Putting Intelligence in Electrical Cable and Conduits

Michael Massey

Senior AEC Application Consultant

@mgmassey01

Presenting Today…..

Applied Software®

- Mike Massey
- William Spier
- Roy Labourdette

Southwire®

- Clay Smith
- Jerry Nestler
- Glen Decker
- Johnny Sellers

About You

- Who is in the audience?
  - Electrical Engineers
    - Commercial
    - Industrial
  - Electrical Contractors
    - Commercial
    - Industrial
  - Revit Users
  - AutoCAD Users
- Why did you come to this class?

Thanks for spending your valuable time with us today!

Door Prize

A free LiveLab Learning® class of your choice

Enter for an additional chance to win a free LiveLab Learning® class of your choice by going to:

www.asti.com/au2015

Class summary

Developing a construction workflow for electrical systems in Revit software can be time consuming and inaccurate. This session will explore new tools to assist in electrical cable routing, cable selection, and construction management. You can extract intelligent data from the design model and use it to calculate exact requirements and bill of material for electrical systems. This session will also show you new tools to assist creating pull tickets, cable inventory, and installation status. Come see how electrical contractors can finally begin to use the intelligence that is built into the design model.

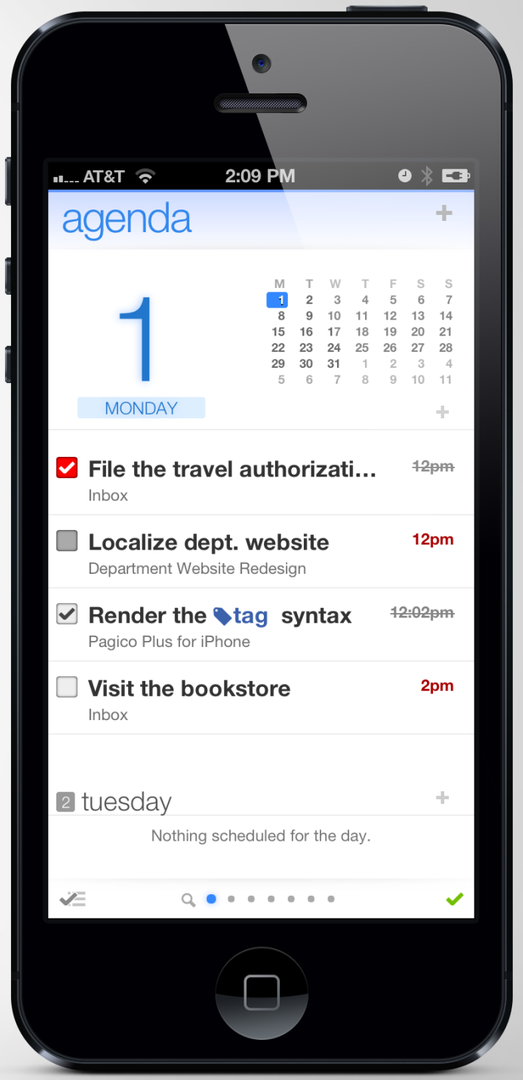
Key learning objectives

At the end of this class, you will be familiar with the processes:

- Of calculating a bill of material based on exact raceway lengths
- Of creating installation tickets and tracking progress & inventory
- Of routing cable automatically using the 3D Geometry of the model designed
- Of streamlining the cable selection process using the tools provided

Agenda

- Introductions
- Current Workflow
- The Gap in the Autodesk™ Offerings
- The Process
  - Routing Conduit, Tray and Cables
  - Annotation and Callouts
  - Parallel Platform Communication
- Planning for Installation
- Installation
- Status Reports
- Hot Off the Press
- Wrap Up



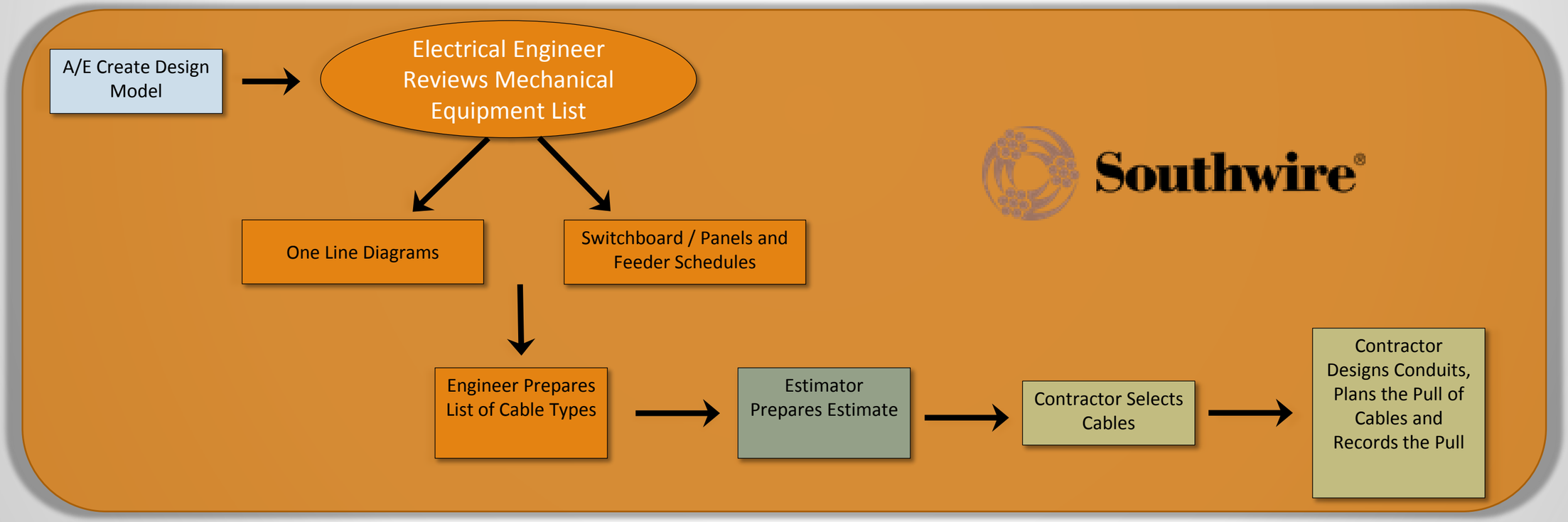
Current Workflow

Southwire®

SIMpull SOLUTIONS®

Engineering Workflow

- Typical Workflow For Coordination Of A Project Between Engineer And Contractor



Benefit For Project Team

Owner

Are you tired of:

- Late information and surprises
- Managing the change process
- Project delays and their cost impact
- Inaccurate and incomplete as-builts

Benefit For Project Team

Engineer

Are you tired of :

- Inputting data over and over in multiple places
- Reworking cable sizing calculations over and over
- Constantly revising breaker sizes and trip settings
- Constantly revising your estimate as inputs change
- Manually creating your load and panel schedules
- Inaccurate estimates
- Losing data when converting to other CAD platforms
- Hunting for product specifications and cable cut sheets

Benefit For Project Team

Contractor

Are you tired of:

- Flipping through endless versions of PDF Drawings
- Manually creating your feeder schedule from multiple data sources
- Constantly updating your Bill of Materials because of changes
- Inaccurate Bill of Materials without product codes
- Manually performing voltage drop, ampacity, and pulling tensions/ sidewall pressure/ raceway fill
- Manually creating estimates over and over as the design changes
- Always being behind schedule

Benefit For Project Team

CAD Designer

Are you tired of:

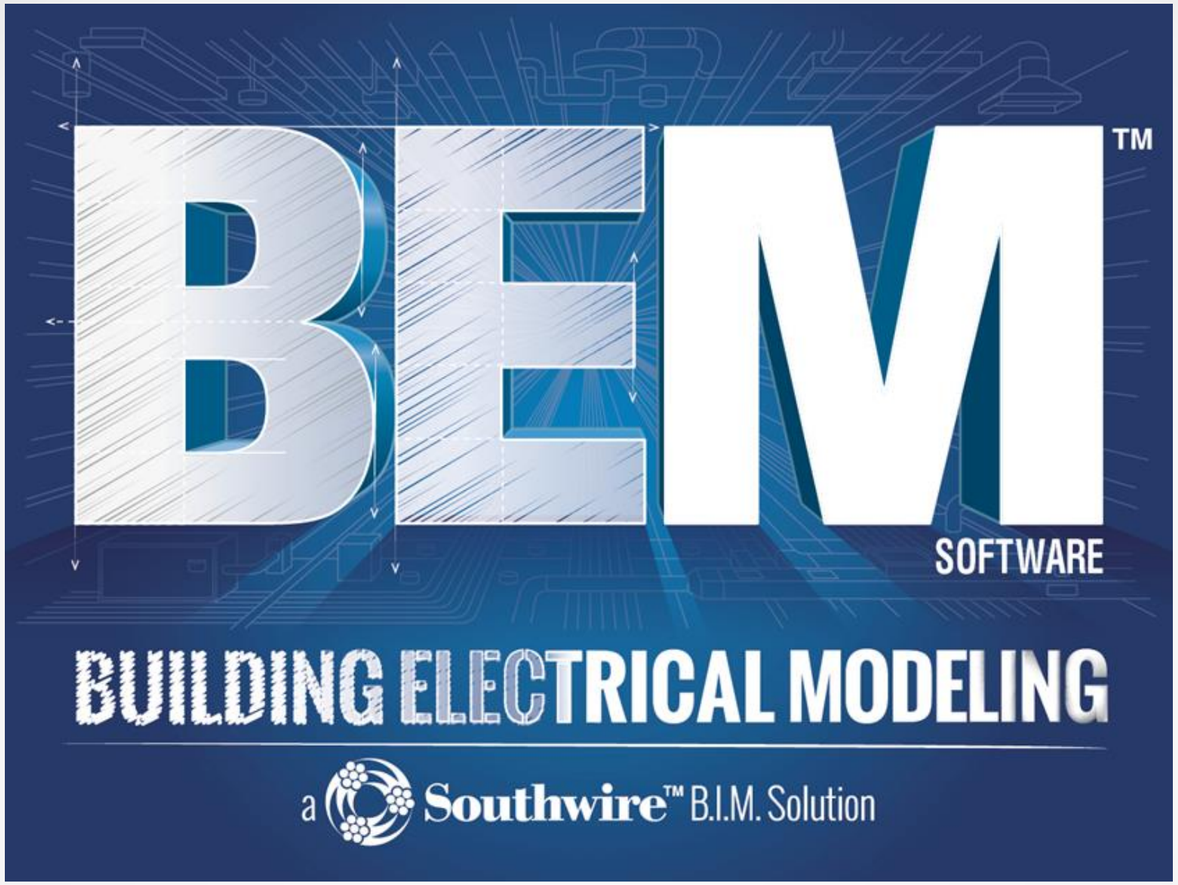
- Not being able to leverage electrical design data in your Revit model
- Not being able to leverage automation tools in your Revit model
- Manually entering the engineer's design data into your installation drawings
- Having no way of extracting cable lengths from your model
- Manually tracking engineer design changes as they affect your field drawings

Benefit For Project Team

Field Guy

Are you tired of:

- Planning and performing work based on old information
- Slow communication involving feeder design
- Manually conducting your pull planning
- Manually configuring your stacked and paralleled wire reels
- Manually performing pull calculations
- Not being able to accurately track progress
- Manually managing your inventory to determine work schedule



BEM's CARS (Cable and Raceway System):

The Link Between Revit and AutoCAD for Automated Electrical Engineering, Design, and Construction

The Gap in the Autodesk™ Offerings

The Gap In The Autodesk™ Offerings

- AutoCAD Electrical™
- Fabrication CADmep™
- AutoCAD MEP™
- Revit MEP™

The Gap In The Autodesk™ Offerings

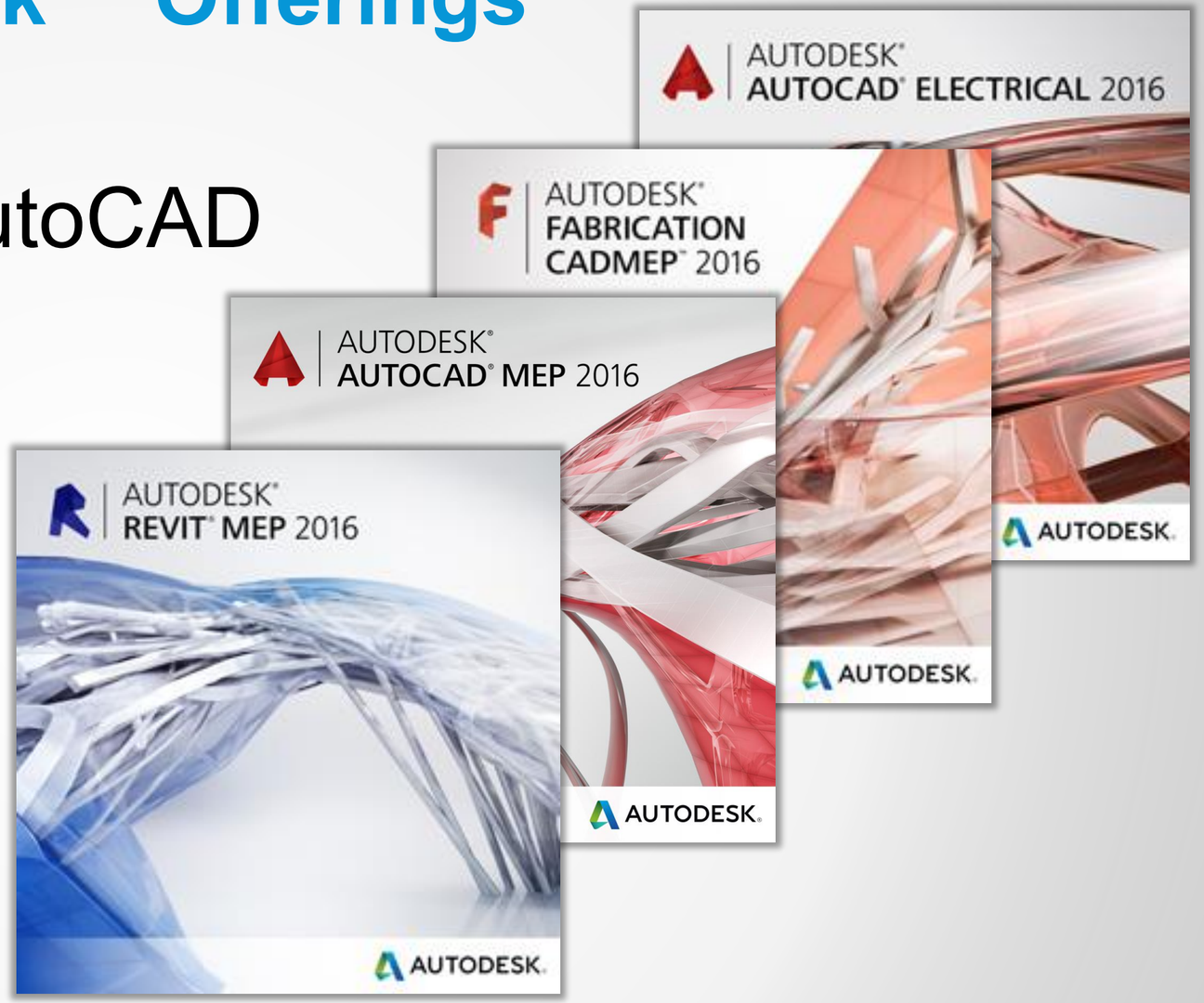
- AutoCAD Electrical™
  - By and large a low voltage solution for PLC design, terminal design, panels design, etc. for manufacturing. I.e. does not play in the commercial or industrial power & lighting transmission design arena that ACAD MEP™ or Revit MEP™ plays in.

The Gap In The Autodesk™ Offerings

- Fabrication CADmep™
  - ITM content development
  - Strictly a fabrication only tool – no voltage calcs, sizing, etc.

The Gap In The Autodesk™ Offerings

- Both Revit MEP™ & AutoCAD MEP™
  - Load coordination – layout panels, transformers & equip (lights, motors, receptacles, etc.) and track loads (a.k.a. demand) and de-rate all of those loads.
  - Geometric coordination – layout all conduit & cable tray
  - Schedules and panel schedules



The Gap In The Autodesk™ Offerings

- AutoCAD MEP™ only:
  - Discrete stick lengths – Revit™ any straight segment is one piece.
  - Can be customized to do about anything you want, even conduit sizing, but is not that way OOTB.

The Gap In The Autodesk™ Offerings

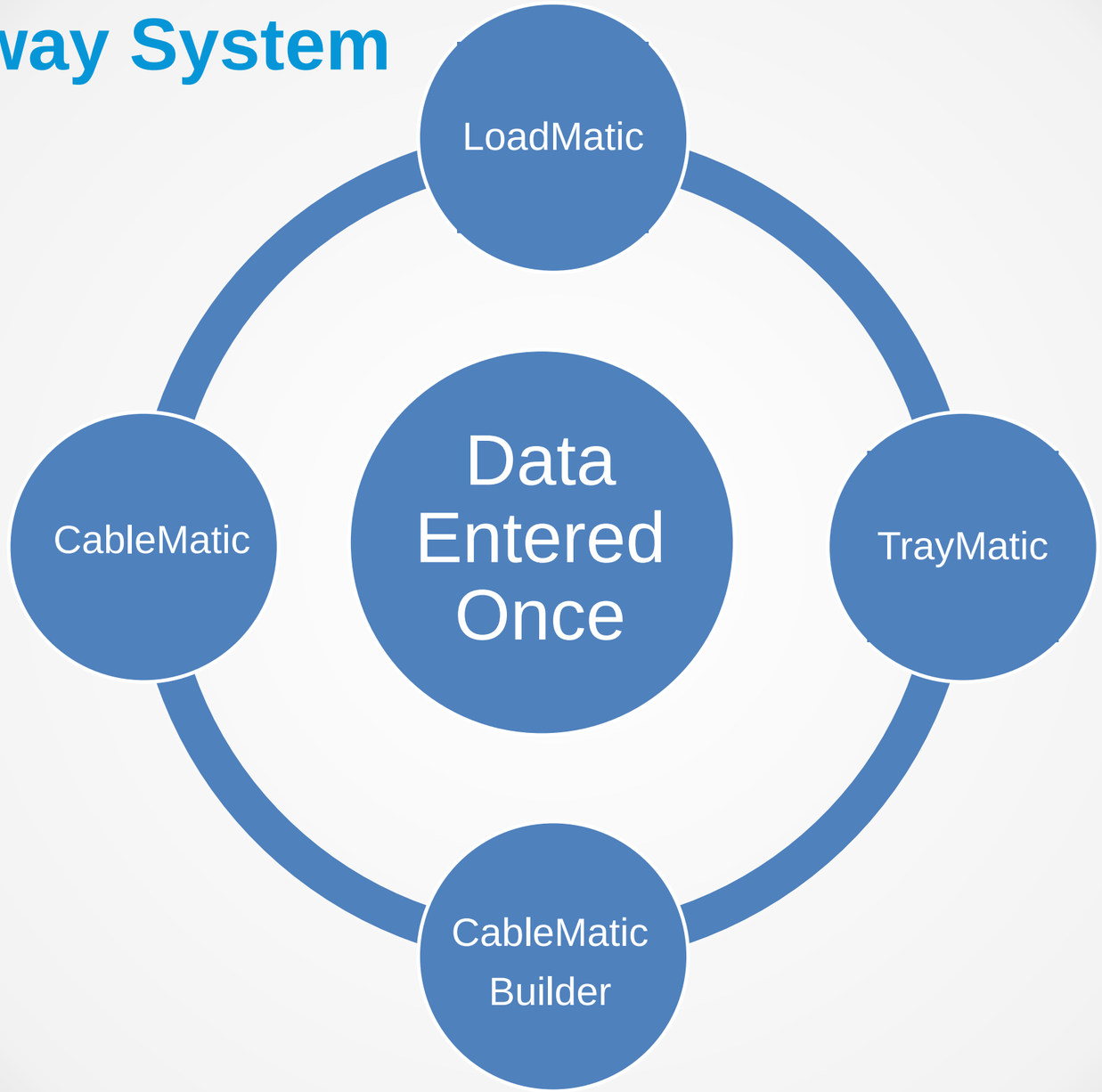
- Revit MEP™ only:
  - The regular stuff: real time updating, easy custom schedule building, interdisciplinary coord., metadata rich environment
  - Wiring: Revit 2016™ is catching up a little bit. See – About Load Calcs, Wiring, About Wire Sizing, and Electrical Settings. But no wire size.
  - Voltage drop: VD=(L*R*I)/1000

The Gap In The Autodesk™ Offerings

- Revit MEP™ only:
  - Voltage drop: VD=(L*I*R)/1000 Hot
  - Wire sizes auto sized to maintain a voltage drop of < 3%for branch, and < 2% for feeder circuit conductors, but only for furthest outlet in parallel & perp. runs. Overall a general, fairly inaccurate calc – not the way most calculate voltage drop. So by and large, no one uses wire sizes RME spits out.

