Empowering a paradigm shift: MicroStation to Civil 3D

Anand Stephen, CME, PE
Engineer| @stevePEanand
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Description

Moving from a MicroStation to a Civil 3D platform is a paradigm shift. We will review the data presented to senior Leadership, arming them with information to make the switch. Not all projects are equal; hence, we will discuss types of projects suitable for the change. Equally, teaching data management, BIM principles, and Civil 3D is key to a successful platform migration. We will cover the pedagogical theory and techniques used to empower users with new skills. We will consider key strategies to facilitate this shift across different offices in the U.S. Data is central to a Civil 3D project. We will examine the data management tools and techniques used to make the learning curve less steep. This will include types of data that are typically necessary for a design project with Civil 3D. In this talk, we consider how data was created, managed, and shared in Civil 3D 2019/20. Finally, we will review a few technical and non-technical challenges encountered while making the shift.
Anand Stephen, P.E., C.M.E

Anand is a Civil Engineer who has designed infrastructure projects in several states in the U.S. He holds Professional Engineer’s licenses in New Jersey and California. He is a Certified Municipal Engineer in New Jersey. Anand is an AutoCAD Civil 3D Certified Professional. He has over two decades of experience across engineering, software development, and sociology. He has facilitated and led the change from a 2D drawing centric design to a 3D centric model design in several AEC firms. Anand mentors and teaches engineers and technicians to use 3D design technologies such as Civil 3D and Infraworks for roadway and site design. He has experience designing and programming enterprise software systems. Besides, he has taught courses at the university.
Learning Objectives

As we go through our story of shifting paradigms, we will cover the four learning objectives of this Industry Talk:

• Identify strategies to shift from MicroStation to Civil 3D
• Describe types of data required for a Civil 3D project while adhering to BIM principles
• Explain best practices to manage, share and create data
• Formulate a pedagogical framework to share new technical knowledge
Paradigm: “a philosophical and theoretical framework of a scientific school or discipline within which theories, laws, and generalizations and the experiments performed in support of them are formulated.” (Merriam-Webster, Dictionary)

Transformation Strategies: MicroStation to Civil 3D

While surveying we pay attention to the three legs of the tripod for precise measurements. Similarly, to effectively navigate the paradigm shift, three facets are necessary to enable the change from a 2D-Drawing Centric (2DDC) to 3D-Model Centric (3DMC) Approach.

1. Facilitate Leadership Commitment
2. Develop Pedagogical Framework
3. Pragmatic Technical Implementation
Facilitate Leadership Commitment
Facilitate Leadership Commitment

• Business leaders constantly balance current needs and future goals

• Need a roadmap showing
  o Current state of technology, processes and knowledge
  o Future Goals
  o How to bridge the gap
FIRST PROJECT: COMPARATIVE PROGRESS

MILESTONES

0% 25% 50% 75% 100%

RESOURCES

Start 1 2 3 4 5 6 7 8 9 10 11 12 13 14

- 2D-Drawing Centric Approach
- 3D-Model Centric Approach
- Resource Inflection
- Expectations ∆
SUBSEQUENT PROJECTS: COMPARATIVE PROGRESS

MILESTONES

RESOURCES

2D-Drawing Centric Approach

3D-Model Centric Approach

Resource Gains
C3D IMPLEMENTATION DECISION MATRIX

- XREFS
- 2D-Resources
- Project Templates
- DREFS
- 3D-Resources
- Sheet Set
- Custom Sub-assemblies
- Custom Scripts
- Custom Pipe Catalogs
- Custom Blocks
- Custom Scripts (use)

QUADRANT

- QUADRANT-1
- QUADRANT-2
- QUADRANT-3
- QUADRANT-4

REWARD

EFFORT
Task Prioritization

• **Tasks in the first quadrant require the least effort and with the least reward**
  o Low-hanging fruit; incentives may not be tangible immediately, efficiencies will accumulate

• **The functions in the second quadrant require the most effort with the least reward**
  o We could defer implementation of these tasks to subsequent projects

