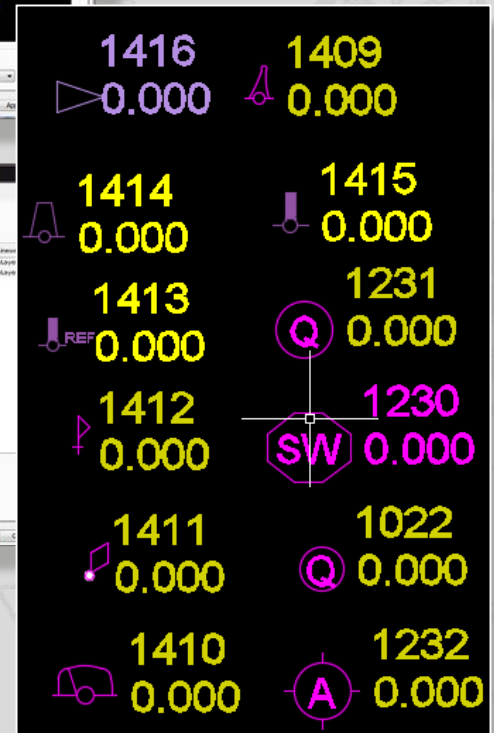
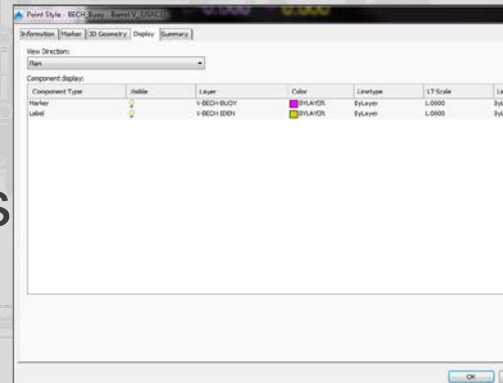
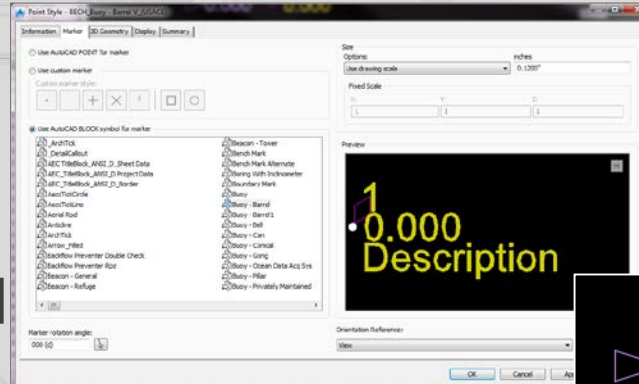
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# POINT STYLES

## 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



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# USACE CIVIL 3D TABLES

## 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)

SECONDARY SPI/PVI		
NAME	NORTHING	EASTING
GC-08	2,354,324.08	2,549,301.13
GC-10	2,354,187.72	2,549,441.23
GC-12	2,354,051.31	2,549,587.49
GC-14	2,353,914.90	2,549,733.76
GC-25	2,354,338.90	2,549,718.98
GC-27	2,354,192.59	2,549,588.73
GC-28	2,354,046.38	2,549,446.16
GC-30	2,353,900.12	2,549,309.75
GC-55	2,354,616.65	2,549,567.79
GC-56	2,354,475.31	2,549,572.72
GC-57	2,354,333.98	2,549,577.64
GC-58	2,354,275.62	2,549,933.45
GC-59	2,354,606.80	2,549,285.12
GC-60	2,354,465.41	2,549,296.21
GC-61	2,353,987.98	2,549,808.12
GC-62	2,354,319.20	2,549,153.64
GC-63	2,354,314.28	2,549,012.30
GC-64	2,354,041.46	2,549,304.82
GC-65	2,354,036.53	2,549,163.49
GC-66	2,354,031.61	2,549,022.15
GC-67	2,353,841.77	2,549,665.55
GC-68	2,353,690.58	2,549,387.80

Point Table Creation

Table style:  
G\_SCHD\_Num\_Lat\_Long (USACE)

- G\_SCHD\_Navigation\_Aids (USACE)
- G\_SCHD\_Num\_Lat\_Long (USACE)**
- G\_SCHD\_Num\_North\_East\_Elev\_Desc\_Atts\_1-10 (USACE)
- G\_SCHD\_Obstruction\_Data (USACE)
- G\_SCHD\_Primary\_SPI\_PVI (USACE)
- G\_SCHD\_Project\_Limits\_By\_PT\_Name (USACE)
- G\_SCHD\_Project\_Limits\_By\_PT\_Num (USACE)
- G\_SCHD\_Secondary\_SPI\_PVI (USACE)
- G\_SCHD\_Sediment\_Sample (USACE)
- G\_SCHD\_Survey\_Control\_Data (USACE)
- G\_SCHD\_Water\_Quality (USACE)
- Standard

No points selected.

