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Creating an Electrical Analytical Model in Revit 2023

BES502481

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Sr. Practice Manager – AEC

CADD MICROSYSTEMS

About the Speaker

Michael Massey

Sr. Practice Manager – AEC

CADD MICROSYSTEMS

- **30+ Years of AEC Experience**
- Industry leading expert for BIM/VDC
- Degree in architecture from **Texas A&M University**
- Autodesk Certified Instructor
- Professional Certifications in Revit Architecture, Revit MEP (Electrical), and Revit MEP (Mechanical)
- **Top Rated Speaker at Autodesk University**
- Contributing author for Autodesk Official Training Courseware

Autodesk Certified Instructor

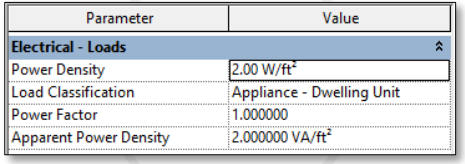
Revit Architecture Certified Professional

Revit MEP: Electrical Certified Professional

Revit MEP: Mechanical Certified Professional

Session Agenda & Learning Objectives

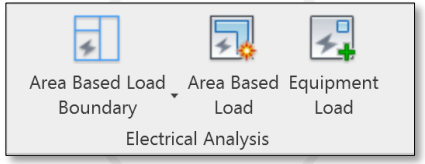
Electrical Analysis for Preliminary Design



Parameter	Value
Electrical - Loads	
Power Density	2.00 W/ft²
Load Classification	Appliance - Dwelling Unit
Power Factor	1.000000
Apparent Power Density	2.000000 VA/ft²

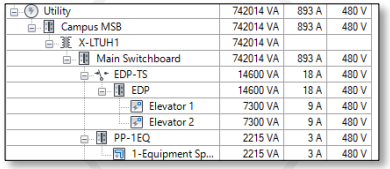
Define

Define the Electrical Analytical Load Type Settings



Create

Create Electrical Analytical Loads



Utility	742014 VA	893 A	480 V
Campus MSB	742014 VA	893 A	480 V
X-LTUH1	742014 VA		
Main Switchboard	742014 VA	893 A	480 V
EDP-TS	14600 VA	18 A	480 V
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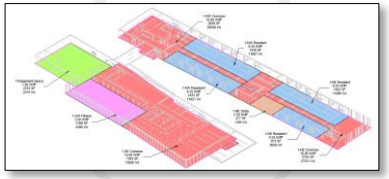
Elevator 1	7300 VA	9 A	480 V
Elevator 2	7300 VA	9 A	480 V
PP-1EQ	2215 VA	3 A	480 V
1-Equipment Sp...	2215 VA	3 A	480 V

Apply

Apply the loads to the Conceptual Distribution System



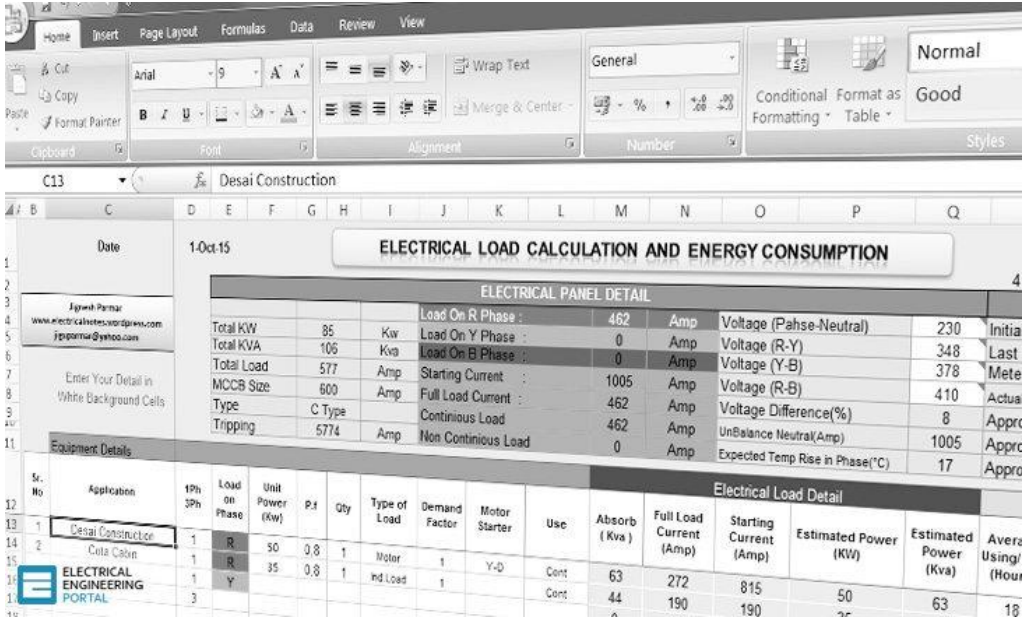
Document

Documenting Electrical Analytical Loads

Importance of Electrical Load Estimation

Preliminary Load Calculations

- Plan the connection to an upstream network
- Apply to Power Company for supply
- Plan the transformers substation(s) (if any) and the main switchgear room
- Calculate the initial budget for the electrical works



Preliminary Electrical Load Estimates

Space-by-Space

- The building will be divided into different space based on its function
  - The Load density in (W/ft2) and/or (VA/ft2) is prescribed for these different spaces. Is used for individual spaces in the building
- May be used for any building or portion of a building

Building Area Method

- Used for buildings bigger than that can be handled by the Space-by-space method
- Easier as you estimate the electrical load based on the activity of the whole building
- Offers less flexibility
- Used for entire building or single, independent, and separate occupancies

Area Method

- Used for Area loads which consist of groups of individual building loads
- Buildings are served by the same subdivision of the electrical distribution system
- Used for the design of substations
- Groups of individual building loads within an area