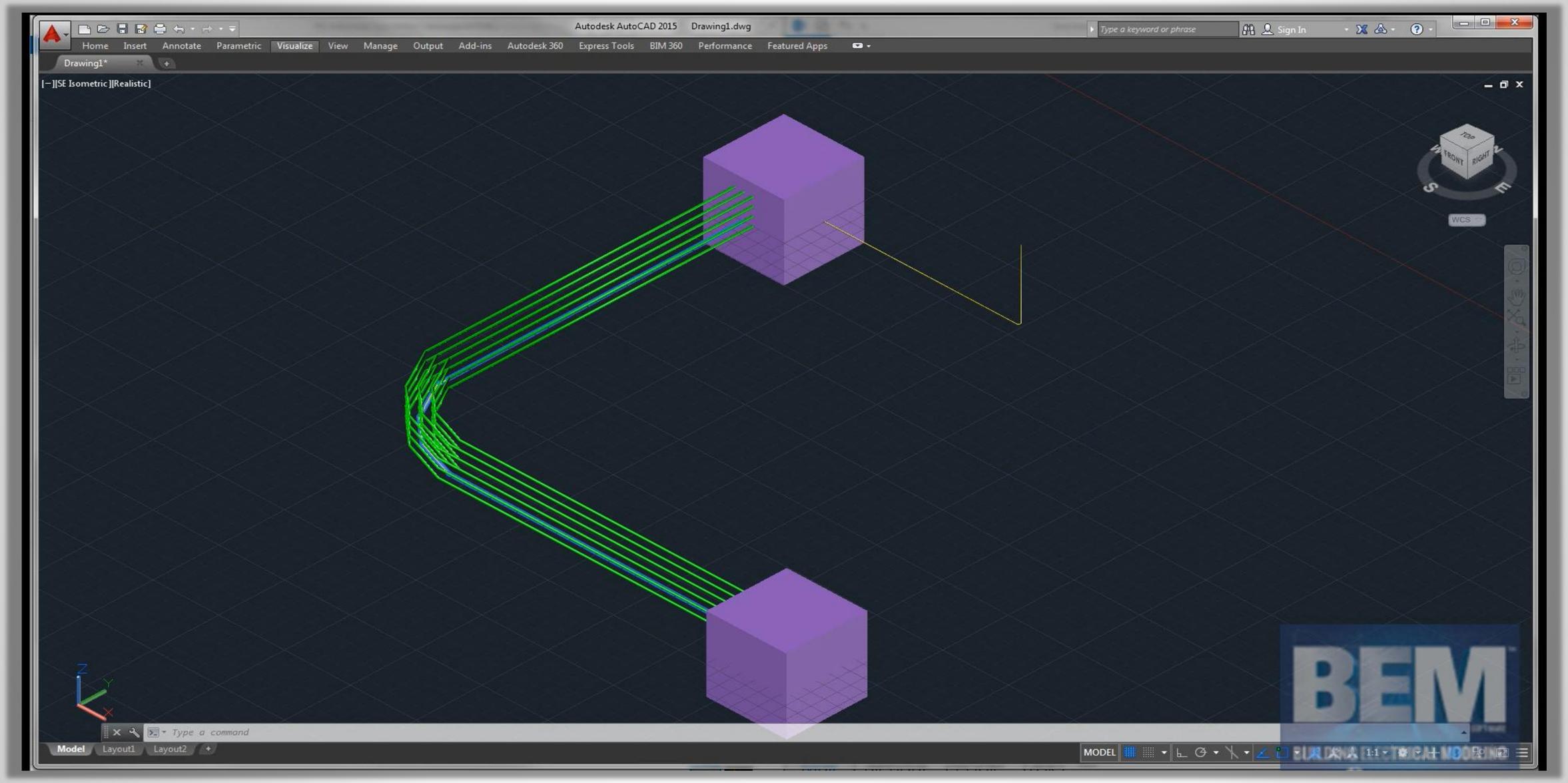
Cable and Raceway System (CARS)

CARS
Cable and Raceway System

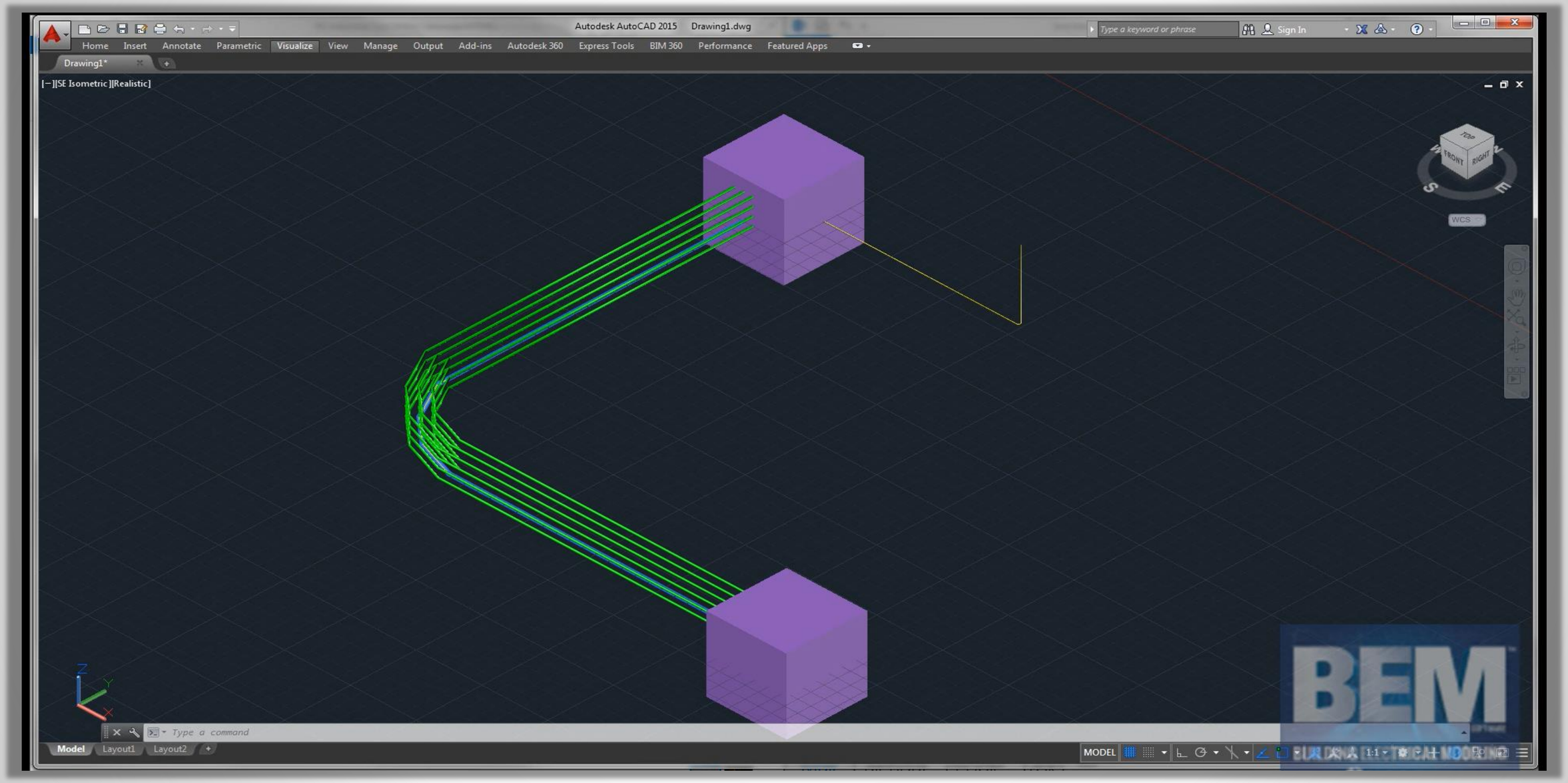


The Process

CARS™

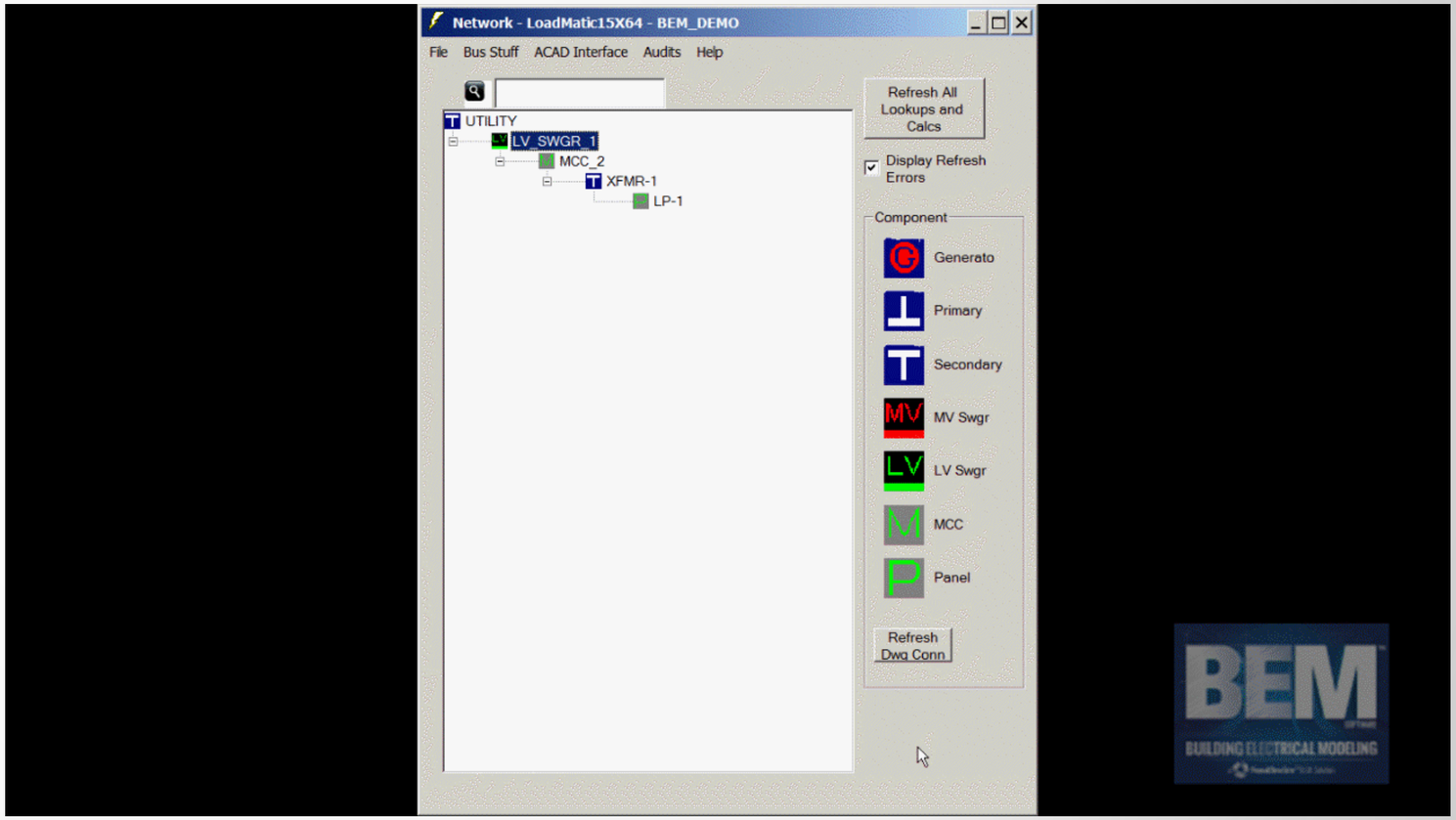

Autodesk AutoCAD 2015
Drawing1.dwg
Home
Insert
Annotate
Parametric
Visualize
View
Manage
Output
Add-ins
Autodesk 360
Express Tools
BIM 360
Performance
Featured Apps
Drawing1*
[−][SE Isometric][Realistic]
TOP
FRONT
RIGHT
WCS
Type a command
Model
Layout1
Layout2
MODEL
BEM

CARS™


Autodesk AutoCAD 2015
Drawing1.dwg
Home
Insert
Annotate
Parametric
Visualize
View
Manage
Output
Add-ins
Autodesk 360
Express Tools
BIM 360
Performance
Featured Apps
Drawing1*
[−][SE Isometric][Realistic]
TOP
FRONT
RIGHT
WCS
Type a command
Model
Layout1
Layout2
MODEL
BEM

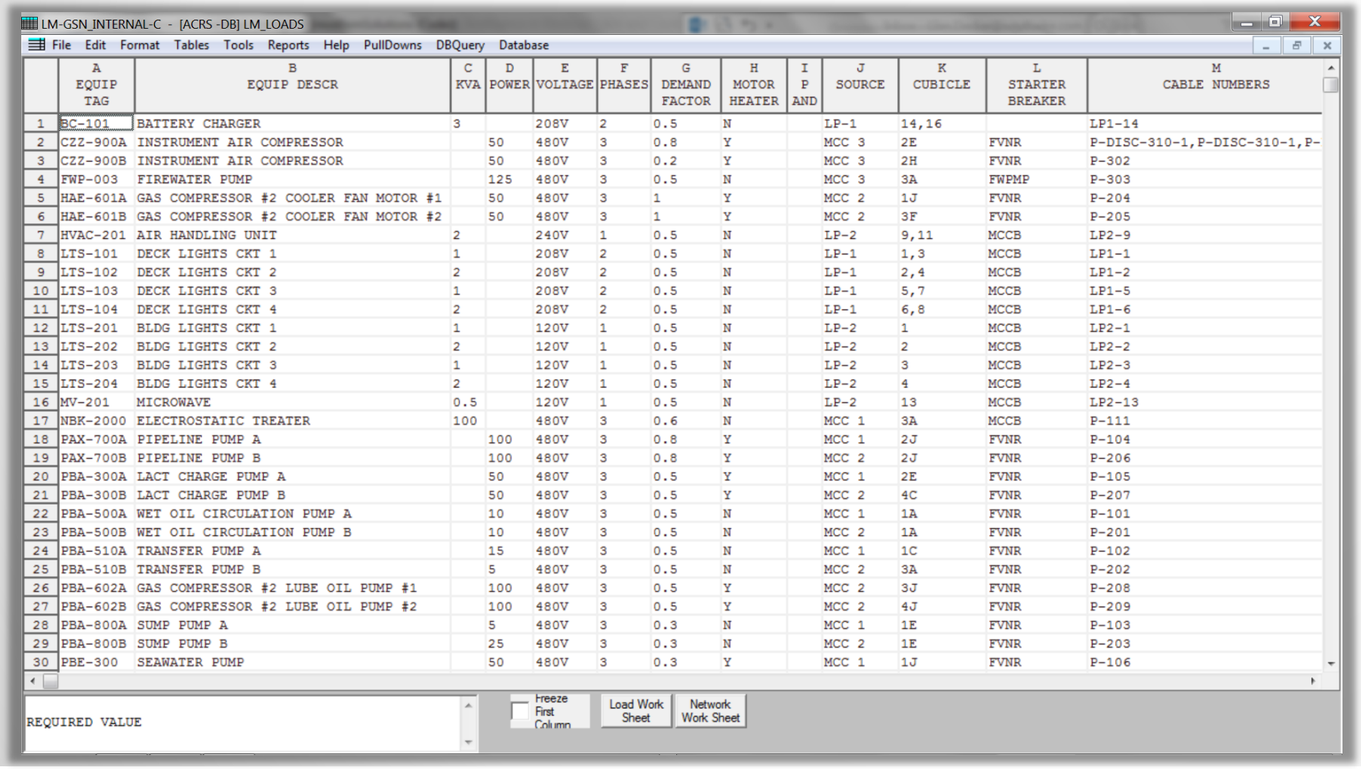
Entering The Network Information

- A Simple Drag And Drop Interface
- Creates The Bus Network's Hierarchy
- Showing The Source And Destination Equipment For Each Cable

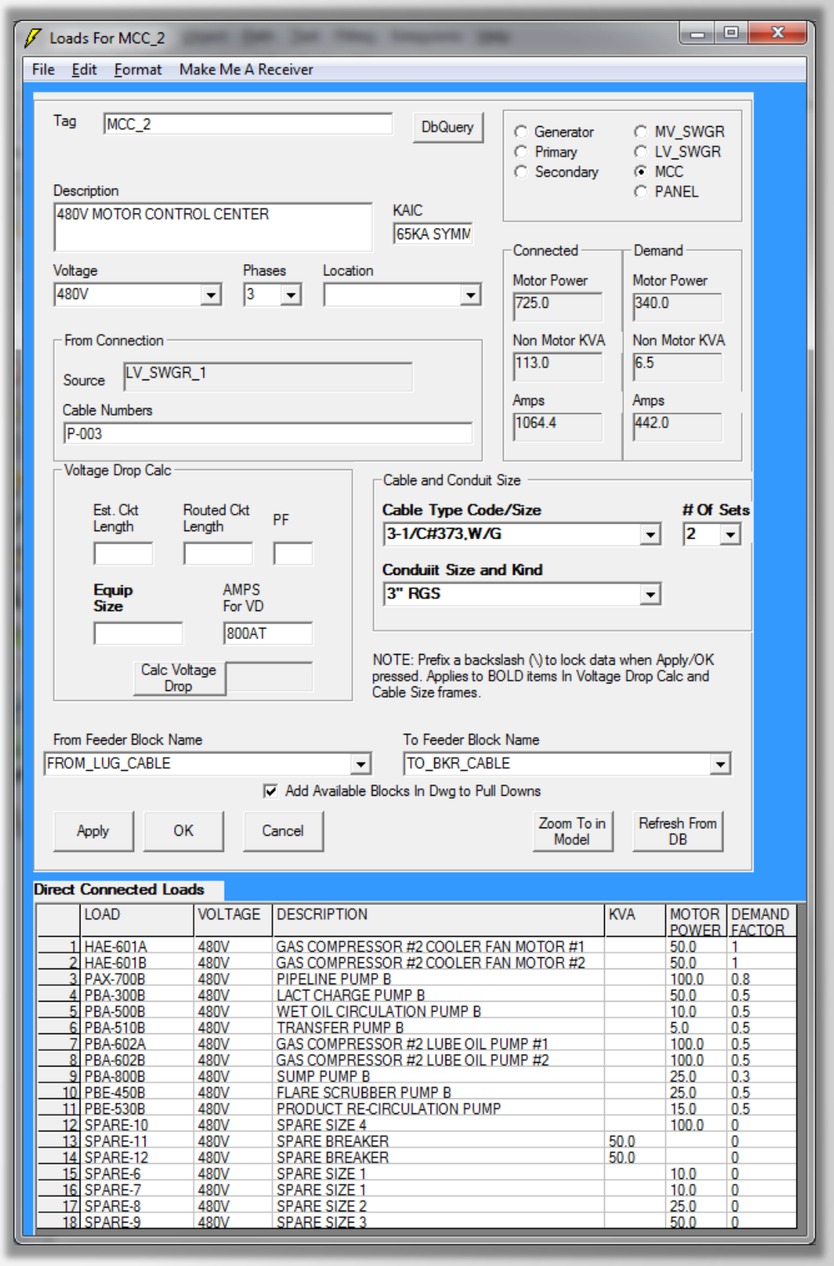


Entering the Information

- Assigned by:
  - Spread Sheet
  - Through the Property Window



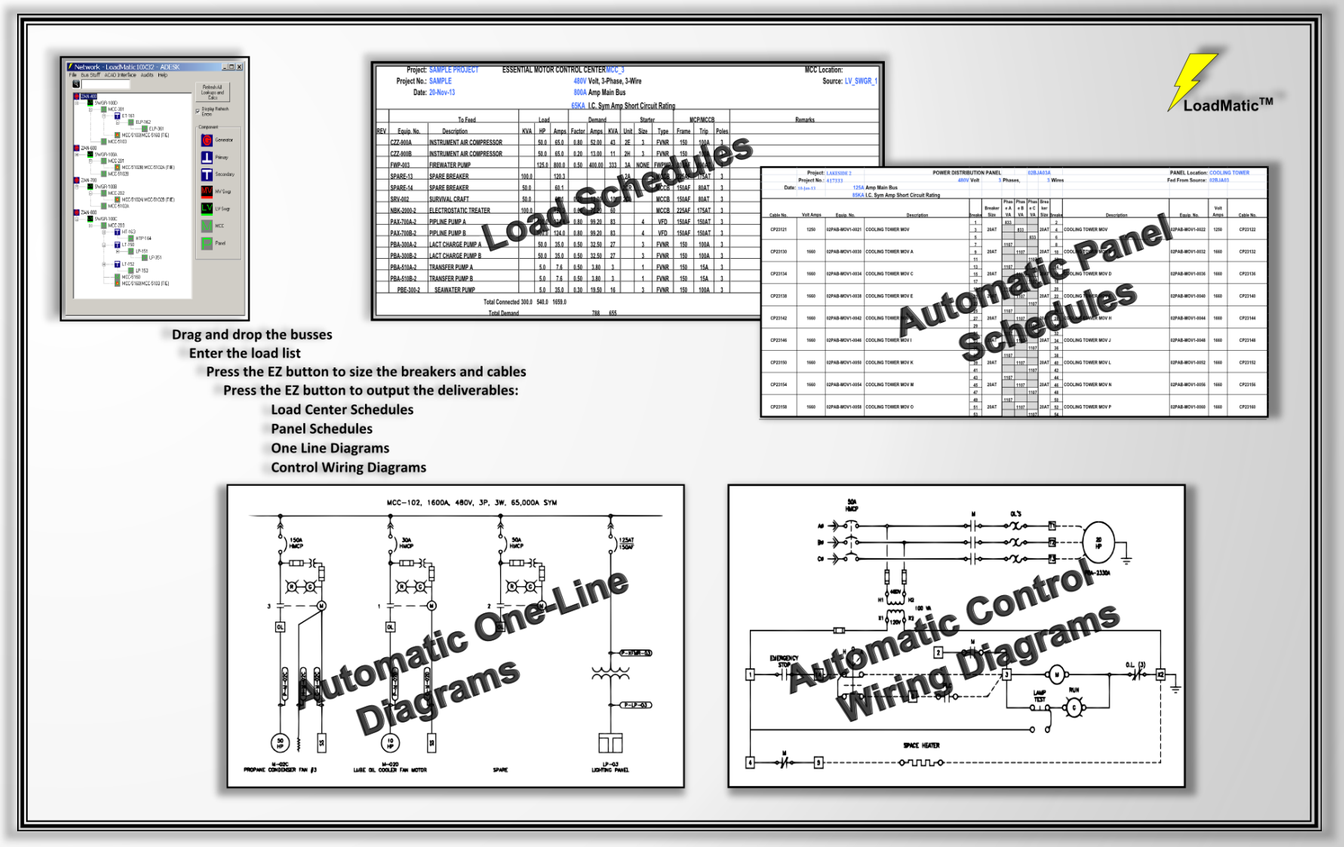
	A EQUIP TAG	B EQUIP DESCR	C KVA	D POWER	E VOLTAGE	F PHASES	G DEMAND FACTOR	H MOTOR HEATER	I P AND	J SOURCE	K CUBICLE	L STARTER BREAKER	M CABLE NUMBERS
1	BC-101	BATTERY CHARGER	3		208V	2	0.5	N		LP-1	14,16		LP1-14
2	CZZ-900A	INSTRUMENT AIR COMPRESSOR		50	480V	3	0.8	Y		MCC 3	2E	FVNR	P-DISC-310-1,P-DISC-310-1,P-
3	CZZ-900B	INSTRUMENT AIR COMPRESSOR		50	480V	3	0.2	Y		MCC 3	2H	FVNR	P-302
4	FWP-003	FIREWATER PUMP		125	480V	3	0.5	N		MCC 3	3A	FWPMP	P-303
5	HAE-601A	GAS COMPRESSOR #2 COOLER FAN MOTOR #1		50	480V	3	1	Y		MCC 2	1J	FVNR	P-204
6	HAE-601B	GAS COMPRESSOR #2 COOLER FAN MOTOR #2		50	480V	3	1	Y		MCC 2	3F	FVNR	P-205
7	HVAC-201	AIR HANDLING UNIT	2		240V	1	0.5	N		LP-2	9,11	MCCB	LP2-9
8	LTS-101	DECK LIGHTS CKT 1	1		208V	2	0.5	N		LP-1	1,3	MCCB	LP1-1
9	LTS-102	DECK LIGHTS CKT 2	2		208V	2	0.5	N		LP-1	2,4	MCCB	LP1-2
10	LTS-103	DECK LIGHTS CKT 3	1		208V	2	0.5	N		LP-1	5,7	MCCB	LP1-5
11	LTS-104	DECK LIGHTS CKT 4	2		208V	2	0.5	N		LP-1	6,8	MCCB	LP1-6
12	LTS-201	BLDG LIGHTS CKT 1	1		120V	1	0.5	N		LP-2	1	MCCB	LP2-1
13	LTS-202	BLDG LIGHTS CKT 2	2		120V	1	0.5	N		LP-2	2	MCCB	LP2-2
14	LTS-203	BLDG LIGHTS CKT 3	1		120V	1	0.5	N		LP-2	3	MCCB	LP2-3
15	LTS-204	BLDG LIGHTS CKT 4	2		120V	1	0.5	N		LP-2	4	MCCB	LP2-4
16	MV-201	MICROWAVE	0.5		120V	1	0.5	N		LP-2	13	MCCB	LP2-13
17	NBK-2000	ELECTROSTATIC TREATER	100		480V	3	0.6	N		MCC 1	3A	MCCB	P-111
18	PAX-700A	PIPELINE PUMP A		100	480V	3	0.8	Y		MCC 1	2J	FVNR	P-104
19	PAX-700B	PIPELINE PUMP B		100	480V	3	0.8	Y		MCC 2	2J	FVNR	P-206
20	PBA-300A	LACT CHARGE PUMP A		50	480V	3	0.5	Y		MCC 1	2E	FVNR	P-105
21	PBA-300B	LACT CHARGE PUMP B		50	480V	3	0.5	Y		MCC 2	4C	FVNR	P-207
22	PBA-500A	WET OIL CIRCULATION PUMP A		10	480V	3	0.5	N		MCC 1	1A	FVNR	P-101
23	PBA-500B	WET OIL CIRCULATION PUMP B		10	480V	3	0.5	N		MCC 2	1A	FVNR	P-201
24	PBA-510A	TRANSFER PUMP A		15	480V	3	0.5	N		MCC 1	1C	FVNR	P-102
25	PBA-510B	TRANSFER PUMP B		5	480V	3	0.5	N		MCC 2	3A	FVNR	P-202
26	PBA-602A	GAS COMPRESSOR #2 LUBE OIL PUMP #1		100	480V	3	0.5	Y		MCC 2	3J	FVNR	P-208
27	PBA-602B	GAS COMPRESSOR #2 LUBE OIL PUMP #2		100	480V	3	0.5	Y		MCC 2	4J	FVNR	P-209
28	PBA-800A	SUMP PUMP A		5	480V	3	0.3	N		MCC 1	1E	FVNR	P-103
29	PBA-800B	SUMP PUMP B		25	480V	3	0.3	N		MCC 2	1E	FVNR	P-203
30	PBE-300	SEAWATER PUMP		50	480V	3	0.3	Y		MCC 1	1J	FVNR	P-106



