UT6584 – Link Between Construction Standards, Compatible Units, and Automated Utility Design (AUD) Feature Classes

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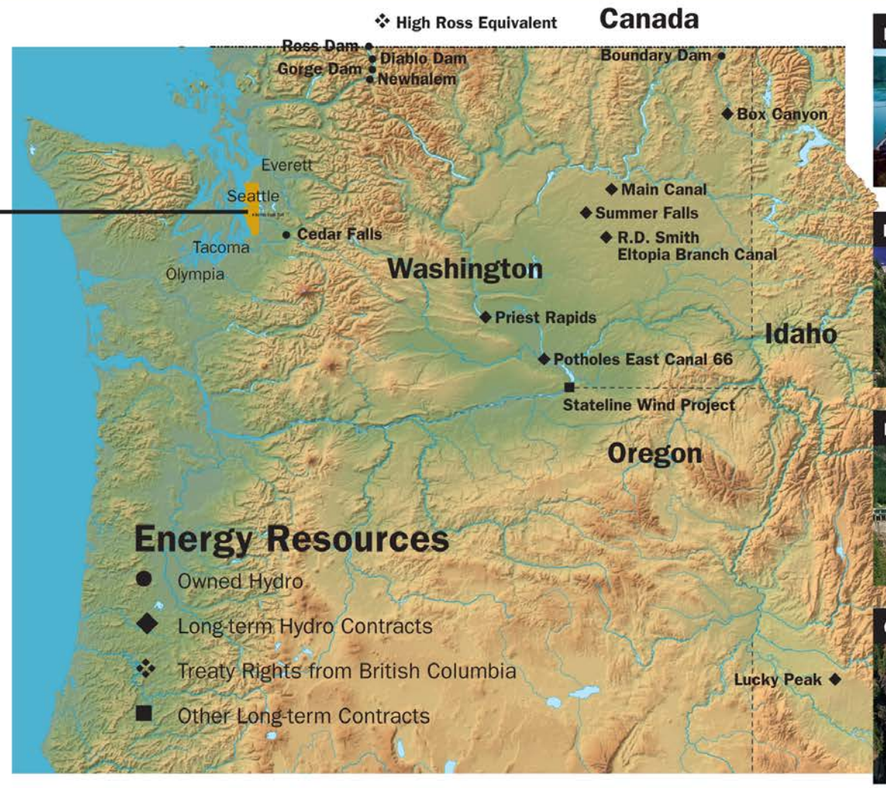
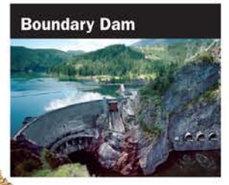
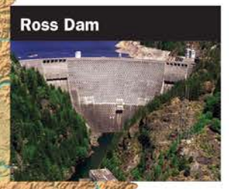
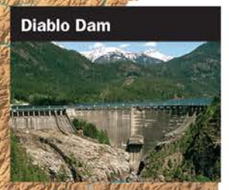
What if you aren't a rural utility?

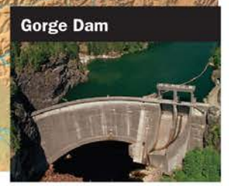
Seattle City Light











Public, municipally-owned utility:

- Incorporated 1902; First streetlights on in 1905
- 131 Square Mile Service Area
- 750,000 Population Served
- 394,000 Customers
- 1722 Employees
- 7 Hydroelectric Plants
- 1800 MW Generation Capacity
- 657 Transmission Circuit Miles
- 2,523 Distribution Circuit Miles
- Current Average Residential Rate = 6.31 cents/kWH (lowest of US urban centers)

Where we were:

- One Utility
- Three semi-autonomous companies
    - North Distribution
    - South Distribution
    - Downtown Network Distribution
- Outdated Construction Standards
- No Design Standards
- No Compatible Units

Where we wanted to be:

- Have a strong set of Design Standards
- Have Construction Standards with current materials
- Have Compatible Units
- Have standardized design tools – such as AUD