Load Density

Preliminary Load Calculations

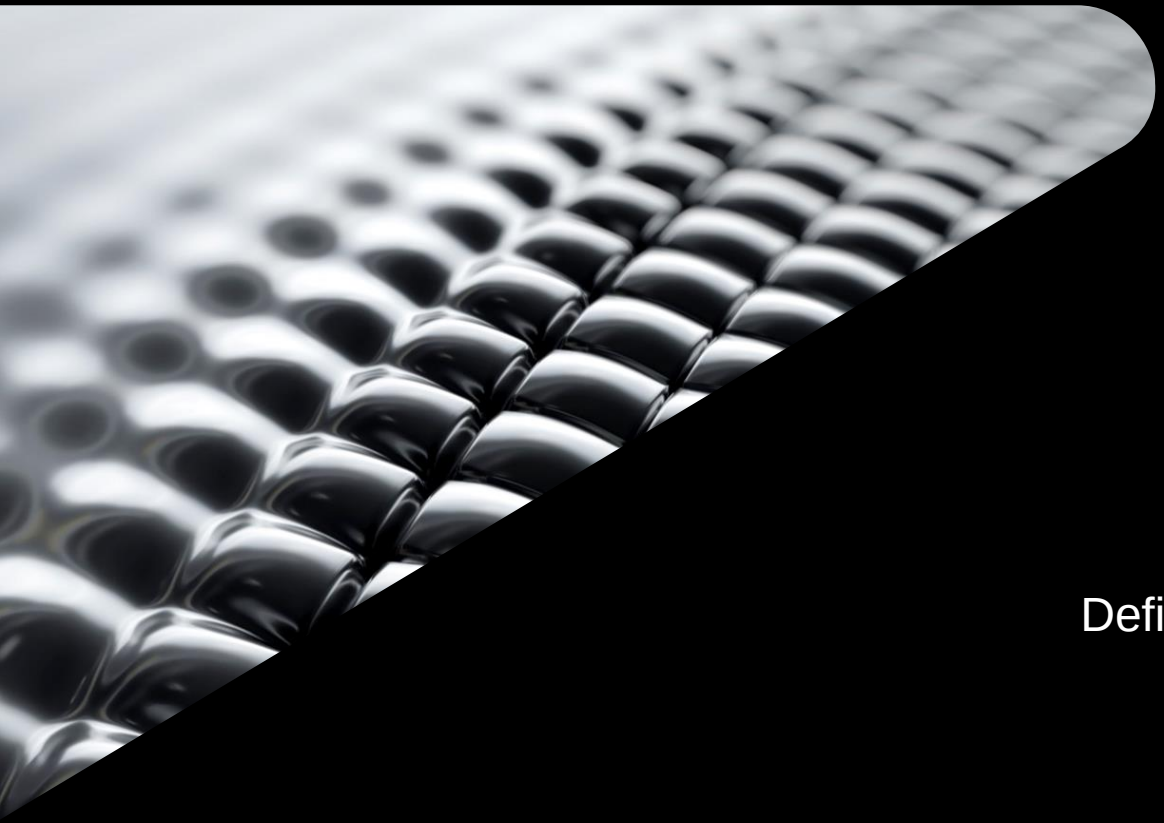
- Grouped Load Density
  - One value covering all lighting, general power and power loads in (W/ft2) and/or VA/ft2)
- Individual Load Density
  - Individual values for lighting, general power and power loads in (W/ft2) and/or VA/ft2)

Steps for Space-by-Space Method

Preliminary Load Calculations

- Divide the building into different spaces based on its function
  - (for example, office, storage, mechanical, and corridor)
- Calculate the gross interior area for each space
- Determine the grouped load density for each space
- Multiply each space's gross interior area by its grouped load density to get the estimated electrical load for the space
- Multiply the total preliminary electrical load for the whole building by the power factor value (=0.8) and a suitable load factor (for future extensions and losses compensations) to get the main service size

Space	Area (sqft)	Load Density Watt/sqft	Estimated lighting Load For Space
Parking Garage / Utilities Areas (Incl. Roof Area)	46,391	0.2	9,278
Shopping Center / Bank	14,701	1.55	22,787
Offices	14,701	1.13	16,612
Total Estimated Lighting load			48,677
Application Of Cos Phi = 0.85			57,267
Application Of Load Level = 70%			81,810
Preliminary lighting load			81.81



Define

Define the Electrical Analytical Load Type Settings

Revit 2023 Electrical Analysis

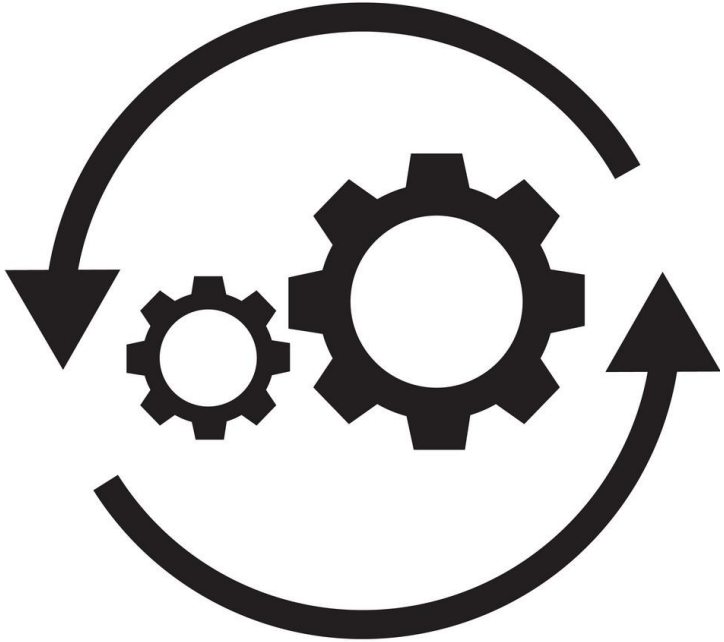
Define

- Provides engineers the ability to analyze and plan the connected load in a Revit model **before** placing physical electrical families
  - Define Equipment Loads
  - Define boundary areas for Area Based Loads
  - Specify Power Density, Load Classification, Power Factor, and Apparent Power Density for Area Based Loads
  - Create an analytical power distribution system with the System Browser
- Electrical Analysis tools work with:
  - Revit model containing a linked architectural model
  - Non-Revit data
    - DWG or PDF
- Currently only support three phase

Workflow

Define

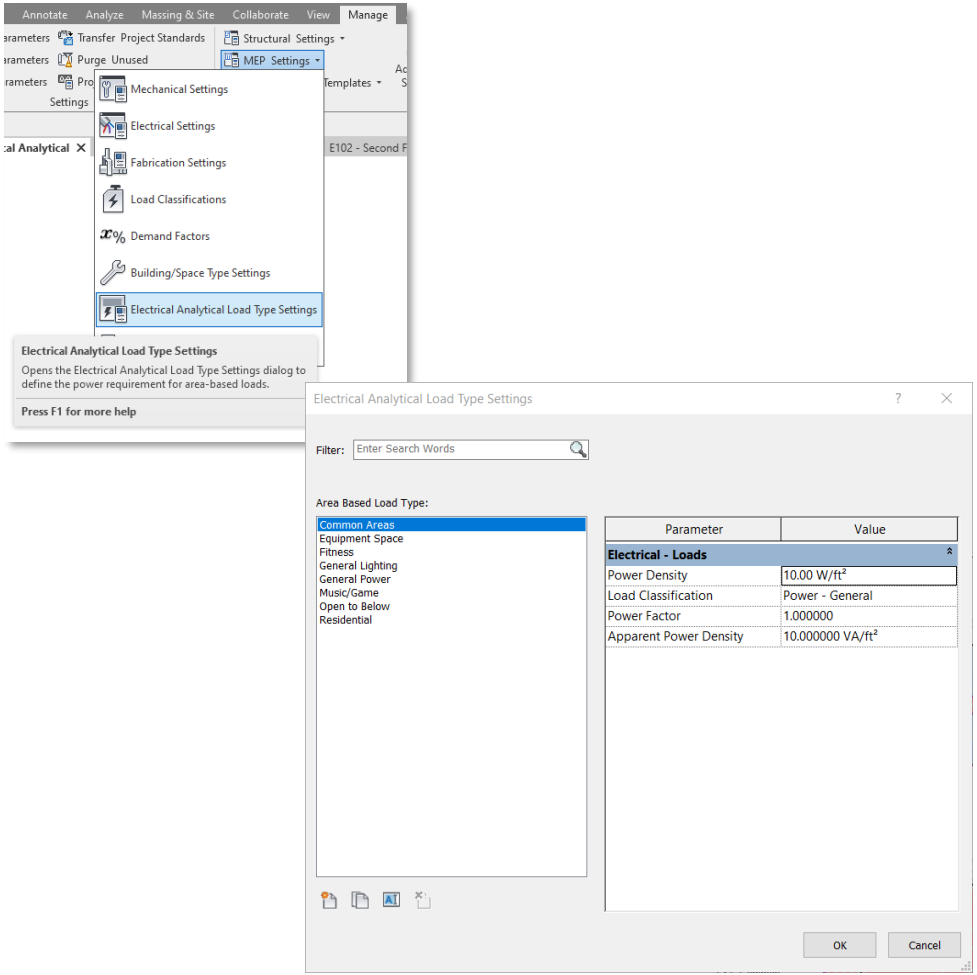
1. *Define* Electrical Analytical Load Type Settings
2. *Create* Electrical Analytical Loads
3. *Apply* the loads to the Conceptual Distribution System
4. *Document* Electrical Load Analysis