	LOAD	VOLTAGE	DESCRIPTION	KVA	MOTOR POWER	DEMAND FACTOR
1	HAE-601A	480V	GAS COMPRESSOR #2 COOLER FAN MOTOR #1		50.0	1
2	HAE-601B	480V	GAS COMPRESSOR #2 COOLER FAN MOTOR #2		50.0	1
3	PAX-700B	480V	PIPELINE PUMP B		100.0	0.8
4	PBA-300B	480V	LACT CHARGE PUMP B		50.0	0.5
5	PBA-500B	480V	WET OIL CIRCULATION PUMP B		10.0	0.5
6	PBA-510B	480V	TRANSFER PUMP B		5.0	0.5
7	PBA-602A	480V	GAS COMPRESSOR #2 LUBE OIL PUMP #1		100.0	0.5
8	PBA-602B	480V	GAS COMPRESSOR #2 LUBE OIL PUMP #2		100.0	0.5
9	PBA-800B	480V	SUMP PUMP B		25.0	0.3
10	PBE-450B	480V	FLARE SCRUBBER PUMP B		25.0	0.5
11	PBE-530B	480V	PRODUCT RE-CIRCULATION PUMP		15.0	0.5
12	SPARE-10	480V	SPARE SIZE 4		100.0	0
13	SPARE-11	480V	SPARE BREAKER	50.0		0
14	SPARE-12	480V	SPARE BREAKER	50.0		0
15	SPARE-6	480V	SPARE SIZE 1		10.0	0
16	SPARE-7	480V	SPARE SIZE 1		10.0	0
17	SPARE-8	480V	SPARE SIZE 2		25.0	0
18	SPARE-9	480V	SPARE SIZE 3		50.0	0

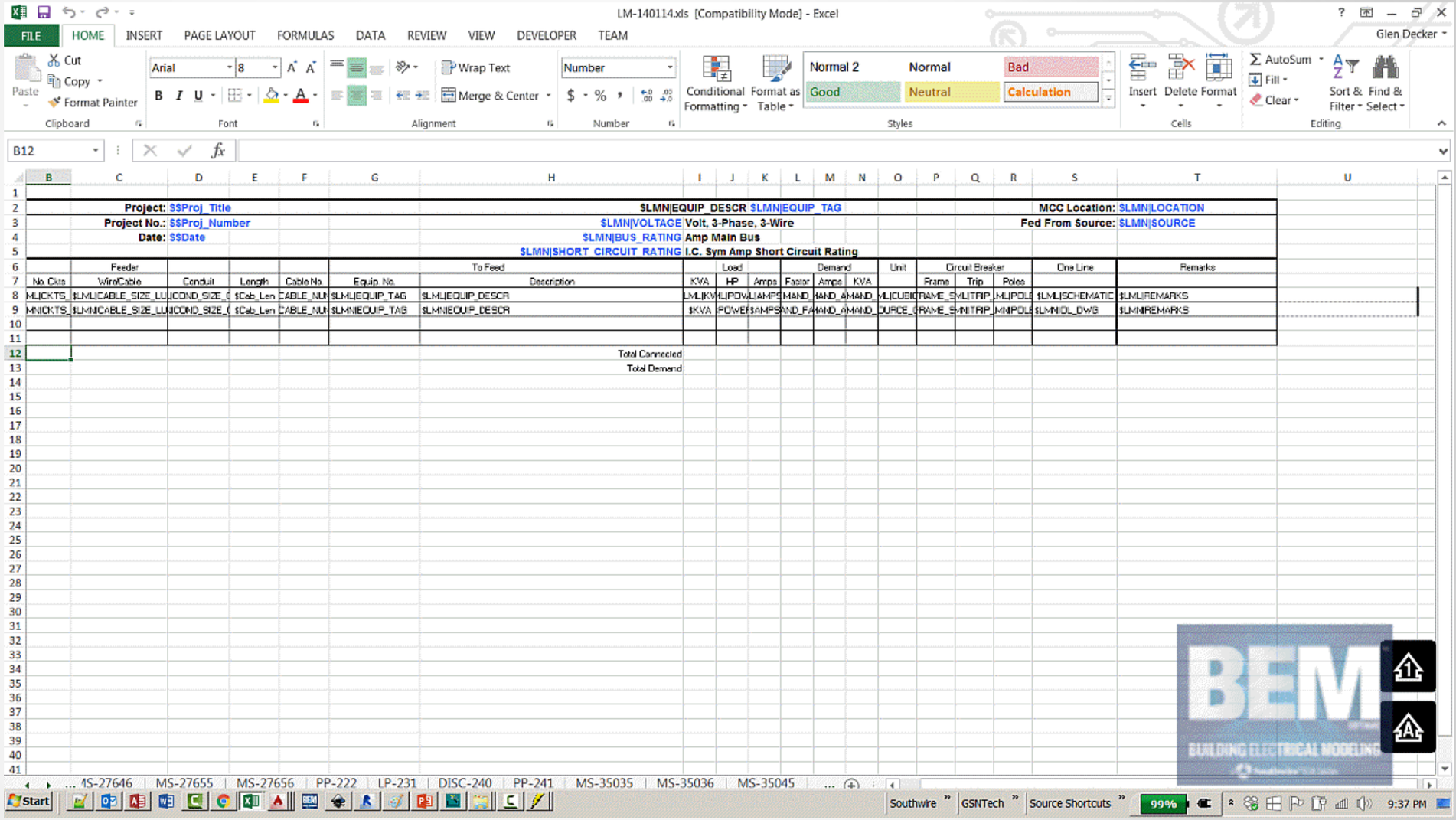
Create Deliverables

- The CARS Software Solution Automates The Process For:
  - Panel Schedules
  - Load Schedules
  - One-line Diagrams
  - Control Wiring Diagrams
  - Raceway Drawings
  - Bills Of Material
  - Cable Schedules
  - Installation Tickets
  - Cable/Wire Markers



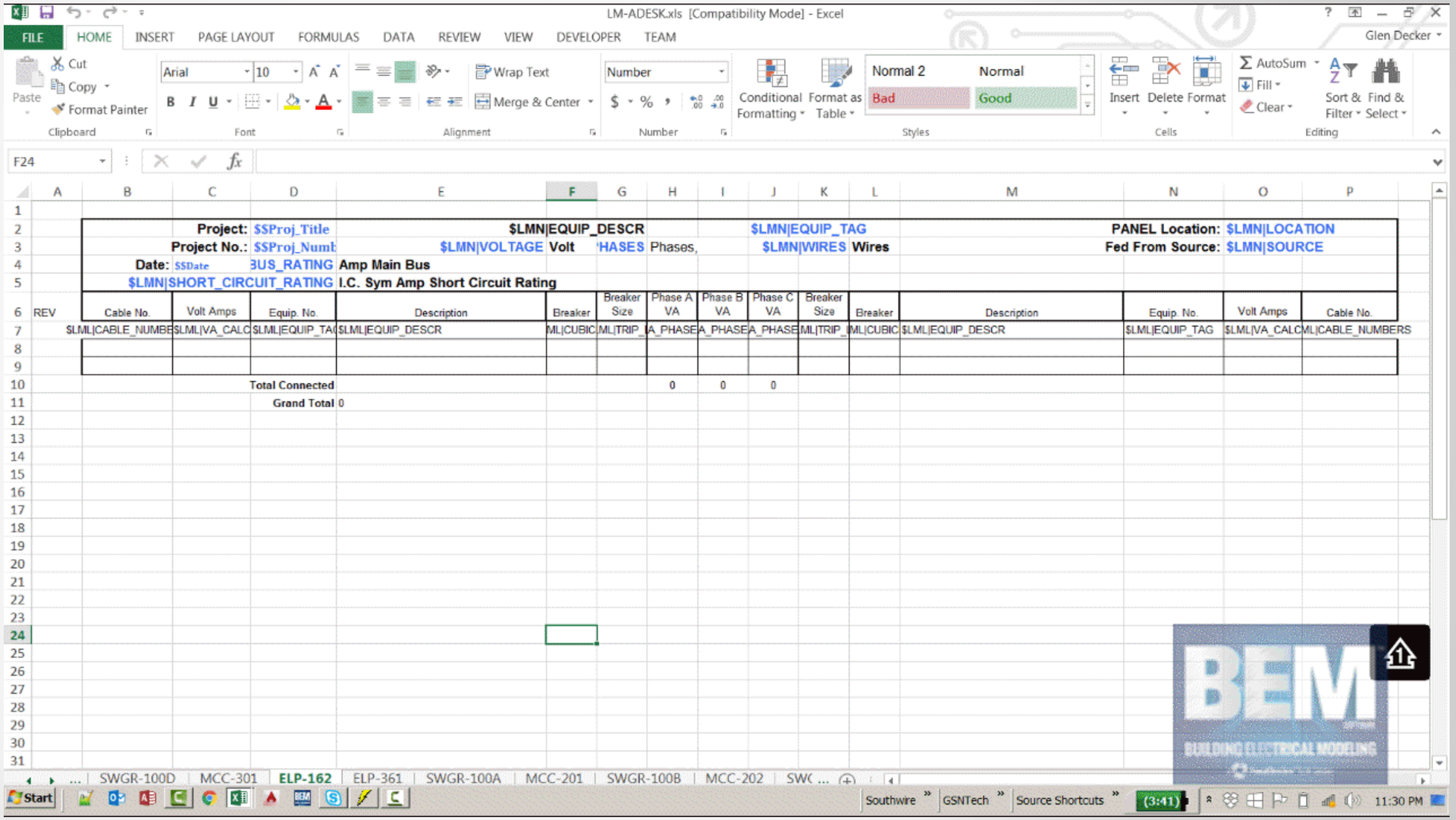
Load Schedules

- Use a Custom Excel Template



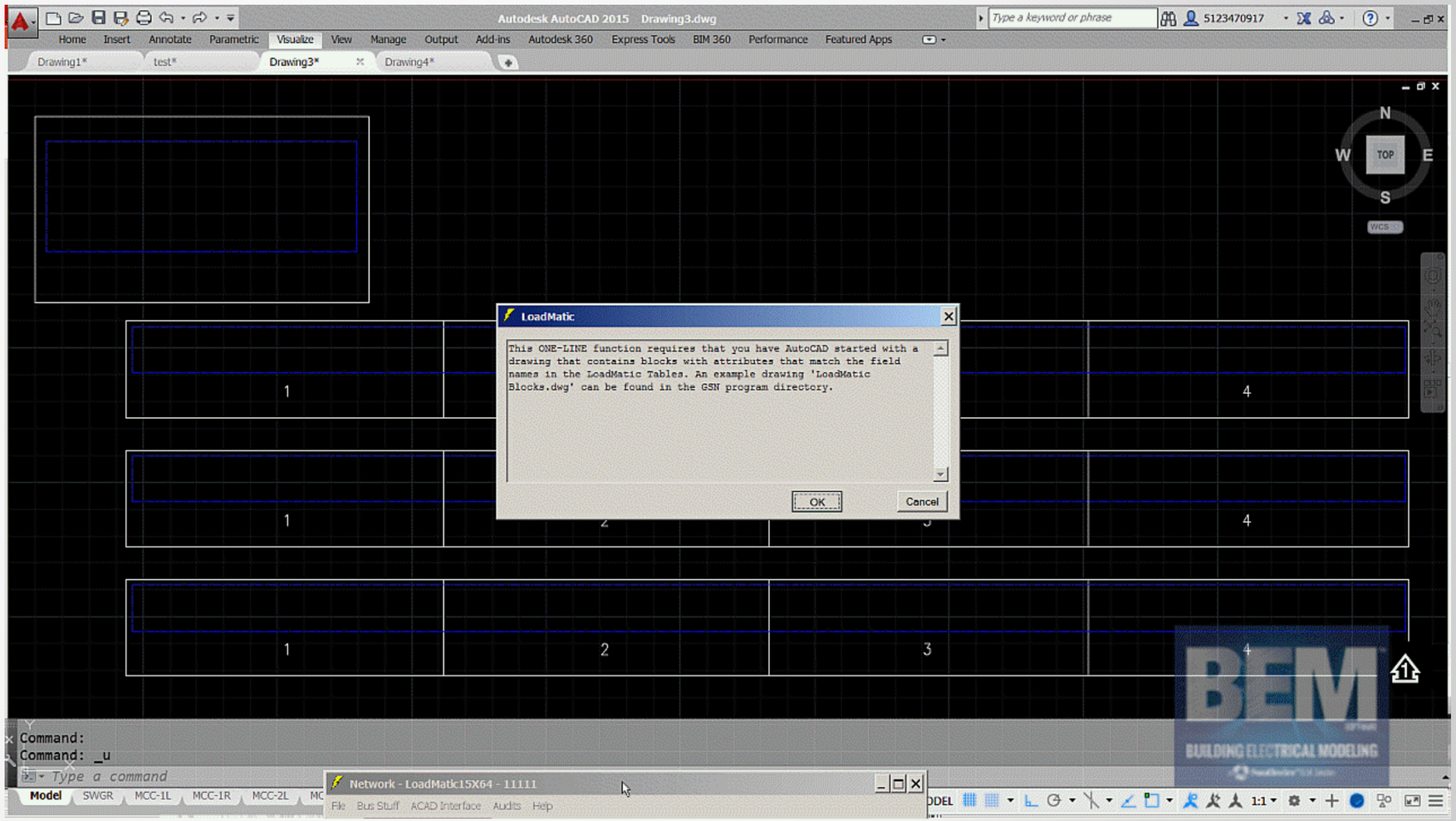
Panel Schedules

- Use a Custom Excel Template

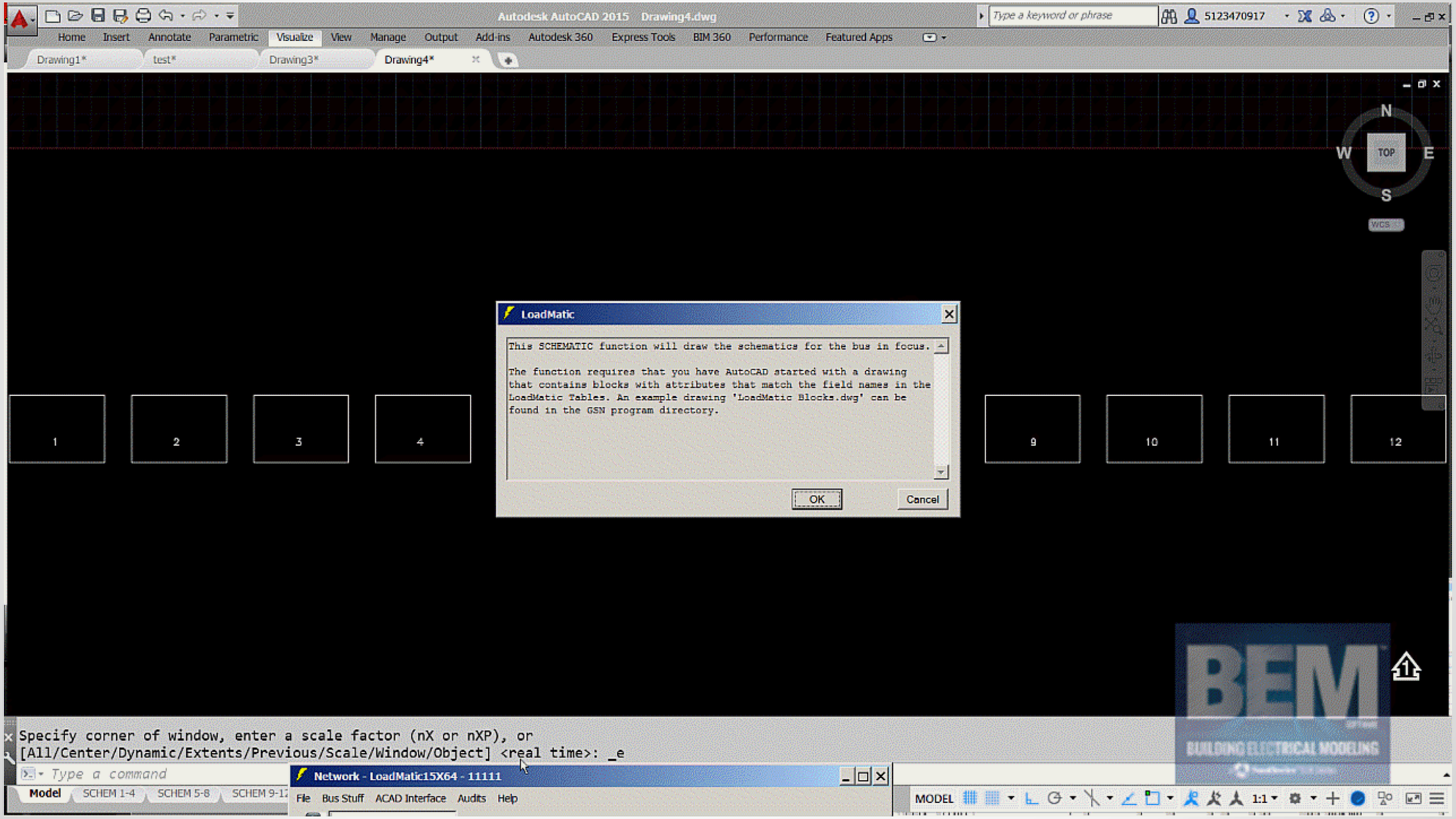


Creating / Importing One-Line Diagrams

- Automatically created using customizable symbols

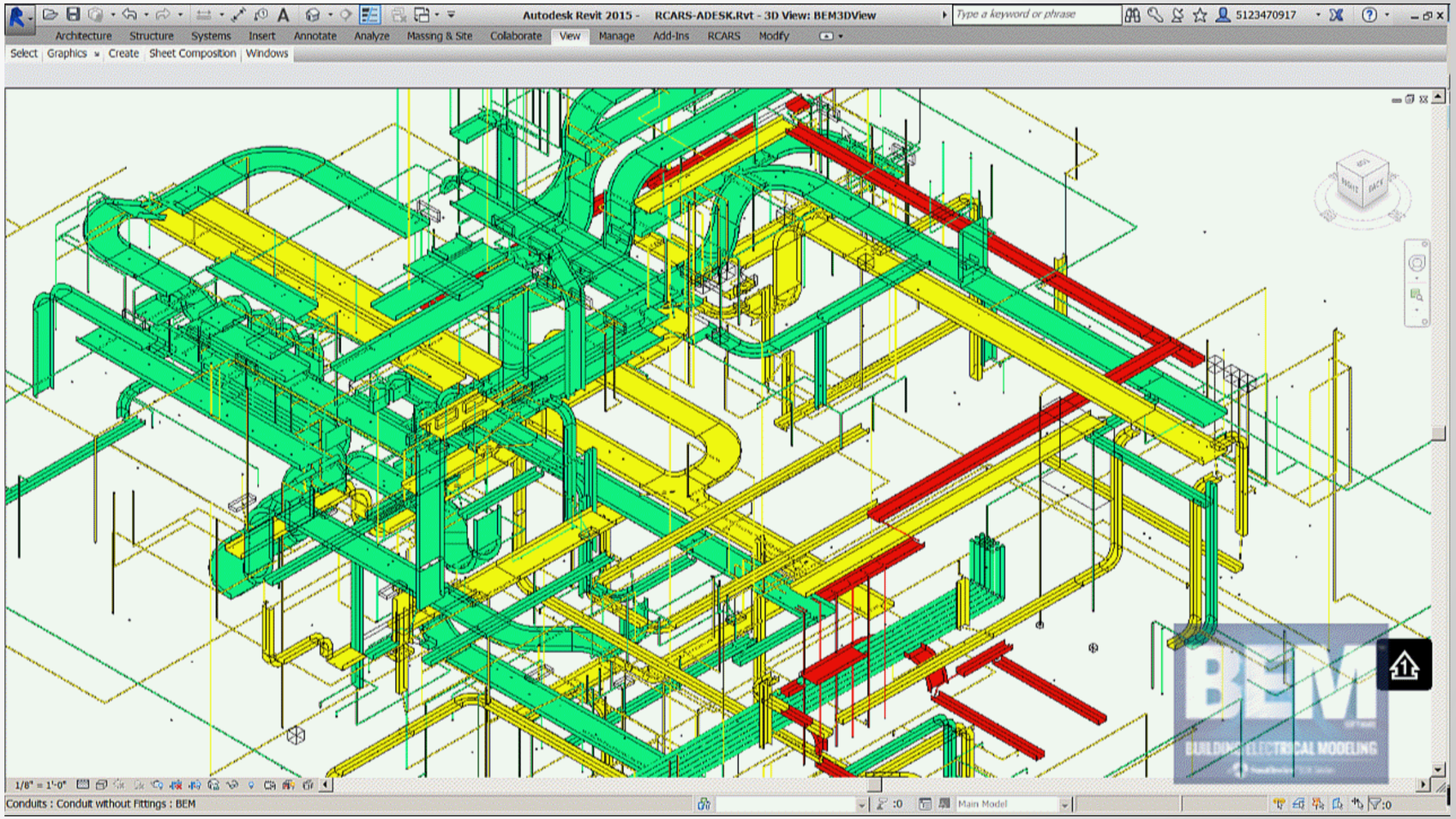


Control Schematics Created from the Same Data



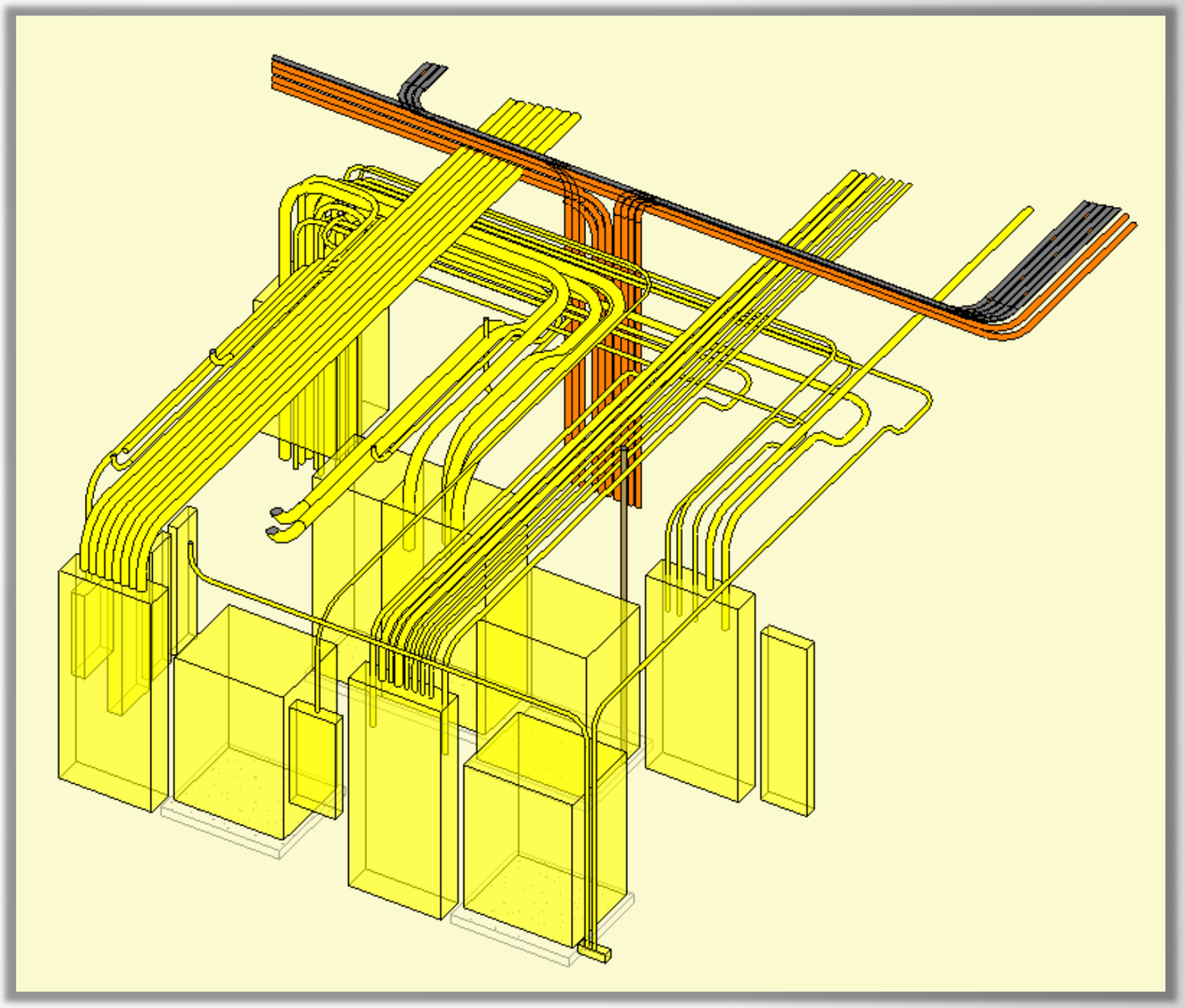
Locating Equipment

- Locate Equipment in the Model using AutoCAD or Revit



Routing Raceway

- Design Raceway Using Revit or AutoCAD



Setting up your project's cable specification

- Cable Selection Tool
- Southwire's Cable Catalog is Pre-Loaded
- Can Be Imported From An Existing Spreadsheet