Implementation Approach

- No Compatible Units = No Building Blocks
- Started real basic and narrow to proof test
- Wanted to create 3 Engineering Drawings
  - Customer Responsibility
  - SCL Civil Infrastructure
  - SCL Electrical
- Expanded scope to include more design options

Implementation Approach (cont'd)

- Wanted to build a fast and efficient tool
  - Balance performance speed vs. system's rule based analysis
  - Use more look-up tables than rule-based part selection subroutines
- Have AUD interface with our Work Management and GIS Systems to extract frequently updated data

Configuring AUD

- AUD Hierarchy:
  - Feature Class
    - Model Group
      - Model Name = Compatible Unit Name
- Preloaded with RUS Model Data, but…

Configuring AUD (cont'd)

- SCL distribution voltage = 26kV
- Short Feeders with High Fault Duty System
- Very dense and urban environment
- Lots of underground vaults and in-building vaults
- Constructed ductbanks

- Not very RUS-like!

- We needed to add all of our assets to the Model Data

Lessons Learned – Feature Classes

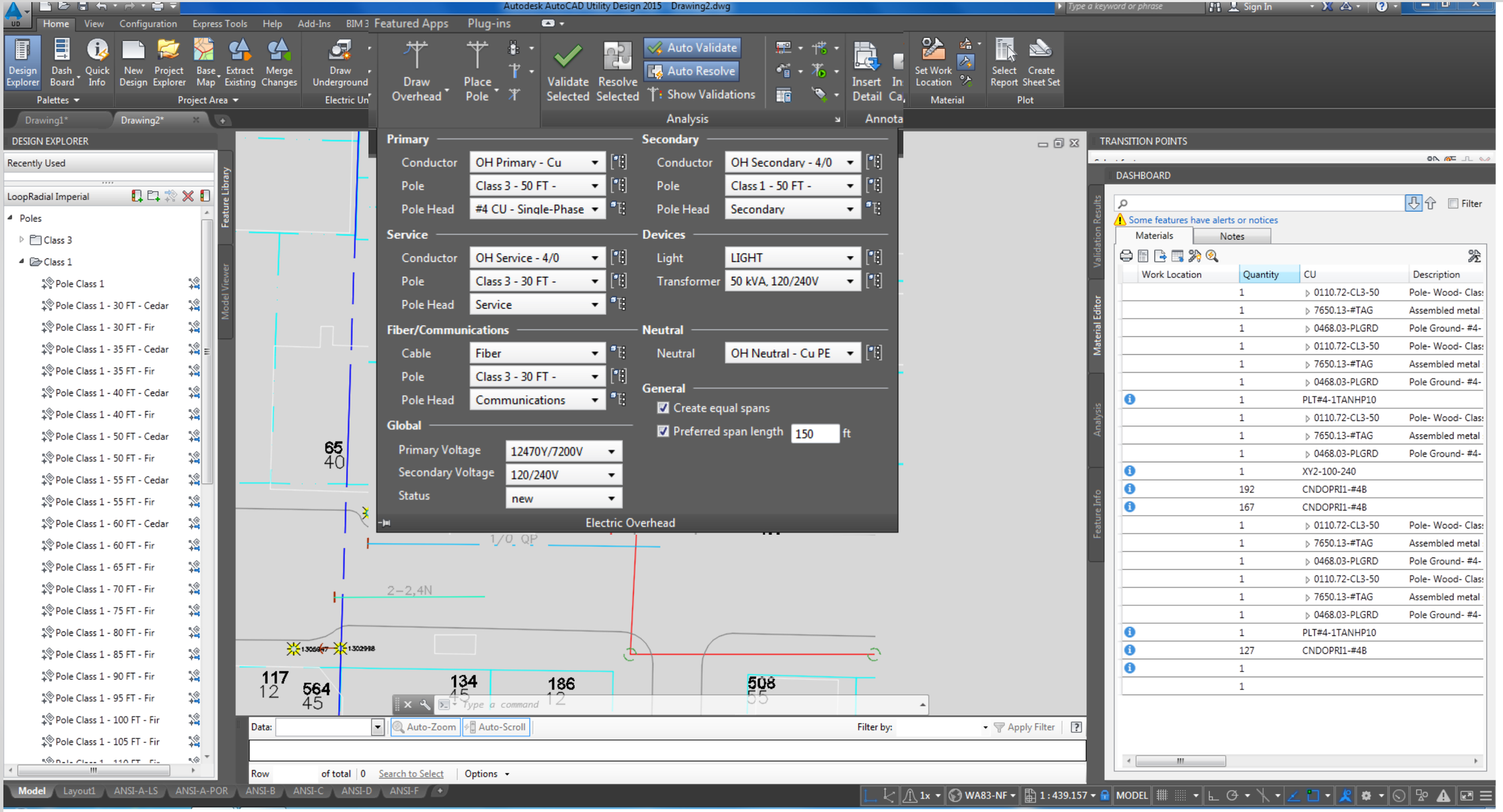
- Straight conduit was all we had in common with RUS data; everything else had to be built up from scratch!
- Develop a Data Dictionary
- Lots of required technical details for each Feature Class asset
- Establish a Data “Guru” to choose your “Source” data