Load Type Settings

Define

- Load types can be created, duplicated, renamed, or deleted
- Defines the power requirements for area-based loads
- Area-Based loads are assigned a load type
- Defines the power density, load classification, power factor, and apparent power density



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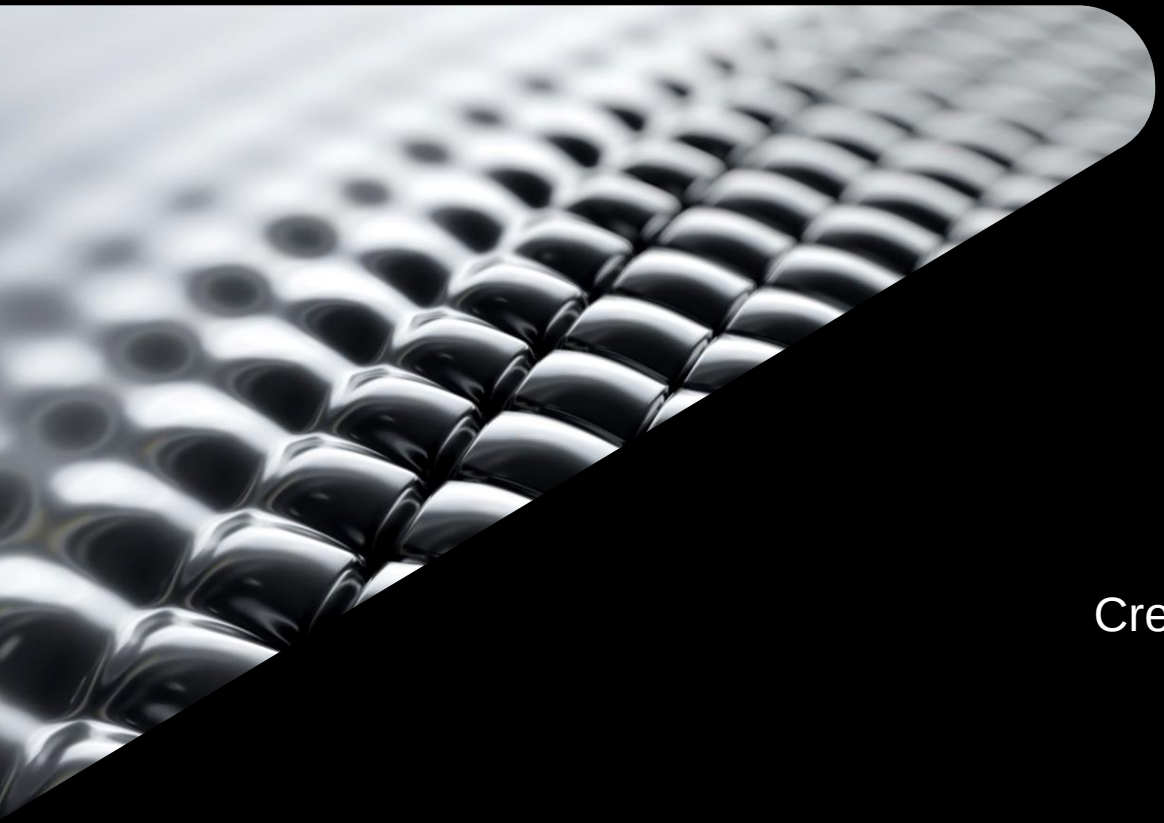
Define Demonstration



Create

Creating Electrical Analytical Loads

Defining Electrical Analytical Loads

Create

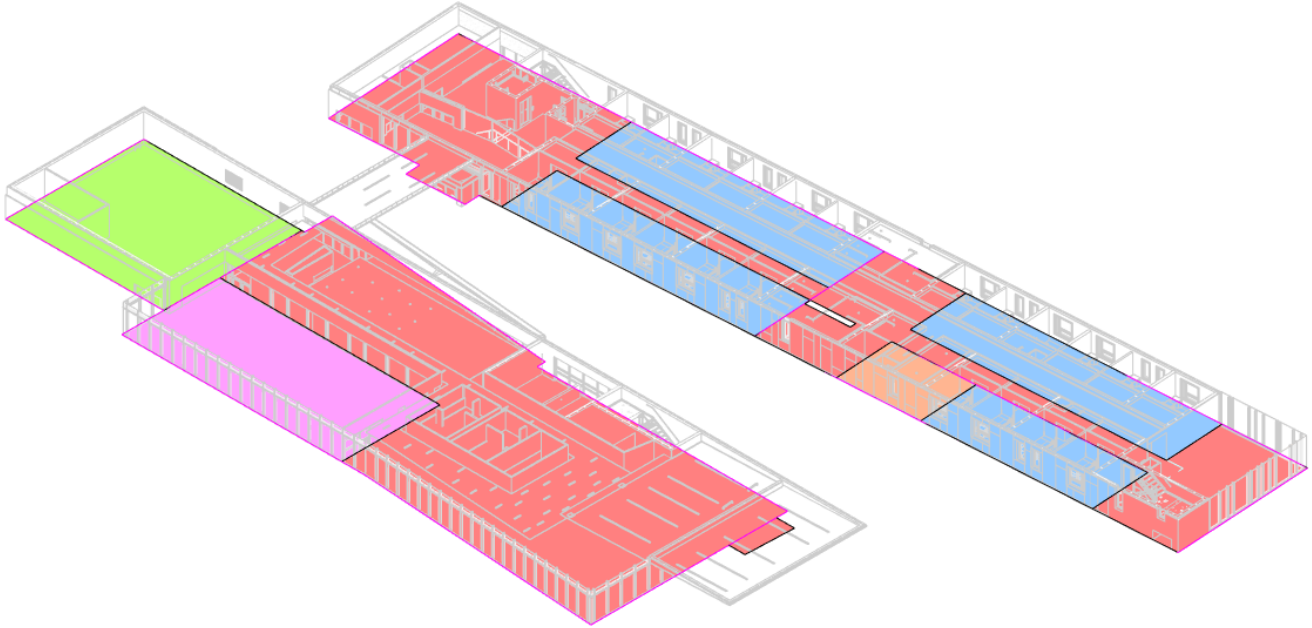
- Loads can be defined with either **Area-Based** loads or **Equipment** loads
- Area-Based loads define a closed region and power requirements are indicated based on Power/Area Density
- Equipment loads are assigned to major components, such as elevators, chillers, or any other component beyond the general power density-based loads
- Both Area-Based Loads and Equipment loads are assigned a power source