SIMpull THHN™ THWN

600 Volts. Copper Conductor
Thermoplastic Insulation/ SIM Nylon Sheath
Heat, Moisture, Gasoline, and Oil Resistant II
Also Rated MTW and THWN-2
SIM Technology® for Easier Pulling

APPLICATIONS

Southwire SIMpull THHN or THWN-2 conductors are primarily used in conduit and cable trays for services, feeders, and branch circuits in commercial or industrial applications as specified in the National Electrical Code. Voltage for all applications is 600 volts. SIMpull THHN conductors are designed to be used without application of pulling lubricant. Allowable temperatures are as follows:

- THHN or T90 Nylon- Dry locations not to exceed 90° C
- THWN-2- Wet or dry locations not to exceed 90° C or locations not to exceed 75° C when exposed to oil
- TWN75- Wet locations not to exceed 75° C
- MTW- Wet locations or when exposed to oil at temperatures not to exceed 60° C or dry locations not to exceed 90° C (with ampacity limited to that for 75° C conductor temperature per NFPA 79)
- AWM- Dry locations not to exceed 105° C when rated and used as appliance wiring material

SPECIFICATIONS

Southwire SIMpull THHN® or THWN-2 or MTW (also AWM) comply with:

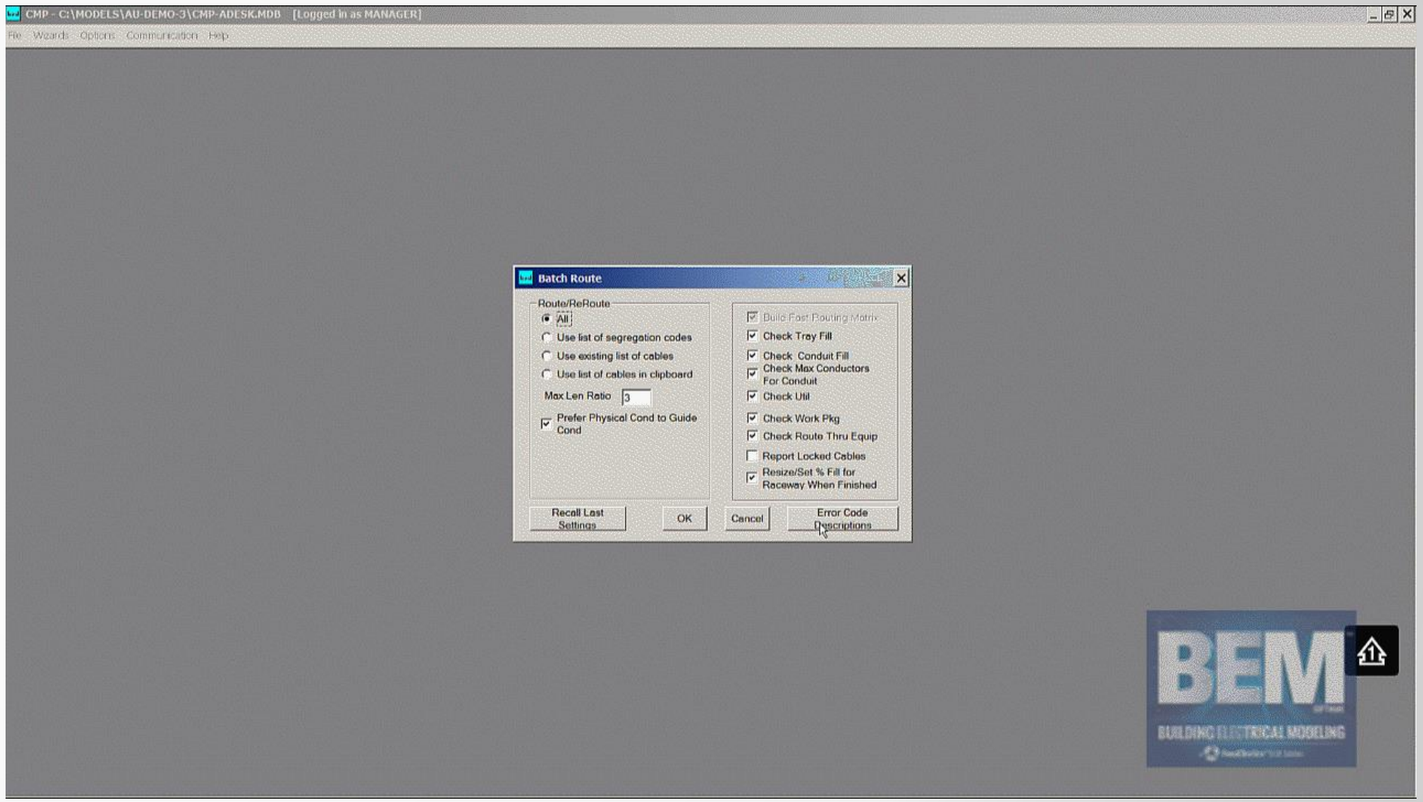
- ASTM - B3, B8 (7,19, 37, 61 Strands), B 787 (19 Wire Combination Unilay Strand)
- UL Standard 83, 1581, and 1063(MTW)
- T90 Nylon/TWN75 sizes through 1000 kcmil CSA C22.2 No. 75
- NOM-ANCE 90° C · Federal Specification A-A-59544
- National Electrical Code, NFPA 70 · VW-1 - Sizes 14 through 1 AWG
- CT rated in sizes 1/0 AWG and larger
- FT1
- AWM - Sizes 14 through 6 AWG. MTW available in stranded only
- NEMA WC-70 Construction Requirements
- RoHS/REACH Compliant

Construction

Southwire SIMpull THHN or THWN-2 or MTW copper conductors are soft annealed copper. #14 - 4/0 AWG uses a combination unilay strand and 250 kcmil and larger uses a compressed copper strand. The wire is insulated with a tough heat and moisture resistant poly vinyl chloride (PVC), over which a SIM (SLIKQWIK® Infused Membrane) nylon (polyamide) or UL Recognized equal jacket is applied. Available in black, white, red, blue, purple, green, yellow, orange, brown and gray. Some colors are subject to economic order quantity.Marked sunlight resistant in sizes 2 AWG and larger.
THWN-2 available in sizes 8 AWG and larger .
Sizes 14 - 10 AWG are available with SIMpull Technology only in SIMpull Barrel or CoilPAK configurations.

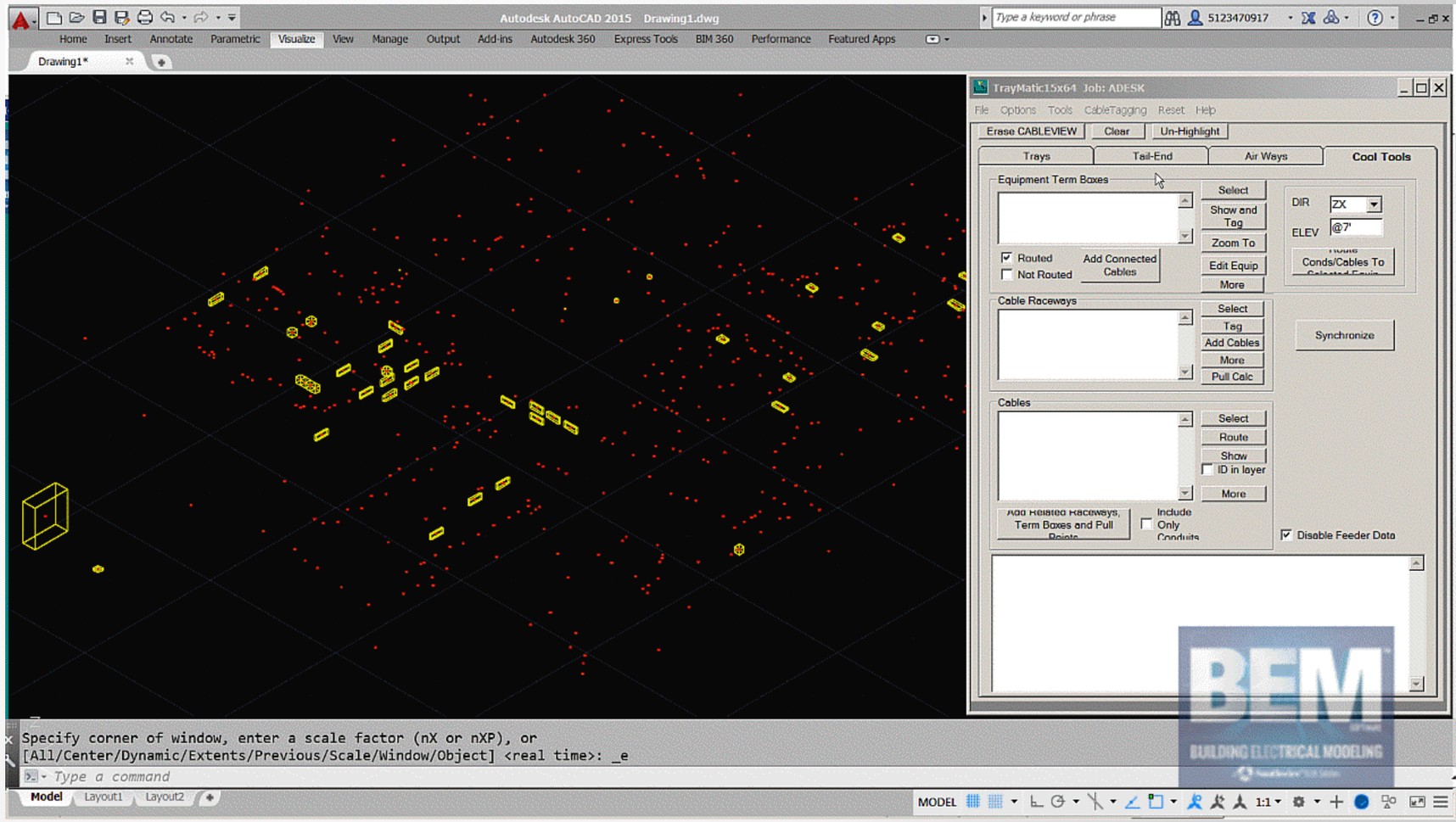
Routing Cables

- Cables Can Be Routed
  - One at a Time
  - By Area
  - By Project
  - By Custom Selection
- Uses Shortest Distance while complying with NEC fill rules.



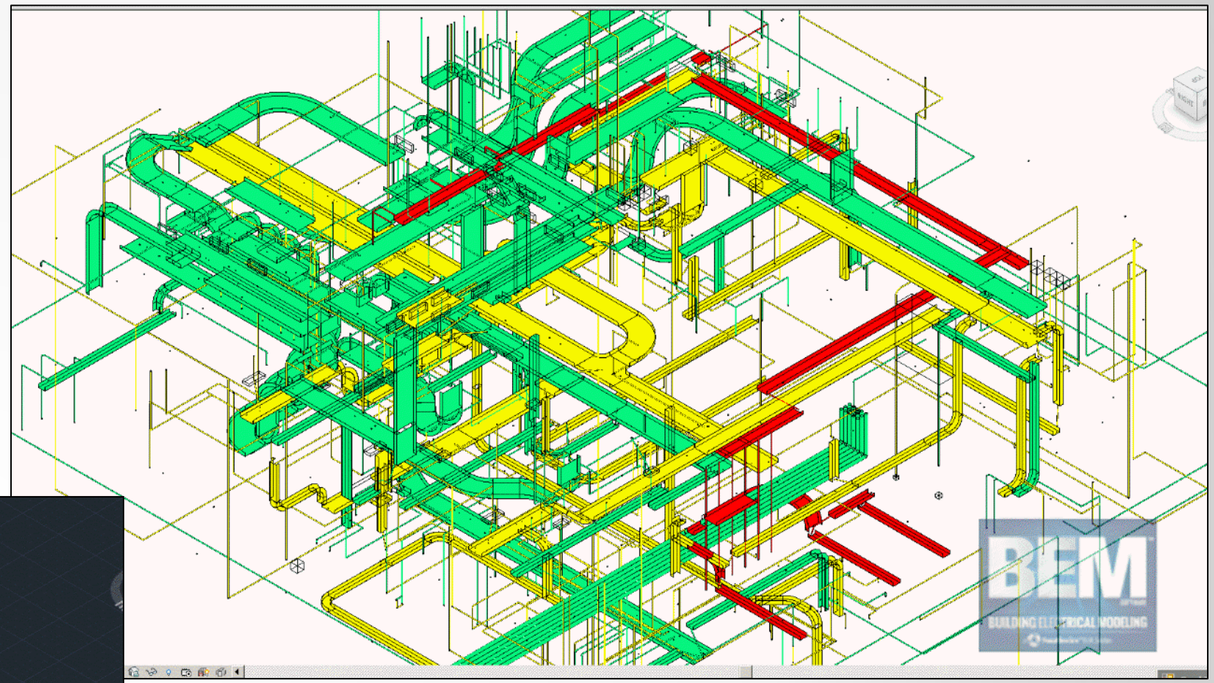
Routing Conduit Automatically Using The CARS Software EZ-Estimating Tool

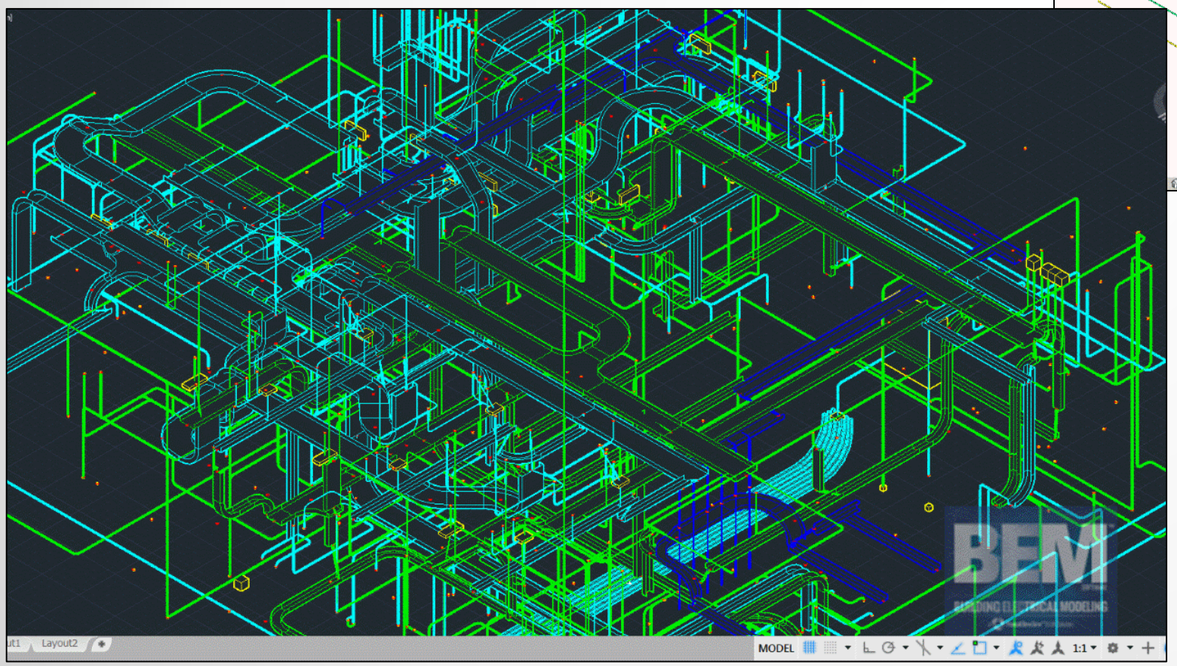
- Automatically Routes Conduit Based On User Inputted Values
- Cables Will Route Through The Conduit
- EZ Estimating Feature



Reviewing Cable Routes

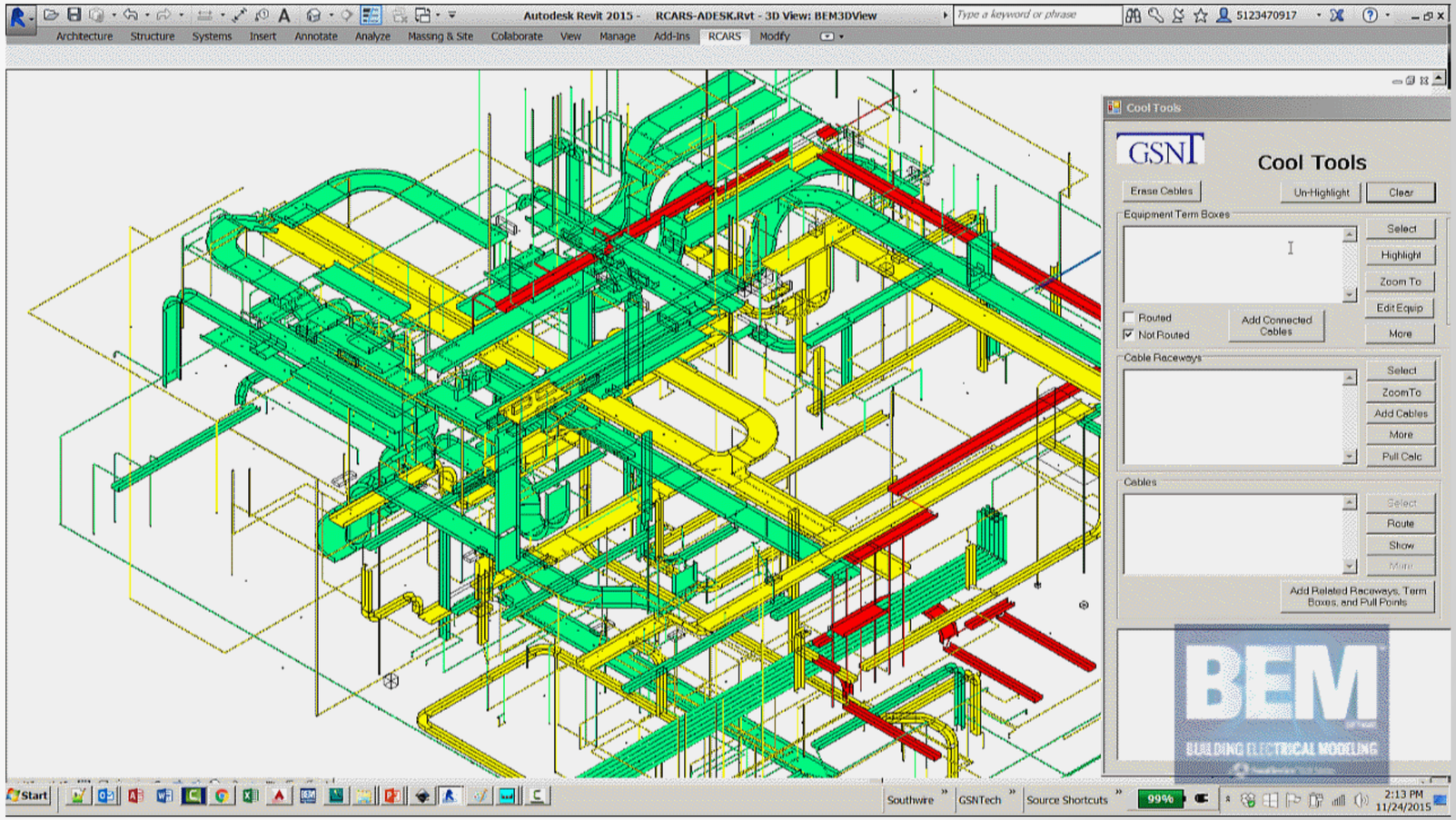
- Cables are displayed with a click





Using Cool Tools

- Use Cool Tools to:
  - Display Cable, Raceways, & Equipment
  - Display Conduit Design Information
  - Find Connected Cables
  - Route Cable
  - Annotate
  - Display Cable Route



Bill of Materials

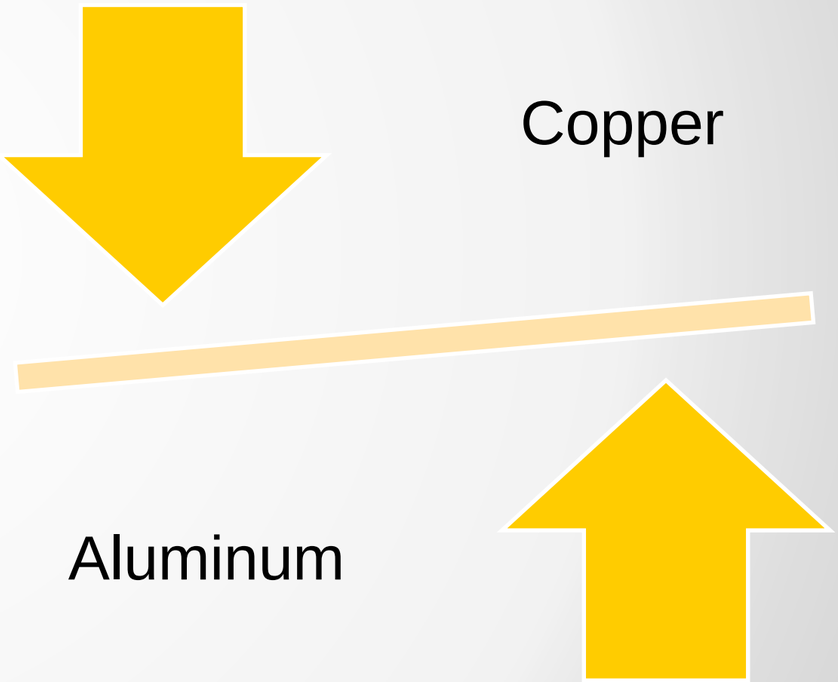
- Automatically generated
- Generated in Microsoft Excel™ and Microsoft Word™