Split table

Maximum rows per table: 20

Maximum tables per stack: 3

0.5000"

Across  Down

Static   Dynamic

Cancel Help

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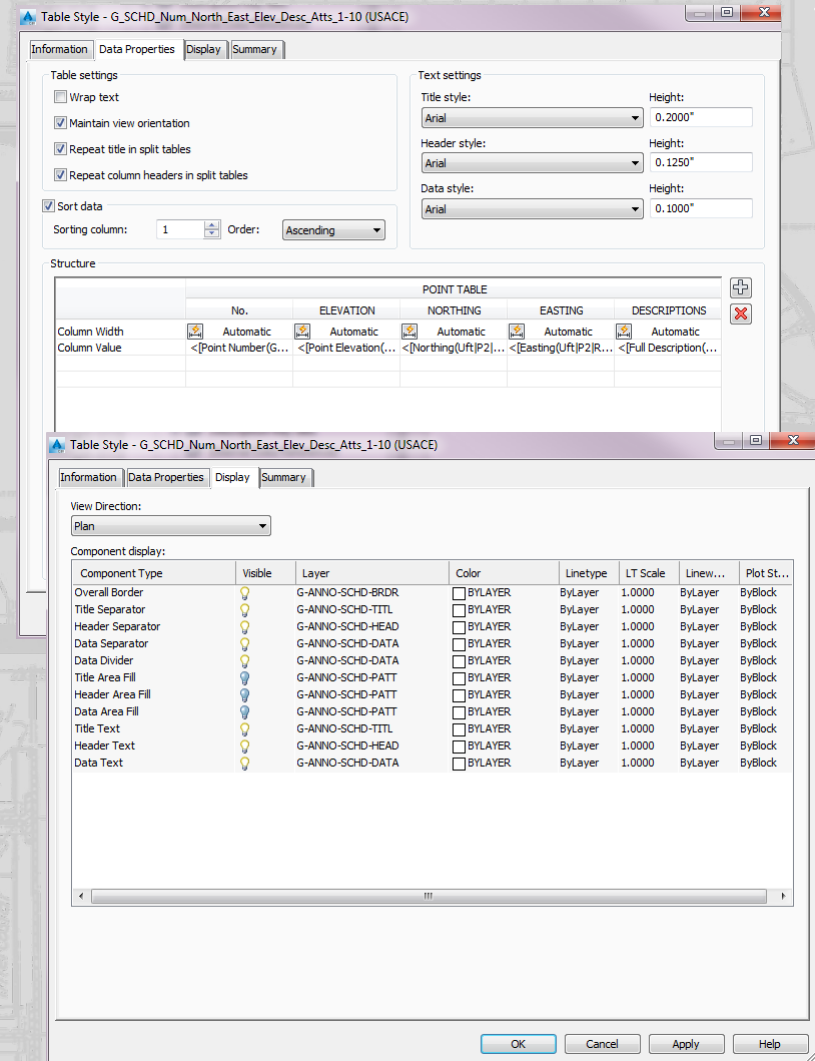




# TABLE SETTINGS

## 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



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# USACE CIVIL 3D TABLES

Tables are Objects

**DRAINAGE STRUCTURE TABLE: SSWR-A**

STR. NO	TYPE	T.C.	F.L. (OUTFALL)	NORTHING	EASTING
STRU (7)	Cylindrical Junction Structure NF	195.43	188.34	3757187.68	11821384.89
STRU (8)	Cylindrical Junction Structure NF	190.80	181.87	3757014.10	11821466.26
STRU (9)	Cylindrical Junction Structure NF	184.14		3756858.00	11821533.71
STRU (10)	Cylindrical Junction Structure NF	190.23	183.86	3757010.61	11821480.00

**DRAINAGE PIPE TABLE: SSWR-A**

PIPE NO	TYPE	LENGTH (FT)	FL U.S.	FL D.S.	SLOPE (FT/FT)	DESIGN FLOW (C.F.S.)
PIPE (6)	12" DIP	191.70'	188.34	183.14	2.72%	0.000
PIPE (7)	30" PVC	170.05'	181.87	174.44	4.37%	0.000
PIPE (8)	4" DIP	14.17'	183.86	183.79	0.48%	0.000