• **Tasks in the third quadrant require the highest effort, but these tasks result in high rewards**
  o Not all tasks use the same strategy in this quadrant
  o Data shortcuts (DREFS), for example, requires a different strategy than one used for custom subassemblies

• **The tasks in the fourth quadrant require a low effort but provide high rewards**
  o For example, creating project templates with correct datum and units is a simple task. It is a straightforward task that project teams could accomplish at the onset, avoiding significant errors downstream
Develop Pedagogical Framework
Pedagogical Framework

• Foster empathetic environment
  o Listen to and address concerns of change adopters
  o Collaboration
  o Non-judgmental learning

• Identify educational approaches
  o Identify theoretical adjustments
  o Identify changes in practice

• Locate learning resources
  o Manuals, Tutorials, Videos
  o Identify personnel for peer mentorship

• Customize educational framework
  o Map skills to educational approach
I am really excited about the new approach. It has been a long time coming. Hmmm.... It requires a lot of communication between team members. And I don’t mean sending emails or messages. We need communication that helps with learning. So that we can learn and grow from each other. I hope we can just pick up the phone and learn from each other. Also... I am concerned not all team members have the same skills. I feel we need to teach some of our colleagues as well.
Multiple Perspectives

All this 3D stuff is great. It sounds and looks good on YouTube. Once you start applying to a real project, it all falls apart. Don’t get me wrong; I will do the work as required; I don’t have a problem with it. I will learn as needed and as fast as possible. But what resources do we have to learn about problems and how to solve them on real projects. I hope we don’t get stranded because we don’t have a quick way of learning beyond what is shown on sample tutorials.

No problem you know me. I have always said I will do whatever it takes to get the project completed. I am committed to completing the project in whatever format clients require. I am concerned about learning a new approach so quickly. It is a lot of new stuff. You should know I won’t able to do everything. Others should be trained too.
Personal Journeys

EMOTIONAL JOURNEY: COMPOSITE PROFILE -1

REACTIONS

Denial

Frustration

Negotiation

Depression

TIME

Acceptance
Personal Journeys

EMOTIONAL JOURNEY: COMPOSITE PROFILE -2

REACTIONS

Excitement
Negotiation
Frustration
Depression
Acceptance

TIME
Personal Journeys

EMOTIONAL JOURNEY: COMPOSITE PROFILE -3

REACTIONS

Acceptance

Negotiation

Frustration

Depression

Acceptance
### Mapping Pedagogical Approaches

#### Classical Education Approaches

- **Behaviorist** (Independent, repetitive tasks)
- **Cognitive Constructivist** (Teacher led, require mental processing)
- **Social Constructivist** (Requires, mental processing, learning in a collaborative setting)

#### Pedagogical Approaches

<table>
<thead>
<tr>
<th>Task</th>
<th>Pedagogical Approach</th>
<th>D.M., Quadrant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom Scripts (use)</td>
<td>Behaviorist</td>
<td>Quadrant -4</td>
</tr>
<tr>
<td>XREFS</td>
<td>Behaviorist</td>
<td>Quadrant -4</td>
</tr>
<tr>
<td>Custom Blocks</td>
<td>Behaviorist</td>
<td>Quadrant -1</td>
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<tr>
<td>2D-Resources</td>
<td>Behaviorist</td>
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<td>Project Templates</td>
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<tr>
<td>DREFS</td>
<td>Cognitive Constructivist</td>
<td>Quadrant -3</td>
</tr>
<tr>
<td>Sheet Set Manager</td>
<td>Cognitive Constructivist</td>
<td>Quadrant -3</td>
</tr>
<tr>
<td>3D-Resources</td>
<td>Social Constructivist</td>
<td>Quadrant -3</td>
</tr>
<tr>
<td>Custom Pipe Catalogs</td>
<td>Cognitive Constructivist</td>
<td>Quadrant -2</td>
</tr>
<tr>
<td>Custom Scripts (create)</td>
<td>Social Constructivist</td>
<td>Quadrant -3</td>
</tr>
<tr>
<td>Custom Sub-assemblies</td>
<td>Social Constructivist</td>
<td>Quadrant -3</td>
</tr>
</tbody>
</table>
Pragmatic Technical Implementation
Pragmatic Technical Implementation