Cable Type	Cable Description	Manuf	Stock Number	UPC Code	Length	UNITS
1/C #4/0	1/C #4/0 AWG	SOUTHWIRE	37-102-119		55	FT
2/C #14	2/C #14 AWG	SOUTHWIRE	37-102-507		90	FT
2-1/C#250,W/G	(2) 1C 250 KCMIL W/GND	SOUTHWIRE	112-31-3511		88	FT
3/C #1 W/G	3/C #1 AWG W/GND	SOUTHWIRE	37-102-315G		92	FT
3/C #1/0 W/G	3/C #1/0 AWG W/GND	HWC	37-102-316G		97	FT
3/C #10 W/G	3/C #10 AWG W/GND	SOUTHWIRE	37-102-308G		77	FT
3/C #10 W/G-MC	3/C #10 AWG W/GND	SOUTHWIRE	546-31-3503		25	FT
3/C #12	3/C #12 AWG	SOUTHWIRE	37-102-516		413	FT
3/C #12 W/G-MC	3/C #12 AWG W/GND	SOUTHWIRE	546-31-3453		424	FT
3/C #2 W/G	3/C #2 AWG W/GND	HWC	37-102-314G		42	FT
3-1/C#10	(3) 1C #10 AWG	SOUTHWIRE			243	FT
3-1/C#12	(3) 1C #12 AWG	SOUTHWIRE	112-31-3111		3586	FT
3-1/C#2,W/G	(3) 1C #2 AWG W/GND	SOUTHWIRE	112-31-3371		212	FT
4-1/C#10	(4) 1C #10	SOUTHWIRE			667	FT
BLACK JACKET ESTIMATE - AS DESIGNED						
	Cable Description	Manuf	Stock Number	UPC Code	Length	UNITS
	1/C #4/0 AWG	SOUTHWIRE	37-102-119		55	FT
	2/C #14 AWG	SOUTHWIRE	37-102-507		90	FT
	(2) 1C 250 KCMIL W/GND	SOUTHWIRE	112-31-3511		88	FT
	3/C #1 AWG W/GND	SOUTHWIRE	37-102-315G		92	FT
	3/C #1/0 AWG W/GND	HWC	37-102-316G		97	FT
	3/C #10 AWG W/GND	SOUTHWIRE	37-102-308G		77	FT
	3/C #10 AWG W/GND	SOUTHWIRE	546-31-3503		25	FT
	3/C #12 AWG	SOUTHWIRE	37-102-516		413	FT
	3/C #12 AWG W/GND	SOUTHWIRE	546-31-3453		424	FT
	3/C #2 AWG W/GND	HWC	37-102-314G		42	FT
	(3) 1C #10 AWG	SOUTHWIRE	3-1/C#10		243	FT
	(3) 1C #12 AWG	SOUTHWIRE	112-31-3111		3586	FT
	(3) 1C #2 AWG W/GND	SOUTHWIRE	112-31-3371		212	FT
	(4) 1C #10	SOUTHWIRE	4-1/C#10		667	FT
BLACK JACKET ESTIMATE - SUBSTITUTING AL FOR CU WHEN AVAILABLE DOES NOT APPLY						

PROJ COMMOD CODE	VENDOR	VENDOR CAT NMBR	QTY	UNITS	DESCRIPTION
100	B-LINE	H46A09-12-240	100	FT	12" W ALUM STRAIGHT TRAY, H46 SERIES , LADDER, 6" H, 9" RUNG
504	B-LINE	35A09-12-144	100	FT	12" W ALUM STRAIGHT TRAY, H35 SERIES, LADDER, 5" H, 9" RUNG
150	B-LINE	H46A09-18-240	107	FT	18" W ALUM STRAIGHT TRAY, H46 SERIES , LADDER, 6" H, 9" RUNG
501	B-LINE	35A09-18-144	107	FT	18" W ALUM STRAIGH TRAY, H35 SERIES, LADDER, 5" H, 9" RUNG
120	B-LINE	6A-12-90HB24	4	EA	12" W ALUM TRAY FITTING, LADDER, 90 DEG HORIZ ELBOW, 6" H, 9" RUNG , 24" RAD
502	B-LINE	5A-12-90HB24	4	EA	12" W ALUM 90 DEG HORIZONTAL BEND, LADDER, 5" H, 9" RUNG
184	B-LINE	6A-18-HT24	2	EA	18" W ALUM TRAY FITTING, LADDER, HORIZ TEE, 6" H, 9" RUNG , 24" RAD
170	B-LINE	6A-18-90HB24	4	EA	18" W ALUM TRAY FITTING, LADDER, 90 DEG HORIZ ELBOW, 6" H, 9" RUNG , 24" RAD
500	B-LINE	5A-18-90HB24	4	EA	18" W ALUM 90 DEG HORIZONTAL BEND, LADDER, 5" H, 9" RUNG
			2	EA	TRAY HORZ TEE 18X5, 24(IR), 3(Ext), LADDER OPEN, ALUMINUM

Value Engineering

- Changing From Copper To Aluminum With A Single Click
- Conduit Will Re-size If Needed
- BOM Is Updated



Planning for Installation

Feeder Schedule Plus

- Information Includes:
  - Origin And Destination Equipment
  - Cable Size/Feeder Tag
  - Cable Length
  - Ampacity Check
  - Voltage Drop
  - Sidewall Pressure
  - Installation Status

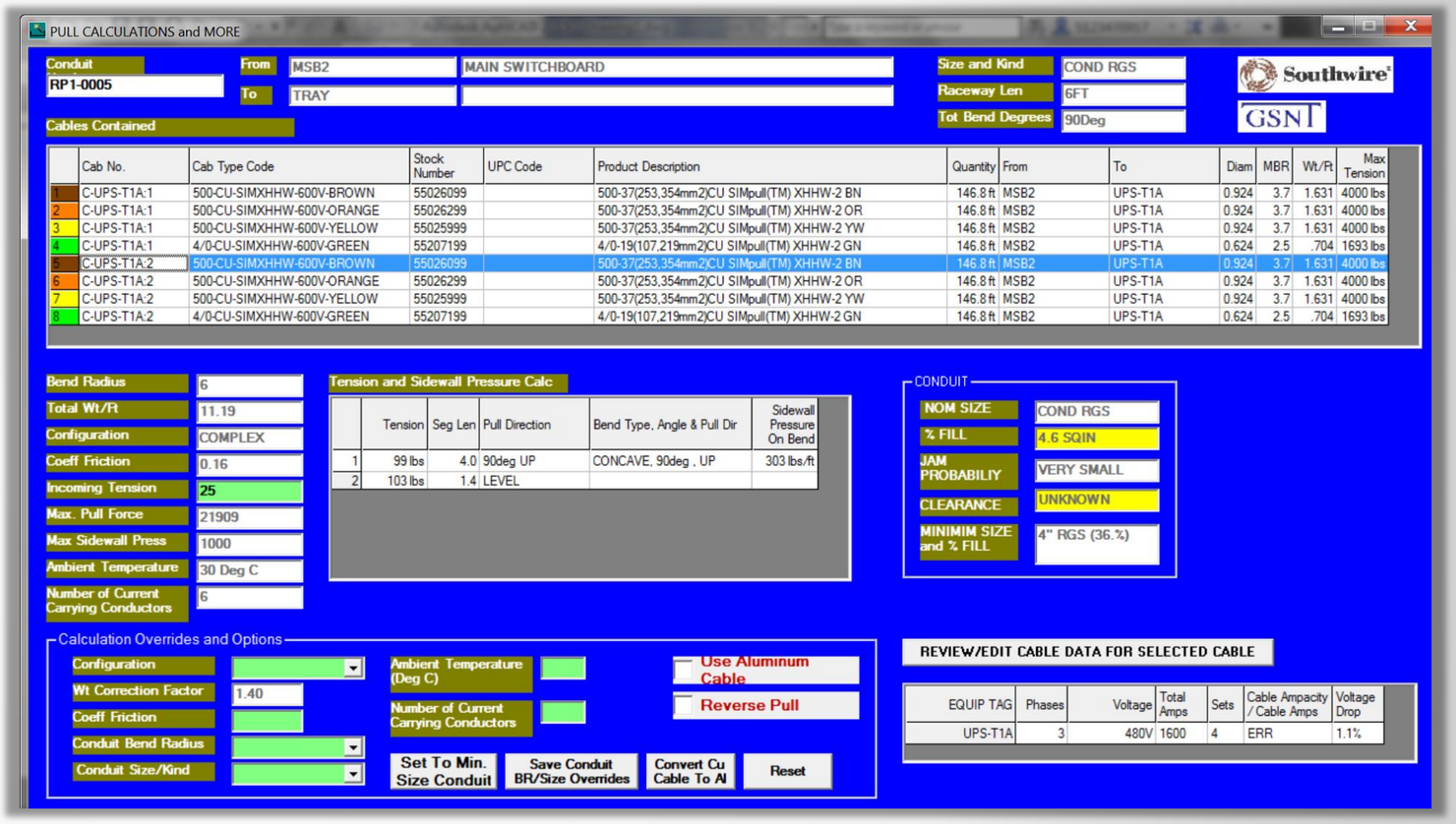
Feeder Schedule Plus

Num Of Sets	Equipment Origin	Equipment Destination	Dest Location	Equip Size	Voltage	Feeder Tag	Cond Tag	Conduit Size	Conduit Type	Total Circuit Length	Primary Metal	Insulation Type	CKT Number	Reel Number	Voltage Drop	Date
1 OF 1	MDSB	LP-1	P08	200A	120V/208V	CCT:3-1/C#4/0,#6G	RLP-1	1-1/4"	EMT	35	CU	XHHW	C-LP-1	251	0.5%	2015-06-26
1 OF 1	UTILITY	MCC-B	P3	NA	120V/208V	CCT:3-1/C#500,#2G	RCP-002	2-1/2"	EMT	120	CU	THHN	C-MCC-1	3	1.5%	
1 OF 1	UTILITY	MDSB	P4	400A	120V/208V	CCT:3-1/C#500,#2G	RP1-891	2-1/2"	EMT	19	CU	XHHW	C-MDS	3	1.2%	2015-06-27
1 OF 1	MDSB-B	RECEP-1	P4	200A	120V/208V	CCT:3-1/C#4/0,#6G	RP1-868	1-1/4"	EMT	26	CU	THHN	C-RCP-1	251	0.9%	
1 OF 1	MECH-1	AH-1	P3	27.8A	208V	CCT:3-1/C#8,#10G	RAH-1	1"	EMT	33	CU	THHN	C-AN-16	82	0.4%	2015-07-08
1 OF 1	MECH-1	AH-2	P7	33.3A	208V	CCT:3-1/C#8,#10G	RAH-2	1"	EMT	46	CU	THHN	C-AN-26	90	2.5%	2015-06-28
1 OF 1	UTILITY	MDSB	P4	400A	120V/208V	CCT:3-1/C#500,#2G	RP1-893	2-1/2"	EMT	119	CU	XHHW	C-MDSB	3	3.9%	
1 OF 1	MDSB-1	RECEP-1	P4	200A	120V/208V	CCT:3-1/C#4/0,#6G	RP1-868	1-1/4"	EMT	216	CU	THHN	C-RCP-14	251	4%	2015-07-06
1 OF 1	MECH-2	AH-1	P3	27.8A	208V	CCT:3-1/C#8,#10G	RAH-1	1"	EMT	133	CU	THHN	C-AH-11	9	2.1%	2015-06-14
1 OF 1	MECH-2	AH-2	P7	33.3A	208V	CCT:3-1/C#8,#10G	RP1-893	1"	EMT	416	CU	THHN	C-AH-2	82	0.2%	2015-07-07
1 OF 1	UTILITY	MDSB	P4	400A	120V/208V	CCT:3-1/C#500,#2G	RP1-891	2-1/2"	EMT	191	CU	XHHW	C-MSB	33	0.3%	
1 OF 1	MDSB-A	RECEP-1	P4	200A	120V/208V	CCT:3-1/C#4/0,#6G	RP1-868	1-1/4"	EMT	246	CU	THHN	C-RCD-1	114	0.7%	2015-07-09
1 OF 1	MECH-B	AH-1	P3	27.8A	208V	CCT:3-1/C#8,#10G	RAH-45	1"	EMT	93	CU	THHN	C-AH-14	78	1.8%	2015-07-05
1 OF 1	MECH-B	AH-2	P7	33.3A	208V	CCT:3-1/C#8,#10G	RAH-45	1"	EMT	56	CU	THHN	C-AH-26	21	1.9%	2015-06-29
																INSTALLED
																PRINTED

**Note: Circuit Number (CKT) was installed in the field with a voltage drop higher than 2%.

Evaluating Pull Scenarios

- Jam Probability
- Clearance
- Cable Contained
- Properties of Raceway
- Coefficient of Friction
- Side Wall Pressure
- Maximum Pulling Tension



Installation

Pull and Termination Tickets

$10-TG-DSW-4000A-K-01/P%

CQP - FORM B18.01A **CABLE PULL TICKET**

Page 1 of 1

CABLE NUMBER:	10-TG-DSW-4000A-K-01	REVISION:	01
		CHECKSUM:	97167
CABLE TYPE:	K3C2G	ISSUE FOREMAN:	A. MASON

CABLE OD: .96In MBR: 3.84In WEIGHT: 954.0Lbs/Ft LAY CABLE: RANDOM

CABLE TYPE DESCR:	3/C #2 AWG 600V POWER W/ GND	EST CKT LEN:	501.8
FROM DEVICE:	10-EL-PNL-0002	TO DEVICE:	10-TG-DSW-4000-A
TURB BLDG - SWGR ROOM 1 - SMALL POWER & LIGHT		Disc.Switch for Bolt Heater - Turbine A	
FROM SECTION:	CKT 1/3		
EST. PULL TENSION:	106 LBS	MAX PULL TENSION:	2424 LBS
VOLTAGE DROP:	2.50%	AMPACITY EXCEEDED:	NO
PLAN FROM DRAWING:	125711-10400-E-AGE-011-2	PLAN TO DRAWING:	125711-10400-E-AGE-032-1
DATE PRINTED:	Jul. 14, 2015	START-UP SYS:	40-0.08
		WRK PKG:	

Route: 10CK2013-298:CR03 10TLK2013-009/K 10TLK2013-005/K 10TLK2013-016/K 10TLK2023-020/K 10TK2023-030 10TK2023-031 10TK2023-032 10TK2023-025 10TK2023-019 10TK2023-034 10TLK2023-003/K 10TLK2023-004/K 10TLK2022-001/K 10CK2031-016:CR03 10JBK2031-002 10CK2031-010:CR09

ROUTED THROUGH 10-TG-JB-4003 TO FIELD SIZED JB

$10-AH-MXR-7994A-K-03/F%

CQP - Form B18.01D **CABLE TERMINATION TICKET** **(FROM END)**

Page 1 of 1

CAB NMBR:	**10-AH-MXR-7994A-K-03**	**FROM REV: A**	**TO REV: A**
CAB TYPE:	C2C12	ISSUE FOREMAN:	G. DECKER
CAB TYPE DESCR:	2/CONDUCTOR #12 AWG CONTROL	START-UP SYS:	32-0.01
CAB PURPOSE:	120VAC PWR FOR MTR SPACE HEATER	WORK PKG:	

DATE PRINTED: Jul. 10, 2015

FROM	TO
DEVICE : 10-EC-JB-MCC0010-A	DEVICE : 10-EC-MCC-0010-A
	SECTION : 4M
TERM DWG:	TERM DWG: 125711-H100-00-0389
120VAC PWR DIST JUNCTION BOX FOR MTR	ASH HANDLING - ELECTRICAL ROOM-9
PLAN DWG:	PLAN DWG: 125711-10760-E-AGE-013-2

TERMINATION POINT	NUMBER/ COLOR	WIRE NUMBER	TERMINATION POINT
TBA-5	BK	10AHMXR7994AK03-1	TB-13
TBA-12	RD	10AHMXR7994AK03-2	TB-10

TERM BY: _____ **DATE:** _____ TERM BY: _____ DATE: _____

FROM TRIMMED FOOTAGE MARKER: _____ TO TRIMMED FOOTAGE MARKER: _____

TERMINATION NOTES:
1. FIELD SUPPLIED JUNCTION BOX.

CONTINUITY CHECK BY:_____ DATE: _____

REFERENCE DRAWINGS:

No	Items To Be Checked	Attrib Req'd	Date Complt /Initials	Verified By By
1	Verify cable type and size according to drawings			
2	Verify cable is formed neatly into enclosure without excess length			
3	Verify overall cable tag is installed			
4	Verify conductor wire markers are correctly inst'd			
5	Verify proper lugs are used as required			
6	Verify all the wraps & anchors are inst'd neatly			

Remarks:

DESCRIPTION	Foreman	Superintendent	QC/Eng.
Signature			
Print Name			
Date			

QA/QC

- Added to Pull & Term Tickets
- Provides Historical Records

TERMINATION NOTES:

CONTINUITY CHECK BY:_____ DATE: _____

REFERENCE DRAWINGS:

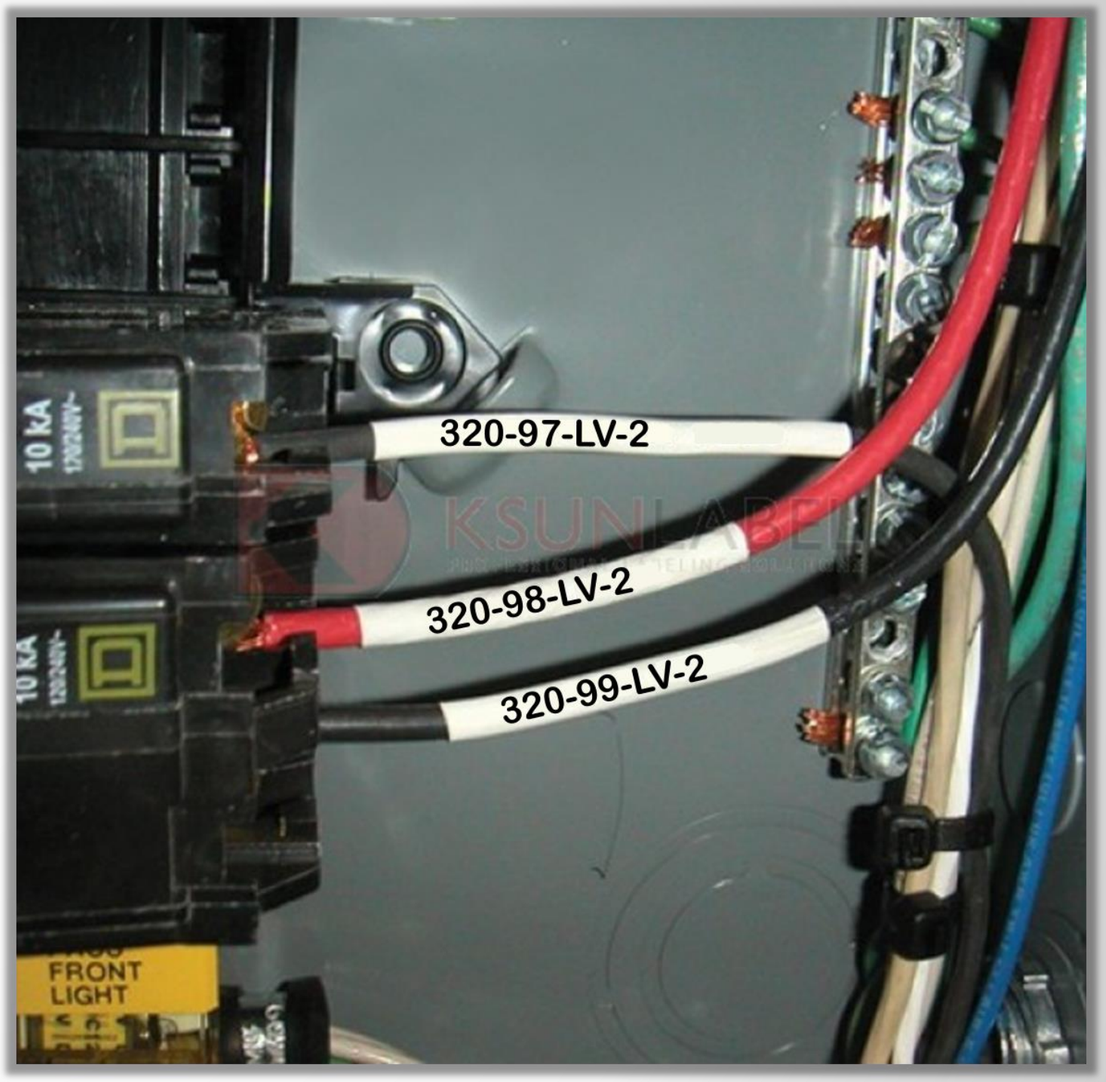
125711-B110-00-1820 -LECHLER- JB FOR TRUCK UNLOADING SKID
125711- B110-00-0044 -FOSTER WHEELER- P&ID
125711-B110-00-1782 -LECHLER- TRUCK UNLOADING SKID GA
125711-K810-00-0101 -VC DATABASE

No	Items To Be Checked	Attrib Req'd	Date Complt /Initials	Verified By By
1	Verify cable type and size according to drawings			
2	Verify cable is formed neatly into enclosure without excess length			
3	Verify overall cable tag is installed			
4	Verify conductor wire markers are correctly inst'd			
5	Verify proper lugs are used as required			
6	Verify all the wraps & anchors are inst'd neatly			
Remarks:				

DESCRIPTION	Foreman	Superintendent	QC/Eng.
Signature			
Print Name			
Date			

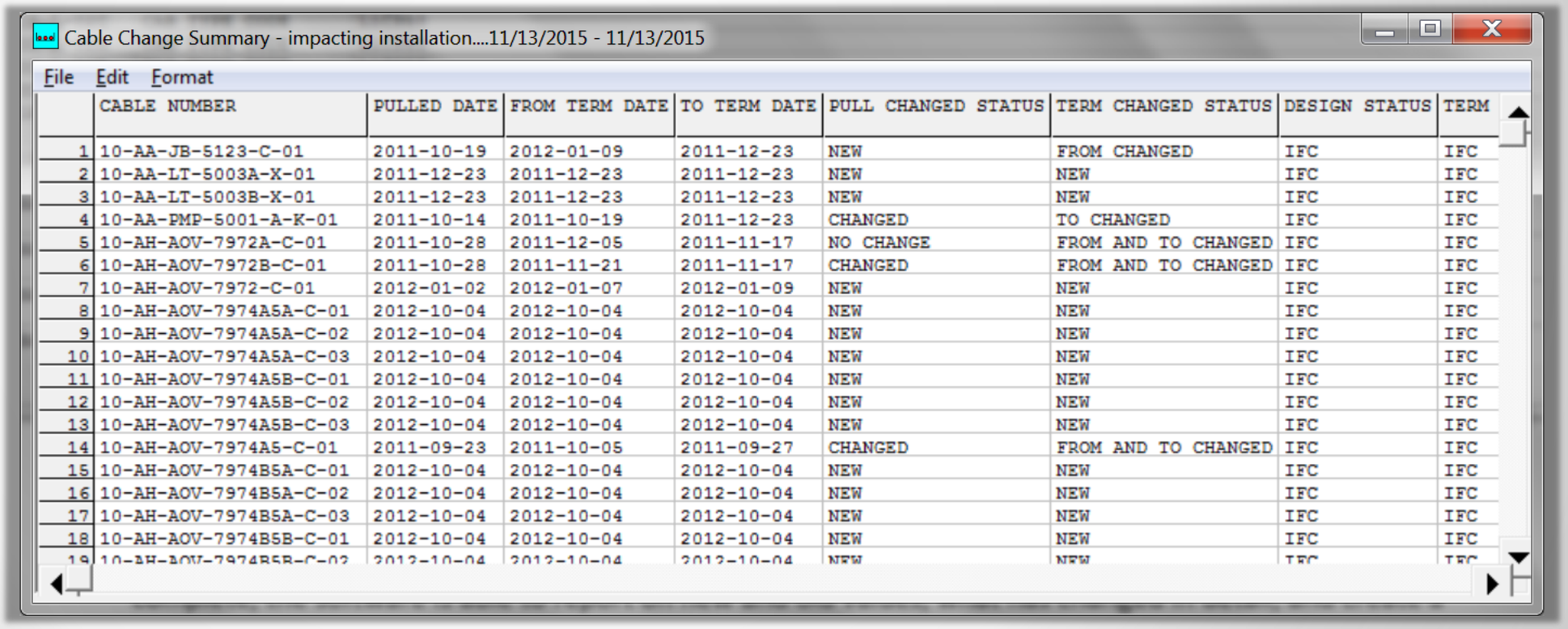
Cable / Wire Markers

- Creates Cable And Wire Markers
- Works With Brady Labeling System



Revision Control & Reporting

- CARS tracks revisions of:
  - Cable
  - Terminations
  - Raceway



Cable Change Summary - impacting installation....11/13/2015 - 11/13/2015

File Edit Format

	CABLE NUMBER	PULLED DATE	FROM TERM DATE	TO TERM DATE	PULL CHANGED STATUS	TERM CHANGED STATUS	DESIGN STATUS	TERM
1	10-AA-JB-5123-C-01	2011-10-19	2012-01-09	2011-12-23	NEW	FROM CHANGED	IFC	IFC
2	10-AA-LT-5003A-X-01	2011-12-23	2011-12-23	2011-12-23	NEW	NEW	IFC	IFC
3	10-AA-LT-5003B-X-01	2011-12-23	2011-12-23	2011-12-23	NEW	NEW	IFC	IFC
4	10-AA-PMP-5001-A-K-01	2011-10-14	2011-10-19	2011-12-23	CHANGED	TO CHANGED	IFC	IFC
5	10-AH-AOV-7972A-C-01	2011-10-28	2011-12-05	2011-11-17	NO CHANGE	FROM AND TO CHANGED	IFC	IFC
6	10-AH-AOV-7972B-C-01	2011-10-28	2011-11-21	2011-11-17	CHANGED	FROM AND TO CHANGED	IFC	IFC
7	10-AH-AOV-7972-C-01	2012-01-02	2012-01-07	2012-01-09	NEW	NEW	IFC	IFC
8	10-AH-AOV-7974A5A-C-01	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
9	10-AH-AOV-7974A5A-C-02	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
10	10-AH-AOV-7974A5A-C-03	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
11	10-AH-AOV-7974A5B-C-01	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
12	10-AH-AOV-7974A5B-C-02	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
13	10-AH-AOV-7974A5B-C-03	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
14	10-AH-AOV-7974A5-C-01	2011-09-23	2011-10-05	2011-09-27	CHANGED	FROM AND TO CHANGED	IFC	IFC
15	10-AH-AOV-7974B5A-C-01	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
16	10-AH-AOV-7974B5A-C-02	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
17	10-AH-AOV-7974B5A-C-03	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
18	10-AH-AOV-7974B5B-C-01	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC
19	10-AH-AOV-7974B5B-C-02	2012-10-04	2012-10-04	2012-10-04	NEW	NEW	IFC	IFC