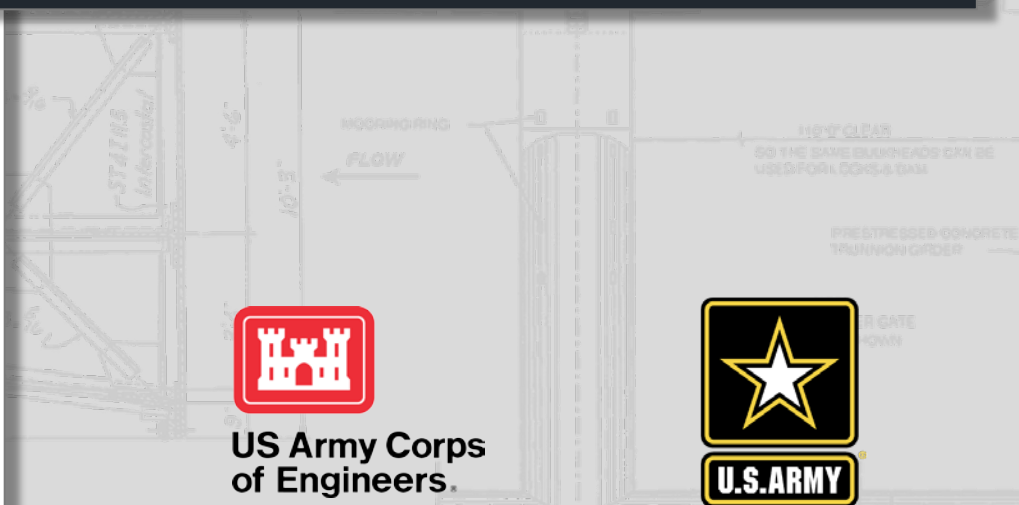
**STRUCTURE TABLE: SSWR-A**

STRUCTURE	STATION	INV. IN	TOP	INV. OUT
STRU (7)	8+00		195.43	188.34 (12" DIP)
STRU (8)	9+91.51	183.14 (12" DIP) 183.79 (4" DIP)	190.80	181.87 (30" PVC)
STRU (9)	11+61.55	174.44 (30" PVC)	184.14	
STRU (10)	10+00		190.23	183.86 (4" DIP)

**PIPE TABLE: SSWR-A**

PIPE	SIZE	MATERIAL	LENGTH	SLOPE
PIPE (6)	12"	DIP	191.70'	2.72%
PIPE (7)	30"	PVC	170.05'	4.37%
PIPE (8)	4"	DIP	14.17'	0.48%

- Table Styles
  - Direction
    - G\_SCHD\_Direction\_Table (USACE)
    - Standard
  - Elevation
    - G\_SCHD\_Elevation\_Table (USACE)
    - Standard
  - Slope
    - G\_SCHD\_Slope\_Table (USACE)
    - Standard
  - Slope Arrow
    - G\_SCHD\_Slope\_Arrow\_Table (USACE)
    - Standard
  - Contour
    - G\_SCHD\_Contour\_Table (USACE)
    - Standard
  - Watershed
    - G\_SCHD\_Watershead\_Table (USACE)
    - Standard
  - User-Defined Contour
    - G\_SCHD\_User\_Defined\_Contour\_Table (USACE)
    - Standard
  - Commands



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# 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