Electrical Area Based Loads

Create

Steps to create an Area Based Load

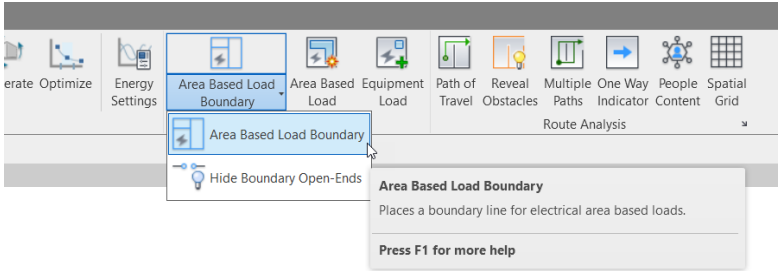
- Create Load Boundary
- Define Loads
- Divide Loads

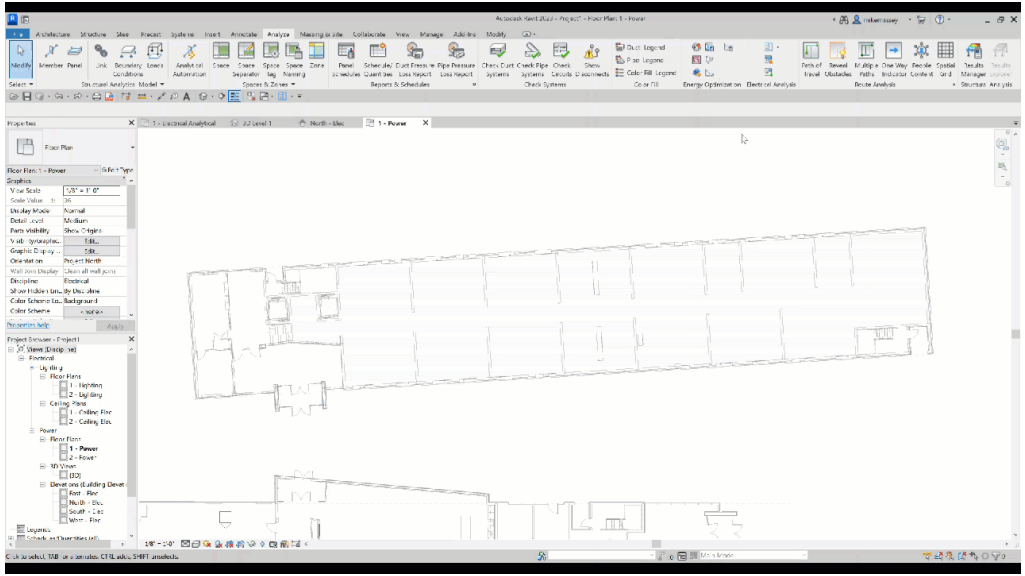


Create Load Boundaries

Create

- Before you can define Electrical Area Based Loads, you must first create a closed region using Area Based Loads Boundaries
- Draw tools are used to sketch a boundary
- Boundary must be completely enclosed by boundaries
- The Show Boundary Open-Ends can be used to identify where boundaries may not be closed
- If the boundary spans multiple levels, the Top Level and Bottom Level can be specified in the Properties palette
- Boundary lines use a specific Line Style that can be customized