Lessons Learned – Compatible Units

- 4 Types of Compatible Units (CU's)
  - Main- Primary Model CU
  - Constant- Always paired and ordered with Main CU
  - Conditional- Rules-based selection
  - Optional- Engineer input of quantity required

Lessons Learned – Compatible Units (Cont'd)

- A Feature Class functional change will drive the need for a uniquely named CU – even though it is the same material
  - Ex. Underground Cable used as a Primary, Neutral, Secondary, and Service would need 4 unique CU names
- Consider grouping Constant, Conditional and Optional CU's with the Main CU
- We added Model Group as part of our Model Name


Autodesk AutoCAD Utility Design 2015 Drawing2.dwg
Home View Configuration Express Tools Help Add-Ins BIM 3 Featured Apps Plug-ins
Design Explorer
Dash Board
Quick Info
New Design
Project Explorer
Base Map
Extract Existing
Merge Changes
Draw Underground
Draw Overhead
Place Pole
Validate Selected
Resolve Selected
Auto Validate
Auto Resolve
Show Validations
Insert Detail
Set Work Location
Select Report
Create Sheet Set
Palettes
Project Area
Electric Un
Analysis
Material
Plot
Drawing1*
Drawing2*
DESIGN EXPLORER
Recently Used
LoopRadial Imperial
Poles
Class 3
Class 1
Pole Class 1
Pole Class 1 - 30 FT - Cedar
Pole Class 1 - 30 FT - Fir
Pole Class 1 - 35 FT - Cedar
Pole Class 1 - 35 FT - Fir
Pole Class 1 - 40 FT - Cedar
Pole Class 1 - 40 FT - Fir
Pole Class 1 - 50 FT - Cedar
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Pole Class 1 - 65 FT - Fir
Pole Class 1 - 70 FT - Fir
Pole Class 1 - 75 FT - Fir
Pole Class 1 - 80 FT - Fir
Pole Class 1 - 85 FT - Fir
Pole Class 1 - 90 FT - Fir
Pole Class 1 - 95 FT - Fir
Pole Class 1 - 100 FT - Fir
Pole Class 1 - 105 FT - Fir
Feature Library
Model Viewer
Primary
Conductor OH Primary - Cu
Pole Class 3 - 50 FT -
Pole Head #4 CU - Single-Phase
Secondary
Conductor OH Secondary - 4/0
Pole Class 1 - 50 FT -
Pole Head Secondary
Service
Conductor OH Service - 4/0
Pole Class 3 - 30 FT -
Pole Head Service
Devices
Light LIGHT
Transformer 50 kVA, 120/240V
Fiber/Communications
Cable Fiber
Pole Class 3 - 30 FT -
Pole Head Communications
Neutral
Neutral OH Neutral - Cu PE
General
Create equal spans
Preferred span length 150 ft
Global
Primary Voltage 12470Y/7200V
Secondary Voltage 120/240V
Status new
Electric Overhead
TRANSITION POINTS
DASHBOARD
Some features have alerts or notices
Materials
Notes
Work Location
Quantity
CU
Description
Validation Results
Material Editor
Analysis
Feature Info
Data:
Auto-Zoom
Auto-Scroll
Filter by:
Apply Filter
Row
of total 0
Search to Select
Options
Model
Layout1
ANSI-A-LS
ANSI-A-POR
ANSI-B
ANSI-C
ANSI-D
ANSI-F
WA83-NF
1 : 439.157
MODEL