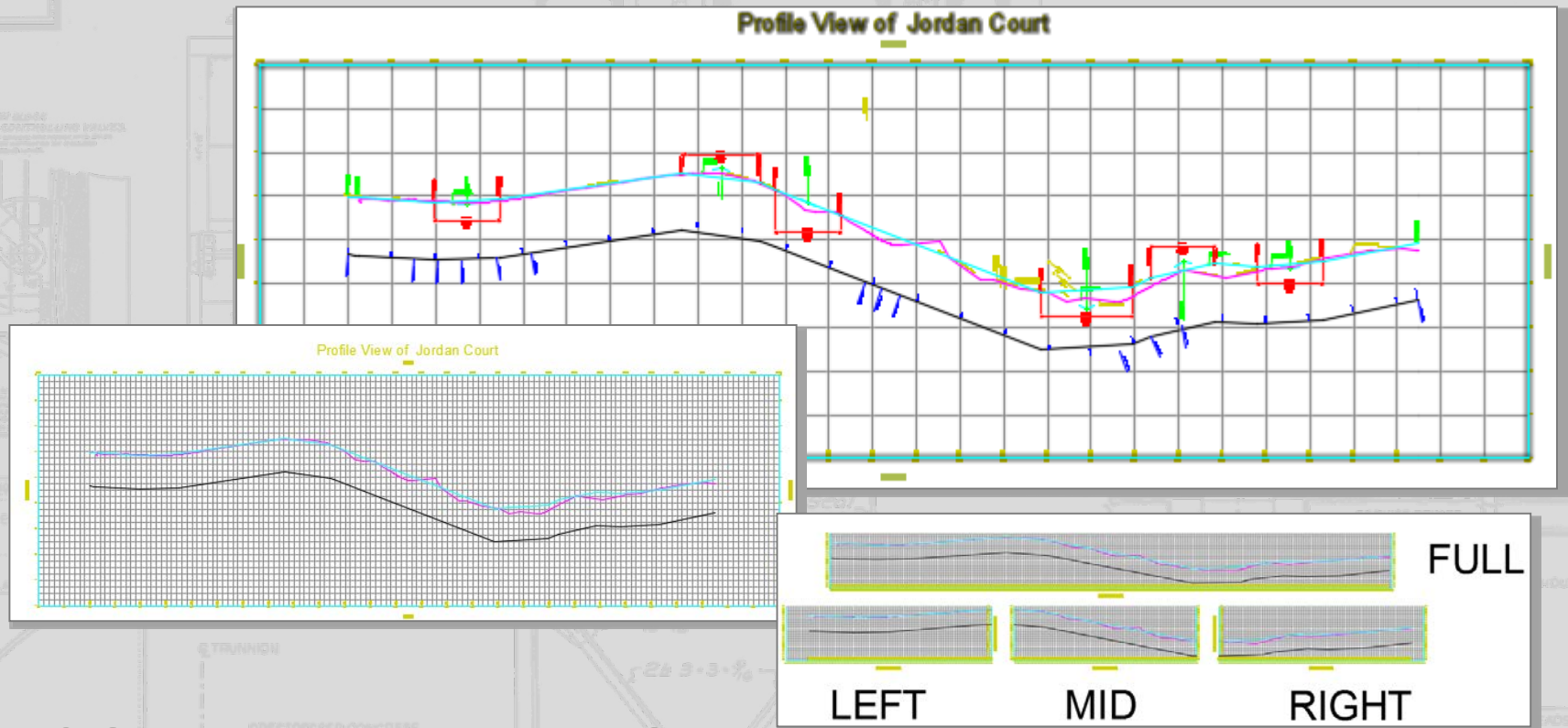


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# PROFILES



## AEC Standards Profile View Settings

- Layer and label settings are built in
- Assign style



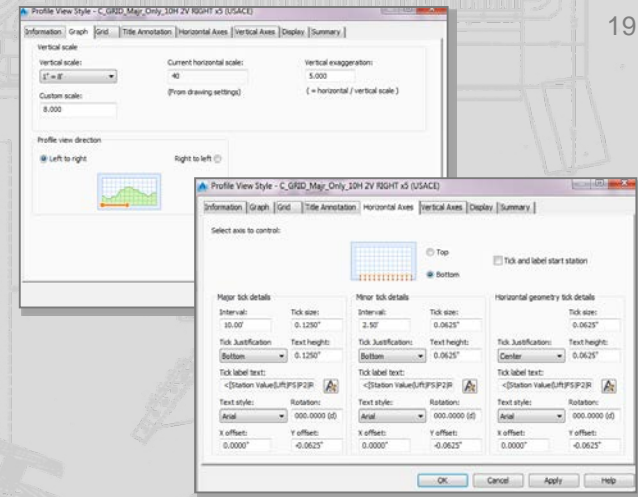
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# PROFILES