- Single Source Of Truth
- Data Encapsulation
- Identify key Data Types
- Just-In-Time Content Creation
Key Concepts

Single Source Of Truth Data Management
• Stores data exactly once
• Avoids multiple copies of the same data
• Problems associated with data increase exponentially with project size

Data Encapsulation
• Protects data from unwanted access
• Allows access to data without revealing details
• Minimizes human errors
• Simplifies maintenance

Just-In-Time Content Creation
• Start with basic templates
• Create content as you as needed
• Avoids project budget overruns
Key Data Types

- **Two-Dimensional Project Data** — Right-of-Way drawings, Proposed Striping Plans
- **Horizontal BIM Data** — Alignments, Profiles, Pipes, Surfaces, etc.
- **Horizontal BIM Support Data** — Templates with styles controlling the display of H-BIM data
- **Resources** — Line types, Plotter Configuration
Data Channels

2D Data via File Reference
- ProjectWise/BIM360
- GIS
- Drawings
- Text, Excel

3D Model via Data Shortcuts
- ProjectWise/BIM360
- Alignments
- Profiles
- Surfaces
- Pipes

Resource Data via user profiles in AutoCAD
- Plot info
- Line styles
- Shape files

3D Model Display Data via C3D Reference Management
- Alignment styles
- Contours
- Pipe styles
Data Organization

Project Root Folder

Common Resources

Discipline Folder

H-BIM Data:
• GEOM (Geometry) – Alignments, Profiles
• PIPE_G – Gravity Pipe Networks
• PIPE_P – Pressure Pipe Networks
• SURF (Surfaces) – Surface Models

2D Data:
• Drawings
• Spreadsheets
• Text files
• Images
Chose ProjectWise as our collaborative platform
• Support for DS
• Most our staff was well-versed in ProjectWise
• Project teams would require upskilling only to manage Data Shortcuts via ProjectWise

Chose BIM360
• Support for DS
• Within the Autodesk Ecosystem
ProjectWise Data Shortcuts Management

- Individual XML files for Data Shortcut of each object are not directly visible.
- The Data Shortcut file (*.CivilDSProj extension) is a “self-healing” file.
- Whenever a user edits Data Shortcuts, the *.CivilDSProj file gets updated in ProjectWise.
- Users can click on the file to update the Project Working Folder and Data Shortcut folder within Prospector in C3D.

In Tool space, within C3D, on the Prospector Tab, right click and "Set Working Folder"

Choose a folder that all sub-consultants can access

In Tool space, within C3D, on the Prospector Tab, right click and create "New Data Shortcut Folder"

A file with an extension ".CivilDSProj" is created in the folder chosen on ProjectWise

Start Creating and Consuming Data Shortcuts within C3D via the Prospector Tab
BIM360 Data Shortcuts Management

- For projects starting in 2020, we began using BIM360 as the collaborative platform
- BIM360 manages Data Shortcuts much like if Data Shortcuts were managed on a local or networked computer
- It uses Autodesk Desktop Connector to synchronize files to the cloud
- There are few crucial points to consider before migrating or setting up project on BIM360

1. Move the project to local folder first
2. Ensure all project data are mapped to the local folder.
3. Relative paths for references
4. Audit and Purge the drawings
5. Remove all references to any networked folders.
6. Migrate the project
Key Lessons Learned

Account for automation
- Leverage programming
- Invest in upskilling

Formalize the librarian concept for knowledge distribution
- Users ask a “librarian” or “librarians” for the best learning resource
- Librarian directs to the appropriate resource: person, tutorial or video
References

• Kuhn TS. The Structure of Scientific Revolutions: 50th Anniversary Edition.
• Merriam-Webster. Definition of PARADIGM.

Credits