Lessons Learned – Compatible Units (Cont'd)

- Pole Framing CU's
  - Started to develop all known Configurations
    - – Too many > 200
  - Engineer will build pole framing by attachment level
    - Tangent pole top with head pin
    - Tangent understory arm for buck arm or double circuit
    - Number of Secondary and Service Drops

      (Note: AUD needs to show these separately even though you may mount them from the same bracket)

Lessons Learned – Compatible Units (Cont'd)

- Just exploring now what happens with a "New" vs "Remove" CU function and its associated material call out
  - For New CU's we want the full Materials and Labor
  - For Remove CU's we only want the labor and maybe only a prorated amount of the labor.
  - How will AUD handle and treat this condition?

Added AUD functionality

- Ductbank Design
- Excavation Volume Estimating
- Improved Voltage Drop and Fault Current Calculations
- More sophisticated cable pulling calculations
- Pole Groundline Moment calculations
- NESC Clearances
- NESC Grades of Construction

Recommendations

- If your Utility does not use RUS materials or standards…
  - Start early collecting technical model data
  - Plan 18-24 months for this data collection, ¾-full time!
  - Interns can help do some of the leg work – but not the solution!
  - Need knowledgeable design engineer who knows how the data will be used in the system rules and calculations so you capture the correct data
  - Have a “Data Guru” to define “Source Data”

Recommendations

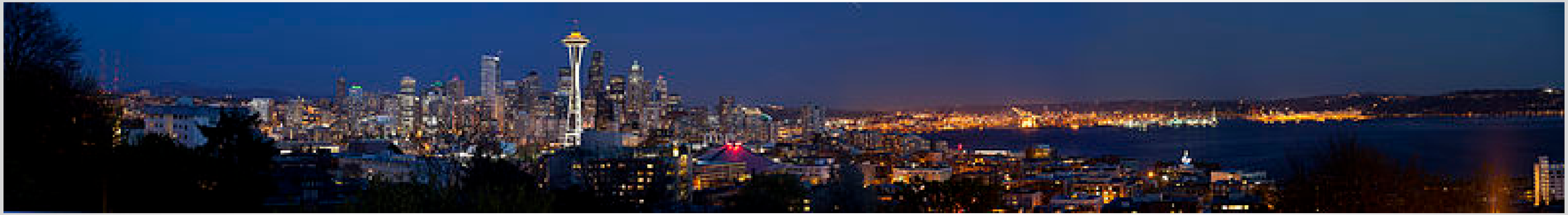
- Standardize your naming convention for asset hierarchy of Feature Class, Model Group, Model Name and Compatible Units EARLY!

- These fields are read by a computer so every character stroke or space matters! Be consistent with spaces, dashes, spaces around dashes, etc.

Recommendations

- Include in your contract for AUD to:
  - Supply a full-time, data person to reside at your work site who can assist in coordinating the gathering of your data;
  - Perform quality control checks to be sure required fields have been filled in with an appropriate value;
  - Create and fill in appropriate values in pull down selection Domain Tables; and
  - Prepare the final formatting and entering all data into AUD's data upload templates.

Questions?



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- Instructors see results in real-time

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