## AEC Standards Profile View Settings

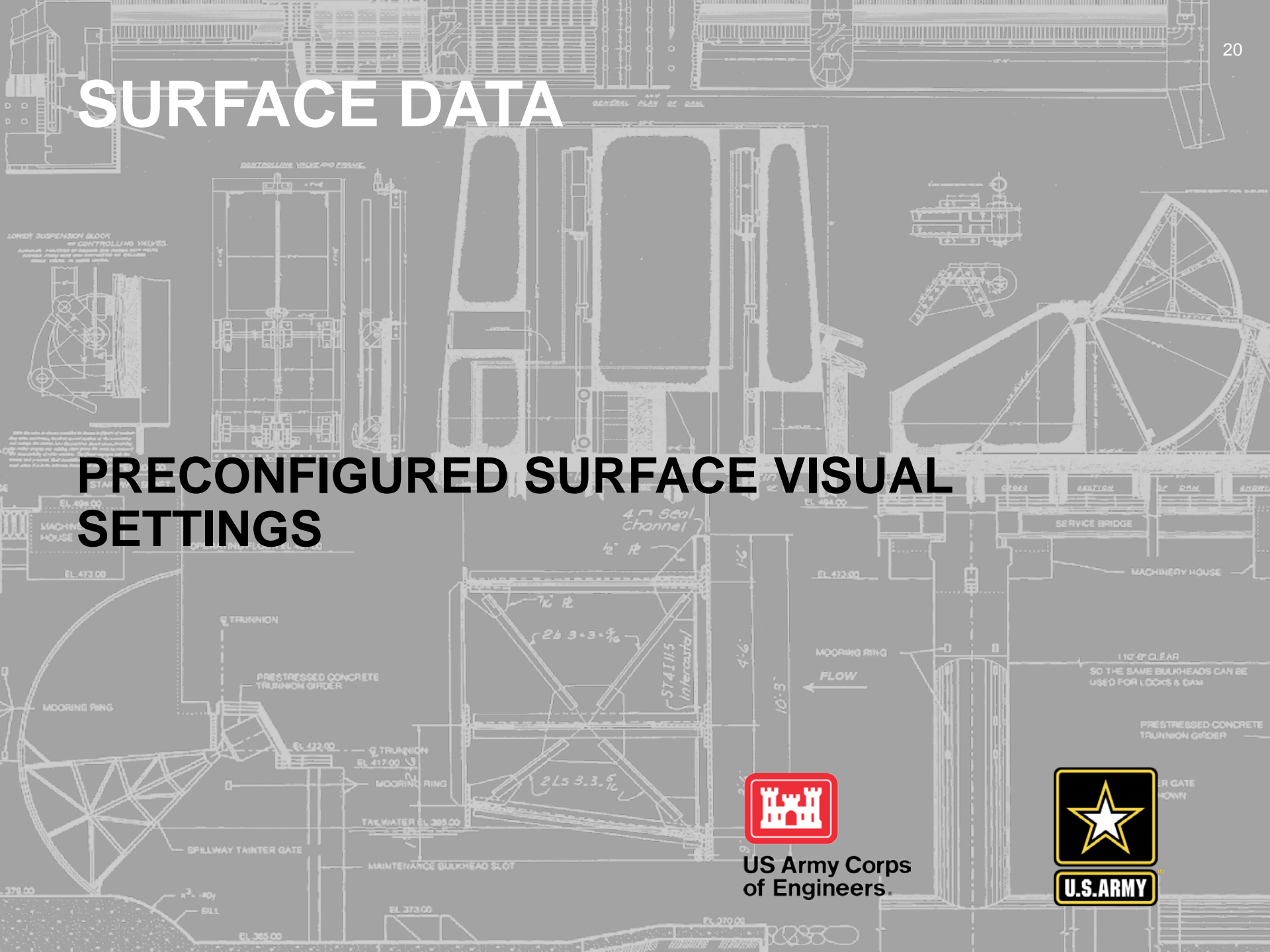
- Profile Styles can be assigned to a profile
- Copy and Modify for different uses if needed
- Graph, Grid, Title Annotation, Horizontal & Vertical Axes, Display



PROFILE	DESCRIPTION
C_GIRD_Projection (USACE)	Object Display - As Drawn
C_GRID_STA_Ex_Only_Majr_Minr (USACE)	Station & Ex ONLY @ Major & Minor Grids 0.5" height box Remember to set Profile 1 in Profile View Properties **Ex text is Hard Coded Italic**
C_GRID_STA_Ex_Only_Majr_ONLY (USACE)	Station & Ex ONLY @ Major Grids ONLY 0.5" height box Remember to set Profile 1 in Profile View Properties **Ex text is Hard Coded Italic**
C_GRID_STA_FG_Offset_Majr_Minr (USACE)	EXTRA "FG" 3rd ROW - Profile 2 @ Major & Minor Grids 0.5" height box - set to NO PLOT **Band Offset will Have to be shifted -.5 Offset **
C_GRID_STA_FG_Offset_Majr_ONLY (USACE)	EXTRA "FG" 3rd ROW - Profile 2 @ Major ONLY Grids 0.5" height box - set to NO PLOT **Band Offset will Have to be shifted -.5 Offset **
C_GRID_STA_Only_Majr_Only (USACE)	Station ONLY @ Major Grids ONLY 0.5" height box **For Use when NO Bands are Necessary**