Status Reports

Progress Reports

- A Wide Variety Of Progress Reports Can Be Created Showing:
  - What's Been Designed
  - What's Been Completed
  - What's Remaining

	DESIGNED			PROGRESS					REMAINING						
CABLE TYPE	NMBR OF CABLES SCHEDULED	DES LEN RELEASED	TERMS DESIGNED	NMBR CABLES PULLED	DES LEN PULLED	LEN CUT	NMBR CABLES COMPLETED	TERMS COMPLETED	NMBR CABLES NOT RELEASED	NMBR CABLES NOT PULLED	EST LEN TO BE PULLED	LENGTH REMAINING ON REELS	LENGTH ON ORDER	TERMS TO GO	NMBR OF INCOMPLETE CABLES
ACCESSORY-VS	36	1550.0	144	36	1550.0	0.0	36	144	0	0	0.0	0.0	0	0	0
C12C12	3	998.8	72	1	304.1	324.0	1	24	0	2	694.7	0	0	48	0
C12C14	281	77151.5	6744	281	77151.5	81855.0	281	6744	0	0	0.0	0	0	0	0
C12C14-VS1	24	0.0	576	24	0.0	275.0	24	576	0	0	0.0	199725.0	0	0	0
C19C14	119	25209.2	4522	118	25209.2	27320.1	118	4484	0	1	0.0	0	0	38	0
C19C14-VS1	4	0.0	152	4	0.0	0.0	4	152	0	0	0.0	100171.0	0	0	0
C1C14	8	717.0	16	8	717.0	715.0	8	16	0	0	0.0	0.0	0	0	0
C1C14-VS	4	4.0	8	4	4.0	4.0	4	8	0	0	0.0	9990.0	0	0	0
C2C12	366	64704.7	1464	355	64352.7	65083.7	355	1420	0	11	352.0	0	0	44	0
C2C12-VS1	17	0.0	68	17	0.0	1.0	17	68	0	0	0.0	360.0	0	0	0
C2C14	1928	683599.9	7712	1906	676324.8	722539.6	1906	7616	0	22	7275.2	0	0	96	0
C2C14-VS	7	156.7	28	7	156.7	165.0	7	28	0	0	0.0	99868.0	0	0	0
C2C14-VS1	74	70.0	296	74	70.0	456.0	74	296	0	0	0.0	101227.0	0	0	0
C2C14-VS2	8	300.0	32	8	300.0	2.0	8	32	0	0	0.0	99998.0	0	0	0
C3C12	72	15803.5	432	72	15803.5	21295.0	72	432	0	0	0.0	0	0	0	0

Reel Inventory Report

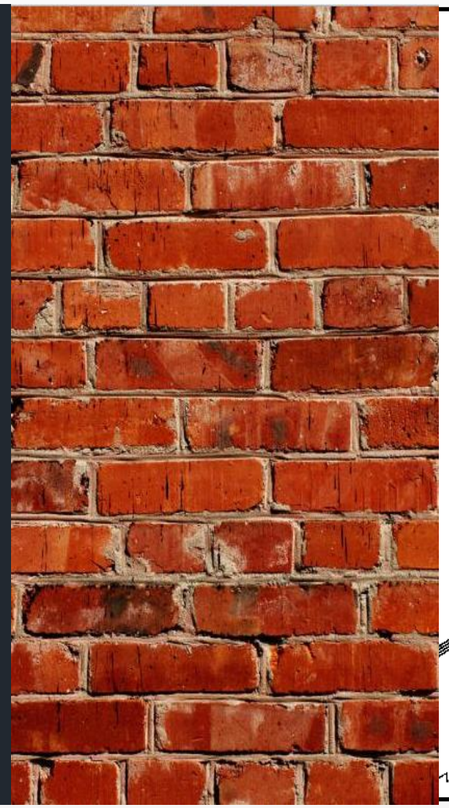
- Tracks
  - Date Delivered
  - Date Ordered
  - Cable Type
  - Reel ID
  - Related PO
  - Amount Of Cable Remaining

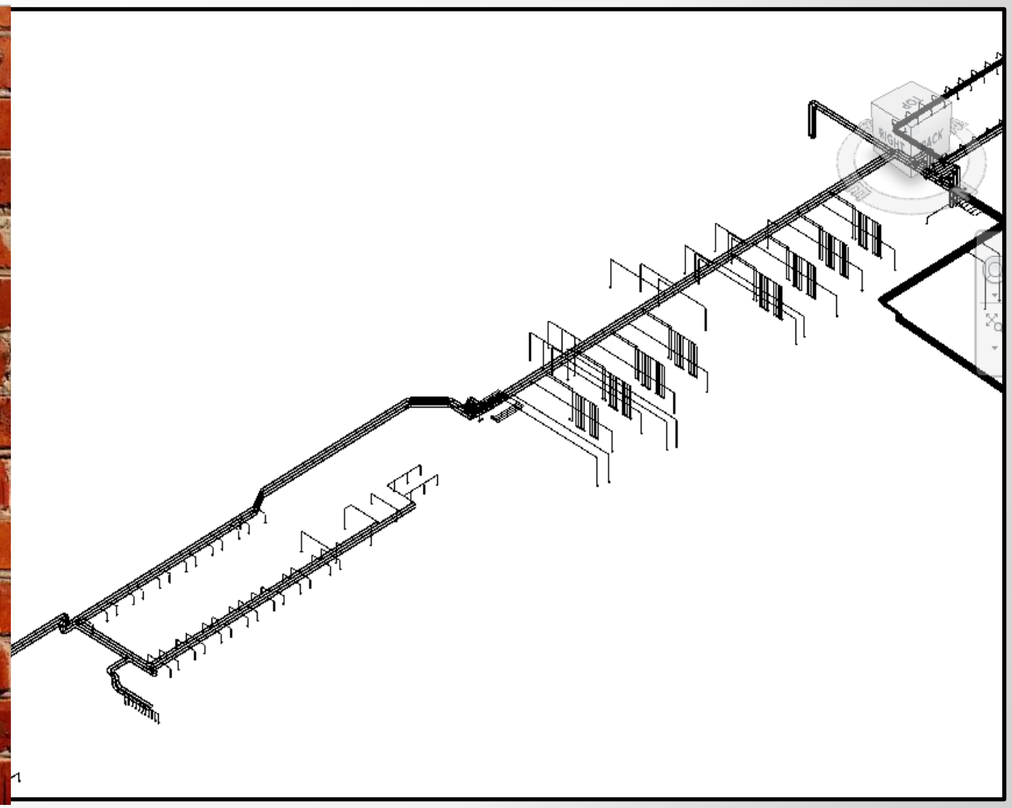
Reel Inventory Report								
REEL NMBR	CAB TYPE CODE	DATE RECEIVED	ORIG LEN	DATE RETIRED	LEN REMAINING	PURCHASE ORDER	ORDERED DATE	SHIPPED DATE
10-AH-CMP-7000-X-01	XCAT5-VS	1/20/2012	80	6/7/2015	0	PO-379901	5/30/2011	11/3/2012
10-AH-CPR-7780-C-04	C9C14	6/5/2013	111	3/31/2015	0	PO-970998	1/28/2011	2/7/2012
10-AH-CPR-7780-C-05	C2C14	7/1/2012	115	2/9/2015	115	PO-17538	3/21/2011	7/16/2012
10-AH-CPR-7780-H-01A	H1C4/0	4/17/2012	456	3/25/2015	454	PO-206932	8/9/2011	8/25/2012
10-AH-CPR-7780-H-01B	H1C4/0	7/18/2012	454	1/10/2014	255	PO-841829	8/4/2011	9/13/2012
10-AH-CPR-7780-H-01C	H1C4/0	4/6/2012	450	5/16/2014	450	PO-449050	10/1/2011	12/5/2012
10-AH-CPR-7950-H-01A	H1C4/0	7/9/2013	920	2/2/2014	10	PO-451744	8/9/2011	5/2/2012
10-AH-CPR-7950-H-01B	H1C4/0	1/18/2012	920	6/26/2014	10	PO-396168	3/5/2011	3/3/2012
10-AH-CPR-7950-H-01C	H1C4/0	9/17/2012	920	12/4/2014	140	PO-916216	3/30/2011	1/19/2012
10-CA-CAB-0100A-K-01	K3C8G	8/7/2012	410	3/11/2015	0	PO-588503	7/27/2011	4/12/2012
10-CA-CAB-0100B-K-01	K3C8G	3/14/2013	420	9/2/2014	0	PO-615212	8/24/2011	3/2/2012
10-CA-CPR-0100A-H-01A	H1C4/0	12/29/2012	337	11/16/2014	0	PO-978383	6/8/2011	11/15/2012
10-CA-CPR-0100A-H-01B	H1C4/0	6/18/2012	385	7/7/2014	48	PO-972306	9/16/2011	2/23/2012
10-CA-CPR-0100A-H-01C	H1C4/0	10/19/2012	385	11/18/2014	48	PO-172624	8/30/2011	3/27/2012
10-CA-CPR-0100B-H-01A	H1C4/0	3/16/2012	395	5/4/2014	52	PO-877667	1/9/2011	2/23/2012
10-CA-CPR-0100B-H-01B	H1C4/0	11/9/2012	395	2/7/2014	52	PO-258769	11/6/2011	4/27/2012
10-CA-CPR-0100B-H-01C	H1C4/0	8/22/2012	395	1/24/2014	52	PO-778282	12/28/2011	10/10/2012
10-CA-CPR-0100B-H-01G	G2	10/7/2013	395	12/4/2014	165	PO-959740	7/17/2011	3/5/2012
10-CA-CPR-0100B-X-01	X1P18-VS	7/24/2012	95	3/22/2014	0	PO-879292	4/15/2011	9/5/2012
10-CA-CPR-0100C-H-01A	H1C4/0	6/2/2013	405	6/12/2014	28	PO-207840	9/25/2011	6/11/2012
10-CA-CPR-0100C-H-01B	H1C4/0	12/15/2012	405	10/8/2014	28	PO-37488	2/4/2011	5/18/2012
10-CA-CPR-0100C-H-01C	H1C4/0	2/10/2013	405	3/29/2015	28	PO-211247	8/6/2011	6/22/2012
10-CA-CPR-0100C-H-01G	G2	1/10/2013	405	9/20/2014	170	PO-805919	7/27/2011	7/14/2012
10-CA-CPR-0100C-X-01	X1P18-VS	2/23/2013	80	5/14/2014	0	PO-969342	5/3/2011	6/11/2012
10-CA-DSW-0100A-K-01	K3C2G	8/7/2012	490	3/8/2015	0	PO-65619	2/11/2011	8/10/2012
10-CA-DSW-0100B-K-01	K3C2G	4/21/2012	480	3/24/2015	0	PO-536023	5/2/2011	7/10/2012
10-CC-PMP-0120A-C-01	C9C14	3/8/2013	98.2	1/31/2015	0	PO-291799	3/10/2011	6/18/2012
10-CC-PMP-0120A-C-02	C2C14	7/31/2013	98.2	6/21/2014	98.2	PO-873914	3/30/2011	11/18/2012

Hot Off the Press

Hot Off the Press

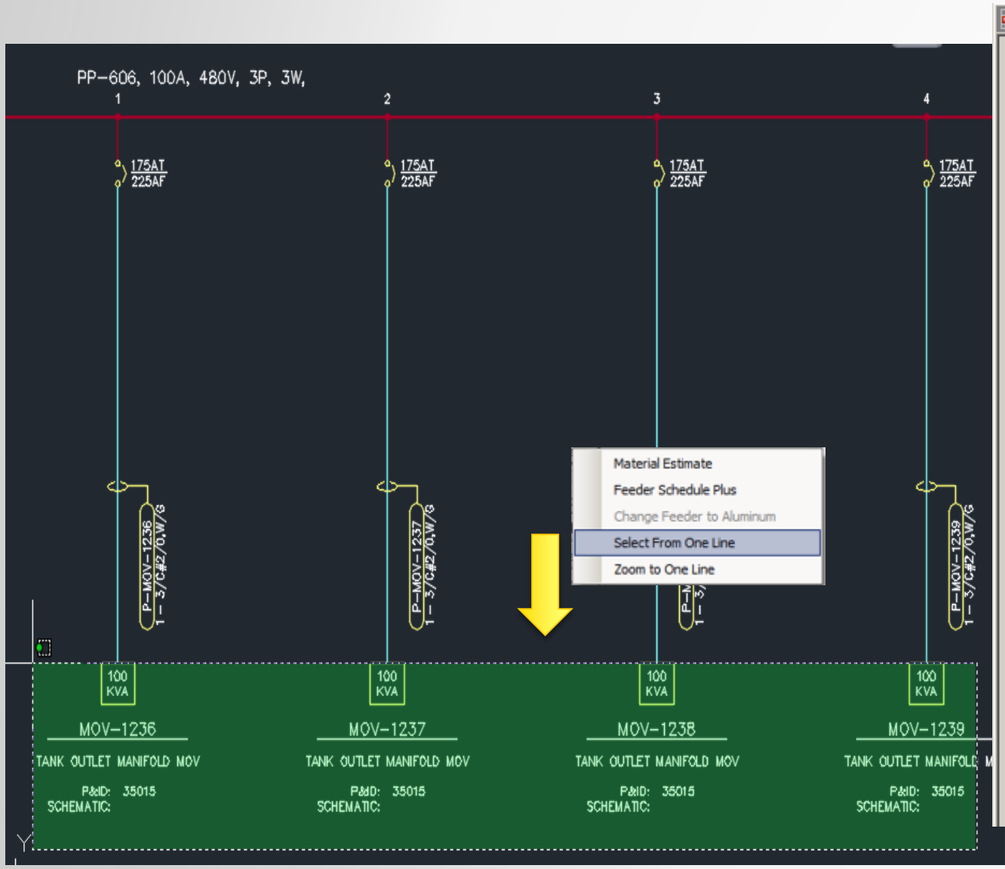
- Presenting One-Line and 3D Integration
- Removing the Barrier