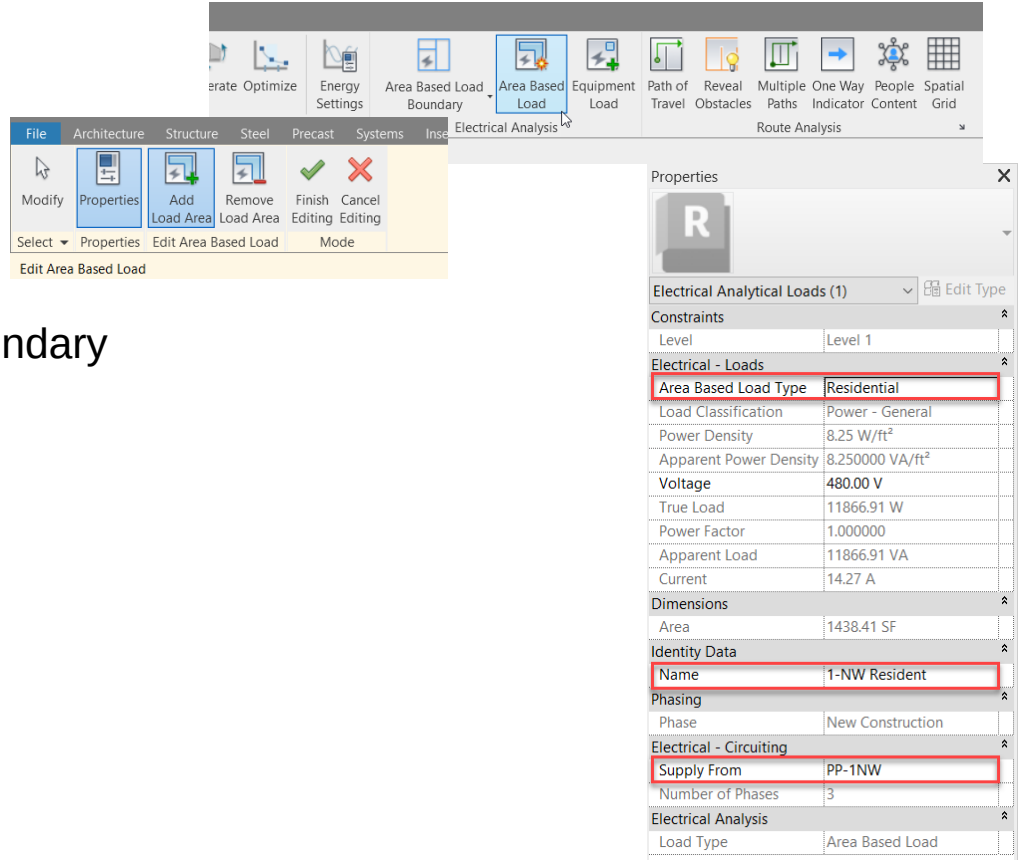




Define an Electrical Area Based Load

Create

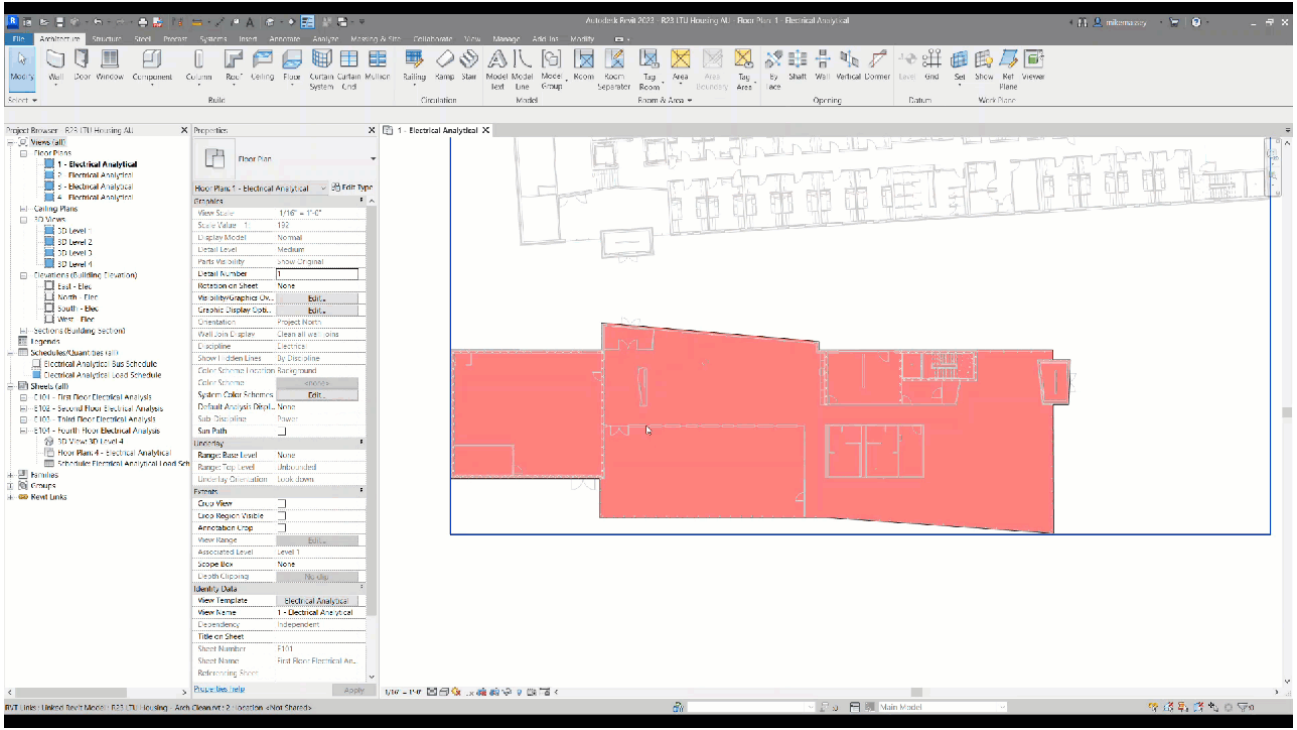
- Use the Area Based Loads tool
  - Adds or Removes Load Areas
- Select the desired enclosed Load Boundary
  - Multiple Load Boundaries can be added
- Define Properties
  - Area Based Load Type
  - Name
  - Supply From



Divide an Electrical Area Based Load

Create

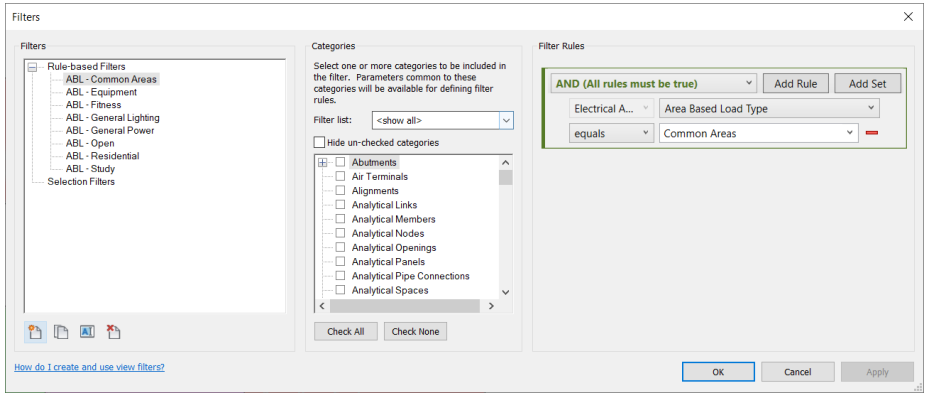
- Area Loads can be divided into smaller loads
  - Create additional boundaries
  - Select load to be divided
  - Select the Divide tool
  - Ensure Move to New is selected
  - Select the new area
  - Click Finish Dividing

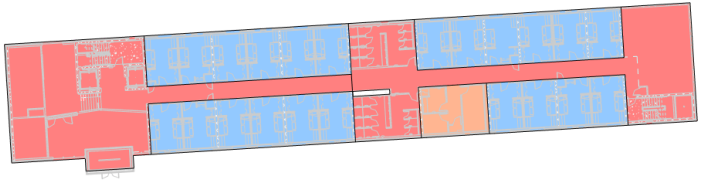


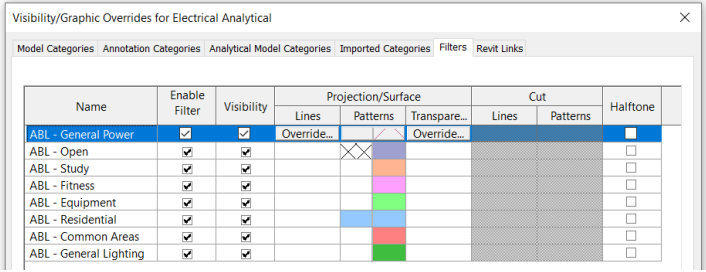
Filters

Create

- It is recommended to create filters to allow color fills to be applied to Area Base Load Types
- Helps to visually see the different areas
- Create a filter for each Area Base Load Types
- Apply filters to Views or View Templates







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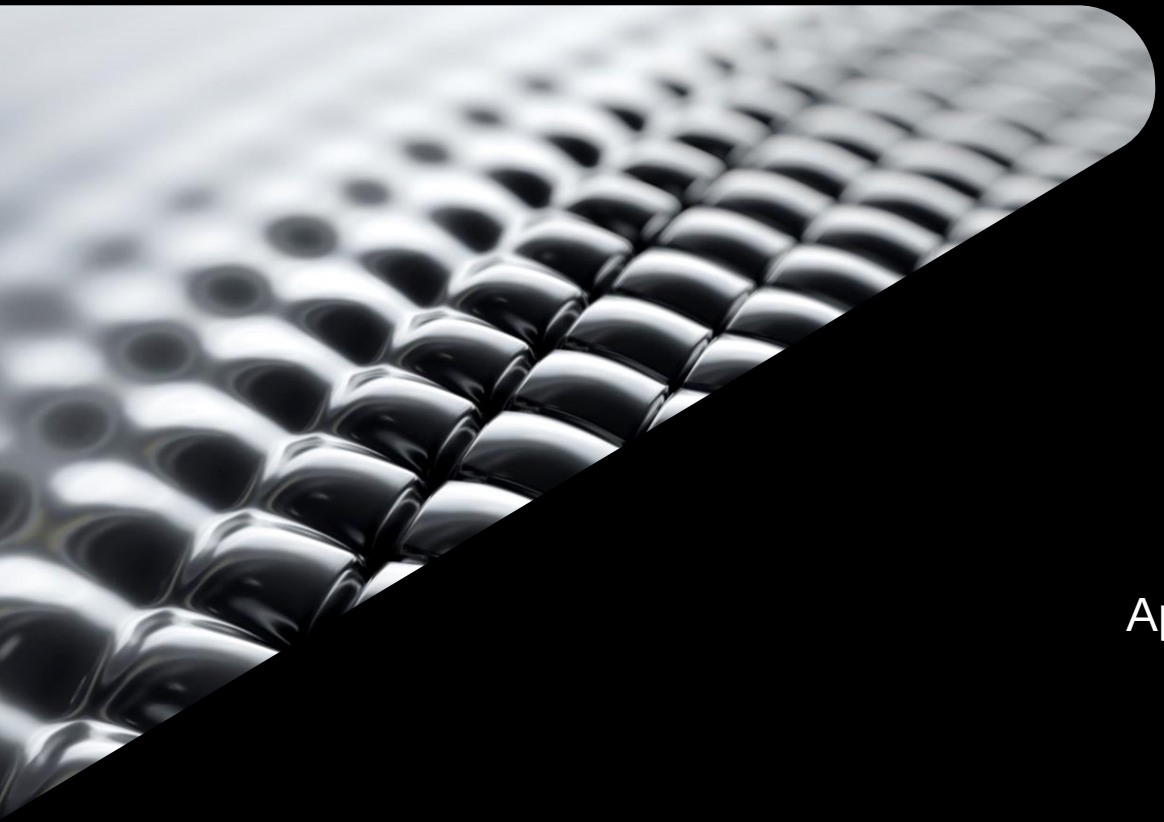
Create Demonstration