# SURFACE DATA

## PRECONFIGURED SURFACE VISUAL SETTINGS



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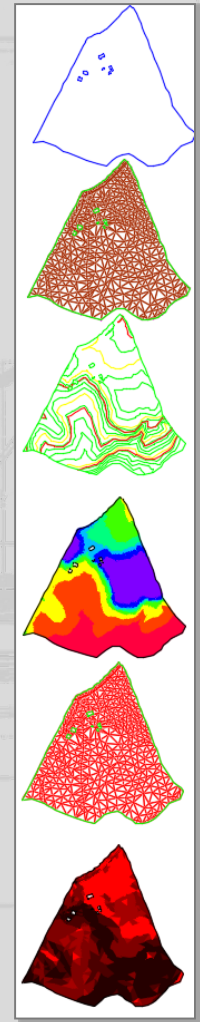
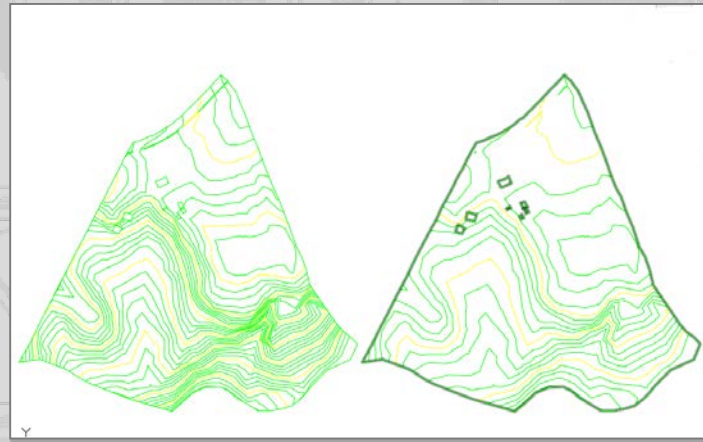
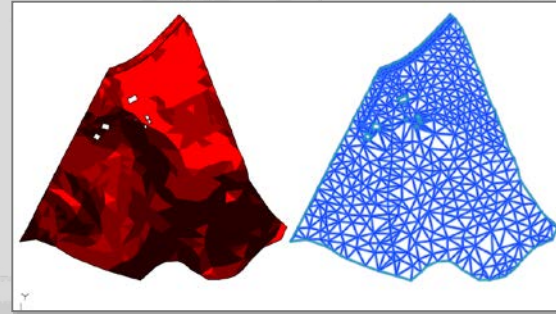


# SURFACE STYLES

Create surface from survey,  
point cloud

Assign visual appearance

- Contours
- Analysis – Slopes
- Analysis – Elevation
- Hydrography
- Watershed
- TIN – Blue lines
- 3D Styles



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# USACE MOBILE DISTRICT IMPLEMENTATION PROJECT

Take the USACE Civil 3D template and apply this to an actual project using design data provided

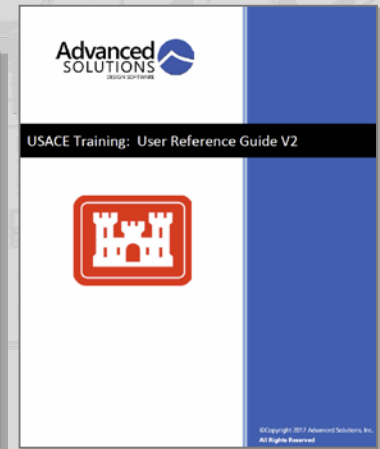
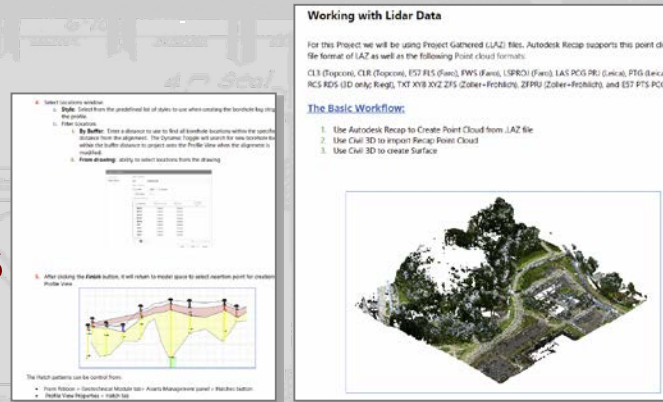


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# DEMONSTRATION OF THE DESIGN PROCESS

- 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



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# 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



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# THE CIM OBJECTS

- CIM Civil Objects demonstrated:
  - ALIGNMENTS
  - PROFILES
  - CORRIDORS
- Civil processes demonstrated:
  - Create Surfaces
    - Existing
    - Proposed
  - Grading
  - Geotechnical
  - Building Pad
  - Sidewalks