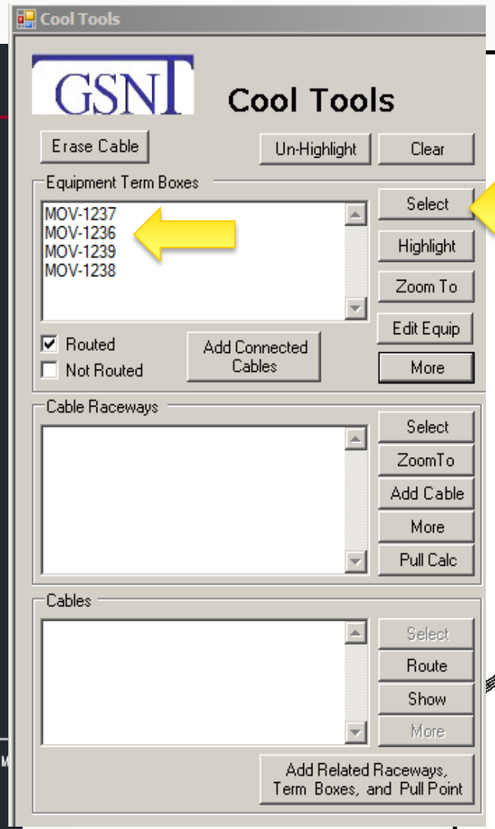


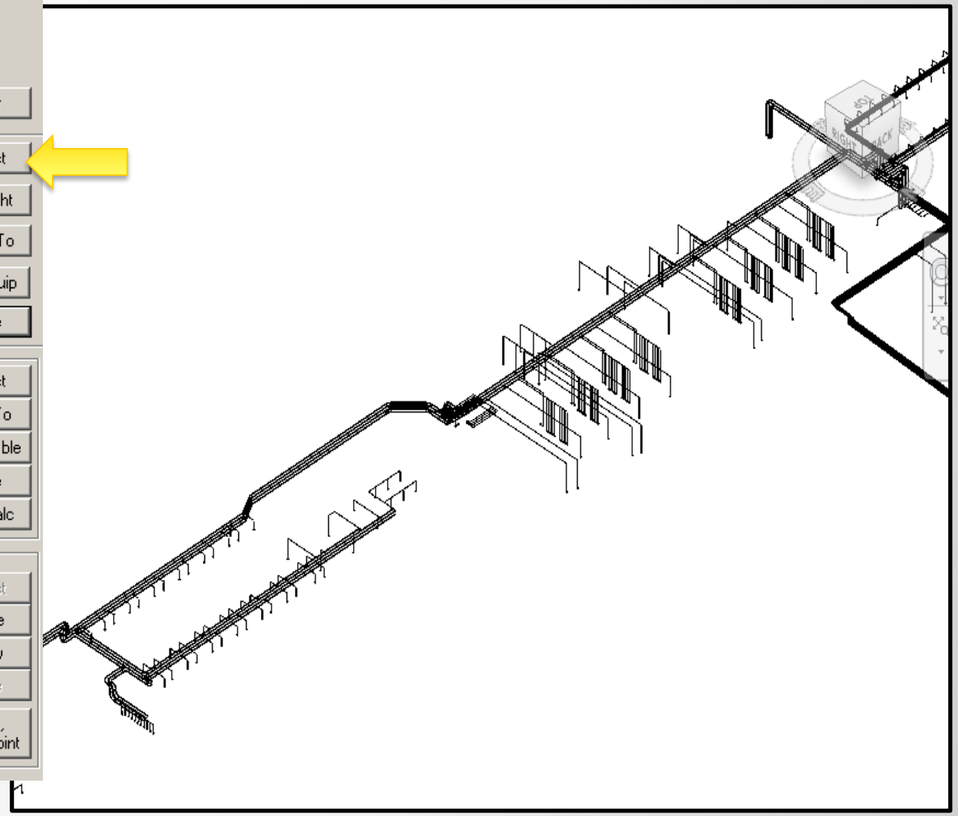


Hot Off the Press – One-Line & 3D Integration

- Bi-Directional between One-Line and 3D model

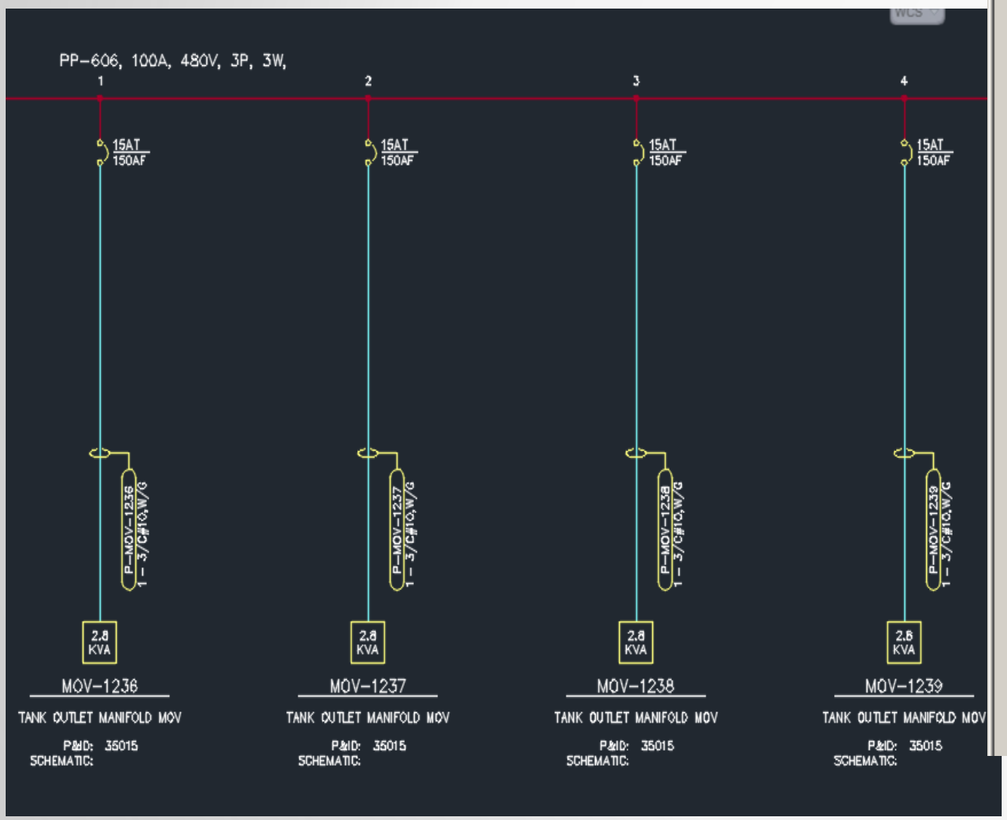


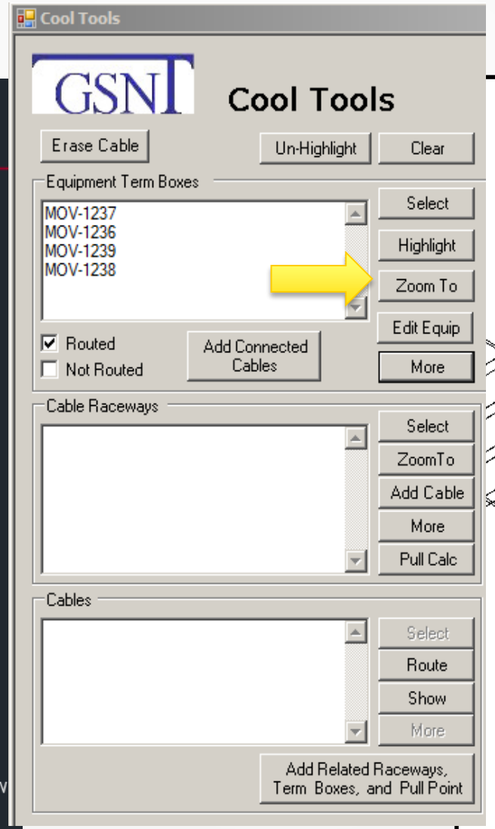


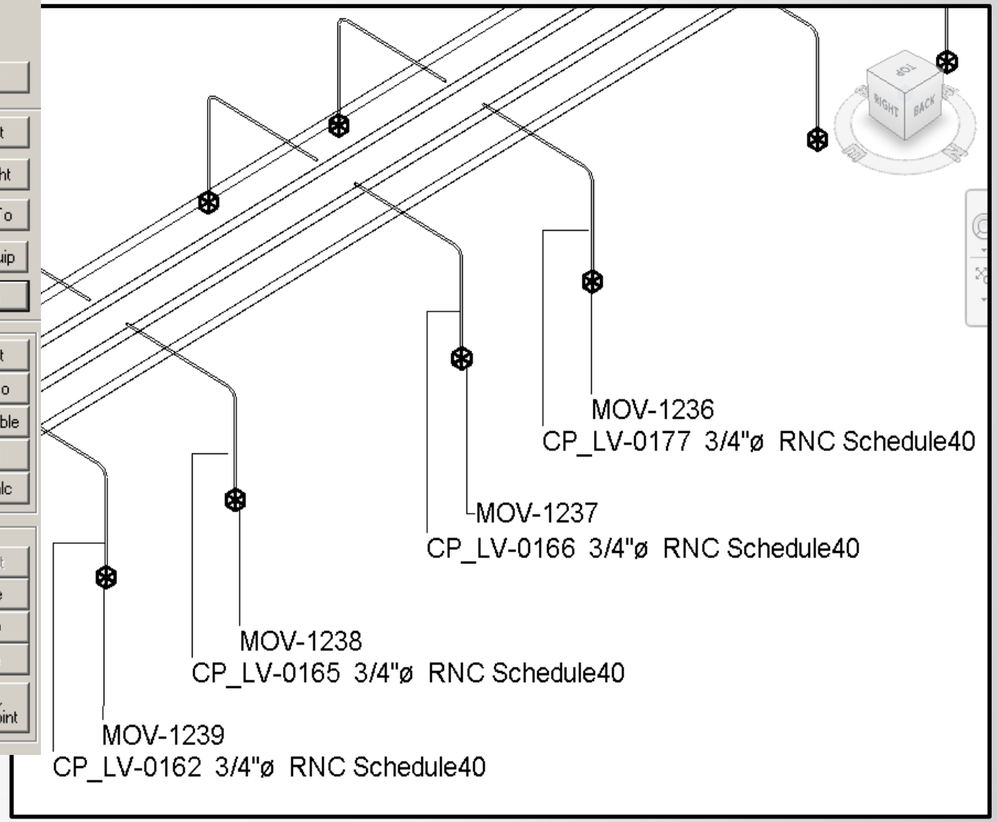


Hot Off the Press – One-Line & 3D Integration

- Zoom to equipment in the 3D model and/or in the One-Line

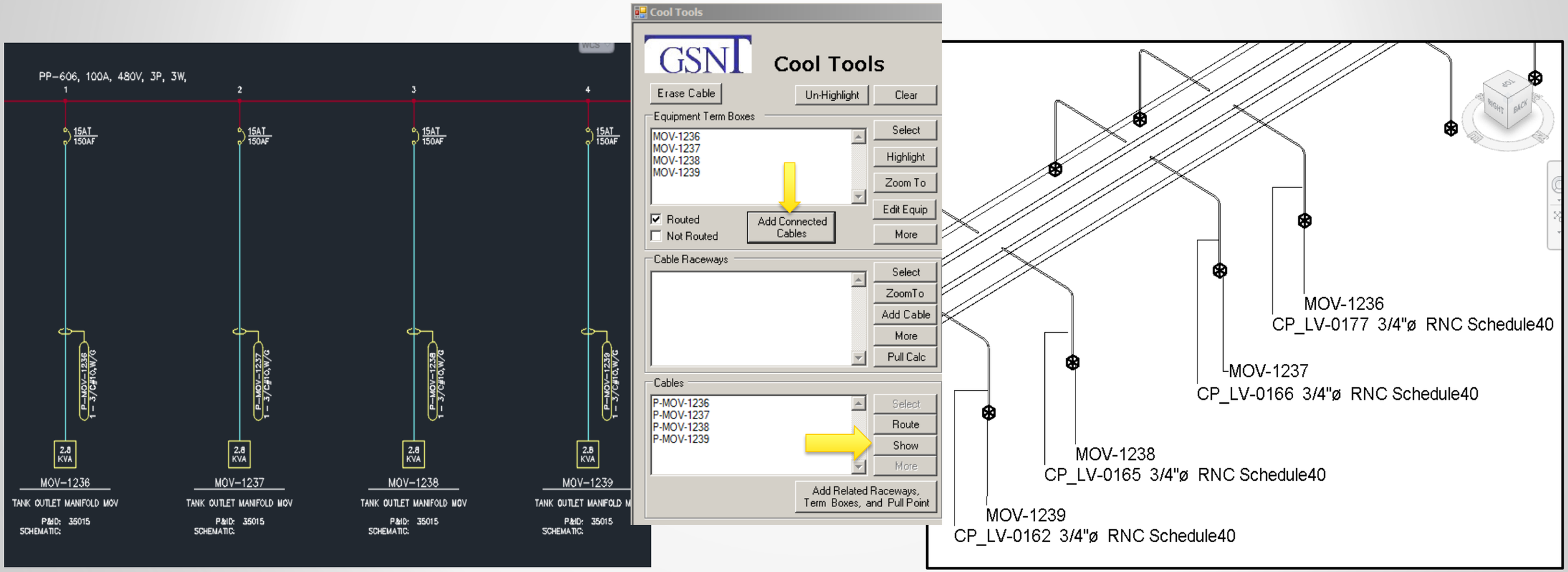






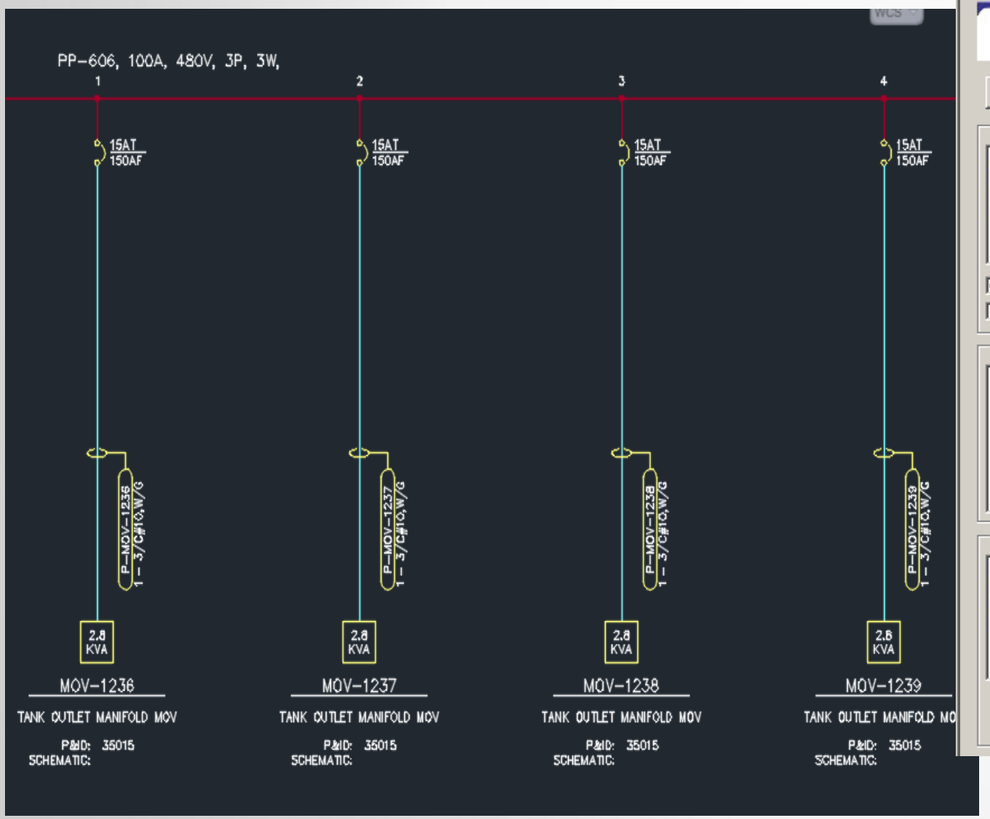
One-Line & 3D Integration

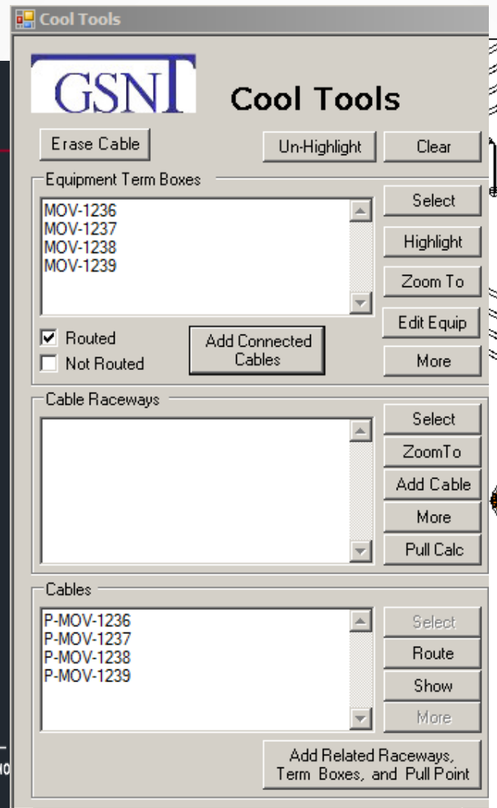
- Reviewing the cable routes

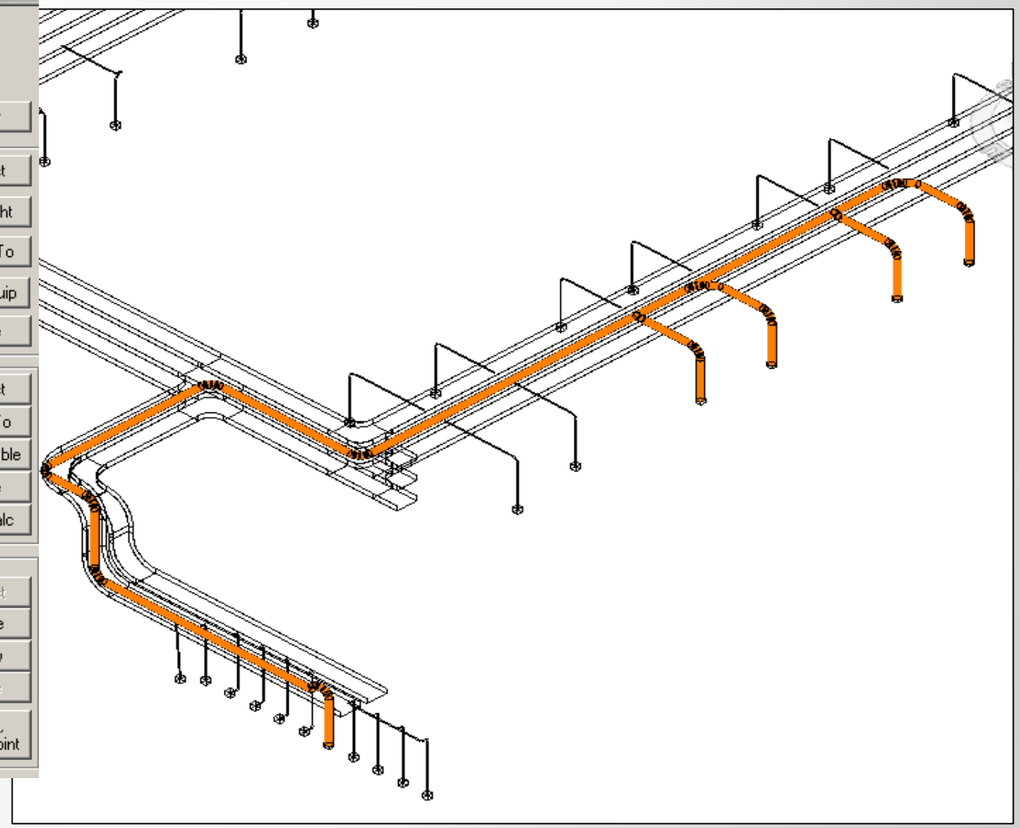


One-Line & 3D Integration

- Displaying the path of the cable feeds







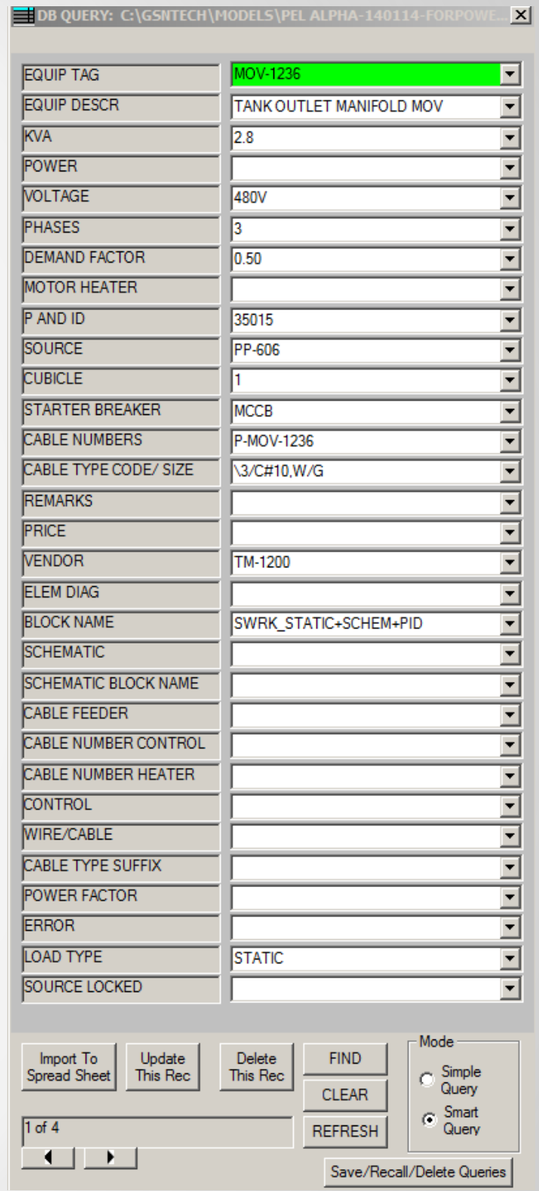
One-Line & 3D Integration

- Editing the CARS database

LM-DBQUERY- - [ACRS -DB] LM_LOADS

File Edit Format Tables Tools Reports Help PullDowns DBQuery Database

	A EQUIP TAG	B EQUIP DESCR	C KVA	D POWE	E VOLTAGE	F PHASES	G DEMANI FACTO	H MOTOR HEATER	I P AND ID	J SOURCE	K CUBICLE	L TARTE REAKE	M CABLE NUMBERS	N CABLE TYPE CODE/ SIZE	O MARI	P PRICI	Q VENDOR	R ELEM DIAG	S BLOCK NAME
1	MOV-1236	TANK OUTLET MANIFOLD	2.8		480V	3	0.50		35015	PP-606	1	MCCB	P-MOV-1236	\3/C#10,W/G			TM-1200		SWRK STATIC+SCHEM+PID
2	MOV-1237	TANK OUTLET MANIFOLD	2.8		480V	3	0.50		35015	PP-606	2	MCCB	P-MOV-1237	\3/C#10,W/G			TM-1200		SWRK STATIC+SCHEM+PID
3	MOV-1238	TANK OUTLET MANIFOLD	2.8		480V	3	0.50		35015	PP-606	3	MCCB	P-MOV-1238	\3/C#10,W/G			TM-1200		SWRK STATIC+SCHEM+PID
4	MOV-1239	TANK OUTLET MANIFOLD	2.8		480V	3	0.50		35015	PP-606	4	MCCB	P-MOV-1239	\3/C#10,W/G			TM-1200		SWRK STATIC+SCHEM+PID
5																			
6																			
7																			
8																			



One-Line & 3D Integration

- Changing the loads to 100 kva

LM-DBQUERY- - [ACRS -DB] LM_LOADS

File Edit Format Tables Tools Reports Help PullDowns DBQuery Database

	A EQUIP TAG	B EQUIP DESCR	C KVA	D POWE	E VOLTAGE	F PHASES	G DEMANI FACTOI	H MOTOR HEATER	I P AND ID	J SOURCE	K CUBICLE	L TARTE REAKE	M CABLE NUMBERS	N CABLE TYPE CODE/ SIZE	O MARI	P PRICI	Q VENDOR	R ELEM DIAG	S BLOCK NAME
1	MOV-1236	TANK OUTLET MANIFOLD	100		480V	3	0.50		35015	PP-606	1	MCCB	P-MOV-1236	\3/C#10,W/G			TM-1200		SWRK STATIC+SCHEM+PID
2	MOV-1237	TANK OUTLET MANIFOLD	100		480V	3	0.50		35015	PP-606	2	MCCB	P-MOV-1237	\3/C#10,W/G			TM-1200		SWRK STATIC+SCHEM+PID
3	MOV-1238	TANK OUTLET MANIFOLD	100		480V	3	0.50		35015	PP-606	3	MCCB	P-MOV-1238	\3/C#10,W/G			TM-1200		SWRK STATIC+SCHEM+PID
4	MOV-1239	TANK OUTLET MANIFOLD	100		480V	3	0.50		35015	PP-606	4	MCCB	P-MOV-1239	\3/C#10,W/G			TM-1200		SWRK STATIC+SCHEM+PID
5																			
6																			
7																			
8																			

DB QUERY: C:\GSNTECH\MODELS\PEL ALPHA-140114-FORPOWE...

EQUIP TAG	MOV-1236
EQUIP DESCR	TANK OUTLET MANIFOLD MOV
KVA	2.8
POWER	
VOLTAGE	480V
PHASES	3
DEMAND FACTOR	0.50
MOTOR HEATER	
P AND ID	35015
SOURCE	PP-606
CUBICLE	1
STARTER BREAKER	MCCB
CABLE NUMBERS	P-MOV-1236
CABLE TYPE CODE/ SIZE	\3/C#10,W/G
REMARKS	
PRICE	
VENDOR	TM-1200
ELEM DIAG	
BLOCK NAME	SWRK_STATIC+SCHEM+PID
SCHEMATIC	
SCHEMATIC BLOCK NAME	
CABLE FEEDER	
CABLE NUMBER CONTROL	
CABLE NUMBER HEATER	
CONTROL	
WIRE/CABLE	
CABLE TYPE SUFFIX	
POWER FACTOR	
ERROR	
LOAD TYPE	STATIC
SOURCE LOCKED	

Import To Spread Sheet | Update This Rec | Delete This Rec | FIND | CLEAR | REFRESH

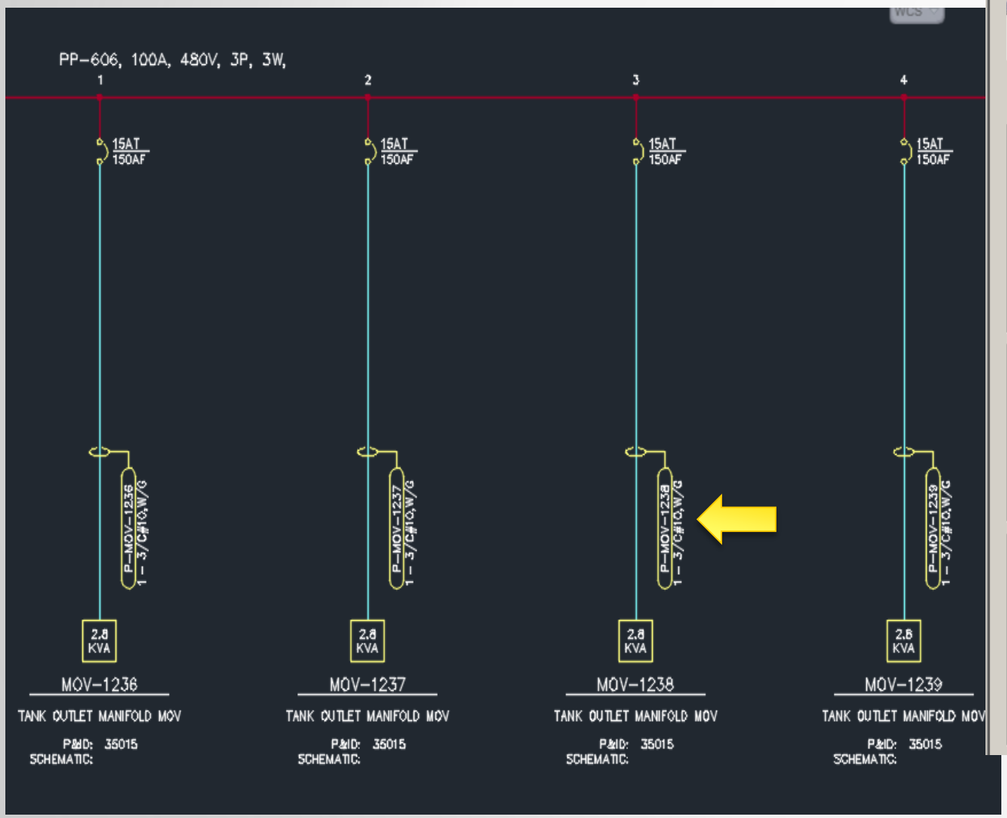
1 of 4

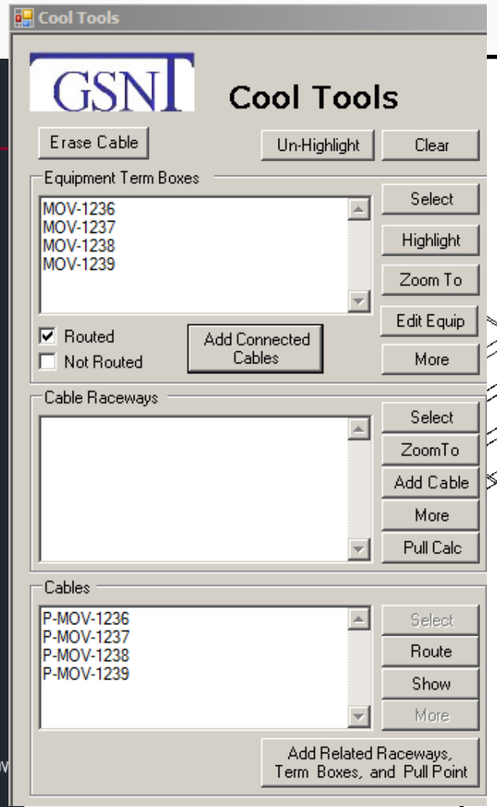
Mode: Simple Query / Smart Query

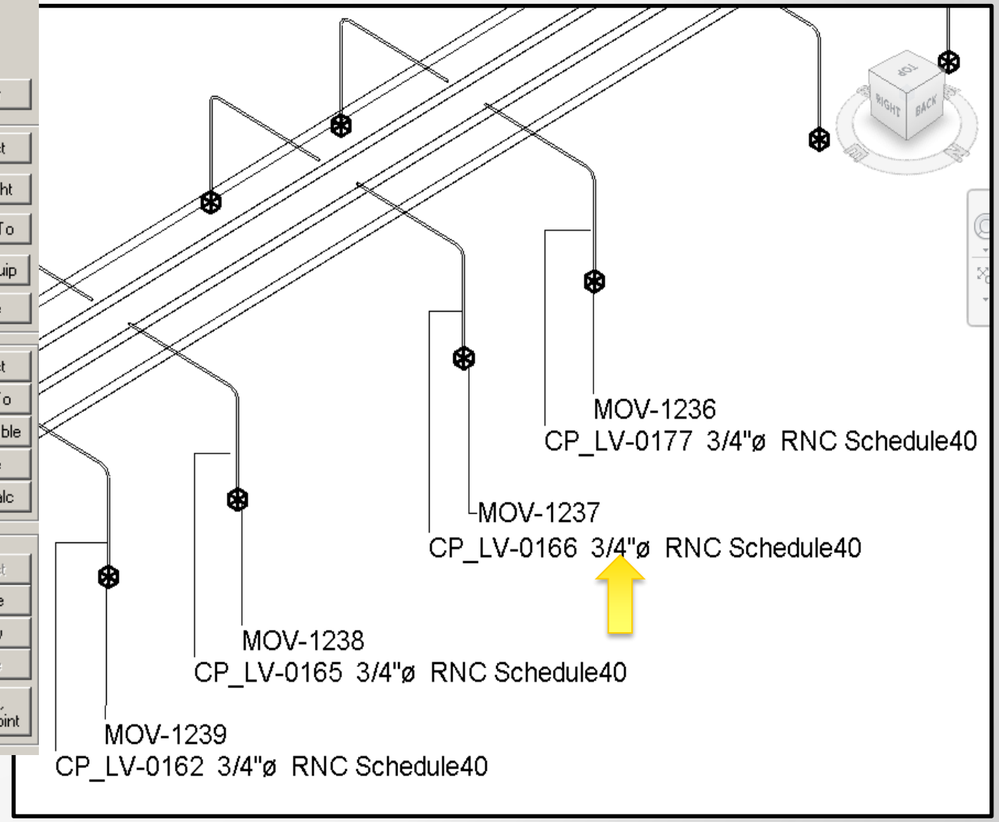
Save/Recall/Delete Queries

One-Line & 3D Integration

- The current cable sizes are 3/c#10,W/G.
- The conduit sizes are ¾”