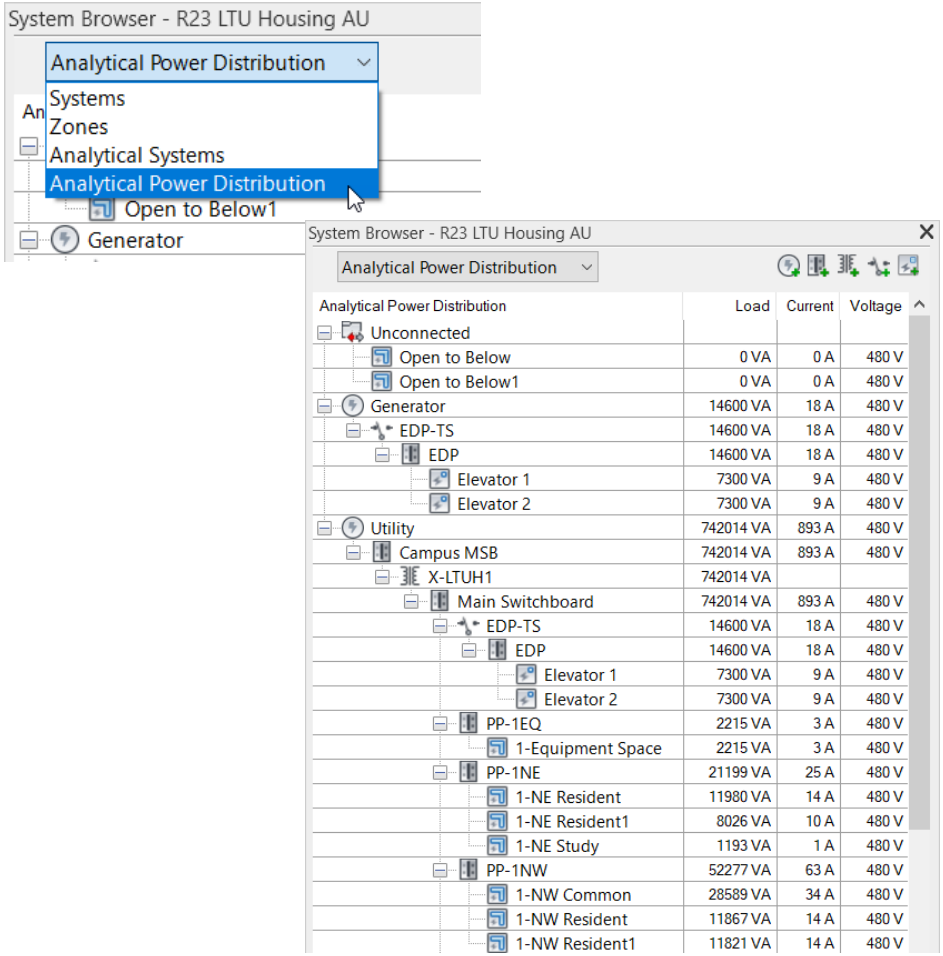
Apply

Apply the loads to the Conceptual Distribution System

The System Browser

Apply

- Displays the hierarchy of the analytical distribution system and electrical elements
- Used to add and connect electrical distribution elements



Creating the Conceptual Distribution System

Apply

- Electrical Analytical Power Source

  (*Utility or Generators*)

- Electrical Analytical Bus

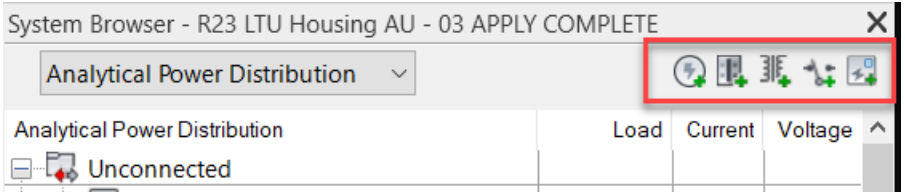
  (*Panel, Switchboard, Busway, Motor Control Center)*

- Electrical Analytical Transformer

- Electrical Analytical Transfer Switch

  (*Has two power sources*)

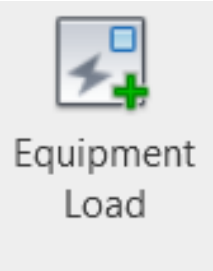
- Electrical Equipment Load

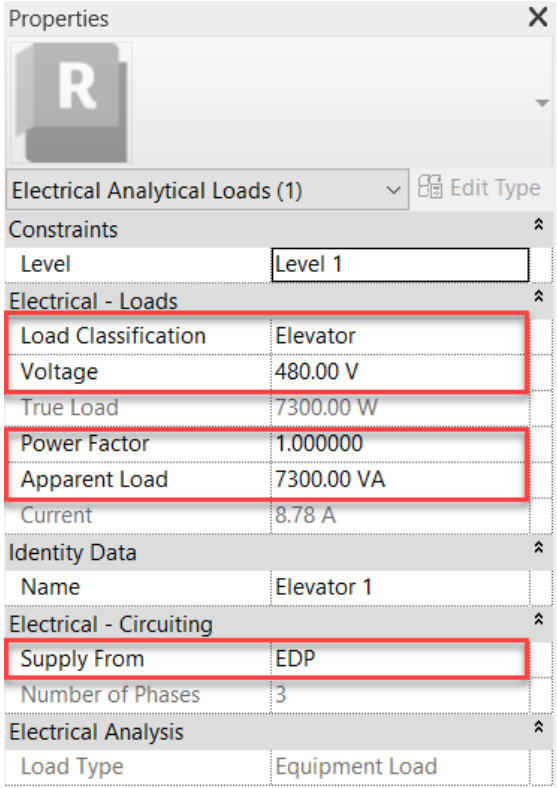


Adding Equipment Based Loads

Apply

- Equipment Loads can be added for specific loads, such as a chiller, elevators, or other equipment
- Assign Properties of Equipment Loads
  - Load Classification
  - Voltage,
  - Power Factor
  - Apparent Load
- Assign the Supply From parameter