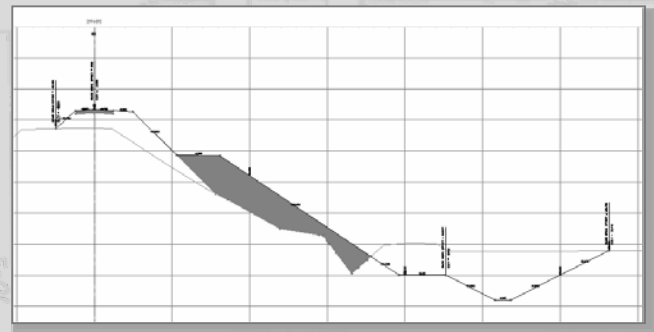
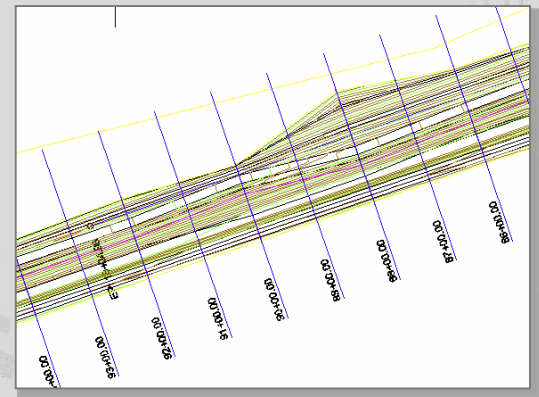


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# BIM PROCESSES

- SURVEY Data:
  - Import data
  - Apply Point styles
- Create Alignments
- Create Profiles
  - Existing grades
  - Proposed grades
- Create Corridors
- Create Sections
  - Existing
  - Proposed



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# CIVIL 3D TRAINING SITE : USACE

## Online CAC training for USACE:

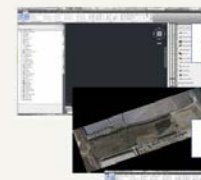
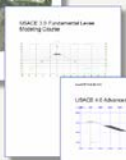
### Course Materials & Data



Instruction Manuals

Data, Materials

Videos



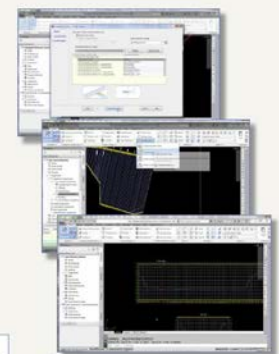
Template

Image

DWG

LandXML

Text



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

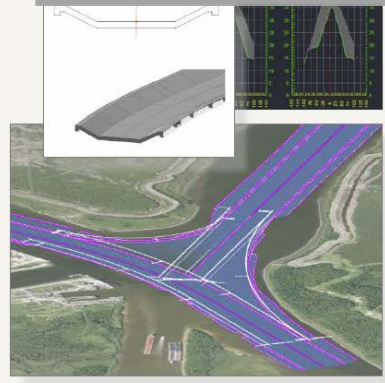


## USACE CIM Civil Information Model

### AutoCAD Civil 3D



Move the mouse. Move the road. Autodesk Civil 3D.