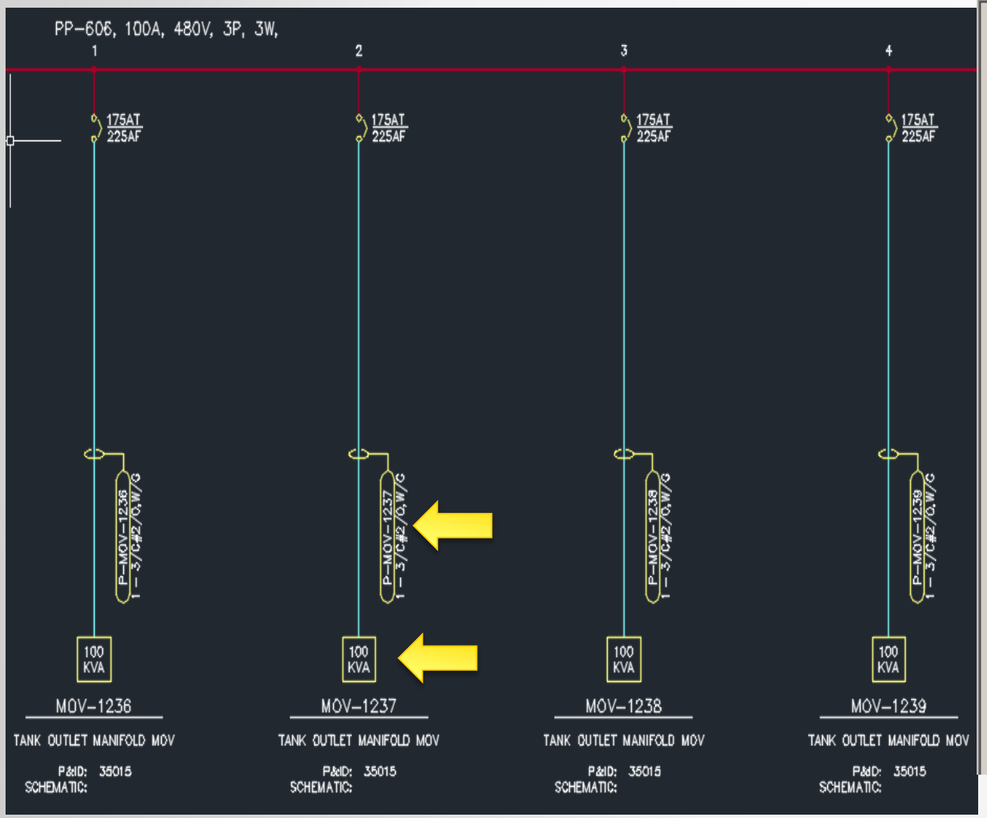


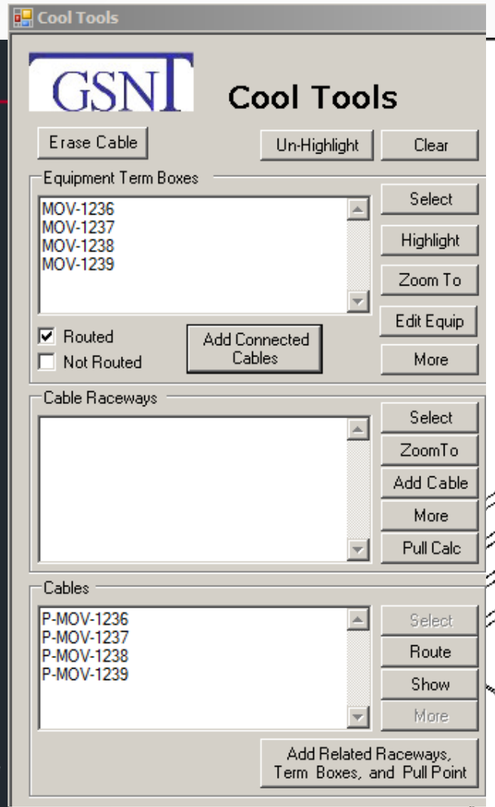


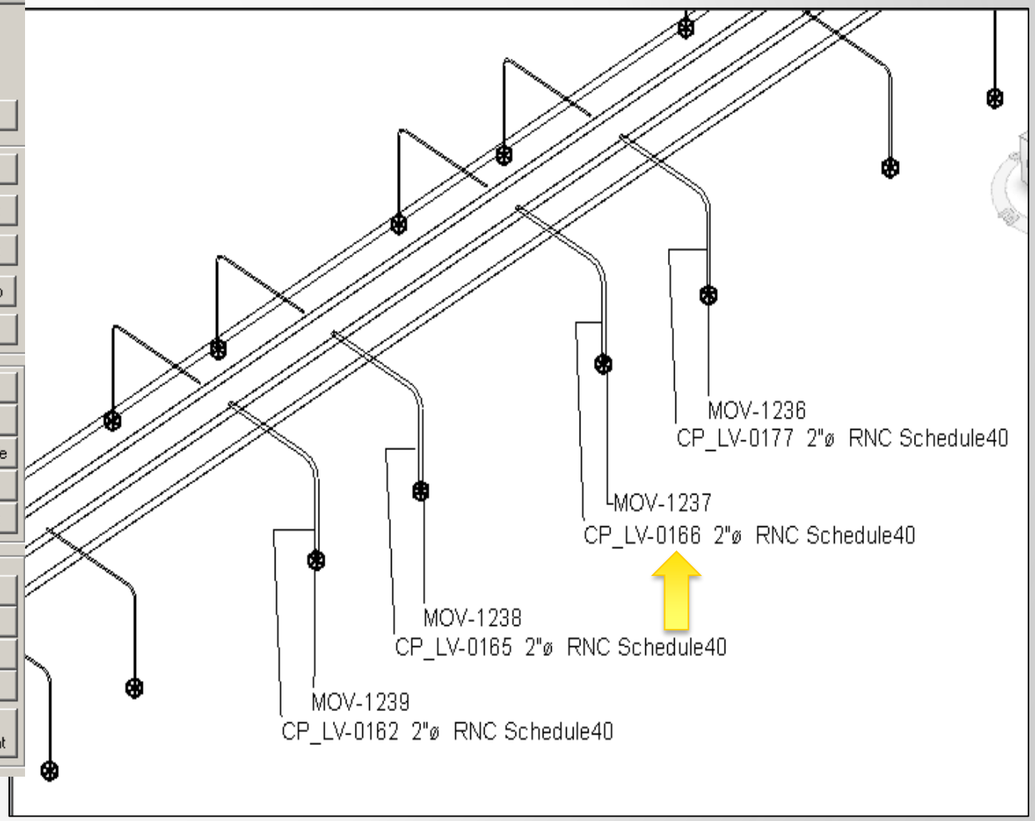


One-Line & 3D Integration

- Changing the load to 100 kva
  - The cable sizes were changed to 3/C#2/0, W/G
  - The conduits in the 3D model were upsized in scale to 2”

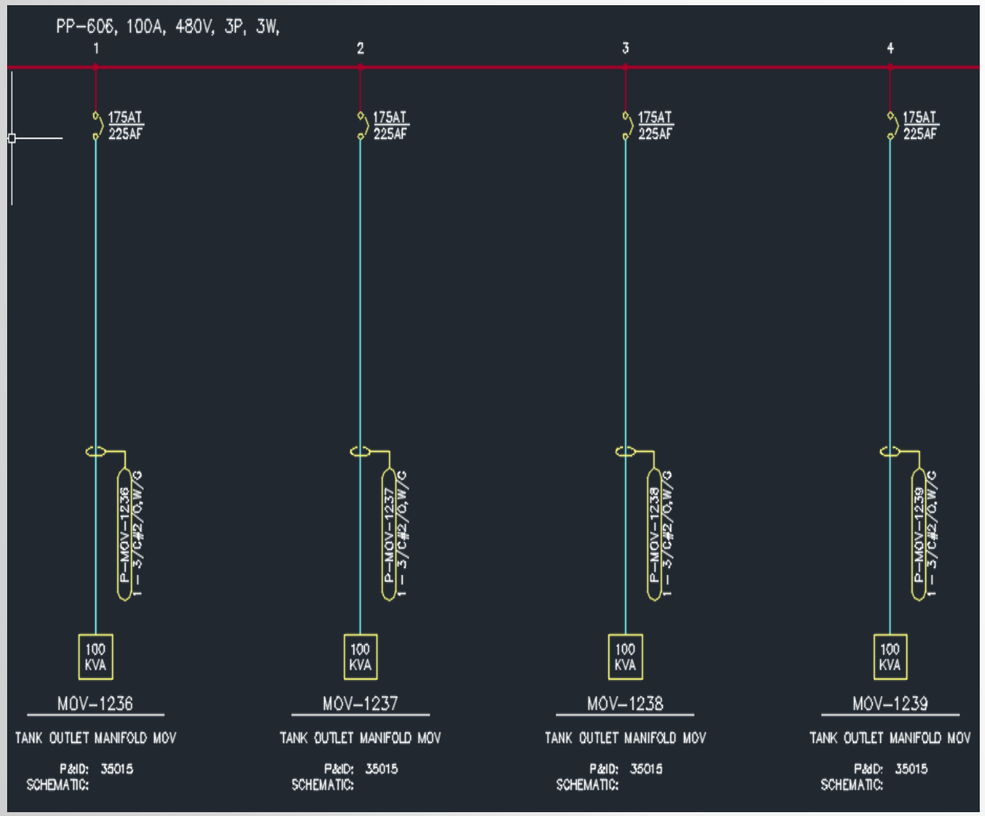


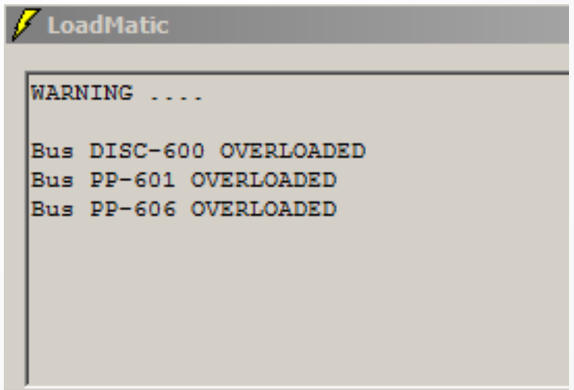


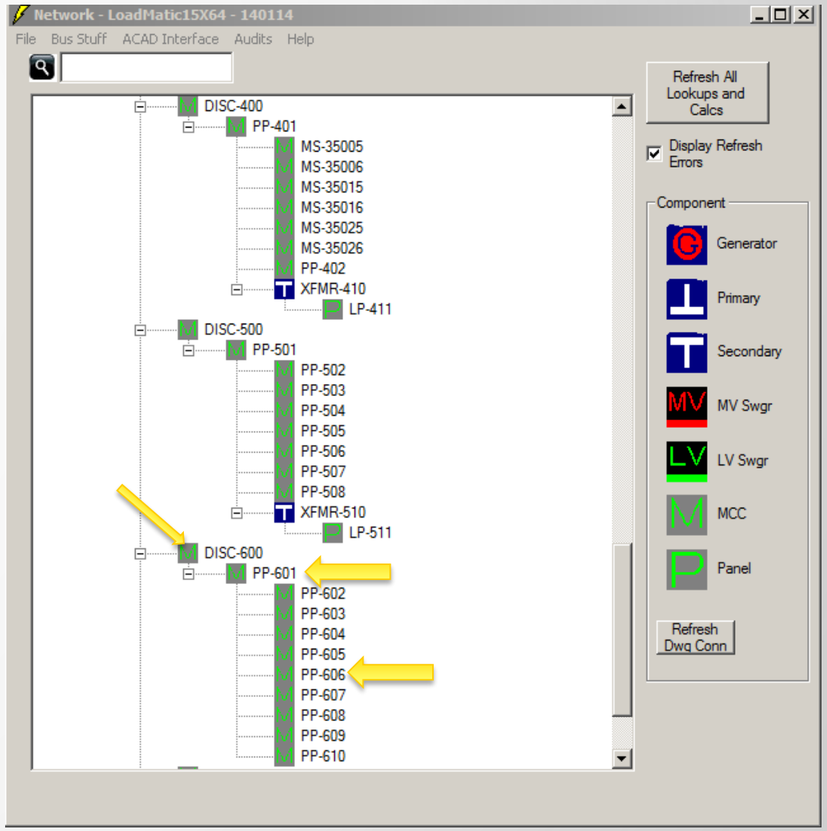


One-Line & 3D Integration

- The change overloaded the bus

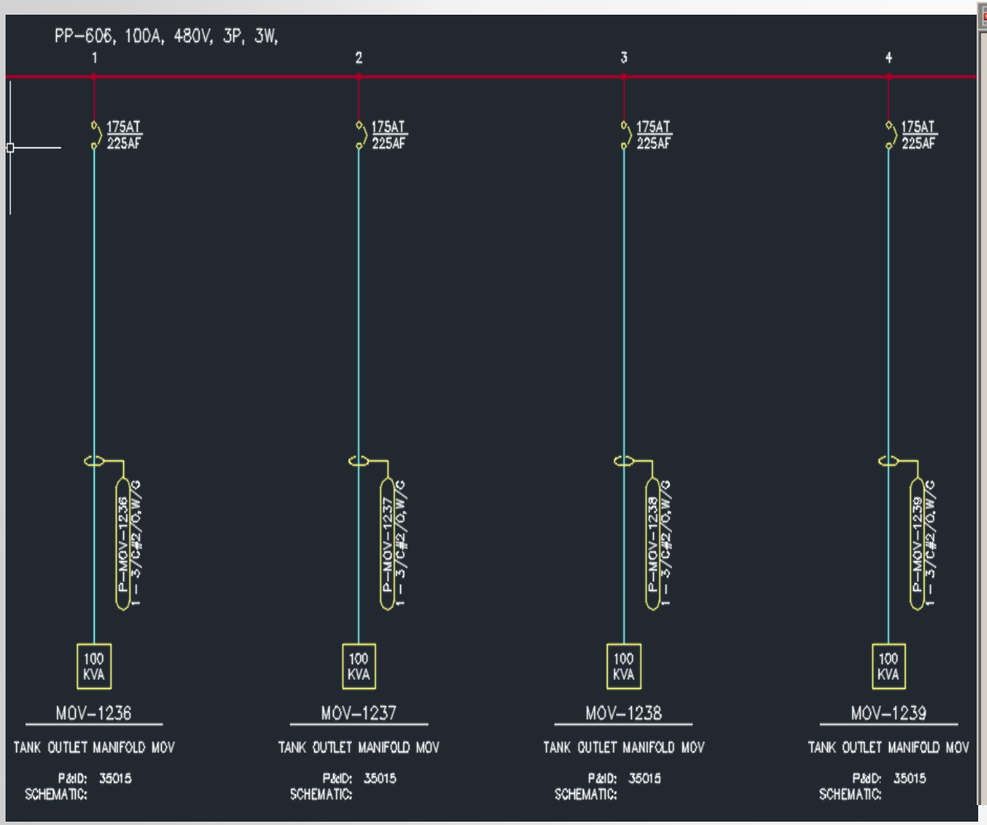


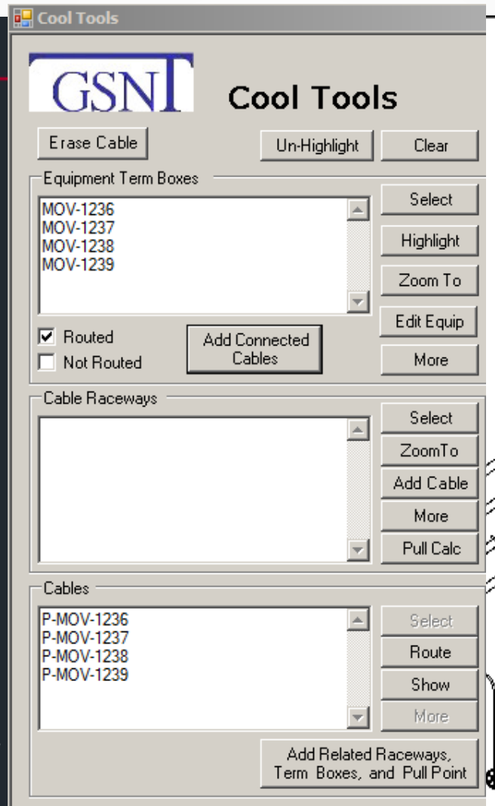


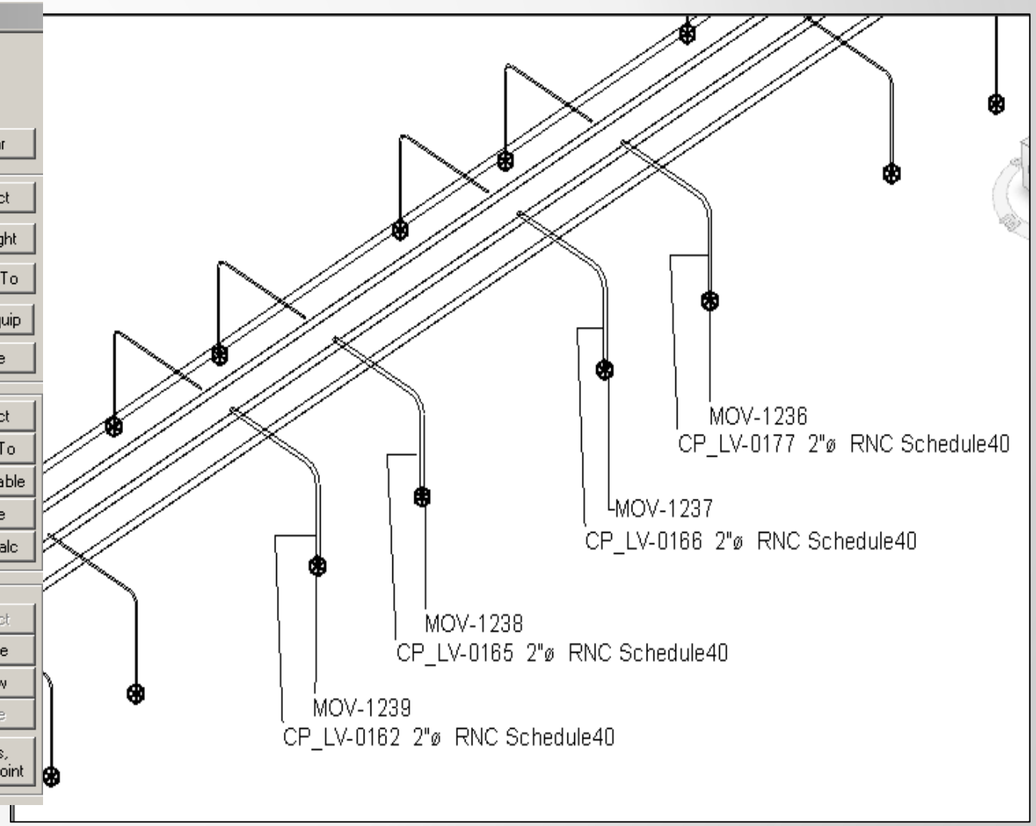


One-Line & 3D Integration

- The barrier is removed
- The One-Line and 3D model are coordinated







Wrap Up

Applied Software®

Stop by our booth (311 and 411)…

Register for a chance to win a free Drone, and Apple Watch!

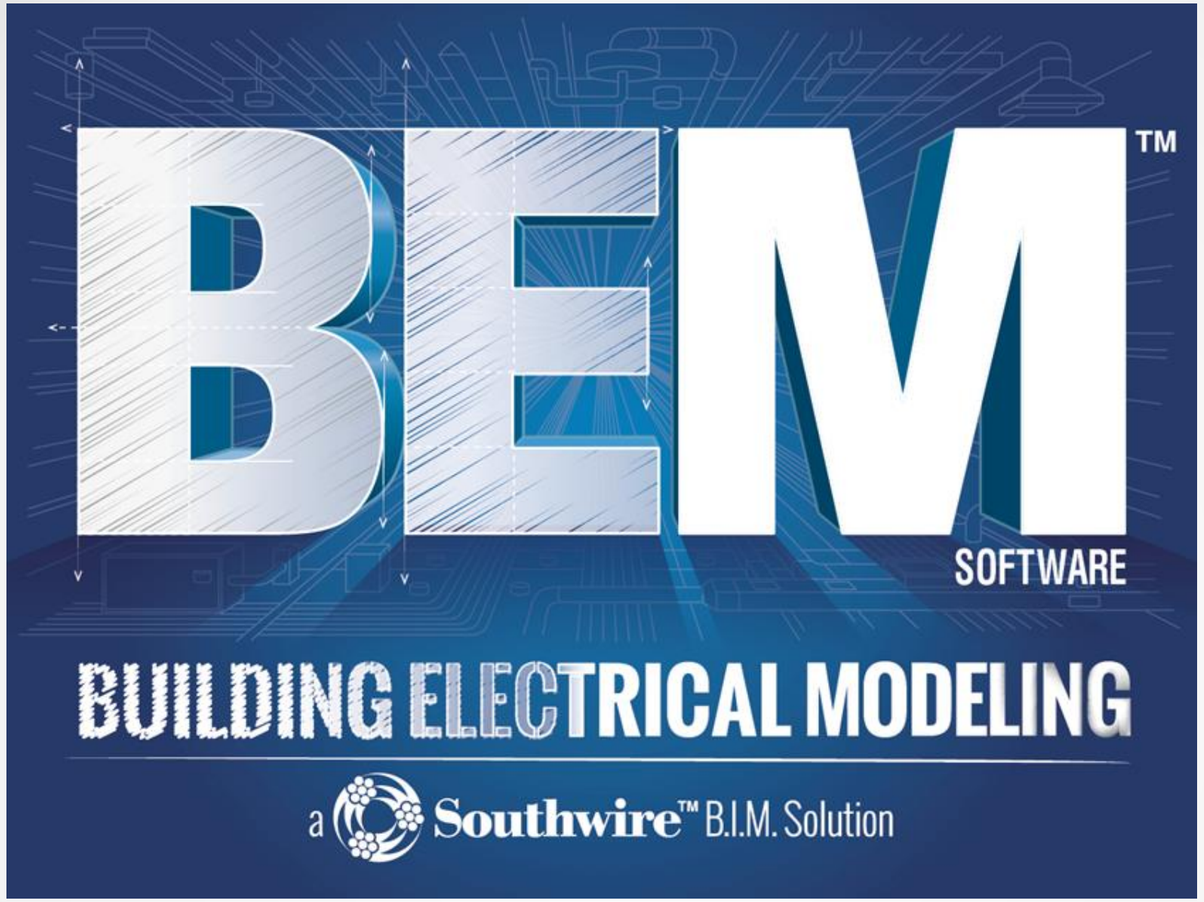
Wrap up

Thank You For Attending

Mike Massey
Email - mike.massey@asti.com

Enter for a chance to win a free LiveLab Learning® class of your choice by going to:

www.asti.com/au2015



The Link Between Revit And AutoCAD For Automated Electrical Engineering, Design, And Construction

Be heard! Provide AU session feedback.

- Via the Survey Stations, email or mobile device.
- AU 2016 passes awarded daily!
- Give your feedback after each session.
- Give instructors feedback in real-time.

Too many sessions, too little time?

After AU visit:

AutodeskUniversity.com

- Recorded sessions
- Presentations and handouts
- Key learnings

Don’t miss a second! Find hundreds of sessions waiting for you.