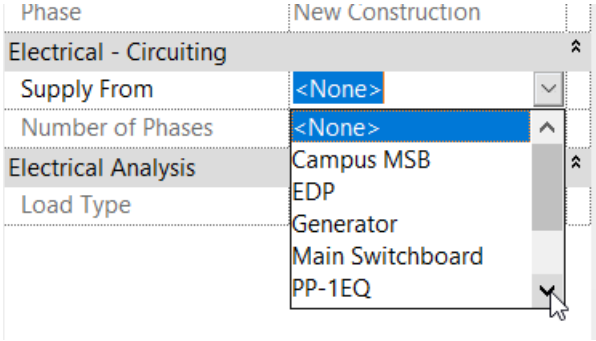


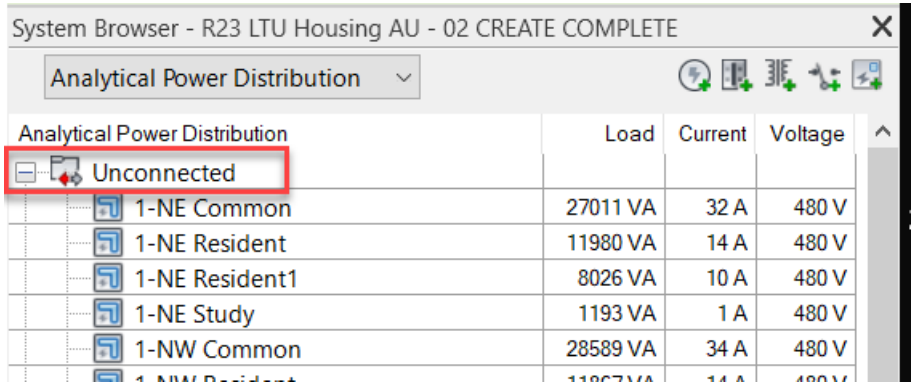


Assigning Area Based Loads Supply

Apply

- Area Based Loads are initially under Unconnected
- The Supply From parameter must be assigned to a power source
- Loads are automatically updated as the power source is provided





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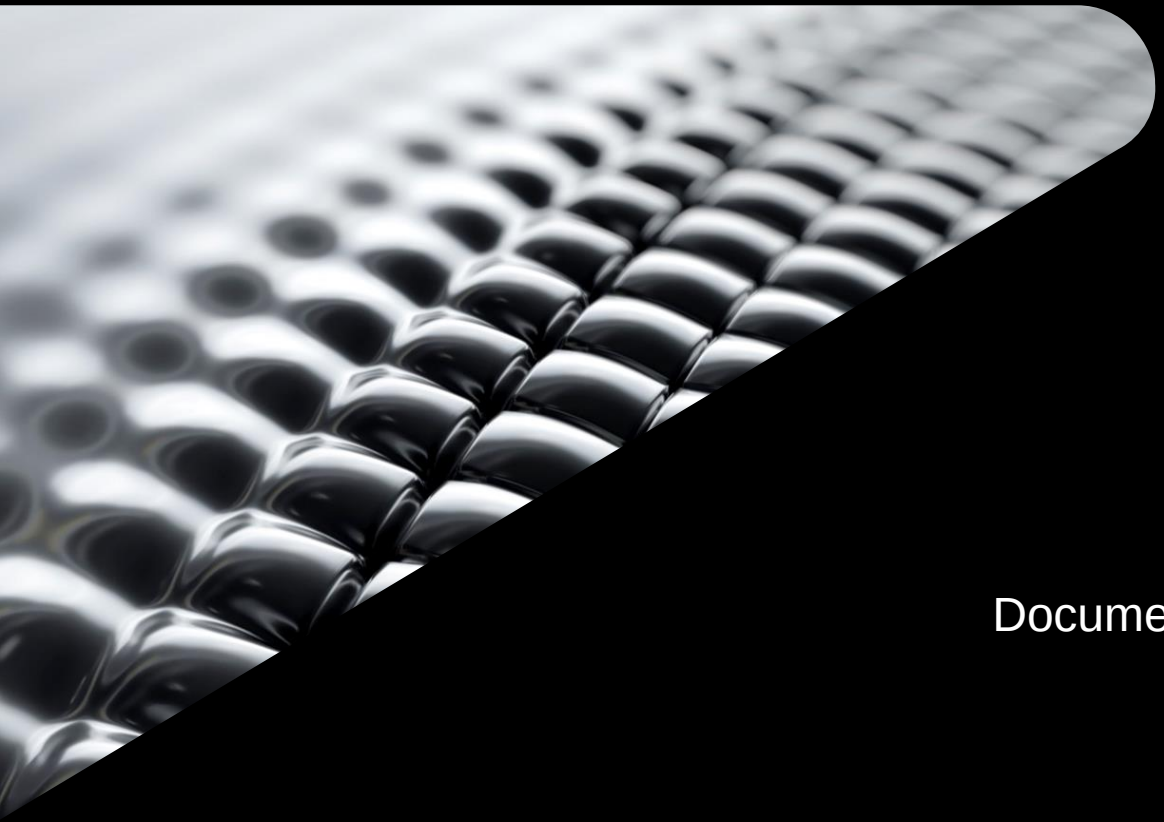
Apply Demonstration



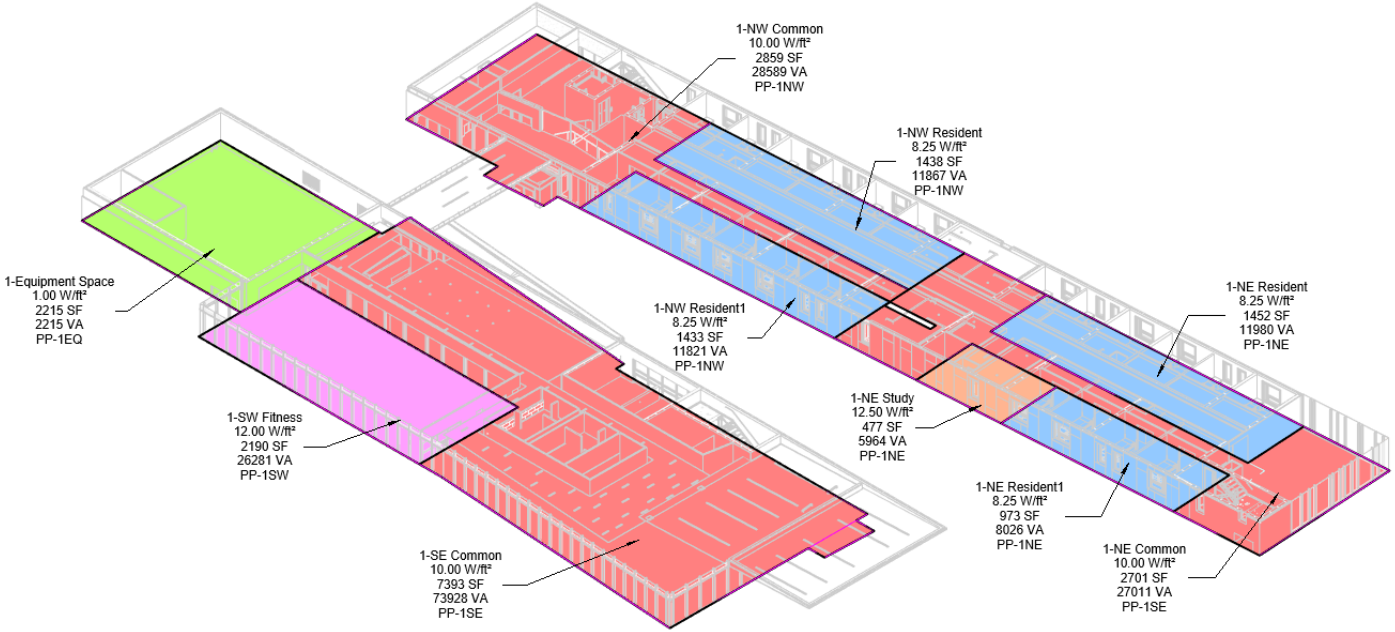
Document

Documenting Electrical Analytical Loads

Tagging

Document

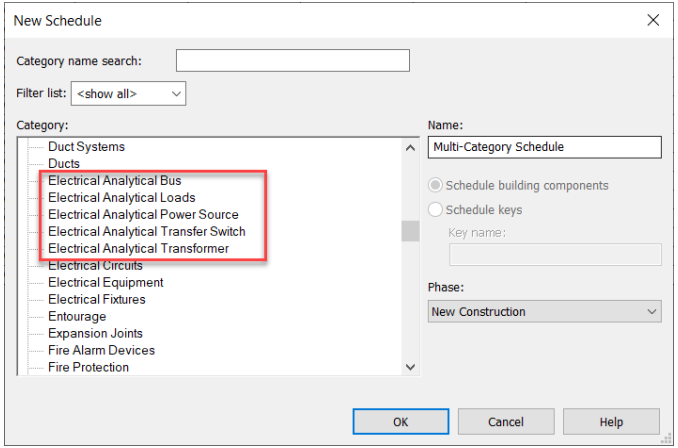
- Area Based Loads can be annotated with Tags
- New Family Category for Area Based Load Tags