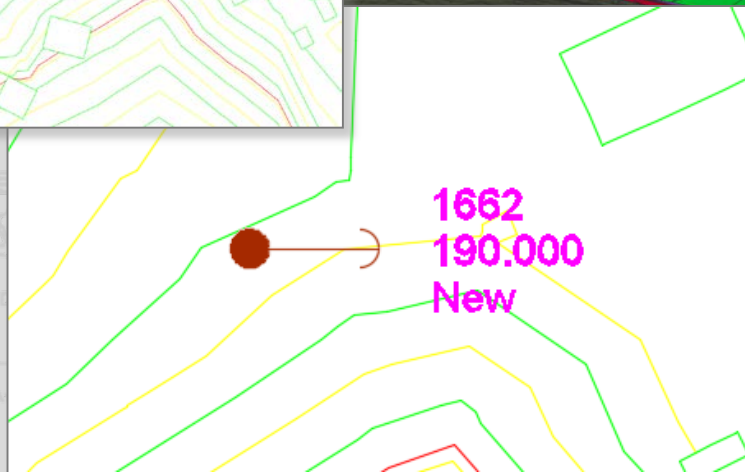
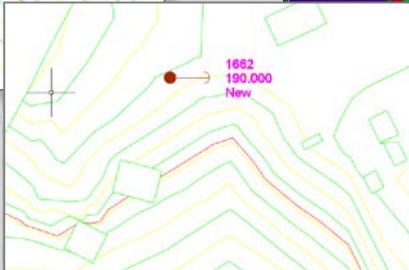
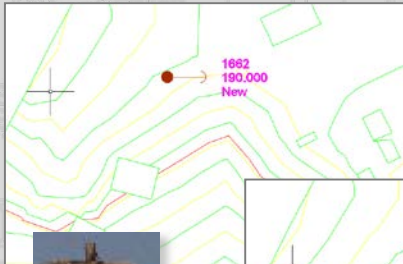
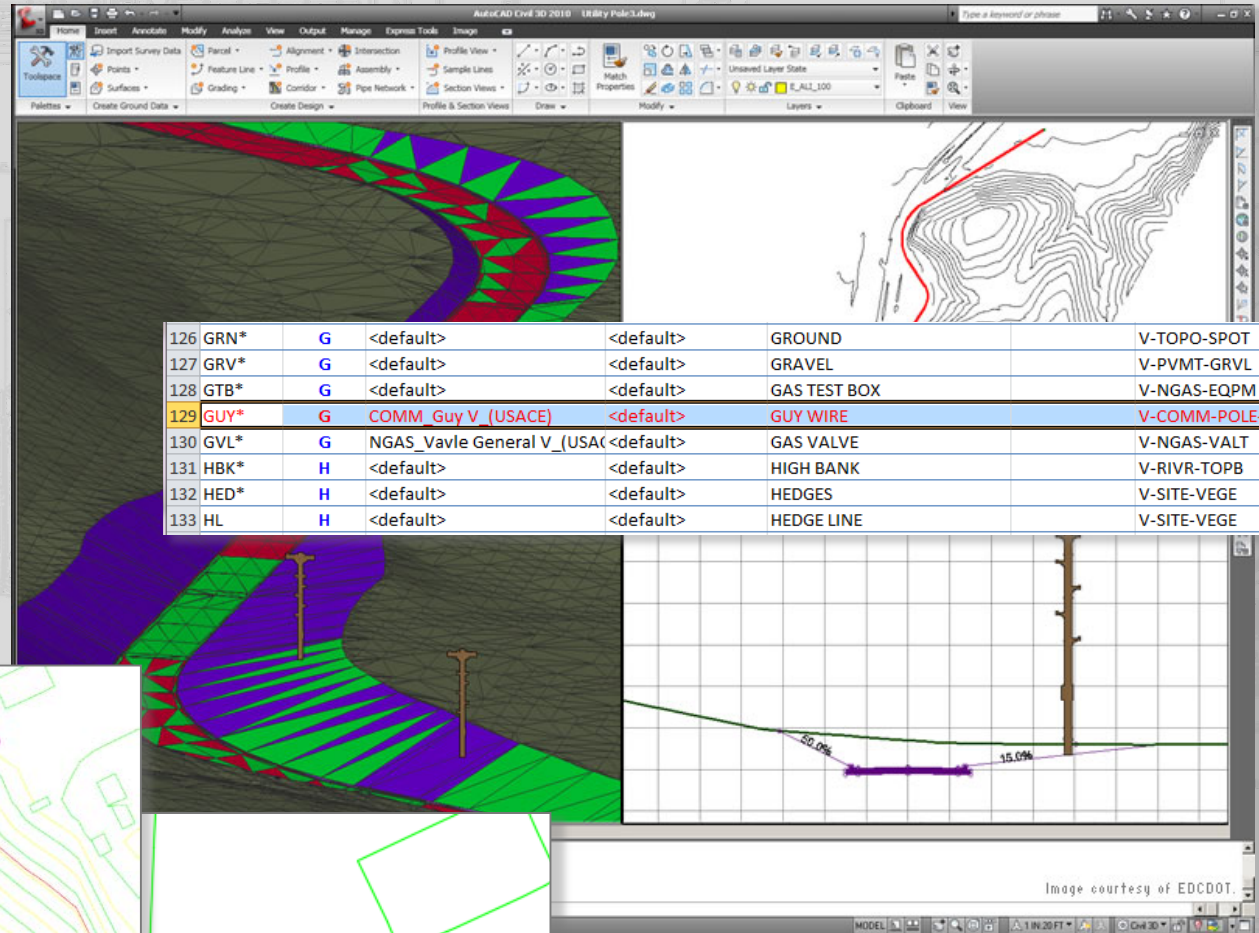
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# SURVEY AUTOMATION

From Site

- to Surveyor
- to Survey
- to DESIGN
- To CAD



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# ?? GOT QUESTIONS ??

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USACE Advanced Modeling - Civil 3D Team



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