Schedules

Document

- New Analytical Schedule Categories are available
- Analytical Load Schedules can be totaled per level, per source, or per project



Electrical Analytical Load Schedule

Name	Supply From	Area Based Load Type	Power Density	Power Factor	Area	Apparent Load	Voltage	Number of Phases	Current
Level 1									
1-Equipment Space	PP-1EQ	Equipment Space	1.00 W/ft²	1	2215 SF	2215 VA	480 V	3	3 A
1-NE Resident	PP-1NE	Residential	8.25 W/ft²	1	1452 SF	11980 VA	480 V		
1-NE Resident1	PP-1NE	Residential	8.25 W/ft²	1	973 SF	8026 VA	480 V		
1-NE Study	PP-1NE	Music/Game	12.50 W/ft²	1	477 SF	5964 VA	480 V		
1-NW Common	PP-1NW	Common Areas	10.00 W/ft²	1	2859 SF	28589 VA	480 V		
1-NW Resident	PP-1NW	Residential	8.25 W/ft²	1	1438 SF	11867 VA	480 V		
1-NW Resident1	PP-1NW	Residential	8.25 W/ft²	1	1433 SF	11821 VA	480 V		
1-NE Common	PP-1SE	Common Areas	10.00 W/ft²	1	2701 SF	27011 VA	480 V		
1-SE Common	PP-1SE	Common Areas	10.00 W/ft²	1	7393 SF	73928 VA	480 V	3	89 A
1-SW Fitness	PP-1SW	Fitness	12.00 W/ft²	1	2190 SF	26281 VA	480 V	3	32 A
Grand total: 10					23131 SF	207682 VA			250 A

<Electrical Analytical Power Source Schedule>

A	B	C	D	E
Name	Number of Phases	Total Connected	Total Connected Cu	Voltage
Generator	3	14600 VA	18 A	480 V
Utility	3	742014 VA	893 A	480 V
		756614 VA	910 A	

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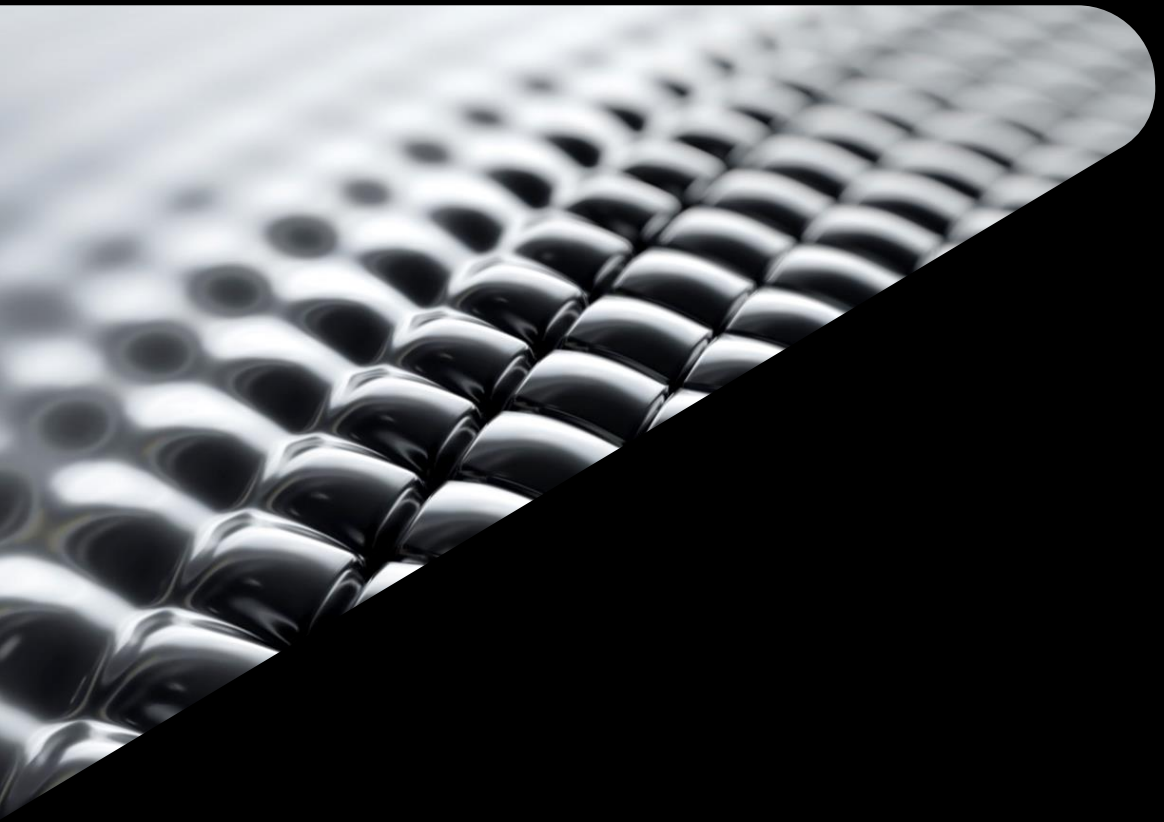
Document Demonstration

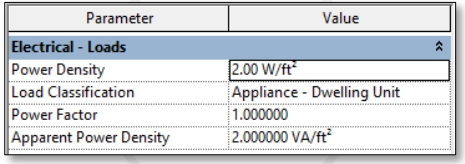


Wrap Up

Closing Comments & Questions

Creating an Electrical Analytical Model in Revit 2023

Electrical Analysis for Preliminary Design



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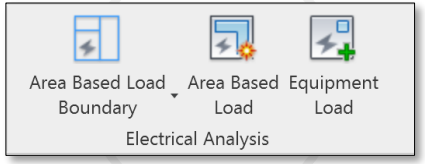
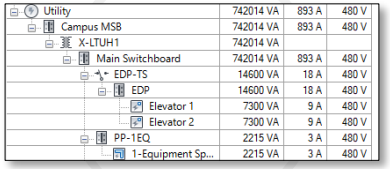
Define the Electrical Analytical Load Type Settings



Create

Create Electrical Analytical Loads



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Main Switchboard	742014 VA	893 A	480 V
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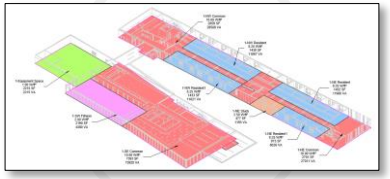
Apply

Apply the loads to the Conceptual Distribution System



Document

Documenting Electrical Analytical Loads

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Thank you!

Michael Massey

mike.massey@caddmicrosystems.com

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